Published by

The Ukuqonda Institute
http://www.ukuqonda.org.za
9 Neale Street, Rietondale 0084, South Africa
Title 21 Company, Reg. No. 2006/026363/08
Public Benefit Organisation, PBO No. 930035134

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Mathematics Teacher Guide Grade 4
ISBN: 978-1-4315-2289-7

This Teacher Guide and its accompanying Learner Book (ISBN: 978-1-4315-2287-3) were developed with the participation of the Department of Basic Education of South Africa (DBE) with funding from the Sasol Inzalo Foundation (SaIF).

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Layout and typesetting: The authors and the Ukuqonda Institute
Illustrations and computer graphics: The authors and the Ukuqonda Institute
IT solution and support for file sharing: Menge Media


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CAPS time allocation 2 hours
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Mathematical background
Understanding place value means that we know that the number represented by the symbol 357 is not “three five seven” or “3 and 5 and 7”, but 300 + 50 + 7. It is crucial that learners understand from the start that 357 is not “three five seven” or “3 and 5 and 7”, but 300 + 50 + 7. Always ask learners to express numbers by saying the whole number name, for example three hundred and fifty-seven, and to avoid referring to the number as three five seven.

Language constructions such as “break down a number into its place value parts” (see Sections 1.1 and 1.3) and learning aids such as place value cards were invented and are prescribed to promote understanding of place value.

Resources
Two resources are absolutely critical for the work in this unit:

- Counting apparatus: wooden or plastic cubes, rods and blocks; or loose sticks, bundles of 10 sticks, and heaps of 10 bundles of 10 sticks each.
- Place value cards, all of the same colour.

Each learner should have their own set of counters (cubes/rods or sticks/bundles) and their own set of place value cards.

Templates for place value cards for learners and teachers are given in the Addendum (pages 416 to 432). Your place value cards for demonstration purposes should be at least A4 size.

Please note: Page numbers in the text of this Teacher Guide always refer to the Learner Book, unless otherwise stated. Addendum page numbers refer to the Addendum at the back of this book.
1.1 Number names and number symbols

**Mathematical notes**

This section deals with number concept, number names and number symbols for numbers up to 100. This is consolidation of Grade 2 work (although in Grade 2 learners are only expected to work up to 99). The rest of the sections deal with numbers up to 999 as required towards the end of Grade 3 and the first term in Grade 4.

Remember that the concepts introduced here will form the basis of the rest of the number work in Grade 4. These concepts will be touched on repeatedly throughout the year. Try to keep the pace of work moving, so that you complete this unit within the 2 hours allocated to it.

**Teaching guidelines**

Try to move quickly through Section 1.1: aim to cover this section in 30 minutes. One possibility is to use

- questions 1 and 2 as diagnostic assessment,
- page 4 and questions 3, 4 and 10 for concept development, and
- questions 5, 6, 7, 8, 9, 11, 12 and 13 for additional practice (e.g. as homework).

Questions 1 and 2 are diagnostic activities to help you to quickly assess the state of your new learners’ knowledge of whole numbers.

Observe learners while they do question 2. Some learners may notice the groups of ten or groups of five, as shown alongside, and use this to produce the correct answer quickly.

Other learners may just count all the cubes one by one. This will take them much longer. It is a waste of time.

Once all learners have completed question 2, talk to them about how counting in groups can save them time and effort. Part of being good at mathematics is doing things in ways that are simple, smart and quick.

**Answers**

1. Learners count from 1 to 120.
2. fifty-five
**Mathematical notes**

Page 4 states that the combined symbol 14 has two parts: 10 and 4. This concept is further explained in the summary bar and tinted passage on page 12, as shown alongside.

The cards that you use in school to show numbers can be called **place value cards.** This is because each card that you use to build a number shows one of the place value parts. Look at this example:

six hundred and thirty-eight is

\[\begin{array}{c}
600 \\
30 \\
8 \\
\end{array}\]

**Teaching guidelines**

Hand out the cubes and rods or sticks and bundles to all learners, and ensure that they have paper or plastic bags in which to keep them safely.

You may let each learner pack out each of the numbers 1 to 9 with cubes or sticks, to form an array as shown on page 4.

Hand out the place value cards for units and tens to learners, and ensure that they have envelopes, plastic bags or small boxes in which to keep them safely. Learners must either store their place value cards and cubes or sticks in a safe place in class, or bring them to school every day.

Demonstrate to learners how numbers can be built up with place value cards. Ask them to show numbers with their cards, for example 14. Ask them to show the two cards that they use: first separately, and then together.

The English number names 13 to 19 work in a slightly different way to other number names. Check that learners understand that “teen” stands for the tens part of these numbers. Check also that they understand that “thir” and “fif” stand for the unit parts three and five respectively.

**Possible misconceptions**

Talk with any learners who use the 1 card and the 4 card to show the number 14. Make sure they understand that 1 + 4 is 5, not 14, hence it is wrong to show 14 with the 1 card and the 4 card. Monitor learners for this error throughout this unit. Explain to all learners that they should place the units card, i.e. 4, over the zero of the tens card.
Teaching guidelines
Let learners show the same 2-digit number in five different ways on their desks:

- by packing it out with cubes and rods or sticks and bundles
- by building it with place value cards
- by writing the number name
- by writing the number symbol
- by writing the expanded notation.

Notes on questions

Questions 3 and 4 have different focuses.

Question 3 focuses learners’ attention on the meaning of the English number names, as explained in the summary bar at the bottom of page 4 of the Learner Book and page 5 of this Teacher Guide. This means that the order of the numbers in the answer to question 3 should be as it is in the name of the number, for example 5 and 10.

Question 4 focuses learners’ attention on the place value parts of the numbers as explained with the place value cards on page 4. This means that the order of the numbers in the answer to question 4 should be in the place value order, for example 10 and 9.

Answers
3. (a) 5 and 10  
   (b) 6 and 10
4. (a) 10 and 9  
   (b) 19
5. (a) 40 and 8  
   (b) 40 + 8
6. 47
Teaching guidelines
To save time you can photocopy the following templates in the Addendum:
- for question 7, the $10 \times 10$ grid (page 435)
- for questions 10 to 13, the number lines (page 436).

Answers
7. 

\[
\begin{array}{cccccccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
11 & 12 & 13 & 14 & 15 & 16 & 17 & 18 & 19 & 20 \\
21 & 22 & 23 & 24 & 25 & 26 & 27 & 28 & 29 & 30 \\
31 & 32 & 33 & 34 & 35 & 36 & 37 & 38 & 39 & 40 \\
41 & 42 & 43 & 44 & 45 & 46 & 47 & 48 & 49 & 50 \\
51 & 52 & 53 & 54 & 55 & 56 & 57 & 58 & 59 & 60 \\
61 & 62 & 63 & 64 & 65 & 66 & 67 & 68 & 69 & 70 \\
71 & 72 & 73 & 74 & 75 & 76 & 77 & 78 & 79 & 80 \\
81 & 82 & 83 & 84 & 85 & 86 & 87 & 88 & 89 & 90 \\
91 & 92 & 93 & 94 & 95 & 96 & 97 & 98 & 99 & 100
\end{array}
\]

8. 

\[
\begin{array}{cccccccccccc}
5 & 10 & 15 & 20 & 25 & 30 & 35 & 40 & 45 & 50 & 55 & 60 & 65 & 70 & 75 & 80 & 85 & 90 & 95 & 100
\end{array}
\]

9. 

\[
\begin{array}{cccccccccccc}
100 & 95 & 90 & 85 & 80 & 75 & 70 & 65 & 60 & 55 & 50 & 45 & 40 & 35 & 30 & 25 & 20 & 15 & 10 & 5 & 0
\end{array}
\]

10. 

\[
\begin{array}{cccccccccccc}
0 & 10 & 20 & 30 & 40 & 50 & 60 & 70 & 80 & 90 & 100
\end{array}
\]

11. 

\[
\begin{array}{cccccccccccc}
0 & 5 & 10 & 15 & 20 & 25 & 30 & 35 & 40 & 45 & 50
\end{array}
\]

12. 

\[
\begin{array}{cccccccccccc}
0 & 2 & 4 & 6 & 8 & 10 & 12 & 14 & 16 & 18 & 20
\end{array}
\]

13. 

\[
\begin{array}{cccccccccccc}
50 & 52 & 54 & 56 & 58 & 60 & 62 & 64 & 66 & 68 & 70
\end{array}
\]
1.2 Count in hundreds, tens and units

Mathematical notes
For the rest of this unit learners will be working with numbers up to 999.

Remember that all the concepts raised here will form the basis of the rest of the number work in Grade 4. These concepts will be touched on repeatedly throughout the year. Try to keep the pace of work moving, so that you can complete this unit within the 2 hours allocated to it.

Teaching guidelines
Try to move quickly through Section 1.2: aim to cover this section in 30 minutes. One possibility is to use

- the illustrations on page 7 and 8, questions 1(a), 2(a), the tinted passage on page 9 and the illustration in question 4 for concept development,
- questions 1(b) and (c), 2(b) and (c), 3(a) and (b), 5(a), 7, 8, 9, 10 and 11(e) to (h) for classwork, and
- questions 1(d) and (e), 2(d), 3(c) and (d), 5(b), 6 and 11(a) to (d) for additional practice.

Ask learners to write the following numbers in number symbols: one hundred, one hundred and one, one hundred and two and one hundred and ten.

Possible misconceptions
Some learners may write 100 1 instead of 101; 100 2 instead of 102; 100 10 instead of 110.

This shows that learners have not yet mastered our way of writing numbers. They are writing the numbers as we say them. It also shows that learners have a good sense of the numbers beyond 100. These learners are writing the numbers in an unconventional expanded notation: they write 100 2 to mean 100 + 2 and 100 10 to mean 100 + 10. This is a good foundation on which to build the work that follows (see Section 1.4, page 13).

Use place value cards and the bottom part of the tinted passage on page 9 to show learners how to “make” the numbers and write the symbols.

Answers
1. (a) 20  (b) 50  (c) 70  (d) 100  (e) 120
Mathematical notes
According to the Curriculum and Assessment Policy Statement (CAPS), the focus of place value for Grade 4 learners is that they “should be able to break down numbers into hundreds, tens and units using:

- the number names (number words)
- place value cards
- expanded notation

Recommended apparatus: place value cards; Dienes blocks.”


Place value cards are an indispensable tool to help learners to distinguish, in their own minds, between number symbols and the numbers themselves. It is important to use place value cards correctly. The basic place value card activity is to ask learners to “show” a number with cards. When learners are asked to show a number, for example 246, they should select and hold up the 200, 40 and 6 cards, not the 2, 4 and 6 cards.

Teaching guidelines
Let learners show the same 3-digit number in five different ways on their desks:

- by packing it out with cubes and rods or sticks and bundles
- by building it with place value cards
- by writing the number name
- by writing the number symbol
- by writing the expanded notation.

Answers
2. (a) 200   (b) 500   (c) 700   (d) 1 000
3. (a) 20   (b) 40   (c) 80   (d) 100

300 sticks are shown below, in three heaps of 100 each.
**Teaching guidelines**

Demonstrate how to use place value cards to show numbers up to 999, that is:

- cover the zeros of the hundreds card with the tens card, and
- cover the zero of the tens card with the units card.
Teaching guidelines

In question 5, ask learners to explain their answers.

Answers

4. 574
5. (a) 501
   (b) 822
6. 475
7. (a) 3 heaps; 84 sticks remaining
   (b) 8 bundles
8. four hundred and sixty-two
   462
   400 + 60 + 2
9. 702
10. 600 and 7
11. (a) 600 40 7
     (b) 700 40 8
     (c) 400 70 8
     (d) 400 30 7
     (e) 700 60 4
     (f) 500 70 4
     (g) 200 and 70
     (h) 200 and 7

4. How many sticks are shown below?

5. Which is more?
   (a) 501 sticks or 389 sticks
   (b) 699 sticks or 822 sticks
6. How many sticks is 4 heaps, 7 bundles and 5 loose sticks?
7. (a) How many heaps of hundred can be made up from 384
    sticks, and how many sticks will remain?
   (b) How many bundles of ten can be made from the sticks
       that remain?
8. Which number has the parts shown below?

   \[\begin{array}{ccc}
   400 & 2 & 60 \\
   \end{array}\]

   Write the number name and the number symbol.
   Also write the number in expanded notation.
9. Which number has the parts \[\begin{array}{cc}
   700 & 2 \end{array}\]?
10. Write down the parts of 607.
11. Write down the parts of each of these numbers.

   \begin{align*}
   & (a) 647 & (b) 746 & (c) 476 & (d) 467 \\
   & (e) 764 & (f) 674 & (g) 270 & (h) 207 \\
   \end{align*}
1.3 Building up and breaking down numbers

Mathematical notes
Most methods of calculation with whole numbers involve:
- breaking numbers down into their place value parts,
- rearranging the parts as allowed by the associative, commutative and distributive properties of operations,
- combining parts by applying knowledge of addition, subtraction and multiplication facts, and
- building up the answers.

Teaching guidelines
Section 1.3 is a short section: aim to cover this section in 20 minutes. One possibility is to use
- page 11 and the summary bar and tinted passage on page 12 for concept development,
- questions 1, 3(a) and (c), and 4(a) for classwork, and
- questions 2(c) and (d), 3(b) and (d), and 4(b) and (c) for additional practice.

Choose any 2-digit number that has both a tens part and a units part: the example provided in the Learner Book is 34. Ask learners to write pairs of numbers (in an addition number sentence) that add up to this number. Then ask learners to use the bundles and loose sticks, and place value cards to show the number. Learners should also write down the number symbol in their exercise books, as well as its place value parts.

Possible misconceptions
Check to see that all learners are using the correct place value cards (they need to use a tens card and a units card and cover the zero on the tens card with the units card). Check to see that they are writing the number symbol correctly.

Answers
1. Various possibilities, e.g. 10 + 24; 7 + 27; 17 + 17
**Answers**

2. (a) forty-seven; 47  
   (b) sixty-three; 63  
   (c) thirty-eight; 38  
   (d) eighty-four; 84  

3. (a) 70 and 4  
   (b) 50 and 9  
   (c) 40 and 7  
   (d) 80 and 3  

4. (a) 500 20 7  
   (b) 700 20 5  
   (c) 500 70 2
1.4 Number names, expanded notation and number symbols

**Mathematical notes**
In the previous sections learners broke down numbers into place value parts, i.e. hundreds, tens and units. This lays the basis for what learners will do when they add, subtract and multiply. It also lays the basis for writing numbers in expanded notation.

**Teaching guidelines**
Section 1.4 is a short section: aim to cover this section in 20 minutes. One possibility is to use
- the tinted passages, questions 1, 2 and 3, and the explanatory text on page 14 for concept development,
- questions 4, 5, 6, 7 and 8 for classwork, and
- questions 9, 10 and 11 for additional practice.

**Answers**
1. 200, 80 and 3
2. 283
3. 200 + 80 + 3
4. eight hundred and thirty-six
5. 800 + 30 + 6
6. 800, 30 and 6
Mathematical notes
Sometimes learners are asked to state the value of a digit. Question 7 asks learners for the same information in a less abstract and less alienating way.

Sometimes learners are asked for the place value of a digit. Question 8 asks learners for this same information in a less abstract and less alienating way.

Teaching guidelines
Use the explanatory text on page 14 to do concept development before learners do questions 7 and 8.

Answers
7.  
(a) The 7 tells us that 70 is one of the parts of 573.
(b) The 7 tells us that 7 is one of the parts of 357.
(c) The 7 tells us that 700 is one of the parts of 735.

8.  
(a) Its position is in the tens place.
(b) Its position is in the units place.
(c) Its position is in the hundreds place.
Answers

9. 100 101 102 103 104 105 106 107 108 109
110 111 112 113 114 115 116 117 118 119
120 121 122 123 124 125 126 127 128 129
130 131 132 133 134 135 136 137 138 139
140 141 142 143 144 145 146 147 148 149
150

10. 420 421 422 423 424 425 426 427 428 429
430 431 432 433 434 435 436 437 438 439
440 441 442 443 444 445 446 447 448 449
450 451 452 453 454 455 456 457 458 459
460

11. Number name | Number symbol | Expanded notation
--- | --- | ---
six hundred and thirty-seven | 637 | 600 + 30 + 7
six hundred and thirty-eight | 638 | 600 + 30 + 8
six hundred and thirty-nine | 639 | 600 + 30 + 9
six hundred and forty | 640 | 600 + 40
six hundred and forty-one | 641 | 600 + 40 + 1
six hundred and forty-two | 642 | 600 + 40 + 2
six hundred and forty-three | 643 | 600 + 40 + 3
six hundred and forty-four | 644 | 600 + 40 + 4
six hundred and forty-five | 645 | 600 + 40 + 5
six hundred and forty-six | 646 | 600 + 40 + 6
six hundred and forty-seven | 647 | 600 + 40 + 7
six hundred and forty-eight | 648 | 600 + 40 + 8
six hundred and forty-nine | 649 | 600 + 40 + 9
six hundred and fifty | 650 | 600 + 50
six hundred and fifty-one | 651 | 600 + 50 + 1
six hundred and fifty-two | 652 | 600 + 50 + 2
1.5 Represent, order and compare numbers

Mathematical notes
When learners have a good understanding of place value and a strong number concept they will find it easy to order and compare numbers. That is why this section is at the end of the unit: it follows lots of work on counting groups of objects and building up and breaking down numbers into place value parts.

Teaching guidelines
Try to move quickly through Section 1.5: aim to cover this section in 30 minutes. One possibility is to use
- questions 1 and 8 as mental mathematics,
- question 10 for concept development,
- questions 2, 3 and 4 for classwork, and
- questions 5, 6, 7 and 9 for additional practice.

If you have already spent more than 2 hours on this topic, you could leave Section 1.5 until you do end-of-term revision or until Term 2.

To save time for learners, you can make copies of the 10 × 10 grid and number lines provided in the Addendum on pages 435 and 436.

Answers
1. (a) 150; 153; 156; 159; 162; 165; 168; 171; 174; 177; 180; 183; 186; 189; 192; 195; 198; 201
   (b) 450; 447; 444; 441; 438; 435; 432; 429; 426; 423; 420; 417; 414; 411; 408; 405; 402; 399
2. 330 360 390 420 450 480 510 540 570 600
3. 183; 201; 479; 609; 685; 748; 989
4. 899; 810; 785; 775; 459; 309; 293
5. 450; 480; 510; 540; 570; 600; 630; 660; 690; 720; 750; 780; 810; 840; 870; 900
6. Answer on next page.
Mathematical notes
The signs <, > and = show the relationships between numbers or expressions. They are called relationship signs.

Teaching guidelines
You can use the text in question 10 to explain to learners when to use the > and < signs.

Answers

6. 
<table>
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<tr>
<th>Number</th>
<th>125</th>
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<td>650</td>
<td>675</td>
<td>700</td>
<td>725</td>
<td></td>
</tr>
</tbody>
</table>

7. (a) 225, 250, 275, 300, 325, 350, 375, 400, 425, 450, 475, 500, 525
(b) 0, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1 000

8. 900; 875; 850; 825; 800; 775; 750; 725; 700; 675; 650; 625; 600; 575; 550; 525; 500

9. 
<table>
<thead>
<tr>
<th>Number symbol</th>
<th>Number name</th>
<th>Expanded notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>634</td>
<td>six hundred and thirty-four</td>
<td>600 + 30 + 4</td>
</tr>
<tr>
<td>546</td>
<td>five hundred and forty-six</td>
<td>500 + 40 + 6</td>
</tr>
<tr>
<td>329</td>
<td>three hundred and twenty-nine</td>
<td>300 + 20 + 9</td>
</tr>
<tr>
<td>910</td>
<td>nine hundred and ten</td>
<td>900 + 10</td>
</tr>
<tr>
<td>734</td>
<td>seven hundred and thirty-four</td>
<td>700 + 30 + 4</td>
</tr>
<tr>
<td>204</td>
<td>two hundred and four</td>
<td>200 + 4</td>
</tr>
<tr>
<td>703</td>
<td>seven hundred and three</td>
<td>700 + 3</td>
</tr>
<tr>
<td>948</td>
<td>nine hundred and forty-eight</td>
<td>900 + 40 + 8</td>
</tr>
</tbody>
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10. (a) 498 < 902 (b) 676 < 687 (c) 291 > 289 (d) 653 > 635
Grade 4 Term 1 Unit 2

Number sentences

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**Mathematical background**

A number sentence is a statement about **numbers**, for example $3 \times 12 + 5 \times 12 = 8 \times 12$.

A number sentence is a **sentence**, the verb is $=$, “is equal to” or “is equivalent to”.

$3 \times 12 + 5 \times 12$ is an expression. It can be called a **calculation plan**, a description of the intention to perform certain calculations.

A number sentence with expressions on both sides, such as $3 \times 12 + 5 \times 12 = 8 \times 12$, is a **statement of equivalence**.

It states that the two different calculation plans will produce the same number, which in this case is 96.

The equals sign means that what is on either side of the equals sign has the same value.

When you press the equals sign after entering an expression on the calculator the answer pops up. Many learners think that the equals sign (=) means “here comes the answer”. If learners only work with calculations of the form $50 + 30 = c$, it can lead them to develop this limited and limiting view of the equals sign. For this reason many of the number sentences in this unit do not take the form $8 + 4 = c$. In this unit many of the number sentences have expressions on both sides of the equals sign. This is to help learners understand clearly that an equals sign only indicates that what is on either side of the equals sign has the same value (even if the expressions look different).

Most aspects of mathematics are connected. Sometimes learners do not connect different topics, or even bits of information from one question to another. This slows down their work rate. It also slows down their success rate in Mathematics. Much of this unit is designed to encourage learners to use the answer from one question in subsequent questions. It is also expected that they will use what they know from Unit 1 in this unit, and use what they learn in this unit in subsequent units. Encourage learners to link each question with what they have done previously and what they know from previous years. Help learners to develop the practice of thinking: "What have I done before that can help me here?"
2.1 State addition and subtraction facts

Mathematical notes
The fact that two different sets of calculations (calculation plans) with the same numbers produce the same answers, can be expressed in the form of a number sentence. For example, the fact that $3 \times 40 + 3 \times 8$ and $3 \times (40 + 8)$ give the same answers can be expressed with the number sentence:

$$3 \times (40 + 8) = 3 \times 40 + 3 \times 8$$

Such a number sentence is called a statement of equivalence.

Number sentences can be true or false. For example, $5 \times (3 + 4) = 5 \times 3 + 4$ is false, but $5 \times (3 + 4) = 5 \times 3 + 5 \times 4$ is true.

Teaching guidelines
Try to move quickly through Section 2.1: aim to cover this section in 45 minutes. One possibility is to use:

- question 1 for mental mathematics,
- the tinted passage on page 18 and questions 2(c) to (e), 5(d) and (e), and 6(a), (c) and (e) for concept development,
- questions 2(a) and (b), 3, 5(a), (b), (c) and (f), and 6(b) and (d) for classwork, and
- questions 4, 5(g) to (l) and 7 for additional practice.

You can begin by checking whether learners understand the meaning of true and false. You can use the example in the tinted passage.

Many learners will know that $10 + 3 = 13$. They can use this number fact to calculate $9 + 4$. Help learners to see that what they can do is to split the 10 into 9 + 1 and transfer the 1 to the 3. This will give them $9 + 4$: see alongside.

Learners can also use this in reverse, by filling up to the nearest 10, as shown alongside.

Learners can apply versions of the strategies outlined above to use question 2(c) to get the answer to 2(d), and question 2(d) to get the answer to 2(e). They can use questions 2(b) and (c) to answer question 3. They can use questions 2(a) and (c) to answer question 4.

Answers
1. (a) True  (b) False  (c) True  (d) True
2. (a) 10  (b) 9  (c) 10  (d) 12  (e) 12
3. False
4. True
Possible misconceptions
Sometimes we do not notice that we are using different words with the same meaning. Check that learners understand that *plus, add* and *the sum of* all mean the same thing. Similarly check that they understand that *subtract, minus* and *difference between* have the same meaning.

Sometimes a word or an expression can have one meaning in mathematics and another meaning in other aspects of life, or in different parts of mathematics. For example, when we ask “what is the difference between boys and girls,” this *difference between* has a different meaning to “what is the difference between 8 and 4”. Learners need to be alerted to the meaning of *difference between* in mathematics, otherwise they may say something like “eight is curvy and four is pointy”.

Answers
5. (a) True  (b) True  (c) True  (d) False; many possible answers, e.g. 80 + 70 = 100 + 50 or 80 + 70 = 90 + 60  (e) False; many possible answers, e.g. 70 + 50 = 80 + 40 or 70 + 50 = 90 + 30 or 70 + 50 = 100 + 20  (f) False; many possible answers, e.g. 19 − 5 = 20 − 6 or 19 − 5 = 18 − 4  (g) True  (h) True  (i) True  (j) True  (k) True  (l) True

6. (a) The sum of 7 and 9 is equal to the sum of 10 and 6. If you add 9 to 7 you will get the same answer as when you add 6 to 10. Seven plus nine is equal to ten plus six.  
(b) The sum of 13 and 7 is equal to the sum of 15 and 5. If you add 7 to 13 you will get the same answer as when you add 5 to 15. Thirteen plus seven is equal to fifteen plus five.  
(c) The difference between 19 and 5 is equal to the difference between 20 and 6. If you subtract 5 from 19 you will get the same answer as when you subtract 6 from 20. Nineteen minus five is equal to twenty minus six.  
(d) The sum of 5, 3 and 6 is equal to the sum of 6, 5 and 3. If you add 5 to 3 and 6 you will get the same answer as when you add 6 to 5 and 3. Five plus three plus six is equal to six plus five plus three.  
(e) The sum of six 4s is equal to the sum of four 6s. If you add six 4s you will get the same answer as when you add four 6s. Four plus four plus four plus four plus four plus four is equal to six plus six plus six plus six plus six plus six.

7. (a) 10 − 3 = 5 + 2  (b) 13 − 8 = 15 − 10  (c) 10 + 4 = 8 + 6
2.2 Equivalence

**Mathematical notes**
This section is about the concept of equivalence.

To be able to write and interpret statements of equivalence, learners need to know certain basic conventions about the order of operations that are used in symbolic calculation plans. In this section in particular learners need to know the following:

- The order in which you add two numbers does not matter, for example $20 + 70 = 70 + 20$. This is the commutative property of addition. If you don't know the answer to $20 + 70$ immediately, then it is easier to start with $70$ and add on $20$.
- When you add many numbers you can group them in different ways without changing the answer, for example $(5 + 27) + 3 = 5 + (27 + 3)$. This is the basis of the associative property of addition.
- Learners do not need to know the names of these properties.
- When part of a calculation appears in brackets, you do this first, for example $120 - (40 + 50) = 120 - 90 = 30$. This is different to $120 - 40 + 50 = 80 + 50 = 130$.

Without adhering to these conventions, different people may interpret the same calculation in different ways and confusion will result.

**Teaching guidelines**
Aim to complete this section in 45 minutes. One possibility is to use

- page 20 and questions 5 and 6(a) for concept development,
- questions 4 and 6(b) to (f) for classwork, and
- question 7 for additional practice.

You can read questions 1(a) and (b) to learners and ask them to calculate the answers. Ask them what they notice about the numbers in the questions and the answers. Use number sentences to explain that when you add two numbers, you can change the order in which you add them without changing the answer. Read the text about Lea, Ada and Piet, and show learners how to write at least one of the calculation plans in a number sentence. Focus on the fact that we first calculate what is inside brackets. Ask learners to write the other calculation plans themselves. Consolidate the role of the brackets by modelling how you would do question 6(a).

**Answers**
1. (a) 80 mangoes (b) 80 mangoes
2. (a) Yes (b) Yes
3. $(20 + 30) + 50$
Mathematical notes

Many people think that the equals sign (=) means “here comes the answer”. This is what happens when you do a calculation on a calculator: after you have pressed the equals sign the answer pops up. If learners only work with calculations of the form $50 + 30 = \square$, they can develop this limited and limiting view of the equals sign. This limited understanding of the equals sign is one reason why young learners sometimes struggle with questions of the form: $50 + \square = 80$.

The equals sign only means that what is on either side of the equals sign has the same value.

Possible misconceptions

Sometimes teachers use the expression “is the same as” when they read a number sentence with an equals sign. This can be confusing to learners as the expressions on different sides of the equals sign may look different to them. For example, in the number sentence $70 + 50 = 80 + 40$, the expressions on different sides of the equals sign look different but have the same value. It is important to be careful about what words we use when talking about the equals sign: “has the same value as” and “is equal to” are mathematically appropriate. You can emphasise that although expressions might look different they can have the same value.

Notes on questions

In question 5 learners are not expected to all come up with all possible answers. Write a list of all the answers that the class finds on the board. This will allow each learner to see a greater range of the answers.

Answers

4. (a) $13 + 7 = 20$  
   (b) $8 + 12 = 20$  
   (c) $8 + 12 = 20$  
   (d) $15 + 5 = 20$

5. Learners' answers will vary; they can include:  
   $(5 + 8) + 7$  
   $(5 + 7) + 8$  
   $5 + (7 + 8)$  
   $5 + (8 + 7)$  
   $(7 + 8) + 5$  
   $(7 + 5) + 8$  
   $7 + (8 + 5)$  
   $7 + (5 + 8)$

6. (a) True  
   (b) True  
   (c) False; $(20 - 8) - 5 = 20 - (8 + 5)$  
   (d) True  
   (e) True  
   (f) True

7. None are false (they are all true).
2.3 Describe patterns with number sentences

Teaching guidelines
Aim to complete this section in 45 minutes. One possibility is to use
- question 1 for concept development,
- questions 2, 3, 6 and 10 for classwork, and
- questions 4, 5, 7, 8 and 9 for additional practice.

You can start by focusing learners’ attention on the number of cubes in each row and in each column in Diagram A. First explain what a row is and what a column is. Ask: “How many cubes in each row in Diagram A?” “Are there the same number of cubes in each row?” Repeat these questions for the columns in Diagram A. You can show learners the number sentences for the first and second row in Diagram A. Ask them to write number sentences for all the other rows as quickly as possible. You can then use the number sentences to show learners how each time 1 more is transferred from the group of red cubes to the group of yellow cubes. Furthermore, if they know that 10 + 1 = 11 they can use transfer to work out 7 + [square] = 11.

Once learners have completed the number sentences for Diagram B and Diagram D, you can again model how you can use transfer and one of the easy number facts to generate all the other number facts represented by the number sentences.

Help learners to see how they can generalise this process to other number facts, e.g. if 250 + 50 = 300, what is the missing number in 241 + [square] = 350 and 231 + [square] = 350?

Answers
1. 8 + 3 = 11 7 + 4 = 11 6 + 5 = 11 5 + 6 = 11
   4 + 7 = 11 3 + 8 = 11 2 + 9 = 11 1 + 10 = 11
2. 8 + 2 = 10 7 + 3 = 10 6 + 4 = 10 5 + 5 = 10 4 + 6 = 10
   3 + 7 = 10 2 + 8 = 10 1 + 9 = 10 0 + 10 = 10
3. (a) 8 + 1 = 9 7 + 2 = 9 6 + 3 = 9 5 + 4 = 9
   4 + 5 = 9 3 + 6 = 9 2 + 7 = 9 1 + 8 = 9
   (b) 8 + 0 = 8 7 + 1 = 8 6 + 2 = 8 5 + 3 = 8
   4 + 4 = 8 3 + 5 = 8 2 + 6 = 8 1 + 7 = 8 0 + 8 = 8
4. Diagram A has 10 rows and 11 columns and Diagram B has 8 rows and 9 columns.
5. (a) 6 + 1 = 7 5 + 2 = 7 4 + 3 = 7
   3 + 4 = 7 2 + 5 = 7 1 + 6 = 7
   (b) 6 + 0 = 6 5 + 1 = 6 4 + 2 = 6
   3 + 3 = 6 2 + 4 = 6 1 + 5 = 6 0 + 6 = 6
**Answers**

6. Bottom to top:  
   9 + 9 = 18  
   8 + 8 = 16  
   7 + 7 = 14  
   6 + 6 = 12  
5 + 5 = 10  
4 + 4 = 8  
3 + 3 = 6  
2 + 2 = 4  
1 + 1 = 2

7. Top to bottom:  
   1 + 2 = 3  
   2 + 3 = 5  
   3 + 4 = 7  
   4 + 5 = 9  
   5 + 6 = 11  
   6 + 7 = 13  
   7 + 8 = 15  
8 + 9 = 17  
9 + 10 = 19  
10 + 11 = 21

8. Top to bottom:  
   1 + 3 = 4  
   2 + 4 = 6  
   3 + 5 = 8  
   4 + 6 = 10  
   5 + 7 = 12  
   6 + 8 = 14  
   7 + 9 = 16  
8 + 10 = 18  
9 + 11 = 20  
10 + 12 = 22

9. (a) 10 more red cubes  
   There are many ways that learners can get the answer. A quick way is to see that in Diagram E each row has 1 more red cube than in Diagram D. Learners can count the rows and see that there are 10 more red cubes.

   (b) 10 more red cubes  
   Each row in Diagram F has 1 more red cube than in Diagram E.

10. Accept any of the following answers or any others that are true.
   The same:
   • They have the same number of cubes: 110.
   • They both have red and yellow cubes.
   • They have the same number of red and yellow cubes.
   • In both diagrams both the red cubes and the yellow cubes are arranged in the shape of a triangle.
   • The arrangement of the yellow cubes is the same in both diagrams.

   Different:
   • The overall shape of Diagram A (square) and Diagram D (triangle) is different.
   • The red cubes are on the left in Diagram A; they are on the right in Diagram D.
   • The position of the red cubes differs in the diagrams.
   • In Diagram A the long sides of the triangles of cubes touch. In Diagram D the short sides of the triangles touch.
   • In Diagram A all the rows have the same number of cubes. In Diagram D each row has a different number of cubes.
   • In Diagram D, the number of red cubes is the same as the number of yellow cubes in each row. In Diagram A, no row has the same number of red cubes and yellow cubes.
   • In Diagram A, each row has a total number of 10 cubes. In Diagram D, each row has a different total number of cubes – from one row to the next the total number of cubes increases by 2 as a red cube and a yellow cube is added.
2.4 Solve and complete number sentences

Mathematical notes
Number sentences can be open or closed.

The sentence $3 \times (7 + 4) = 3 \times 7 + 3 \times 4$ is a closed sentence; all the numbers are given.

$73 + \ldots = 100$ or $73 + \square = 100$ is an open sentence; it is incomplete. It contains an unknown. It is actually a question: $73 + ? = 100$.

In algebra this is usually called an equation.

This section starts by introducing the idea of open number sentences, and completing them by finding the missing number.

Teaching guidelines
Aim to complete this section in 45 minutes. One possibility is to use
- questions 3(a) to (c) and (g) to (x) for mental mathematics,
- questions 1(c), (d), (e) and (h), 2, 3(d) to (f), and 5(a) to (l) for concept development,
- questions 1(a) and (b), and 5(m) to (x) for classwork, and
- questions 1(f), (g), (i) and (j), and question 4 for additional practice.

Notes on questions
In question 2 there are many possible answers. Take feedback on learners’ answers. Write these on the board.

The number added to 8 must be 2 more than the number added to 10; this is because 10 is 2 more than 8. Learners in Grade 4 only work with positive numbers, so the numbers added to 8 need to be 2 or more. If 1 is added to 8, then the number added to 10 is $-1$: this is beyond the requirements for Grade 4 learners.

Answers
1. (a) 5 (b) 60 (c) 200 (d) 30 (e) 6 (f) 25 (g) 500 (h) 80 (i) 250 (j) 13
2. (a) to (c) Various possibilities; accept any answers that are true, for example $8 + 3 = 10 + 1$ $8 + 20 = 10 + 18$ $8 + 7 = 10 + 5$ $8 + 2 = 10 + 0$
   $8 + 102 = 10 + 100$,
   as long as the difference between the two numbers added is 2, with the bigger one added to 8 (the left-hand side of the equation).

24 UNIT 2: NUMBER SENTENCES
Teaching guidelines

Help learners to see how they can use patterns to get to the answers. Perhaps start with questions 3(d), (e) and (f). Explain that if $3 + 6 = 9$, then $3$ tens + $6$ tens = $9$ tens, or $30 + 60 = 90$, and similarly $3$ hundreds + $6$ hundreds = $9$ hundreds, or $300 + 600 = 900$.

Also help learners to see that they can use the answers in some rows to get the answers in the next row. For example, if they have worked out that $3 + 7 = 10$ they can use this to solve $3 + 6$ because $6$ is one less than $7$; the answer is one less than $10$, i.e. $9$.

Answers

3. (a) 10  (b) 100  (c) 1 000
   (d) 9  (e) 90  (f) 900
   (g) 8  (h) 80  (i) 800
   (j) 10  (k) 100  (l) 1 000
   (m) 8  (n) 80  (o) 800
   (p) 7  (q) 70  (r) 700
   (s) 13  (t) 130  (u) 1 200
   (v) 13  (w) 130  (x) 1 100

4. (a) 7  (b) 70  (c) 700
   (d) 6  (e) 60  (f) 600
   (g) 5  (h) 50  (i) 500
   (j) 4  (k) 40  (l) 400
   (m) 3  (n) 30  (o) 300
   (p) 4  (q) 40  (r) 400
   (s) 5  (t) 50  (u) 500
   (v) 6  (w) 60  (x) 600

5. (a) 14  (b) 140  (c) 240
   (d) 9  (e) 90  (f) 190
   (g) 8  (h) 80  (i) 180
   (j) 380  (k) 370  (l) 360
   (m) 15  (n) 150  (o) 130
   (p) 7  (q) 70  (r) 670
   (s) 5  (t) 50  (u) 350
   (v) 5  (w) 50  (x) 60
Grade 4 Term 1 Unit 3          Whole numbers: Addition and subtraction

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CAPS time allocation 8 hours
CAPS page references 14 to 15 and 43 to 44

Mathematical background
Calculations with multi-digit numbers are done by breaking the task down into separate smaller tasks. For example, the single task 254 + 538 can be broken down into smaller tasks as follows:

Single task

\[254 + 538 = (200 + 50 + 4) + (500 + 30 + 8)\]

Three separate tasks

\[(The\ numbers\ are\ broken\ down)\]

\[(The\ rearrangement\ can\ be\ done\ because\ addition\ is\ commutative\ and\ associative.)\]

Learners can only use breaking-down, rearranging and building-up methods effectively if they know the addition and subtraction bonds for units and for multiples of 10 and multiples of 100 well, or can quickly reconstruct these facts. Unfortunately most learners have poor knowledge of addition and subtraction bonds, and can only reconstruct addition and subtraction facts by drawing stripes and counting. Many learners do not even try to remember addition facts like 5 + 7 = 12, and adopt the habit of drawing stripes to count.

Resources
Learners still need sets of place value cards.
You will need two sets of large place value cards for teaching purposes.
Using place value cards when doing addition is a powerful way of consolidating understanding of the role of place value parts, and of the commutative and associative properties of addition.
### 3.1 Adding on

**Critical knowledge**
Some Grade 4 learners may still count all to add two small numbers, for example count as
follows to calculate $8 + 5$:

- one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen

It is critical that learners progress beyond this way of adding, first by learning to count on from the larger number (for example nine, ten, eleven, twelve, thirteen in this case), and then to using strategies that are quicker than counting, for example filling up to the nearest ten in this case: $8 + 2 \rightarrow 10 + 3 = 13$. Practise these strategies during mental mathematics.

**Mathematical notes**
Because so many learners rely on counting to calculate, this unit builds calculation skills and strategies. It starts by encouraging counting-on skills, and then progresses to using known number facts to find other number facts. This is initially done in the Grade 2 calculation range (up to 99). By the end of the unit, learners work with the Grade 3 and Grade 4 Term 1 calculation range: adding and subtracting numbers up to 999. This is a long unit as it is building and consolidating Grade 2 and 3 skills. Encourage learners to work quickly and smartly. Aim to complete Section 3.1 in 45 minutes.

**Notes on questions**
The numbers in questions 1 to 4 were deliberately chosen to discourage counting.

**Teaching guidelines**
Talk with learners about mathematics being more than counting, and the importance of linking information and different parts of mathematics. Explain to learners that they should use the statement and answer in each question to quickly find the answer to the next question. For example, if you know $35 + 1 = 36$, then $35 + 2 = 36 + 1 = 37$. You can demonstrate question 1 using a number line.

**Answers**
1. (a) 36 (b) 37 (c) 38 (d) 39 (e) 40 (f) 41
2. (a) 80 (b) 90 (c) 100 (d) 110 (e) 120 (f) 130
3. (a) 63 (b) 59 (c) 56 (d) 58 (e) 2
4. (a) 49 (b) 50 (c) 50 (d) 51 (e) 20 (f) 21 (g) 22 (h) 23 (i) 25 (j) 26 (k) 27 (l) 28

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**Unit 3 Whole Numbers: Addition and Subtraction**

**3.1 Adding on**
1. How much is each of the following?
   (a) $35 + 1$  
   (b) $35 + 2$  
   (c) $35 + 3$  
   (d) $35 + 4$  
   (e) $35 + 5$  
   (f) $35 + 6$
2. How much is each of the following?
   (a) $70 + 10$  
   (b) $70 + 20$  
   (c) $70 + 30$  
   (d) $70 + 40$  
   (e) $70 + 50$  
   (f) $70 + 60$
3. (a) What number is seven more than 56?  
   (b) What number is three more than 56?  
   (c) What number is seven less than 63?  
   (d) What number is five less than 63?  
   (e) What is the difference between 56 and 58?

You can use one addition fact to find another addition fact. You know that 11 is 1 more than 10. So if you know that $5 + 5 = 10$, you know that $5 + 6 = 11$. You know that $3 + 3 = 6$. Two more than 6 is 8, so $3 + 5 = 8$.

If you always have to count, you will work so slowly that you will never perform well in Mathematics!

Do the questions below without counting on your fingers or other objects.

4. How much is each of the following?
   (a) $48 + 1$  
   (b) $48 + 2$  
   (c) $49 + 1$  
   (d) $48 + 3$  
   (e) $10 + 10$  
   (f) $10 + 11$  
   (g) $10 + 12$  
   (h) $10 + 13$  
   (i) $11 + 14$  
   (j) $12 + 14$  
   (k) $13 + 14$  
   (l) $14 + 14$
Possible misconceptions

Replacing a given computational task with a combination of separate tasks (as described on the introductory page and shown on page 27 of the Learner Book) only makes sense if the separate tasks are easy for learners to do. This means that learners should know or be able to quickly work out the answers to calculations like 200 + 500, 50 + 30 and 4 + 8.

Learners need to learn basic number facts and acquire skills to reconstruct basic number facts if they are to move beyond drawing stripes and counting. Sections 3.1 and 3.2 help learners to practise using given knowledge to form new knowledge and so avoid counting.

Teaching guidelines

The purpose of the tinted passage is to help learners understand why they have to learn basic addition and subtraction facts, and skills to make facts, namely in order to be able to do calculations with bigger numbers quickly and easily. Although learners do not do calculations with bigger numbers in this section, you may demonstrate the calculation of 543 + 236 (or other numbers) on the board. It works quite well to use large place value cards. The place value cards can be shifted around on the board to visually display the commutative and associative properties of addition.

Encourage learners to think: “What have I done before that can help me here?” and to use the information from previous questions in the question that follows. For example, in questions 5(b), (c) and (d) all learners need to do is add 1 to the previous answer:

(a) 6 + 6 = 12
(b) 6 + 7 = 6 + 6 + 1 = 12 + 1 = 13
(c) 7 + 7 = 6 + 1 + 7 = 13 + 1 = 14
(d) 7 + 8 = 7 + 7 + 1 = 14 + 1 = 15

In questions 5(e), (f), (g) and (h) 5 is added to the previous answer. Learners can simply count in 5s to get their answers.

In questions 5(i), (j), (k) and (l) 5 is taken away from the previous answer. Learners can simply count back in 5s.

Answers

5. (a) 12 (b) 13 (c) 14 (d) 15
(e) 10 (f) 15 (g) 20 (h) 25
(i) 30 (j) 25 (k) 20 (l) 15
(m) 10 (n) 10 (o) 10 (p) 10
(q) 7 (r) 3 (s) 6 (t) 4
(u) 10 (v) 20 (w) 30 (x) 40

To calculate 543 + 236 you can break the numbers down into their place value parts:

\[
\begin{array}{ccc}
500 & 40 & 3 \\
200 & 30 & 6 \\
\end{array}
\]

You can add the hundreds parts: 500 + 200 = 700

and the tens parts: 40 + 30 = 70

and the units parts: 3 + 6 = 9

You can then build the answer up: 700 + 70 + 9 = 779

To add numbers in this way you need to know facts like those below and many others very well.

8 + 5 = 13 \hspace{1cm} 80 + 50 = 130 \hspace{1cm} 50 + 80 = 130

13 - 8 = 5 \hspace{1cm} 130 - 50 = 80 \hspace{1cm} 6 + 4 = 10

60 + 40 = 100 \hspace{1cm} 70 + 30 = 100 \hspace{1cm} 800 - 300 = 500

You need to know the answer immediately, or you must be able to work out the answers very quickly.

In this Unit, you will strengthen your knowledge of basic addition facts, and you will learn ways to quickly form facts that you do not know immediately.
Notes on questions
Learners may approach Question 7 in different ways. They do not need to work out how many eggs are in the basket. They can simply work with the numbers they are given.

\[ + 6 = 44 \]
\[ + 9 = \]

Learners can split 9 into 6 + 3.

This means that the total number of eggs is 3 more than 44.

\[ + 9 = \]
\[ + 6 + 3 = 44 + 3 = 47 \text{ eggs.} \]

Question 7 provides a forced experience of finding a total without counting all, because counting all is impossible in this case. It is also an example of using given number facts to make new number facts.

Answers
6. (a) 3 + 7 = 10  (b) 3 + 8 = 11  
   (c) 11 – 3 = 8  (d) 11 – 8 = 3
7. “9 eggs more” means 3 more than 6 eggs. She now has 44 + 3 = 47 eggs.

3.2 Add without counting

Teaching guidelines
This section continues the focus on helping learners to build calculation strategies and to make new number facts from given number facts.

Aim to complete this section in 45 minutes.

Think about whether you can use parts of Sections 3.1 to 3.3 for baseline assessment. These sections build basic calculation skills that can be used or consolidated in mental mathematics.

Answers
1. (a) 20  (b) 23
   (c) 20  (d) 20

6. Copy and complete the number sentences. Do not count!
   (a) 3 + 7 = \ldots
   (b) 3 + 8 = \ldots
   (c) 11 – 3 = \ldots
   (d) 11 – 8 = \ldots
7. Ma Susan is collecting her hens’ eggs. She knows that if she finds 6 eggs more, she will have 44 eggs in total in her basket.
   To her surprise Ma Susan finds 9 eggs more, not only 6. How many eggs does she now have in total?

3.2 Add without counting

If you always have to count to find facts like 7 + 5 = 12, it will always take you very long to do calculations. You have to learn to make addition and subtraction facts without counting!

A good way to do that is to make new facts from facts that you already know. For example if you know that 35 + 2 = 37, it is easy to know that 35 + 3 = 38, because it is just 1 more.

In this section you will learn different ways to form new facts from facts that you already know.

1. You know that 10 + 10 = 20.
   Try to use this fact to quickly find the answers to the following. Start from 10 + 10 = 20 in each case.
   (a) 8 + 12  (b) 10 + 13
   (c) 9 + 11  (d) 7 + 13

An easy way to make a new addition fact from a fact that you know, is to shift part of one number to the other number, for example:

\[ 3\]
\[ 10 + 20 = 30 \]

By shifting 3 from the 20 to the 10, you get the new fact 13 + 17 = 30.
Answers

2. Note that the order in which two numbers are added does no matter. For example, in
(a) learners could write either 25 + 15 = 40 or 15 + 25 = 40. This applies in general to the
order of addition and the answers below.

(a) 25 + 15 = 40
(b) 23 + 17 = 40
(c) Any three from: 19 + 21 = 40; 18 + 22 = 40; 16 + 24 = 40; 14 + 26 = 40;
    13 + 27 = 40; 12 + 28 = 40; 11 + 29 = 40; 10 + 30 = 40; 9 + 31 = 40; 8 + 32 = 40;
    7 + 33 = 40; 6 + 34 = 40, etc.

3. (a) Any three from: 11 + 4 = 15; 13 + 2 = 15; 14 + 1 = 15; 9 + 6 = 15; 8 + 7 = 15
(b) Any three from: 9 + 8 = 17; 11 + 6 = 17; 12 + 5 = 17; 13 + 4 = 17; 14 + 3 = 17;
    15 + 2 = 17; 16 + 1 = 17

4. Many possibilities, e.g.
If you add 2 to 20, the answer is increased by 2:  (20 + 2) + 10 = (30 + 2) → 22 + 10 = 32
If you subtract 2 from 20 and 1 from 10, the answer is 3 less:
(20 − 2) + (10 − 1) = (30 − 3) → 18 + 9 = 27
If you add 2 to 20 and subtract 4 from 10, you must add 2 and subtract 4 from the
answer, i.e. (20 + 2) + (10 − 4) = 30 + 2 − 4 → 22 + 6 = 32 − 4 = 28
(20 + 5) + (10 + 2) = (30 + 7) → 25 + 12 = 37
(20 − 3) + (10 + 4) = (30 +1) → 17 + 14 = 31
(20 + 2) + (10 + 4) = (30 + 6) → 22 + 14 = 36
(20 − 1) + (10 − 4) = (30 − 5) → 19 + 6 = 25
(20 + 6) + (10 − 4) = (30 + 2) → 26 + 6 = 32
(20 + 3) + (10 − 2) = (30 + 1) → 23 + 8 = 31
(20 + 7) + (10 − 3) = (30 + 4) → 27 + 7 = 34

5. 8 + 8 = 16. Shifting 1 from the first 8 to the second 8 → (8 − 1) + (8 + 1) i.e. 7 + 9 = 16
   Subtracting 1 from both 7 and 16 keeps the number sentence correct.
   → (7 − 1) + 9 = (16 − 1) i.e. 6 + 9 = 15

6. 16 + 9 → 16 + 4 → 20 + 5 = 25
   28 + 7 → 28 + 2 → 30 + 5 = 35
**Answers**

7. $15 + 8 \rightarrow 15 + 5 \rightarrow 20 + 3 = 23$
   $35 + 8 \rightarrow 35 + 5 \rightarrow 40 + 3 = 43$
   $17 + 7 \rightarrow 17 + 3 \rightarrow 20 + 4 = 24$
   $46 + 9 \rightarrow 46 + 4 \rightarrow 50 + 5 = 55$

8. (a) $8 + 7 \rightarrow 8 + 2 + 5 \rightarrow 10 + 5 = 15$
   (b) $6 + 7 \rightarrow 6 + 4 + 3 \rightarrow 10 + 3 = 13$
   (c) $8 + 9 \rightarrow 8 + 2 + 7 \rightarrow 10 + 7 = 17$

9. (a) $7 + 5 = 12 \quad 12 - 5 = 7 \quad 7 + 3 \rightarrow 10 + 2 = 12 \quad 12 - 2 \rightarrow 10 - 3 = 7$
   (b) $6 + 9 = 15 \quad 15 - 9 = 6 \quad 6 + 4 \rightarrow 10 + 5 = 15 \quad 15 - 5 \rightarrow 10 - 4 = 6$

**Notes on questions**

We have stressed the importance of learners knowing certain addition-subtraction facts (number bonds) and learning calculation strategies that allow them to make one number fact from another. One method to learn number facts like bonds and tables is used in question 10 on page 31. This has been used successfully in South Africa and other countries. This is a mental mathematics activity in which learners identify the number facts they can recall at speed. Mental mathematics has two aspects: the rapid recall of number facts and the development of calculation strategies that can be applied quickly.

The purpose of question 10 is not to assess learners by giving them marks for those number facts they know. The purpose is for them to think about strategies that they can use to find the answers to questions they do not automatically know the answers for. Learners then practise these strategies with these number bonds until they are able to calculate them at speed and can rapidly recall these number facts. This consolidates the work done on calculating strategies in this unit.

**Teaching guidelines**

Ask learners to write the letters (a) to (x) in their exercise books. Then ask them to write the answers to questions (a) to (x) as you read them out. They should also have their textbooks open so that they can see the patterns in the structuring of the questions. Reading the questions to learners will help them to keep up the pace. Learners should not spend time working out the answers. Once you have finished reading out the questions, ask learners to turn to the back of their exercise books and write a log. Here they should record the questions they could not answer. They should use strategies they have learnt in this unit to work out the answers. Explain that they should then learn these calculation strategies.
It is important for learners to take responsibility for their own learning from an early age rather than always relying on the teacher or parents to tell them how well they are doing or what they still need to learn and do. We suggest that learners themselves identify which calculations they need to work on. Successful learners take responsibility for their own learning.

**Answers**

10. (a) $10 + 7 = 17$  
   (b) $7 + 8 = 15$  
   (c) $7 + 9 = 16$  
   (d) $9 + 7 = 16$  
   (e) $7 + 7 = 14$  
   (f) $7 + 6 = 13$  
   (g) $7 + 10 = 17$  
   (h) $7 + 4 = 11$  
   (i) $7 + 3 = 10$  
   (j) $10 + 9 = 19$  
   (k) $9 + 8 = 17$  
   (l) $9 + 2 = 11$  
   (m) $9 + 10 = 19$  
   (n) $9 + 4 = 13$  
   (o) $9 + 3 = 12$  
   (p) $10 + 6 = 16$  
   (q) $6 + 8 = 14$  
   (r) $6 + 7 = 13$  
   (s) $6 + 9 = 15$  
   (t) $6 + 6 = 12$  
   (u) $6 + 5 = 11$  
   (v) $6 + 10 = 16$  
   (w) $6 + 4 = 10$  
   (x) $6 + 3 = 9$

11. See above.

### 3.3 Differences between numbers

**Mathematical notes**

Subtraction has different meanings. We can also say subtraction relates to different types of situations (see the second row on page 120 in the Intermediate Phase Mathematics CAPS):

- **To decrease (take away):**
  *If I have R50 and I spend R8, I can calculate 50 – 8 to find out how much money I have left.*

- **To determine a shortfall or missing part of a sum:**
  *If an item costs R80 and I have only R65, I can calculate 80 – 65 to find out how much money I am short.*

- **To determine a difference (sometimes called comparison by difference):**
  *If Mr Setati is 64 years old and Mrs Setati is 28 years old, I can calculate 64 – 28 to establish the difference in their ages.*

**Answers**

1. 7 m
2. (a) 7  
   (b) 16  
   (c) 17  
   (d) 9  
   (e) 8  
   (f) 15  
   (g) 6  
   (h) 9
3. 5 cm

10. Copy the number sentences for which you *cannot* find the answers quickly.

   (a) $10 + 7 = \ldots$  
   (b) $7 + 8 = \ldots$  
   (c) $7 + 9 = \ldots$  
   (d) $9 + 7 = \ldots$  
   (e) $7 + 7 = \ldots$  
   (f) $7 + 6 = \ldots$  
   (g) $7 + 10 = \ldots$  
   (h) $7 + 4 = \ldots$  
   (i) $7 + 3 = \ldots$  
   (j) $10 + 9 = \ldots$  
   (k) $9 + 8 = \ldots$  
   (l) $9 + 2 = \ldots$  
   (m) $9 + 10 = \ldots$  
   (n) $9 + 4 = \ldots$  
   (o) $9 + 3 = \ldots$  
   (p) $10 + 6 = \ldots$  
   (q) $6 + 8 = \ldots$  
   (r) $6 + 7 = \ldots$  
   (s) $6 + 9 = \ldots$  
   (t) $6 + 6 = \ldots$  
   (u) $6 + 5 = \ldots$  
   (v) $6 + 10 = \ldots$  
   (w) $6 + 4 = \ldots$  
   (x) $6 + 3 = \ldots$  

11. Now complete the sentences you have copied in question 10. You may work from the facts that you know, or fill up to 10, or work in any other way you prefer.

   **3.3 Differences between numbers**

   The red candle below is 19 units long and the purple candle is 14 units long.

   The **difference** between the lengths is 5 units, or $19 - 14 = 5$.

   1. A certain tree is 16 m tall, and another tree is 9 m tall. What is the difference between the heights of the two trees?

   2. Calculate each of the following.

   (a) $16 - 9$  
   (b) $9 + 7$  
   (c) $8 + 9$  
   (d) $17 - 8$  
   (e) $17 - 9$  
   (f) $6 + 9$  
   (g) $15 - 9$  
   (h) $15 - 6$

   3. The blue line is 7 cm long, and the red line is 12 cm long.

   By how much do the lengths of the two lines differ?
Notes on questions

Questions 1, 3, 4(a) and 12 demonstrate the use of subtraction to find a difference. Questions 5 and 10 demonstrate subtraction as taking away. Questions 9 and 11 demonstrate subtraction to find a shortfall or missing part of a sum.

Teaching guidelines

Aim to complete Section 3.3 in 1 hour. One possibility is to use

- the tinted passage on page 31, questions 5, 9, 10 and 13 for concept development,
- questions 1, 3, 4, 6, 14 and 15 for classwork, and
- questions 2, 7, 8, 11, 12 and 16 for additional practice.

Note that learners should do the parts of question 17 that relate to questions 14 and 15 as classwork.

Instead of counting to get answers, learners should think: “What have I done before that can help me here?”, particularly from question 6 onwards.

Answers

4. (a) 8 units  (b) 22 units

5. The candle burns down 5 cm every half an hour. For question (c), learners will need to know that $1\frac{1}{2}$ hours = $(\frac{1}{2} + \frac{1}{2} + \frac{1}{2})$ hour, or $3 \times \frac{1}{2}$ hour, so it burns down

5 cm + 5 cm + 5 cm, or $3 \times 5$ cm.

(a) 13 cm  (b) 8 cm  (c) 3 cm

6. (a) 13  (b) 8  (c) 3  (d) 7  (e) 10  (f) 11

(g) 12  (h) 13  (i) 14

7. (a) 5  (b) 7  (c) 5  (d) 6  (e) 13  (f) 4

8. (a) $6 + 4 = 10$  (b) $10 - 6 = 4$  (c) $10 - 4 = 6$

(d) $10 - 5 = 5$  (e) $8 + 4 = 12$  (f) $12 - 4 = 8$

(g) $8 + 10 = 18$  (h) $18 - 8 = 10$  (i) $8 + 9 = 17$

(j) $17 - 8 = 9$  (k) $8 + 7 = 15$  (l) $15 - 8 = 7$

9. $8 + 2 \rightarrow 10 + 4 = 14$; you have to add 6

10. $13 - 3 \rightarrow 10 - 5 \rightarrow 5$; $13 - 8 = 5$
Mathematics notes

Most aspects of mathematics are connected. Sometimes learners do not connect different topics, or even bits of information from one question to another. This slows down their work and success rate in Mathematics. Much of this unit is designed to encourage learners to use the answer from one question in subsequent questions.

Notes on questions

Question 11 is the reverse of question 10. Learners should use what they know from one sub-question to get the answers to the other sub-questions in questions 13, 14, 15 and 16. Refer to the “Notes on questions” in Section 3.2, which talks about question 10, for how to handle questions 14, 15 and 16.

Answers

11. $8 + 2 \rightarrow 10 + 3 = 13$; you must add 5.

12. 6 m

13. (a) $14 + 6 \rightarrow 20 + 10 \rightarrow 30 + 2 = 32$
(b) $6 + 10 + 2 = 18$
(c) $32$ (from (a) and (b))
(d) 14
(e) 18

14. Learners copy the number sentences for which they cannot find the answers quickly.

(a) $10 - 5 = 5$
(b) $15 - 8 = 7$
(c) $15 - 7 = 8$
(d) $15 - 9 = 6$
(e) $15 - 5 = 10$
(f) $15 - 6 = 9$
(g) $15 - 10 = 5$
(h) $15 - 4 = 11$
(i) $5 - 3 = 2$
(j) $10 - 7 = 3$
(k) $17 - 8 = 9$
(l) $17 - 9 = 8$
(m) $9 - 7 = 2$
(n) $17 - 7 = 10$
(o) $17 - 6 = 11$
(p) $17 - 10 = 7$
(q) $7 - 4 = 3$
(r) $7 - 3 = 4$
(s) $10 - 4 = 6$
(t) $14 - 8 = 6$
(u) $14 - 7 = 7$
(v) $14 - 9 = 5$
(w) $14 - 4 = 10$
(x) $14 - 6 = 8$

15. Learners copy the number sentences for which they cannot find the answers quickly.

(a) $14 - 10 = 4$
(b) $14 - 5 = 9$
(c) $14 - 3 = 11$
(d) $10 - 9 = 1$
(e) $19 - 8 = 11$
(f) $19 - 7 = 12$
(g) $19 - 9 = 10$
(h) $19 - 2 = 17$
(i) $19 - 6 = 13$
(j) $19 - 10 = 9$
(k) $19 - 4 = 15$
(l) $19 - 3 = 16$
(m) $10 - 6 = 4$
(n) $16 - 8 = 8$
(o) $16 - 7 = 9$
(p) $16 - 9 = 7$
(q) $16 - 6 = 10$
(r) $16 - 5 = 11$
### Answers

16. Learners copy the number sentences for which they cannot find the answers quickly.

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<td>(b)</td>
<td>18 − 8 = 10</td>
<td>(c)</td>
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<tr>
<td>(d)</td>
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<td>(e)</td>
<td>8 − 4 = 4</td>
<td>(f)</td>
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<td>(g)</td>
<td>10 − 3 = 7</td>
<td>(h)</td>
<td>13 − 8 = 5</td>
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<td>(j)</td>
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<td>(s)</td>
<td>12 − 9 = 3</td>
<td>(t)</td>
<td>12 − 4 = 8</td>
<td>(u)</td>
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</tbody>
</table>

17. See answers to questions 14 to 16 above.

### 3.4 Addition facts for multiples of 10 and 100

**Teaching guidelines**

You can use question 1 as a baseline assessment. If learners cannot answer all the questions very quickly, then explain (as in the first tinted passage on page 34) that they know that 4 + 5 = 9, so 4 tens + 5 tens = 9 tens, or 40 + 50 = 90, and 4 hundreds + 5 hundreds = 9 hundreds, or 400 + 500 = 900. Then demonstrate how to use a number line first to add on in tens and then to add on multiples of ten, building up to the nearest 100 (see the tinted passages at the bottom of page 34 and top of page 35).

Aim to complete Section 3.4 in 1 hour. One possibility is to use

- question 1 on page 34 as a baseline assessment,
- the tinted passages on pages 34, 35 and 36 for concept development,
- questions 2(a) to (e), 3(a) and (b), 4(a) and (b), 5(a) and (b), 6, 7, 8 and 9 for classwork, and
- questions 2(f) to (i), 3(c) to (f), 4(c) and (d), 5(c), 10 and 11 for additional practice.

**Answers**

1. (a) 150  (b) 900  (c) 120  (d) 900  (e) 50  
(f) 400  (g) 160  (h) 60  (i) 90  (j) 1 400
**Teaching guidelines**

You can show learners how to add on in multiples of ten, bridging to the next 100, using the number line. Encourage learners to use an empty number line.

At first you can demonstrate this with units, for example $8 + 7 = \square$. Then repeat it with multiples of ten, for example $80 + 70 = \square$. Learners can either do question 2 mentally or draw rough empty number lines.

Ask learners to do question 3 mentally. Show them how to use transfer to make more number facts from doubles facts: see the second tinted passage on page 35.

**Answers**

2. (a) 150  (b) 130  (c) 130  
   (d) 60  (e) 120  (f) 170  
   (g) 160  (h) 70  (i) 150

3. (a) 40  (b) 400  (c) 60  
   (d) 600  (e) 80  (f) 800

4. (a) $40 + 60 = 100$; $30 + 70 = 100$; $20 + 80 = 100$; $10 + 90 = 100$, or any other correct facts. Some learners may generalise the strategy from the example and offer other solutions, such as $45 + 55 = 100$.
   (b) $400 + 600 = 1000$; $300 + 700 = 1000$; $200 + 800 = 1000$; $100 + 900 = 1000$, or any other correct facts.
   (c) $30 + 50 = 80$; $20 + 60 = 80$; $10 + 70 = 80$, or any other correct facts.
   (d) $300 + 500 = 800$; $200 + 600 = 800$; $100 + 700 = 800$, or any other correct facts.
Answers

5. (a) Examples: $(20 + 10) + 30 = (50 + 10) \rightarrow 30 + 30 = 60$
   $(20 + 10) + (30 + 10) = (50 + 20) \rightarrow 30 + 40 = 70$
   $20 + (30 + 10) = (50 + 10) \rightarrow 20 + 40 = 60$
   $(20 + 20) + (30 + 20) = (50 + 40) \rightarrow 40 + 50 = 90$
   $(20 + 20) + (30 + 10) = (50 + 30) \rightarrow 40 + 40 = 80$

(b) Examples: $(200 + 200) + 300 = (500 + 200) \rightarrow 400 + 300 = 700$
   $(200 + 200) + (300 + 100) = (500 + 300) \rightarrow 400 + 400 = 800$
   $200 + (300 + 200) = (500 + 200) \rightarrow 200 + 500 = 700$
   $(200 + 100) + (300 + 300) = (500 + 400) \rightarrow 300 + 600 = 900$
   $(200 + 100) + (300 + 100) = (500 + 400) \rightarrow 500 + 400 = 900$

(c) Examples: $(300 + 200) + 400 = (700 + 200) \rightarrow 500 + 400 = 900$
   $(300 + 100) + (400 + 200) = (700 + 300) \rightarrow 400 + 600 = 1000$
   $300 + (400 + 100) = (700 + 100) \rightarrow 300 + 500 = 800$
   $(300 + 100) + (400 + 100) = (700 + 200) \rightarrow 400 + 500 = 900$
   $(300 + 100) + 400 = (700 + 100) \rightarrow 400 + 400 = 800$

6. (a) $80 + 90 = 170$  (b) $80 + 80 = 160$  (c) $80 + 60 = 140$
   (d) $80 + 10 = 90$  (e) $80 + 40 = 120$  (f) $80 + 30 = 110$
   (g) $10 + 30 = 40$  (h) $30 + 80 = 110$  (i) $30 + 70 = 100$
   (j) $30 + 90 = 120$  (k) $30 + 30 = 60$  (l) $30 + 60 = 90$
   (m) $30 + 10 = 40$  (n) $30 + 40 = 70$  (o) $30 + 50 = 80$

7. See above.

8. (a) $100 + 700 = 800$  (b) $700 + 200 = 900$
   (b) $900 + 100 = 1000$  (d) $300 + 700 = 1000$
   (e) $800 + 900 = 1700$  (f) $600 + 400 = 1000$
   (g) $100 + 400 = 500$  (h) $400 + 300 = 700$
   (i) $400 + 200 = 600$  (j) $200 + 300 = 500$

9. See above.
Answers

10. (a) 600 (b) 600
    (c) 100 (d) 400
    (e) 600 (f) 700
    (g) 900 (h) 30
    (i) 90 (j) 70
    (k) 40 (l) 60
    (m) 770 (n) 495

11. (a) 780 (b) 900
    (c) 950 (d) 650

3.5 Subtraction facts for multiples of 10 and 100

Mathematical notes

This section focuses on subtraction facts for multiples of 10 and 100. It focuses learners’ attention on the connection between addition and subtraction.

Teaching guidelines

Aim to complete Section 3.5 in 1 hour. One possibility is to use

- the tinted passages on pages 38 and 40, questions 6(a) and (b), 9(b) and 10(a) for concept development,
- questions 1, 2, 3, 4, 5, 6(c) and (d), 7, 8, 9(a), (c) and (d), 10(b), (c) and (d), 11, 12 and 13 for classwork, and
- questions 14 and 15 for additional practice. Explain to learners that they should first read the first tinted passage on page 40.

Let learners start by working through questions 1 to 5 as quickly as they can. Then use the tinted passage at the top of page 38 to show learners the connection between addition and subtraction. They ought to have used this in questions 1 to 5. They also should have seen that questions 1, 2 and 3 were connected by the numbers and operations. Similarly questions 4 and 5 are connected by the numbers and operations.

Answers

1. (a) 500 chickens (b) 700 chickens
2. (a) 700 (b) 500
3. 500
4. 500 sheep
5. (a) 300 (b) 200

10. Find the numbers that are missing from the number sentences below. Write the answers only.
   (a) $400 + \ldots = 1000$
   (b) $1000 - 400 = \ldots$
   (c) $40 + 60 = \ldots$
   (d) $340 + 60 = \ldots$
   (e) $570 + 30 = \ldots$
   (f) $570 + 130 = \ldots$
   (g) $570 + 330 = \ldots$
   (h) $270 + \ldots = 300$
   (i) $210 + \ldots = 300$
   (j) $530 + \ldots = 600$
   (k) $160 + \ldots = 200$
   (l) $740 + \ldots = 800$
   (m) $400 + 370 = \ldots$
   (n) $300 + 195 = \ldots$

11. How much is each of the following?
   (a) $300 + 400 + 20 + 60$
   (b) $200 + 300 + 400$
   (c) $500 + 30 + 400 + 20$
   (d) $200 + 300 + 80 + 70$
Mathematical notes
In this section learners work with the relationship between addition and subtraction. If the same numbers are used, then subtraction undoes what addition does, for example $3 + 4 = 7$ implies that $7 - 4 = 3$ and also that $7 - 3 = 4$. Similarly, addition undoes what subtraction does: if $8 - 3 = 5$, then $3 + 5 = 8$ and $5 + 3 = 8$. This means that learners can use addition to check their subtraction calculations and use subtraction to check their addition calculations. It also means that learners can use addition to do subtraction calculations. This is the focus of this section. More particularly, learners use “filling up” to 100, as they did in Section 3.4.

In Unit 2 Section 2.2 of this guide we discussed the commutative property of addition.

- The order in which you add two numbers does not matter. For example, $200 + 700 = 700 + 200$. This is the commutative property of addition. If you don’t know the answer to $200 + 700$ immediately, then it is easier to start with 700 and add on 200.

We mentioned that learners do not need to know the name of this property, but that they should use it to make calculations more manageable.

Teaching guidelines
This section starts with word problems. Learners can use any method they like to solve the problems, but do discourage counting in units. The questions have been designed to highlight the relationship between addition and subtraction. In the Intermediate Phase CAPS addition and subtraction are always discussed together. This is because learners can use addition to do subtraction calculations.

Focus learners’ attention on question 6. Suggest to them that they can rewrite the number sentences to begin with the biggest number, for example $200 + 700 = 700 + 200$. It is far more efficient to count on from 700. This is dealt with again in Section 3.6, question 4, page 41.

Use the tinted passages for concept development and especially for explaining the “filling up” method. You might like to refer to the “Teaching guidelines” for Term 2 Unit 2 Section 2.2, which outline a suggested role play to explain using adding on to subtract.

Answers
6. (a) $90; 90 - 50 = 40$ and $90 - 40 = 50$
   (b) $900; 900 - 300 = 600$ and $900 - 600 = 300$
   (c) $80; 80 - 30 = 50$ and $80 - 50 = 30$
   (d) $900; 900 - 200 = 700$ and $900 - 700 = 200$
Notes on questions

In question 12 learners practise and apply what they have learnt in this section. It is important that learners show addition number sentences for each subtraction number sentence. This movement between addition and subtraction will encourage the development of mental calculation strategies and efficiency with number bonds. Learners should also take note of the connections between sub-questions, e.g. sub-questions (b), (c), (e) and (f) use transfer to get the answers quickly; i.e., if $170 - 80 = 90$, then $170 - 90 = 80$. They do not have to work out the second calculation.

Answers

7. $160 - 70 = 30 + 60 = 90$

8. $130 - 80 = 20 + 30 = 50$

9. (a) $70 + 30 \to 100 + 20 = 120$, so $120 - 70 = 30 + 20 = 50$
    (b) $50 + 50 \to 100 + 40 = 140$, so $140 - 50 = 50 + 40 = 90$
    (c) $70 + 30 \to 100 + 60 = 160$, so $160 - 70 = 30 + 60 = 90$
    (d) $50 + 50 \to 100 + 30 = 130$, so $130 - 50 = 50 + 30 = 80$

10. (a) $120 - 20 \to 100 - 60 = 40$, so $120 - 80 = 40$
     (b) $140 - 40 \to 100 - 30 = 70$, so $140 - 70 = 70$
     (c) $150 - 50 \to 100 - 30 = 70$, so $150 - 80 = 70$
     (d) $130 - 30 \to 100 - 50 = 50$, so $130 - 80 = 50$

11. Learners check their answers by doing addition, e.g. question 9(a): $70 + 50 = 120$

12. (a) $100 - 70 = 30$
    (b) $170 - 80 = 90$
    (c) $170 - 90 = 80$
    (d) $130 - 90 = 40$
    (e) $170 - 70 = 100$
    (f) $170 - 60 = 110$
    (g) $170 - 10 = 160$
    (h) $130 - 60 = 70$
    (i) $160 - 50 = 110$
    (j) $100 - 40 = 60$
    (k) $140 - 80 = 60$
    (l) $140 - 70 = 70$
    (m) $140 - 90 = 50$
    (n) $140 - 40 = 100$
    (o) $140 - 60 = 80$
    (p) $100 - 90 = 10$
    (q) $190 - 80 = 110$
    (r) $190 - 70 = 120$
    (s) $100 - 60 = 40$
    (t) $160 - 80 = 80$
    (u) $160 - 70 = 90$
    (v) $160 - 90 = 70$
    (w) $160 - 60 = 100$
    (x) $150 - 70 = 80$

13. See above.

7. Make a rough drawing of a number line to show how $160 - 70$ can be calculated by adding on to 70 as shown on the previous page.

8. Make a rough drawing of a number line to show how $130 - 80$ can be calculated by subtracting 80 piece by piece.

9. Use arrows as you did before to show how the following can be calculated by filling up to 100.
   (a) $120 - 70$
   (b) $140 - 50$
   (c) $160 - 70$
   (d) $130 - 50$

10. Show how the following can be calculated by subtracting piece by piece.
    (a) $120 - 80$
    (b) $140 - 70$
    (c) $150 - 80$
    (d) $130 - 80$

11. Check each of your answers for questions 9 and 10 by doing addition.

12. Write the answers for the questions that you can do quickly, and show with addition that your answers are right. Copy the number sentences for which you cannot find the answers quickly.
    (a) $100 - 70 = \ldots$
    (b) $170 - 80 = \ldots$
    (c) $170 - 90 = \ldots$
    (d) $130 - 90 = \ldots$
    (e) $170 - 70 = \ldots$
    (f) $170 - 60 = \ldots$
    (g) $170 - 10 = \ldots$
    (h) $130 - 60 = \ldots$
    (i) $160 - 50 = \ldots$
    (j) $100 - 40 = \ldots$
    (k) $140 - 80 = \ldots$
    (l) $140 - 70 = \ldots$
    (m) $140 - 90 = \ldots$
    (n) $140 - 40 = \ldots$
    (o) $140 - 60 = \ldots$
    (p) $100 - 90 = \ldots$
    (q) $190 - 80 = \ldots$
    (r) $190 - 70 = \ldots$
    (s) $100 - 60 = \ldots$
    (t) $160 - 80 = \ldots$
    (u) $160 - 70 = \ldots$
    (v) $160 - 90 = \ldots$
    (w) $160 - 60 = \ldots$
    (x) $150 - 70 = \ldots$
Answers

14. 900 - 100 = 800
    900 - 500 = 400
    900 - 700 = 200
    900 - 200 = 700

15. (a) 500   (b) 300   (c) 400   (d) 600
    (e) 500   (f) 400   (g) 700   (h) 400

3.6 Add and subtract with multiples of 10

Mathematical notes
This section consolidates the work done in Sections 3.4 and 3.5. Learners continue to use the following calculation strategies:
- breaking down numbers into hundreds and tens (this is further extended in Section 3.8)
- filling up to a multiple of hundred (this is further extended in Section 3.8)
- adding on
- rounding off and compensating (this is further extended in Section 3.7)
- thinking of number line images to help when calculating.

New methods are continuously introduced to learners so that they have a range of methods they can use. This will allow them to be flexible in their calculation methods.

Teaching guidelines
Aim to complete Section 3.6 in 1 hour. One possibility is to use
- the tinted passages on pages 41 and 42, and question 3 for concept development,
- questions 1, 2, 4(a) to (e), 9 and 10 for classwork, and
- questions 4(f) to (j), 5, 6, 7 and 8 for additional practice.

Answers

1. (a) 350   (b) 350   (c) 230   (d) 820
2. (a) 350 because 270 + 30 → 300 + 50 → 350
    (b) 540   (c) 650   (d) 440
Notes on questions

In question 4 learners can use any method. Please take note of learners’ preferred method of calculation and the methods they choose not to use. It is important that for question 4(d) and (h) learners recognise that they can “switch” the numbers around and place the bigger number first, i.e. (d) 230 + 60 and (h) 380 + 70. This will allow for a far more efficient calculation.

Answers

3. (a) 200 + 70 + 70 → 200 + 140 → 200 + 100 + 40 → 300 + 40 = 340
   270 + 30 → 300 + 40 = 340
(b) 600 + 60 + 80 → 600 + 140 → 600 + 100 + 40 → 700 + 40 = 740
   660 + 40 → 700 + 40 = 740
(c) 300 + 50 + 200 + 80 → 300 + 200 + 130 → 500 + 100 + 30 = 630
   350 + 50 → 400 + 230 → 400 + 200 + 30 → 600 + 30 = 630
4. (a) 810  (b) 810  (c) 530  (d) 290
   (e) 720  (f) 760  (g) 820  (h) 450
   (i) 830  (j) 890

Teaching guidelines

The second tinted passage demonstrates two methods that learners can use to do addition and subtraction calculations.

Learners have used rounding off in Grade 3. Here they are using rounding off as part of a calculation strategy. You might like to look at the “Teaching guidelines” on rounding off in Section 3.7. You can use the tinted passage at the bottom of page 43 to explain rounding off and compensating, but it is also useful to illustrate this on a number line. For example, 830 – 270 can be shown in stages like this: 830 – 300 → 530 + 30 = 560

When learners do rounding off and compensating it is important that they remember to put back the numbers. It is important that they practise this method often in mental mathematics, especially with a lower number range.
Answers
5. (a) 490; 460  (b) 490; 460  (c) \(360 + 490 = 850; 270 + 460 = 730\)
6. (a) 260  (b) 240  (c) 270  (d) 480  
   (e) 340  (f) 80  (g) 140  (h) 590
   Check answers with addition.

Teaching guidelines
Learners often break down numbers into place value parts. In some subtraction examples this does not make the calculation easier.

You can use the tinted passage on page 42 to explain to learners how to break down numbers and then build them up to make the subtraction more manageable. Learners can say to themselves: “How can I split and recombine these particular numbers to make the calculation easier?” You can also use arrow diagrams like the ones below to help learners recognise ways of breaking the numbers down.

```
720  450
\[\downarrow\] \[\downarrow\] \[\downarrow\] \[\downarrow\]
700  20  400  50

This is easy to do.

700  400  20  50

This is NOT easy to do.
```

Let’s try another way to break it down:

```
600  120  450
\[\downarrow\] \[\downarrow\] \[\downarrow\] \[\downarrow\]
600  400  200  120  50

600 \(\to\) 400 = 200  This is easy to do.

120 \(\to\) 50 = 70  This is manageable.
```

Focus learners’ attention on the recording strategy suggested in the tinted passage.

Possible misconceptions
Some learners may assume that because they can swap the order of numbers when they add, they can do the same with subtraction. Learners sometimes swap the order of numbers they subtract, especially in examples like \(20 - 50\). However, subtraction is not commutative. This needs to be stressed through examples and be explicitly stated: if you swap the order of numbers when you subtract you are doing a different calculation and will get a different answer.
Answers

7. (a) 270    (b) 480    (c) 340    (d) 80
8. Learners compare their answers with the ones they had in question 6.
9. (a) 590    (b) 590
   (c) 300    (d) 170
   (e) 270    (f) 540
10. Learners write a short paragraph on Lerato’s method.

3.7 Round off and estimate

Mathematical notes
In this section learners use rounding off and estimating as a calculation strategy. Learners will first round off numbers to the nearest ten and then round off the same numbers to the nearest hundred, and then calculate.

Teaching guidelines
Aim to complete Section 3.7 in 1 hour.
One possibility is to use
- the tinted passage on page 43 to 44 and the one from Grade 6 alongside, questions 1(a) and (b), 2(a) and (b), and 6 (and related parts of questions 7 and 9) for concept development,
- questions 1(c) to (h), 3(a), (b) and (c), 4(a) and (b), and 8 (and related parts of questions 7 and 9) for classwork, and
- questions 3(d), (e) and (f), 4(c) and (d), and 5 (and related parts of questions 7 and 9) for additional practice.

You can use a number line to help learners to see the connection between rounding to the nearest 10 and seeing the closest 10.

Pages 14 to 16 of the Grade 6 Learner Book illustrate how you can use a number line to show rounding off.
A commonly taught procedure is to underline the tens part of the number and to circle the units part. For example, if rounding 34, you would do this: 3\underline{4}. Learners are then told that if the number in the circle is 5 or more, you increase the underlined number, but if the number in the circle is less than 5 the underlined number stays the same. It is best to avoid teaching this procedure. It does not help learners to understand the meaning of rounding off. It causes problems when learners need to round to 5, from Grade 5 onwards.

Rather stick with number lines that show the multiples and which are closest or nearest. When using number lines you can see that 638 is more than halfway between 630 and 640, so it is rounded up to 640.

However, 638 is less than halfway between 600 and 700, so it is rounded down to 600.

**Critical knowledge**

Rounding off to the nearest 10 means seeing which multiple of 10 is closest to the number being rounded. Fives are halfway between tens, they are rounded up.

Rounding off to the nearest 100 means seeing which multiple of 100 is closest to the number being rounded. Fifties are halfway between hundreds, they are rounded up.

Learners need to understand how rounding off can help them in Mathematics and in the world.

**Answers**

1. (a) 390  (b) 480  (c) 190  (d) 590  
   (e) 250  (f) 260  (g) 250  (h) 60 
2. (a) 400  (b) 500  (c) 200  (d) 600  
   (e) 200  (f) 300  (g) 300  (h) 100 
3. (a) 40 + 50 = 90  (b) 50 + 50 = 100  (c) 50 + 60 = 110  
   (d) 70 – 40 = 30  (e) 80 – 40 = 40  (f) 80 – 30 = 50 
4. (a) 300 + 500 = 800  
   (c) 300 + 500 = 800  
   (b) 900 – 400 = 500  
   (d) 900 – 300 = 600 
5. There are approximately 100 + 400 + 300 = 800 houses.

**Example**

A traveller has driven 268 kilometres of the 859 kilometres to his destination. Approximately how far does he still have to drive?

268 and 859 rounded off to the nearest hundred are 300 and 900. The traveller still has to drive approximately 900 – 300 kilometres, that is 600 kilometres.

Round off to the nearest hundred when you do questions 5 and 6.

5. There are 108 houses in one town, 362 houses in another town and 269 houses in a third town. Approximately how many houses are there in the three towns together?
Notes on questions

Once learners have completed question 8, make time to talk about the usefulness of rounding in the context of the word sum. Ask learners how rounding off helps Mrs Tshabalala, or anyone else, when shopping.

Answers

6. Approximately $700 - 600 = 100$ cows are left.
7. Question 5: $110 + 360 + 270 = 740$ Question 6: $730 - 570 = 160$
8. $50 + 130 + 30 + 70 + 60 + 60 + 200 + 70 = R670$
9. Question 5: Rounding: $100 + 400 + 300 = 800$ houses Compensation: $800 + 8 - 38 - 31 = 739$ houses
   Question 6: Rounding: $700 - 600 = 100$ cows
   Compensation: $100 + 34 + 32 = 166$ cows

Learners may find the compensating section of the question above challenging. They rounded 734 down to 700, so they add back 34. They rounded 568 up to 600. They subtracted more than they should have, so they have to add 32 back.

Question 8: Rounding: $50 + 130 + 30 + 70 + 60 + 60 + 200 + 70 = R670$
   Compensation: $670 - 3 + 4 + 4 - 2 - 2 - 4 = R667$

3.8 Break down and build up numbers

Teaching guidelines

This is a critically important section. It provides for consolidation of the break-down, rearrange and build-up method of addition and subtraction (that learners will eventually, in Grade 5, document in the vertical column notation).

Demonstrate the calculation of $364 + 588$ as outlined in the tinted passage, but let learners complete the last step, as asked in question 1.

Question 1 (and 8) address an important subskill, namely transfer, which means to convert the sum obtained when different place value parts are added or subtracted in the break-down and build-up method to the standard expanded notation for a number, e.g.

$800 + 140 + 12 = 800 + (100 + 40) + (10 + 2) = (800 + 100) + (40 + 10) + 2 = 900 + 50 + 2$

(Learners need not express it in this way with brackets.)

Mathematical notes

In this and other sections, calculation strategies are named. Learners are not expected to remember and use the names of the strategies. Learners are never given the name of a strategy in a test or exam and asked to use the named strategy. Learners are only required to know how to use the range of strategies. It is also expected that they should be able to decide which calculation strategy will suit them best in any specific situation.
Teaching guidelines

Allow learners to engage with questions 2 and 3 on their own. When they have engaged with question 3 for at least 5 minutes, demonstrate the break-down, rearrange and build-up method on the board, using the example in the tinted passage.

You can use your large demonstration place value cards on the board, as shown below, to demonstrate how to break down numbers into place value parts, rearrange the parts, combine parts and then build up the answer. You can work with the cards on the left-hand side of the board, and document the work in writing on the right-hand side of the board.

\[
\begin{align*}
458 + 276 & = 400 + 50 + 8 + 200 + 70 + 6 \\
& = 400 + 200 + 50 + 70 + 8 + 6 \\
& = 600 + 120 + 14 \\
& = 734
\end{align*}
\]

Now separate the cards to produce a new display on the board:

\[
\begin{align*}
458 + 276 & = 400 + 50 + 8 + 200 + 70 + 6 \\
& = 400 + 200 + 50 + 70 + 8 + 6 \\
& = 600 + 120 + 14 \\
& = 734
\end{align*}
\]

Rearrange the cards to produce another new display on the board:

\[
\begin{align*}
458 + 276 & = 400 + 50 + 8 + 200 + 70 + 6 \\
& = 400 + 200 + 50 + 70 + 8 + 6 \\
& = 600 + 120 + 14 \\
& = 734
\end{align*}
\]

Ask learners how much 400 + 200, 50 + 70 and 8 + 6 is, then replace the hundreds cards (400 and 200) on the board with the 600 card, the tens cards with a 100 card and a 20 card, and the units cards with a 10 card and a 4 card:

\[
\begin{align*}
458 + 276 & = 600 + 120 + 14 \\
& = 734
\end{align*}
\]

Rearrange the cards so that the display is now as below:

\[
\begin{align*}
458 + 276 & = 600 + 120 + 14 \\
& = 734
\end{align*}
\]

Allow learners to use place value cards to support their work for question 4 if they wish to, but allow them to decide individually whether they do so or not. (While aids like the place value cards can be very useful, learners should also press along to learn to calculate without aids as soon as they can.)

Answers

1. 952 2. 787 3. 1,042 4. (a) 695 (b) 675 (c) 814 (d) 766

2. Two numbers are given in expanded notation below. Add the two numbers and write the answer as a single number.

   The numbers are 400 + 30 + 4 and 300 + 50 + 3.

3. Calculate 364 + 678.

   To calculate 458 + 276 you may break down the numbers and work with the parts, then build up the answer:

   Break down:
   
   \[
   458 = 400 + 50 + 8 + 200 + 70 + 6
   \]

   Work with the parts:
   
   \[
   400 + 200 = 600 \\
   50 + 70 = 120 \\
   8 + 6 = 14
   \]

   Build up the answer:
   
   \[
   600 + 120 + 14 = 700 + 30 + 4 = 734
   \]

4. Calculate.

   (a) 239 + 456
   (b) 387 + 288
   (c) 368 + 446
   (d) 532 + 234

Two different ways to calculate 734 – 568 are shown below.

A. The filling-up or add-on method

To calculate how much 734 – 568 is you may ask yourself how much you must add to 568 to reach 734.

You may then do this in steps as shown below.

\[
568 + 32 = 600 + 134 = 734
\]

You had to add 32 and 134 which is a total of 166.

So 734 – 568 = 166.
Answers

5. (a) \(900 - 600 + 30 - 20 + 7 - 4 = 300 + 10 + 3 = 313\)
   (b) \(800 - 400 + 70 - 10 + 6 - 5 = 400 + 30 + 1 = 431\)
   (c) \(300 + 40 - 30 + 8 - 3 = 300 + 10 + 5 = 315\)
   (d) \(900 - 300 + 80 - 50 + 7 - 2 = 600 + 30 + 5 = 635\)

6. (a) \(624 + 76 \rightarrow 700 + 200 \rightarrow 900 + 37 = 937,\)
    and \(76 + 200 + 37 \rightarrow 200 + 70 + 30 + 6 + 7 = 313\)
    so, \(937 - 624 = 313\)
   (b) \(445 + 55 \rightarrow 500 + 300 \rightarrow 800 + 76 = 876,\)
    and \(55 + 300 + 76 \rightarrow 300 + 50 + 70 + 5 + 6 = 431\)
    so, \(876 - 445 = 431\)
   (c) \(315\)
   (d) \(635\)

7. \(924 = 800 + 110 + 14\) and \(637 = 600 + 30 + 7\)
   \(800 - 600 = 200;\) \(110 - 30 = 80;\) \(14 - 7 = 7\)
   so, \(924 - 637 = 287\)

8. (a) \(843\)  (b) \(843\)
    (c) \(689\)  (d) \(699\)

Notes on questions

In question 7 it is not helpful to simply break down both numbers into their place value parts. Learners will have to remember the method that was outlined in Section 3.6 on page 42. For those learners who do not remember this method, you can use the tinted passage on page 48 to help them. You can also refer back to the arrow diagrams that were shown in this guide in Section 3.5.

In question 8 learners build up the number from parts and write it as a single number. Questions 8(b), (c) and (d) are important because learners will break down numbers in this way when doing subtraction using the breaking down method. Question 8 prepares learners for question 9 and other instances where they will be using the breaking down method.
Answers

9. (a) 258   (b) 376   
   (c) 183   (d) 565
10. Different method, but same answers as for question 9.

11. (a) 531   (b) 534   
   (c) 258   (d) 237

12. (a) No   (b) Own investigation

Notes on questions
Question 11 allows learners to practise the relationship between addition and subtraction. By the end of this unit they should know that a subtraction calculation can be checked by doing addition, and vice versa.

Question 12 focuses learners’ attention on the fact that the subtraction sign only applies to the number immediately behind it: for example $8 - 2 + 3 \neq 8 - 5$. If you want the subtraction sign to apply to all the numbers that follow, you have to insert brackets: for example $8 - (2 + 3) = 8 - 5$.

Possible misconceptions
In question 12 learners can investigate by doing both Janice’s and Zain’s calculations. They will see that they get different answers. They can then try calculations with similar structures but different (smaller) numbers, for example $10 - 3 + 4$. They can also swap the order of the numbers and operations, for example $10 + 4 - 3$. They should try to make some general statements. They can try using several more sets of small numbers. It is important that there is discussion after this calculation.

When we have to calculate $843 - 385$ and we break down $843$ and $385$, we find that the parts are not convenient for calculating $843 - 385$:

$843 = 800 + 40 + 3$
$385 = 300 + 80 + 5$

Fortunately we can make a plan:

We can replace $800 + 40 + 3$ with $700 + 130 + 13$.

$843 = 700 + 130 + 13$
$385 = 300 + 80 + 5$

It is now easy to work with the parts, that is to subtract the hundreds parts, the tens parts and the units parts:

$700 - 300 = 400$  $130 - 80 = 50$  $13 - 5 = 8$

Now you can build up the answer:

$843 - 385 = 400 + 50 + 8$, which is 458.

9. Use the break down and build up method to calculate these.
   (a) 934 - 676   (b) 845 - 469
   (c) 348 - 165   (d) 952 - 387

10. Do the calculations in question 9 by using the filling-up method. Then compare the answers that you got with the two methods to check whether you worked correctly.

11. Use any method that you prefer to do each calculation below. Use addition to check your answers.
   (a) 876 - 345   (b) 766 - 232
   (c) 734 - 476   (d) 624 - 387

    Janice first calculates $760 - 340$; then she adds $260$.
    Zain first calculates $340 + 260$; then he subtracts from $760$.
    (a) Do you expect them to get the same answer?
    (b) Investigate whether your expectation is right.
3.9 Solve problems

Teaching guidelines

Learners have learnt and practised a range of calculating strategies in this unit. These include adding on, working from known number facts, using doubles and near doubles, transferring amounts from one number to another to make the calculation easier, building up to tens/hundreds, rounding off and compensating, and breaking down and building up numbers. They can use any of these strategies when they solve these problems.

There are many calculations you could do to solve most of these problems. If learners use a different strategy or calculation plan from the one you expect, check to see whether it is also valid. For example, in question 1(a) learners may add on to get an answer, i.e. do $78 + 2 + 20 + 53 = 153$ (the shorter stick is 75 cm), where you might have subtracted to get the answer $153 \text{ cm} - 78 \text{ cm} = 75 \text{ cm}$. The only strategy that should be discouraged is counting in ones to get the answer.

It can build learners’ confidence if they approach problems with the mindset that they have the tools to solve the problem. This is why we have suggested that you encourage learners to think: “What have I done before that can help me here?”

Aim to complete Section 3.9 in 1½ hours. One possibility is to use

- questions 1(a), 2, 7, 8, 12 and 13 for concept development,
- questions 1(b), 4, 5 and 9 for classwork, and
- questions 1(c), 3, 6, 10 and 11 for additional practice.

Notes on questions

In question 2(a) the difference between 349 m and 276 m is less than 100 m. This means that it is not sensible to round to 100 m.

Answers

1. (a) $153 \text{ cm} - 78 \text{ cm} = 75 \text{ cm}$  
   $153 \text{ cm} + 75 \text{ cm} = 228 \text{ cm}$

(b) $364 \text{ cm} - 118 \text{ cm} = 246 \text{ cm}$
   $364 \text{ cm} + 118 \text{ cm} = 482 \text{ cm}$

(c) $387 \text{ cm} - 185 \text{ cm} = 202 \text{ cm}$
   $387 \text{ cm} + 202 \text{ cm} = 589 \text{ cm}$

2. (a) $300 \text{ m} - 300 \text{ m} = 0 \text{ m}$
   (b) $350 \text{ m} - 280 \text{ m} = 70 \text{ m}$
   (c) 73 m 
   (d) 73 m 
   (e) 3 m
Teaching guidelines

Remember that learners need to estimate their answers before calculating. You can help learners to estimate by asking them to choose the best estimate from a choice of three to five options. For example, in question 3 you could ask them to choose the best estimate from:

(i) 600    (ii) 900    (iii) 300    (iv) 6000    (v) 9000

They should also explain their choice.

There are a range of different ways in which learners could add or subtract to solve these problems. For example, in question 4 learners should estimate that the answer will be about 400. They could add on and compensate: 507 + 400 → 907 − 5 = 902. They will then get 400 girls − 5 girls = 395 girls. Or they could subtract 902 − 507. This could be done in stages: 902 − 500 → 402 − 2 → 400 − 5 = 395.

Notes on questions

Questions 4 and 5 have the same answer because question 5 is one possible number sentence that could be used to solve question 4. This is also true for questions 7 and 8. Questions 5 and 7 prepare learners for how they could approach question 9, but also questions 10, 12 and 13.

Answers

3. 839 fruit trees
4. 395 girls
5. 395
6. R910
7. 547
8. 547 trees
9. □ + 324 = 713
10. R703
11. 610 hamburgers
12. R166
13. 632 pumpkins

In all the questions below, make an estimate of the answer before you do the accurate calculations. Write your estimates down.

3. Johannes has 168 peach trees, 392 plum trees and 279 pear trees in his orchard. How many fruit trees are there altogether?
4. Out of the 902 children in a school, 507 are boys. How many girls are there in the school?
5. What number is missing from this number sentence?
   902 = 507 + □
6. John saved R374 for a bike in one year. The next year he saved another R536. How much did he save over the two years?
7. What number is missing from 308 + □ = 855?
8. A farmer has already pruned 308 of her 855 peach trees. How many trees must she still prune?
9. Write a number sentence, such as in question 5 or 7, that will have the same answer as the question below.
   During the year, 324 houses were built in a housing development. At the end of the year there were 713 houses. How many houses were there at the beginning of the year?
10. After Rallai had withdrawn R275 of his savings, there was still R428 left. How much money did he originally have in his savings account?
11. Shop A sold 462 hamburgers and Shop B sold 148 hamburgers more. How many hamburgers did Shop B sell?
12. Jan has saved R568. He wants to buy a jacket that costs R734. How much more must he save?
13. Katharina grows pumpkins on her plot. Last month she harvested 867 pumpkins and sold 235 to shops in her village. She sent the rest to the fresh produce market in Durban. How many pumpkins did she send to the market?
Grade 4 Term 1 Unit 4          Numeric patterns

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**CAPS time allocation**
4 hours

**CAPS page references**
18 to 19 and 46 to 51

**Mathematical background**
Numeric patterns, as part of the Content Area “Patterns, Functions and Algebra”, should serve as building blocks to develop the basic concepts of Algebra in the Senior and FET phases. The study of numeric patterns should develop the idea of a relationship between two variable quantities, for example:

<table>
<thead>
<tr>
<th>One variable quantity (the “input numbers”)</th>
<th>1</th>
<th>2</th>
<th>3+1</th>
<th>4+1</th>
<th>5+1</th>
<th>6+1</th>
<th>7+1</th>
<th>8+1</th>
<th>9+1</th>
<th>10+1</th>
<th>11+1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Another variable quantity (the “output numbers”)</td>
<td>4</td>
<td>7</td>
<td>10+1</td>
<td>13+1</td>
<td>16+1</td>
<td>19+1</td>
<td>22+1</td>
<td>25+1</td>
<td>28+1</td>
<td>31+1</td>
<td>34+1</td>
</tr>
</tbody>
</table>

The word pattern means that something is repeated. In the above case, the sequence 4, 7, 10, 13, 16, ... can be formed by repeatedly adding 3.

This pattern in the sequence is formed by performing the same calculation each time, to move from one number to the next.

Such a pattern is called a **recursive pattern**. The word “recur” means that something occurs repeatedly or repeats itself.

The above sequence of output numbers can also be formed by multiplying each input number by 3 and adding 1:

1 2 3 4 5 6 7 8 9 10 11
3 × 1 + 1 3 × 2 + 1 3 × 3 + 1 3 × 4 + 1 3 × 5 + 1 3 × 6 + 1 3 × 7 + 1 3 × 8 + 1 3 × 9 + 1 3 × 10 + 1 3 × 11 + 1
4 7 10 13 16 19 22 25 28 31 34

A relationship between two variable quantities, in which each value of the second quantity is uniquely determined by the corresponding value of the first quantity, is called a **function** – the middle word in the CAPS title for this content area.

In the above case, the link between the input and output numbers (also called the independent and dependent variables) is given by the calculation plan (rule) “multiply the input number by 3 and add 1”, which can also be represented as $3 \times \square + 1$, or with this flow diagram:

input number $\rightarrow \times 3 \rightarrow + 1 \rightarrow$ output number
4.1 Seeing patterns

Mathematical notes
This introduction to the notion of patterns develops the underlying big idea that to see patterns means to look for the aspect that remains unchanged (constant) as all other aspects change (vary).

Critical knowledge
Learners have to develop the understanding of looking for the one aspect that remains unchanged as all other things change. This defines the notion of “pattern”.

Teaching guidelines
We suggest that instead of letting learners read and complete the questions in their exercise books, you rather teach this section live in class through questions and answers (with different content if needed).

During such whole-class teaching you can take input from learners, and let learners explain their reasoning so that they can learn from each other.

Learners should find the introduction (identifying the one that does not fit) relatively easy and you should help build their confidence that working with patterns is in fact common sense and easy.

Answers
1. (a) 56; not a multiple of 5
   (b) 23; the only odd number
   (c) aca; no b
   (d) E; only shape with five sides
2. The answers and reasons are all correct.
4.2 Making patterns

Mathematical notes

Our approach to introducing sequences is to connect it to the familiar work of counting in multiples (e.g. 5, 10, 15, ...) and counting on in multiples (e.g. 1, 6, 11, 16, ...).

It is not really new work; it is only different in representation. When counting, we usually do it verbally, but in our work with sequences we have to write it down.

Of course our focus is also different. Whereas our counting activities are mostly aimed at number concept development and mental fluency, our work with numeric patterns studies the relationships between the numbers in the sequences we produce.

And we ask different questions, for example:

- If Sally would continue counting 5, 10, 15, 20, ...
  - What is the 100th number that she will count?
  - Will she count 436?

Our work on numeric patterns must develop the knowledge that will enable Sally to calculate the 100th number instead of actually counting all the way up to the 100th number, and to reason whether 436 is in the sequence without actually having to count past 436.

Teaching guidelines

We suggest that instead of letting learners read the tinted passage, you rather teach it live in class through questions and answers (with different content if needed). That is, that you ask individual learners to “count in fives” and to “count on in fives”, etc. and that you then write it down while introducing necessary vocabulary and notations.

Also, you should make sure that learners know how to read values from a table representation. The best way to do this is to ask them specific questions, for example: “By just looking at the table and without counting, if the Position no. is 5, what is the number in the sequence?” and “In what position is 20 in the sequence?” and “Complete the table.”

You should note that representation in a table is a social convention, and learners can only learn how to read and handle tables by learning it from others. In the beginning learners often complete missing values as below, i.e. by continuing the sequence without considering the corresponding position number:

<table>
<thead>
<tr>
<th>Position no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
</tr>
</tbody>
</table>

We introduced the zigzag notation in an effort to prevent this, to show learners that there are some missing values. You should discuss the problem and the notation with learners.
Teaching guidelines

Learners are often confused by the instruction “count on in fives” and will probably ask: “But when should we stop?”

This highlights the difference between a finite sequence and an infinite sequence:

- A finite sequence has a last number. For example, the sequence 1, 6, 11, 16, 21 has only five numbers and the last number is 21.
- An infinite sequence has no last number and goes on forever. For example, the sequence 1, 6, 11, 16, 21, ... goes on forever.

So you can answer learners that they should “not stop”, but should write down only the first few numbers and then use the notation of three dots introduced on page 52 to indicate that it goes on forever.

Finding the 100th number

Methods for finding a rule in order to calculate the 100th number is only developed later (see pages 58 to 59 for multiples and pages 265 to 266 for non-multiples). Therefore you should not teach it now. Rather, it is an opportunity for learners to think about the problem and to begin to formulate their attempts to answer the question.

Answers

1. (a) 5, 10, 15, 20, 25, ... The units digit is only 5 or 0; the pattern 5, 0 is repeated.
   100th number = 100 × 5 = 500 Learners will probably find this easy.
   (b) 1, 6, 11, 16, 21, ... The units digit is only 1 or 6; the pattern 1, 6 is repeated.
   100th number = 496 One can reason that it is 4 less than the multiples of 5.
   (c) 2, 7, 12, 17, 22, ... The units digit is only 2 or 7; the pattern 2, 7 is repeated.
   100th number = 497
   (d) 3, 8, 13, 18, 23, ... The units digit is only 3 or 8; the pattern 3, 8 is repeated.
   100th number = 498
   (e) 4, 9, 14, 19, 24, ... The units digit is only 4 or 9; the pattern 4, 9 is repeated.
   100th number = 499
   (f) See (a)

2. Different: they all start with different numbers (except (a) and (f)).
   Same: you add on 5 to the previous number in all the sequences.

3. Let learners explain their instructions and then decide if the generated sequence is correct.
4.3 Describing patterns

**Teaching guidelines**

The critical knowledge for learners to gain from this section is the central idea of patterns, namely to describe what remains constant as all other things change.

In this specific context, although the ages of the father and son are not the same and changing all the time, there is something that remains unchanged (constant) all the time, and that is the difference between their ages, namely 30 years.

You can help learners understand this idea of searching for what remains constant while other things change by writing a series of equivalent statements, for example:

\[
\begin{align*}
30 - 0 &= 30 \\
31 - 1 &= 30 \\
32 - 2 &= 30 \\
35 - 5 &= 30 \\
50 - 20 &= 30
\end{align*}
\]

Once we have identified this essence of the situation, it of course becomes a model or method to solve problems in the context, for example to find unknown ages of the father or the son in question 3:

1. \(c - 12 = 30\)
2. \(c - 20 = 30\)

The rest of the activity introduces or develops different representations for the situation: how to say it in words, write it in a table, put it in a flow diagram, and write a calculation plan (rule).

You should especially make sure that learners understand how the flow diagram representation works, because it may be new to them. Probably the best strategy is to ask them to explain how they got their answers, for example in questions 4 to 7 on the next page. See also the discussion of flow diagrams with two operators on page 187.

**Answers**

1. 40 years
2. Their ages change, but the difference between their ages remains the same (30 years).
3. (a) When the son is 12 years, the father will be 30 years older: \(12 + 30 = 42\) years.
   (b) When the son is 20 years, the father will be 30 years older: \(20 + 30 = 50\) years.
Teaching guidelines

Questions 4, 5 and 6 do not specify which representation (words, tables, calculation plans, flow diagrams) learners should use to answer the questions. You could carefully note which representations learners are actually using, which they find easy; where and why they make mistakes.

It is also important to make connections with other concepts in mathematics. For example, the problem to find the son’s age in question 6 can be transformed to the equivalent mathematical problem to solve an open number sentence:

For which value of \( c \) is \( c + 30 = 46 \)

This can then be solved by using the inverse operation: \( c = 46 - 30 = 16 \).

Answers

4. \( 12 + 30 = 42 \)  \( 15 + 30 = 45 \)  \( 20 + 30 = 50 \)

5. \( 60 - 30 = 30 \)

6. \( 37 - 30 = 7 \)  \( 40 - 30 = 10 \)  \( 43 - 30 = 13 \)  \( 46 - 30 = 16 \)  \( 50 - 30 = 20 \)

7. Input numbers  

<table>
<thead>
<tr>
<th>Son’s age</th>
<th>Father’s age</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>31</td>
</tr>
<tr>
<td>12</td>
<td>37</td>
</tr>
<tr>
<td>15</td>
<td>40</td>
</tr>
</tbody>
</table>

Calculation plan (operator)

\( +25 \)  \( +30 \)  \( ? \)  \( ? \)  \( ? \)

Output numbers

\( 38 \)  \( 63 \)  \( 36 \)  \( ? \)  \( ? \)  \( ? \)
4.4 Recognising and describing patterns

**Critical knowledge**

The critical knowledge for learners to gain from this section is the central idea of patterns, namely that although the number of candles and the cost are changing, there is something that remains unchanged (constant) all the time, and that is the rate of cost per candle (R4).

It is therefore the same ideas as the father–son ages in the previous section, but here we have a different model, namely multiplication or division instead of addition and subtraction. Again, you can help learners understand this by writing a series of equivalent statements showing the constant quotient of 4. Recognising this constant of course also helps with a solution strategy to solve problems. For example:

\[
\begin{align*}
4 \div 1 &= 4 \\
8 \div 2 &= 4 \\
12 \div 3 &= 4 \\
16 \div 4 &= 4 \\
20 \div 5 &= 4 \\
100 \div c &= 4 \\
8 \div 2 &= 4 \\
20 \div 5 &= 4 \\
12 \div 3 &= 4 \\
20 \div 5 &= 4
\end{align*}
\]

Although learners should be able to solve these by inspection, you could also draw their attention to the use of the inverse operation, for example:

\[
c \div 20 = 4, \text{ so } c = 4 \times 20 = 80.
\]

**Answers**

1. (a) | No. of candles | 1 | 2 | 3 | 4 | 5 | 6 | 10 | 20 | 25 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost (rands)</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>40</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

(b) Learners may already be using Theo’s method or Nadia’s method.

2. (a) Yes, but Theo may struggle to calculate the cost of a large number of candles.

(b) Theo added R4 to the cost for each candle added.

(c) Cost of 6 candles = R20 + R4 = R24; Cost of 7 candles = R24 + R4 = R28

Cost of 20 candles = R4 + 19 \times R4 = 80; or R28 + 13 \times R4 = R80

3. (a) Yes

(b) \[ \text{Cost} = \text{No. of candles} \times 4 \]

(c) Cost of 6 candles = 6 \times 4 = R24

Cost of 7 candles = 7 \times 4 = R28

Cost of 20 candles = 20 \times 4 = R80

4. Nadia’s method is easier/quicker/convenient when you have to work out the cost of large numbers of candles.
Note on finding input numbers
To find unknown input numbers for known output numbers in the flow diagram is equivalent to solving an open number sentence.

In question 5, for the given 68 as output number, the problem is to find the unknown □ in □ × 4 = 68. Learners will mostly use one of the following two solution strategies:

*Trial and improvement*, working from left to right (forward):
Is □ = 5? No, 5 × 4 = 20, not 68. Try a bigger number.
Is □ = 12? No, 12 × 4 = 48, which is still too small. Try a bigger number.
Is □ = 17? Yes, 17 × 4 = 68!

*Using inverse operations*, i.e. working from right to left (backwards):
If □ × 4 = 68, then □ = 68 ÷ 4 = 17

Answers
5.  
   ![Flow diagram with numbers]
   
   6.  
   ![Flow diagram with numbers]

5. Calculate the missing numbers in the flow diagram.
6. This flow diagram shows the cost of candles at another shop.

(a) What is the calculation plan connecting the input and output numbers?
(b) Find the missing input and output numbers.
4.5 Tables or multiples

Mathematical notes
We thoroughly develop and reinforce sequences of multiples by connecting it to the familiar work of “the times table”. Help your learners to make the connections between the two contexts. The sequences of multiples (e.g. 5, 10, 15, 20, …) will in turn become the building block to study other sequences such as 6, 11, 16, 21, … (one more than a multiple of 5).

Critical knowledge
All learners should understand, know and be able to apply the knowledge common to all sequences of multiples:

- The multiples of \( k \) all have a constant difference of +k between consecutive numbers (the “horizontal” pattern).
- The multiples of \( k \) all have a calculation plan of the form \( \times k \) (the “vertical” pattern).

Teaching guidelines
Learners often are very unproductive and waste much time by first having to draw a neat table. It may be a good idea for you to make copies of the table provided in the Addendum (page 437) for each learner – this should save time and ensure that learners are productive.

Answers

1.

<table>
<thead>
<tr>
<th>( \times )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>18</td>
<td>21</td>
<td>24</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>28</td>
<td>32</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>42</td>
<td>48</td>
<td>54</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td>28</td>
<td>35</td>
<td>42</td>
<td>49</td>
<td>56</td>
<td>63</td>
<td>70</td>
</tr>
</tbody>
</table>

2. Let learners discuss and share their methods so that they can learn from each other.
3. Let learners discuss and share the patterns they see so that they learn from each other.
Teaching guidelines
It is important that you encourage learners to use both recursive (here counting on) and functional reasoning (here the multiplication tables).
You should also help learners to understand their usefulness: counting on is easy to continue the sequence for a few numbers, while vertical multiplication (using a rule) will be easier to find further-lying larger output numbers.

Note on finding the 100th number
You should try to help learners to connect new work with previous, known ideas. That gives meaning to the new work and makes it easy. Let’s take as example the new work to find a rule to calculate the 100th number in sequences of multiples (question 4). Have we seen this before? Now look at this simple word problem:

At the market there are many boxes with 5 apples in each box. How many apples are there in 6 boxes? How many apples are there in 100 boxes?

If we would count the apples in 6 boxes, we will count 5, 10, 15, 20, 25, 30.
But we also know the number of apples is 5 + 5 + 5 + 5 + 5 + 5, and we know this is \(6 \times 5 = 30\).
Comparing these two methods, but now thinking about sequences, we should realise that the 6th number in the sequence 5, 10, 15, 20, ... is \(6 \times 5\).
Similarly: To find the number of apples in 100 boxes we could count 5, 10, 15, 20, ...
But we also know that the number of apples in 100 boxes is \(100 \times 5\).
Therefore, the 100th number in the sequence 5, 10, 15, 20, ... is \(100 \times 5\).

Answers
4. (a) A ..., 18, 20, 22, 24, 26 100th: 200
   B ..., 24, 27, 30, 33, 36 100th: 300
   C ..., 40, 45, 50, 55, 60 100th: 500
   D ..., 49, 56, 63, 70, 77 100th: 700
   E ..., 72, 81, 90, 99, 108 100th: 900
   F ..., 80, 90, 100, 110, 120 100th: 1000
(b) In each sequence the numbers change, but the difference between consecutive numbers is the same. In the different sequences the constant differences are different, but they all have a constant difference.
Grade 4 Term 1 Unit 5 Whole numbers: Multiplication and division

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</tr>
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**CAPS time allocation**

4 hours

**CAPS page references**

13 to 15 and 52 to 55

**Mathematical background**

Multiplication can be understood:
- as repeated addition (see the illustrations on pages 61, 63 and 64),
- in terms of rectangular arrays of objects (objects arranged in rows and columns – see the illustrations on pages 60, 67 and 68), and
- in terms of the ratio between two quantities.

Division can be understood in the same ways as multiplication.

Division and multiplication are linked. For example, if we want to know $36 ÷ 9 = □$ it is the same as finding out $9 × □ = 36$. Division is done to find out by what a number must be multiplied to obtain a given result (see Section 5.5 of this unit). This is why division is called the inverse of multiplication.

In previous units we have mentioned that many South African learners solve all kinds of calculations by drawing dots or stripes and/or counting in ones. Unit 5 continues to develop learners' calculation strategies so that they stop counting everything in ones. In this unit learners will work with multiplication and division represented in different ways: words, pictures, arrays, flow diagrams, tables, multiplication grids, and number sentences with multiplication and division signs.

This unit draws on the work done on place value in previous units, as well as the work done on multiplication in Unit 4. It builds learners' knowledge and conceptual understanding of the multiplication tables. The multiplication tables are important number facts for learners to know but, equally important, are strategies for quickly calculating those multiplication facts that they do not know off by heart.

This is a long unit. Encourage learners to work quickly and smartly. Further guidance on time allocation is provided in the discussions for each section.
5.1 Multiplication

**Mathematical notes**

This short section motivates the need for multiplication. It shows that counting in ones, and even skip counting is inefficient once numbers get beyond a certain size.

This section also gives a glimpse of what learners will do in later terms, i.e. breaking down numbers into place value parts and multiplying each of the parts. The aim here is not for them to learn this method, but merely to see that multiplication is helpful and efficient.

**Teaching guidelines**

Aim to complete this section in 20 minutes.

Ask learners if they can find the number of red squares on the page without counting them all. While they work, you may draw a similar array on the board. It has 18 rows, with 16 squares (or crosses) in each row.

Once learners have done the work and compared their answers, you may demonstrate that the answer can easily be found by dividing the array into four sections as shown below, provided one knows the answers for $10 \times 10$, $6 \times 10$, $10 \times 8$ and $6 \times 8$. You can then tell learners that they will learn facts like these in the days ahead, so that they can quickly and easily do calculations such as $16 \times 18$ later.

**Answers**

1. 288 squares
2. Learners compare their answers to question 1.
5.2 Count objects

**Mathematical notes**

There is more to mental mathematics than the rapid recall of number facts such as multiplication tables and addition and subtraction bonds. Mental mathematics also involves building number concept and calculation strategies. Mental mathematics can involve jotting down numbers and making sketches.

The focus of this section is the 3 times table. Grade 3 learners multiply by 3; this section revises it but also develops a conceptual understanding of multiplication that includes the commutative property of multiplication and the order of operations.

The commutative property of multiplication states that when two numbers are multiplied the answer remains the same even if the numbers are swapped around. This is sometimes called the order property of multiplication. Learners are *not* expected to know the name of this property. They are just expected to know that they can swap the order of two numbers that are multiplied. They are expected to use this to make calculations easier.

**Teaching guidelines**

Try to move quickly through Section 5.2: aim to cover this section in 35 minutes. One possibility is to use

- questions 1 and 10 for mental mathematics, keeping in mind that this is also concept development
- question 1, the summary bar and tinted passage on page 61, questions 8(a) and (d) and the tinted passages on page 62, questions 9(a), 10, 11, 12 and 13, and the summary bar on page 63 for concept development,
- questions 2, 3, 4, 5, 7 and 8(c) and (e) for classwork, and
- questions 6, 8(b) and (f), and 9(b) to (d) for additional practice.

You can introduce this lesson by asking learners to write down the answers to question 1 while they look at the picture on page 61. Explain to them that this is called multiplication. Demonstrate how to write questions 1(a), (b) and (c) as number sentences using the multiplication sign.

**Answers**

1. (a) 3  (b) 15  (c) 30  (d) 27  (e) 21  (f) 18
2. $3 \times 9 = 27$ or $9 \times 3 = 27$
3. 3  6  9  12  15  18  21  24  27  30
   33  36  39  42  45  48  51  54  57  60

In question 1(b) you multiplied 3 by 5. This can be written in symbols: $5 \times 3$. You may write $5 \times 3 = 15$. You can also write $3 \times 5 = 15$, because $5 \times 3 = 3 \times 5$.

2. Write your answer to question 1(d) in symbols.
3. Copy the numbers below and count on in threes to write the first 20 numbers in this pattern:
   3  6  9  12  ...
Teaching guidelines

Ask learners to look at the pictures on page 63. You can read questions 10(a) and (b) while learners write down the answers in their exercise books. They could discuss question 11 in pairs before reporting back to the whole class. You can draw an array of $3 \times 5$ circles on a piece of paper. Show this to learners and then make a quarter turn with the paper. This shows that 3 columns of 5 circles become 5 columns of 3 circles, or vice versa. This demonstrates that $3 \times 5 = 5 \times 3$.

In questions 12 and 13 learners should try out several pairs of numbers to see whether it makes a difference if they swap them around. Take feedback on these questions and emphasise that changing the order of two numbers in a subtraction statement changes the calculation completely.

Use the second tinted passage on page 62 and questions 8(a) and (d) to explain to learners that when a number sentence contains multiplication and addition or multiplication and subtraction, you always do multiplication first, for example:

$3 \times 10 - 3 \times 4 = 30 - 12 = 18$.

A template for the table in question 7 is provided in the Addendum (page 438).

Possible misconceptions

Learners sometimes overgeneralise in Mathematics. This is the reason for questions 12 and 13. You can change the order of two numbers that are multiplied or added without affecting the answer, for example $7 \times 3 = 3 \times 7$ and $70 + 30 = 30 + 70$. This is not true for subtraction or division, for example $6 - 4 \neq 4 - 6$ and $6 + 3 \neq 3 + 6$. Learners sometimes assume that they can swap the order of the numbers when subtracting without changing the answer. It is important that they see and experience that this cannot be done.

Answers

4. (a) 18  (b) 21  (c) 24  (d) 12

5. Learners check and correct their answers.

6. (a) 30  (b) 27  (c) 21  (d) 15
    (e) 6   (f) 9   (g) 18  (h) 12

7. $\times$ 1  2  3  4  5  6  7  8  9  10
   3  3  6  9  12  15  18  21  24  27  30

8. (a) $15 + 9 = 24$  (b) 36
    (c) $18 + 18 = 36$  (d) $30 - 12 = 18$
    (e) $27 - 12 = 15$  (f) $12 + 15 = 27$
**Mathematical notes**

Question 9 begins to show learners the relationship between multiplication and division. We nearly always use multiplication when we do division.

**Teaching guidelines**

Learners can use skip counting and the pictures of bananas on page 63 to answer question 9(a). They can use skip counting and the pictures of the bananas on page 61 to answer questions 9(b), (c) and (d).

**Answers**

9. (a) 6  
   (b) 8  
   (c) 7  
   (d) 10

10. (a) 15  
    (b) 15

11. $3 \times 5 = 5 \times 3$

12. Investigate, e.g. $3 + 5 = 8$ and $5 + 3 = 8$.  
   Yes, it is also a property of addition.  
   Note that learners can use any examples to test whether the answer stays the same when they change the order of two numbers added.

13. Investigate, e.g. $5 - 3 = 2$, but $3 - 5 \neq 2$.  
   No, subtraction does not have this property.  
   Note that learners can use any examples to test whether the answer stays the same when they change the order of two numbers subtracted.
5.3 Learn more multiplication facts

Possible misconceptions
Many learners do calculations by skip counting, or drawing dots or lines and counting in ones. This not only slows learners down, but reduces their chances of learning any mathematics. It is imperative that learners develop a good sense of both numbers and operations, and that they learn basic addition, subtraction and multiplication facts.

Grade 4 learners should move beyond skip counting to knowing multiplication facts off by heart and being able to reconstruct some multiplication facts from others at a high speed.

Mathematical notes
Learners move from counting pictures of groups (bunches of 4 bananas) to counting using symbols to multiplying by 4 in a function table. The aim is to encourage learners to count in groups (skip count), first with the help of pictures if necessary (question 1), then skip count without the aid of pictures (question 2), then moving to multiplying (questions 3 and 4), and finally to doing multiplication in reverse, which is division (question 5).

Teaching guidelines
Aim to complete this section in 1 hour. Templates for all the tables are provided in the Addendum (pages 438 to 440). You can copy these to save time.

You can ask learners how many bananas there are in each bunch in the picture above question 1. Learners can then skip count in 4s as they point to bunches of bananas.

Learners can also skip count in 4s backwards. This should be revision of Grade 3 work. In order to keep up the pace of work you could read questions 1, 2, 3 and 4 and let learners write the answers in their exercise books.

In question 5 learners work with multiplication in reverse, which is division. Learners can use the table in question 4 to answer questions 5(a) and (b).

Answers
1. (a) 40 (b) 36 (c) 32 (d) 28
2. 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80
3. (a) 24 (b) 28 (c) 32 (d) 16 (e) 36 (f) 40
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5. (a) 5 (b) 7 (c) 14 (d) 12 (e) 3
Notes on questions

In questions 5(c) and (d) learners can draw on what they learnt about multiplying by 3 in Section 5.2. However, learners cannot simply copy the answers from the table on page 62, as the answers are higher than 10 \( \times \) 3. Show learners how they can use what they know (e.g. 10 \( \times \) 3 = 30) and an empty number line to find the answer.

After showing that 10 \( \times \) 3 = 30 on the number line, some learners may know that 4 \( \times \) 3 = 12 will take you to 42; other learners may skip count on: 33, 36, 39, 42.

In question 5(e) some learners may know that \( \square \times 5 = 15 \) means the answer is 3. Other learners could draw a number line with 5 jumps (hops) and try skip counting in different numbers until they get the answer.

In question 6 remind learners that in Section 5.2 they learnt that when a number sentence contains multiplication and addition and/or subtraction, they should do the multiplication first. For example, question 6(a)

\[ 5 \times 4 + 4 \times 4 \]

means: do the two multiplication sections first and then add them, i.e.

\[ 5 \times 4 + 4 \times 4 = 20 + 16 = 36. \]

Learners can use the table in question 7 to answer questions 9 and 10.

Answers

5. (f) 4
6. (a) 20 + 16 = 36 (b) 40 – 16 = 24 (c) 24 + 24 = 48
   (d) 48 (e) 36 – 16 = 20 (f) 16 + 20 = 36
7. \[
\begin{array}{cccccccccc}
\times & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
5 & 5 & 10 & 15 & 20 & 25 & 30 & 35 & 40 & 45 & 50 \\
\end{array}
\]
8. Learners describe their methods. Accept all reasonable answers. There are many possible methods that learners could use, including but not limited to: skip counting in 5s; adding on in 5s with or without the use of a number line; filling in known answers and using these to find the rest.
9. (a) 50 (b) 45 (c) 35
   (d) 25 (e) 10 (f) 30
   (g) 40 (h) 15 (i) 20
10. (a) 30 bananas (b) 50 bananas (c) 45 bananas
    (d) 40 bananas (e) 35 bananas
Notes on questions

In question 12 first ask learners to fill in any multiplication facts for 6 that they know, for example 1 × 6; 2 × 6 (which is double 1 × 6); 10 × 6; 3 × 6 = 6 × 3; 5 × 6 = 6 × 5; 4 × 6 = 6 × 4. They can then compare the 6 times table with the 3 times table. Ask whether they see any patterns. If learners do not see that ×6 = double ×3, then let them work with questions 1, 2 and 3 on pages 71 and 72.

In questions 14 and 15 learners can use a range of strategies to work out the multiplication facts that they do not know. These include but are not limited to:

- doubling to get ×2; doubling and doubling again or double ×2 to get ×4; doubling, doubling and doubling again to get ×8 or double ×4 to get ×8,
- halving ×10 to get ×5,
- doubling ×3 to get ×6, and
- using the fact that the order of multiplication does not matter, e.g. 5 × 9 = 9 × 5.

Answers

11. (a) 

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(b) 30 + 50 = 80  (c) 80 − 40 = 40

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13. (a) 48  (b) 54

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15. Learners describe their methods (plans).

16. (a) 48  (b) 36  (c) 48  (d) 36
5.4 Multiply by 7, 8 and 9

**Mathematical notes**
In Grade 3 learners solve problems using multiplication and division (grouping and sharing). But when they work with decontextualised calculations they are only expected to multiply and divide by 1, 2, 3, 4, 5 and 10. Skip counting, multiplying and dividing by 6, 7, 8 and 9 is new in Grade 4.

**Teaching guidelines**
Aim to complete this section in 40 minutes.

Remind learners that the order in which you multiply two numbers does not matter, for example $2 \times 8 = 8 \times 2 = 16$.

Ask learners to fill in all the answers they know in question 1 as quickly as they can. Then let them work out the answers to question 2. This will help them to complete the $\times 9$ column. In question 4 you can show learners that by blocking off 1 column of dots at a time you can show $7 \times 9$; $7 \times 8$; $7 \times 7$. Templates for the tables are provided in the Addendum (page 441).

**Answers**

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2. (a) 63 (b) 72 (c) 81 (d) 90

3. Learners should at least know the $\times 1$, $\times 2$, $\times 3$ and $\times 10$ columns off by heart. Ask them to explain how they derived some answers from other answers. Learners’ answers will differ. Accept all reasonable answers. Learners’ answers might include, but not be limited to:

I can complete the $\times 2$ column by doubling the $\times 1$ column, the $\times 4$ column by doubling the $\times 2$ column, the $\times 8$ column by doubling the $\times 4$ column.

I can complete the $\times 6$ column by doubling the $\times 3$ column.

I can complete the $\times 5$ column by halving the $\times 10$ column.

4. (d) $7 \times 10 = 70$
Notes on questions
In question 5 learners are only expected to state the number of small squares. Some learners may count squares within squares and get a much bigger number than what is stated in the answers below. For example, apart from the 100 1×1 squares there are 2×2 squares, 3×3 squares, 4×4 squares, 5×5 squares, 6×6 squares, 7×7 squares, 8×8 squares and 9×9 squares. These can overlap. If learners get very big answers for questions 5(a), (b), (c) and (d), ask them to explain how they counted. Discourage learners from counting in ones. They should rather treat each grid as an array, and skip count rows or columns, or multiply rows with columns.

In question 6, ask learners to first fill in the answers they know. They should at least know the 1×1, 2×2, 3×3, 10 columns off by heart, as well as the 3×3 row. Then ask them to use known multiplication facts to derive the others.

They can complete the 2 column by doubling the 1 column, the 4 column by doubling the 2 column, and the 8 column by doubling the 4 column.

They can complete the 6 column by doubling the 3 column.

They can complete the 5 column by halving the 10 column.

They can complete the 9 column by subtracting one multiple from the 10 column; for example 10 × 8 = 80, so 9 × 8 = 80 − 8. Similarly, 9 × 6 = 60 − 6; 9 × 7 = 70 − 7; 9 × 9 = 90 − 9.

They can complete the 7 column by swapping the order of the numbers multiplied and filling in the answers they have calculated already, for example 8 × 7 = 7 × 8; 9 × 7 = 7 × 9, etc.

Question 7 contains rate problems.

Answers
5. (a) 10 × 10 = 100 (b) 7 × 8 = 56 (c) 9 × 8 = 72 (d) 8 × 8 = 64

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7. (a) R63 (b) R72 (c) R56 (d) R54 (e) R48 (f) R64
5.5 Multiplication in reverse

**Mathematical notes**
In this section learners use multiplication facts that they know to solve division problems (sharing and grouping) and division calculations. In Grade 4 learners always use multiplication to do division.

**Teaching guidelines**
Aim to complete this section in 50 minutes. One possibility is to use
- page 69 and the summary bar and tinted passage on page 70 for concept development,
- questions 2, 4(a), (b), (f) and (g), and 5(a) for classwork, and
- questions 3, 4(c) to (e) and (h) to (l), and 5(b) for additional practice.

You can explain to learners how to use the multiplication grid on page 69 to solve division calculations or problems. Problem B in the tinted passage on page 69: “How many loaves of bread at R6 each can Musi buy with R48?” can be thought of as: “How many sixes make up 48?” To find the answer, learners find the ×6 row, place their ruler/exercise book/a piece of paper under it and read across the ×6 row until they find 48. They can then place another straight edge on the right of the column with 48 in it, and read the top number in this column: 8. This means that 6 × 8 = 48. So Musi can buy 8 loaves of bread. Repeat this process to explain to learners how to use the multiplication grid to solve “7 × which number = 63” as a way of solving Problem A: “David paid R63 for 7 packets of sweets. How much did each packet cost?”

Regular use of the multiplication grid will help learners to learn their multiplication tables.

Explain to learners that 4 × □ = 24 means the same as 24 ÷ 4 = □. “24 divided by 4” can be thought of as “how many fours are there in 24?” or “4 × what is 24?” Explain that this means that they can always rewrite a division calculation as a multiplication calculation.

**Answers**
1. (a) 8  (b) 9
Teaching guidelines
Ask learners to complete question 2. They should see which questions they can answer automatically. They can use the multiplication grid on page 69 to answer the rest of question 2.

Suggest that one learner keeps the textbook open to page 69 and the learner next to him or her keeps it open to page 70. This way they will be able to read the questions and use the grid.

Encourage learners always to think: “What do I already know that can help me here?” Learners should multiply to solve division calculations. Learners should also see where they can use answers they have already worked out. For example, in question 3(e) they can use the answer to 3(d); similarly they can use 3(a) for 3(g); 2(i) for 4(b); 2(h) for 4(c); 2(g) for 4(d); 2(f) for 4(k); and 4(f) for 4(g).

Critical knowledge
Multiplication and division are related. You can use multiplication to check division.

The following are equivalent statements: $7 \times \square = 63$ and $\square \times 7 = 63$ and $63 \div 7 = \square$.

This means that learners can always change a division calculation, problem or number sentence into an equivalent multiplication calculation, problem or number sentence.

Learners should use what they know about multiplication to solve division calculations.

Answers
2. (a) 6 (b) 4 (c) 9
   (d) 4 (e) 6 (f) 7
   (g) 7 (h) 8 (i) 9
   (j) 10 (k) 9 (l) 7

3. (a) 5; $5 \times 2 = 10$ (b) 3; $3 \times 3 = 9$ (c) 6; $6 \times 2 = 12$ (d) 4; $4 \times 3 = 12$
   (e) 3; $3 \times 4 = 12$ (f) 5; $5 \times 4 = 20$ (g) 2; $2 \times 5 = 10$ (h) 5; $5 \times 5 = 25$

4. (a) 9 (b) 7 (c) 8
   (d) 7 (e) 10 (f) 10
   (g) 9 (h) 9 (i) 9
   (j) 4 (k) 7 (l) 8

5. (a) 4 mangoes (b) R9 for one bar of soap

What you did to find the answers to question 1 is called division.

2. Find the missing number in each of the following number sentences. Try to do this by using your knowledge of multiplication facts. The table on the previous page may also be helpful.
   (a) $4 \times \square = 24$ (b) $\square \times 8 = 32$ (c) $27 = 3 \times \square$
   (d) $\square \times 9 = 36$ (e) $3 \times \square = 18$ (f) $49 = \square \times 7$
   (g) $8 \times \square = 56$ (h) $\square \times 8 = 64$ (i) $63 = 7 \times \square$
   (j) $\square \times 6 = 60$ (k) $6 \times \square = 54$ (l) $35 = \square \times 5$

The correct answer for question 2(a) is 6, because $4 \times 6 = 24$.

There is a different way in which question 2(a) can be asked. Instead of asking $4 \times ? = 24$, we can ask the question “How much is 24 divided by 4?”

We can write “24 divided by 4” in symbols, like this: $24 \div 4$.

3. Calculate, and check your answers by doing multiplication.
   (a) $10 + 2$ (b) $9 + 3$ (c) $12 + 2$ (d) $12 + 3$
   (e) $12 + 4$ (f) $20 + 4$ (g) $10 + 5$ (h) $25 + 5$

4. How much is each of the following? You can get the first four answers from your work in question 2.
   (a) $63 \div 7$ (b) $35 \div 5$ (c) $64 \div 8$
   (d) $56 \div 8$ (e) $100 \div 10$ (f) $90 \div 9$
   (g) $90 \div 10$ (h) $81 \div 9$ (i) $45 \div 5$
   (j) $28 \div 7$ (k) $49 \div 7$ (l) $72 \div 9$

5. (a) One mango costs R8. How many mangoes can Christelle buy with R32?
   (b) Emma paid R45 for five bars of soap. What was the price of one bar of soap?
5.6 Multiplying in steps

**Mathematical notes**
In this section learners are shown that when they multiply by a number, they can split that number into factors and multiply by each factor in succession. For example, $\square \times 25 = \square \times 5 \times 5$; $\square \times 27 = \square \times 3 \times 3 \times 3$, etc. In Term 2 Unit 5 learners will see how to use this to multiply by multiples of 10 (see Sections 5.1 and 5.2). The aim is to use this to make it easier to multiply mentally, by reconstructing multiplication facts that you don’t know off by heart.

**Teaching guidelines**
Aim to complete this section in 30 minutes.

The aim of this section is to learn ways to quickly reconstruct multiplication facts from multiplication facts you already know.

You can use questions 1 to 4 for concept development. You can use this for whole-class teaching, but make sure that learners have their textbooks open because it is important that they see the flow diagrams as they work through the calculations. Learners can answer question 1 – it is easier to start with $2 \times 6$, then $3 \times 6$, then $4 \times 6$. Learners can then answer questions 2 and 3. Focus learners’ attention on the fact that the following are all equal to $24$: $4 \times 6$; $4 \times 2 \times 3$; $4 \times 3 \times 2$. These are equivalent statements. Learners already know that $2 \times 3 = 6$, so what they are learning here is that they can split a number into factors and multiply by each factor in stages; this will not change the answer. Let learners check whether $3 \times 6 = 3 \times 2 \times 3 = 3 \times 3 \times 2$ and whether $2 \times 6 = 2 \times 2 \times 3 = 2 \times 3 \times 2$. Let them take any other number and check whether $\times 6$ is always equal to $\times 2 \times 3$ and $\times 3 \times 2$.

Explain to learners that when they do not know a multiplication fact off by heart, they can use this strategy to quickly reconstruct the multiplication fact by multiplying by factors they know off by heart. Explain that this can be represented by two flow diagrams, each with one operator, or one flow diagram with two operators.

**Answers**
1. (a) 24 (b) 18 (c) 12
2. (a) 6 (b) 18 (c) 4 (d) 12
3. (a) 12 (b) 24 (c) 9 (d) 18 (e) 6 (f) 12

**Possible misconceptions**
Check that learners understand that they have been splitting numbers into factors here and that if they split numbers into bonds (using $+$ or $-$ ) they need to multiply both parts, for example $8 = 5 + 3$, so $3 \times 8 = 3 \times 5 + 3 \times 3$. 
**Critical knowledge**

When two numbers are multiplied, the answer remains the same even if the order of the two numbers is swapped around, for example $2 \times 3 = 3 \times 2$.

When three or more numbers are multiplied, you can change the way in which the operations are grouped and the answer will remain the same, for example $6 \times 7 = (2 \times 3) \times 7 = 2 \times (3 \times 7) = 2 \times 21 = 42$.

You can use known number facts to create new number facts. One way to do this is to split numbers into factors and multiply by the factors in stages. If you don’t know the six times table or a particular number fact, for example $6 \times 7$, you can split 6 into $2 \times 3$ and multiply by each factor separately.

So $3 \times 7 = 21$; $21 \times 2$ is simply double 21 = 42. So $6 \times 7 = 2 \times 3 \times 7 = 3 \times 7 \times 2 = 21 \times 2 = 42$.

Stated differently: to multiply by 6, you can multiply by 2 and then by 3, or first multiply by 3 and then by 2. Similarly, to multiply by 8, you can

- multiply by 2 then by 4, or multiply by 4 then by 2, or
- multiply by 2, by 2 again, and by 2 again, which is the same as double, double, double.

To multiply by 5, you can first multiply by 10, then halve, for example $7 \times 5 = 70$, half of 70 is 35.

**Teaching guidelines**

Ask learners to suggest any number from 2 to 9. Use this example to multiply

- $\times 2$
- $\times 4$  

Repeat this with other examples.

Learners can check with each number chosen whether they get the same results when they multiply it by $\times 4 \times 4$; $\times 2 \times 2 \times 2$; $\times 4 \times 2$ and $\times 8$. Learners will see that $\times 8 = \times 2 \times 4$ and $\times 4 \times 2$ and $\times 2 \times 2 \times 2$, but not $\times 4 \times 4$. Ask learners to multiply out the various factors, i.e. what does $2 \times 4 \times 2$; what does $4 \times 4 \times 2$; what does $4 \times 2 \times 2$; they will see that except for $4 \times 4$ all the other answers are 8. Remind learners that multiplying by 2 is the same as doubling. Explain that a quick way to multiply by 8 is to double, double again, and double a third time. Let learners test this out with some big number, for example $31 \times 8$:

- Double 31 = 62
- Double 62 = 124
- Double 124 = 248, so $31 \times 8 = 248$.

Once learners have seen that $\times 5$ gives the same results as $\times 10 \div 2$, they can use $\times 10$ and then halve to multiply by 5 mentally, for example $645 \times 5 = \text{half of } 6450 = 3225$.

**Answers**

4. (a) Flow diagrams B, C and D  
(b) Learners investigate

5. $\times 5$
Grade 4 Term 1 Unit 6  Time

<table>
<thead>
<tr>
<th>Sections in this unit</th>
<th>Content</th>
<th>Pages in Learner Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Days, weeks, months and years</td>
<td>Focusing on longer lengths of time (years, months, weeks and days) and reading calendars</td>
<td>73 to 76</td>
</tr>
<tr>
<td>6.2 Measuring time</td>
<td>Making a water clock and experiencing some of the difficulties with measuring time</td>
<td>77 to 79</td>
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<tr>
<td>6.3 Understanding the 12-hour clock</td>
<td>Reading clocks and calculating time intervals using hours and minutes in 12-hour time</td>
<td>79 to 82</td>
</tr>
<tr>
<td>6.4 Understanding the 24-hour clock</td>
<td>Reading analogue and digital clocks using 12-hour and 24-hour time</td>
<td>83 to 84</td>
</tr>
<tr>
<td>6.5 Hours, minutes and seconds</td>
<td>Reading time in hours, minutes and seconds on analogue and digital clocks</td>
<td>84 to 85</td>
</tr>
</tbody>
</table>

**CAPS time allocation**

6 hours

**CAPS page references**

27 and 55

**Mathematical background**

Some Grade 4 learners can read clocks and watches, but many learners find it difficult. There are three issues that make the concept of time difficult:

- Time cannot be seen, touched or physically experienced like length, capacity or volume, area and mass. We measure time by looking at environmental changes, changes in the position of the hands of an analogue clock, or the numbers on a digital clock face.
- Unlike the number system and other forms of measurement, the numbers do not get bigger forever. We measure time in modular units: when we reach certain numbers, for example 60 seconds, 60 minutes, 24 hours, 365 days, the numbers “wrap around” and go back to the beginning. This is different to the way primary school learners work with numbers in other aspects of mathematics.
- In primary school mathematics, numbers are organised in groups and powers of ten. In the topic of time, numbers are also organised in groups of 60, 24, 7, 28, 29, 30, 31, 365 and 366.

Much time is spent on reading clocks when learners study time. However, the topic of time involves more than just that. There are three aspects of time that need to be developed:

- the duration of time
- the passing and sequencing of time
- identifying a point in time by, for example, reading a clock.

All three aspects of time are developed in this unit.

**Resources**

This topic involves a number of practical activities for which various resources are needed. These resources are listed in the various sections.
6.1 Days, weeks, months and years

Mathematical notes
In this section learners work with days, weeks, months and years. They also read calendars and talk about public holidays.

Resources
You could use two calendars from the current year (one with the weeks starting on Mondays and one with the weeks starting on Sundays) to replace the two calendars on pages 73 and 75. You will, however, then need to check all the questions against the current year’s calendar.

Teaching guidelines
You can check whether learners know the number of days in a year, the number of months in a year, the number of days in a week, and the number of weeks in a year. You can also check whether they know how leap years differ from other years. The extra day in February every four years is the culmination of four quarter days.

You can use the tinted passage to fill in any gaps that learners may have. Learners can also use it to revise this information for tests or exams.

Notes on questions
Explain to learners that when a public holiday falls on a Sunday, the Monday also becomes a public holiday. In question 4, some learners may count the yellow blocks in the calendar on page 73 and give an answer of 13, but other learners may count from the list of public holidays on page 74 and give an answer of 12.

Possible misconceptions
The school week starts on Mondays. The calendar shown on page 75 has each week beginning on a Monday. However, the calendar shown on page 73 has each week beginning on a Sunday. In the Jewish and Christian traditions Sunday is the first day of the week. However, Monday is the first day of the school and working week.

Both types of calendars are provided here with the aim to teach learners to always check whether the calendar starts the week with a Sunday or a Monday.

Below is the calendar for 2016. The public holidays are marked in yellow.

<table>
<thead>
<tr>
<th>JANUARY 2016</th>
<th>FEBRUARY 2016</th>
<th>MARCH 2016</th>
<th>APRIL 2016</th>
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<td>S M T W T S</td>
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<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5 6</td>
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<tr>
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<td>7 8 9 10 11</td>
<td>7 8 9 10 11</td>
<td>7 8 9 10 11</td>
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<tr>
<td>12 13 14 15</td>
<td>12 13 14 15</td>
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<td>12 13 14 15</td>
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<tr>
<td>16 17 18 19</td>
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<td>16 17 18 19</td>
<td>16 17 18 19</td>
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<tr>
<td>20 21 22 23</td>
<td>20 21 22 23</td>
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<td>24 25 26 27</td>
<td>24 25 26 27</td>
<td>24 25 26 27</td>
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<table>
<thead>
<tr>
<th>MAY 2016</th>
<th>JUNE 2016</th>
<th>JULY 2016</th>
<th>AUGUST 2016</th>
</tr>
</thead>
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<td>S M T W T S</td>
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<td>1 2 3 4 5 6</td>
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<td>20 21 22 23</td>
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<td>24 25 26 27</td>
<td>24 25 26 27</td>
<td>24 25 26 27</td>
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<tr>
<td>28 29 30 31</td>
<td>28 29 30 31</td>
<td>28 29 30 31</td>
<td>28 29 30 31</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEPTEMBER 2016</th>
<th>OCTOBER 2016</th>
<th>NOVEMBER 2016</th>
<th>DECEMBER 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>S M T W T S</td>
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<td>S M T W T S</td>
<td>S M T W T S</td>
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<tr>
<td>1 2 3 4 5 6</td>
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<td>1 2 3 4 5 6</td>
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<td>28 29 30 31</td>
<td>28 29 30 31</td>
<td>28 29 30 31</td>
<td>28 29 30 31</td>
</tr>
</tbody>
</table>
Teaching guidelines
You might want to supply learners with a calendar and a list of the public holidays for the current year. You could adapt questions 2, 3, 4 and 5(a) and (b) to focus on the current year.

Learners will find it easier to complete question 5 if they can see the questions (on page 74) and the calendar (on page 73) at the same time. You could suggest that pairs of learners organise their textbooks so that one learner has page 74 open and the other learner has page 73 open.

Answers
1. (a) April, June, September, November
   (b) January, March, May, July, August, October, December
   (c) February
2. Accept any legitimate ways that learners suggest.
   Learners can recite the rhyme:
   30 days has September,
   April, June and November,
   all the rest have 31
   except for February,
   which has twenty-eight
   – rain or shine –
   but in leap years, twenty-nine.
   Learners can count on their knuckles:
   Starting with January on a knuckle, February off a knuckle, March on a knuckle, etc. All the months that “land on knuckles” have 31 days, as long as you count both July and August on a knuckle. The other months have 30 days, except for February.
3. Yes. We can see on the calendar that there are 29 days in February 2016.
4. 12
5. (a) Sunday
   (b) In South Africa, when a public holiday falls on a Sunday the following day becomes a public holiday as well.
   (c) On this day we celebrate the first time that all South Africans could vote. Most South Africans were not able to vote before 27 April 1994.
   (d) September 24 is Heritage Day.
6. Answers will differ from class to class and year to year.
7. Learners’ answers to this question will differ, because they were born on different days.
Teaching guidelines
Learners will find it easier to answer the questions if they can see the questions (on page 76) and the calendar (on page 75) at the same time. You could suggest that pairs of learners organise their textbooks so that one learner has page 75 open and the other learner has page 76 open.

You might like to adapt this activity to the current year by providing learners with a calendar and a list of school and public holidays for the current year. You could adapt questions 8 and 9(a) accordingly.
8. No, different calendars are organised differently. Many calendars have Sunday as the beginning of the week, while others have Monday as the beginning of the week.

9. (a) 1, 15, 22  
    (b) 6, 13, 27  
    (c) There are 7 days in a week, so you add or subtract in 7s.

10. (a) Learners' answers will differ.  
    (b) Term 2 starts on 13 April; Term 2 ends on 26 June.  
    (c) 3 weeks and 2 days  
    (d) When the school closes on 9 December.  
    (e) Term 2

11. The Term 1 dates for schools in coastal provinces are given in brackets.

<table>
<thead>
<tr>
<th>Term no. and dates</th>
<th>No. of week days</th>
<th>No. of public holidays</th>
<th>Actual no. of school days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Starts: 14 (21) January Ends: 25 Mar (1 April)</td>
<td>51</td>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>2 Starts: 13 April Ends: 26 June</td>
<td>56</td>
<td>3</td>
<td>53</td>
</tr>
<tr>
<td>3 Starts: 20 July Ends: 02 October</td>
<td>55</td>
<td>2</td>
<td>53</td>
</tr>
<tr>
<td>4 Starts: 12 October Ends: 9 December</td>
<td>43</td>
<td>0</td>
<td>43</td>
</tr>
<tr>
<td>TOTAL</td>
<td>205</td>
<td>5</td>
<td>200</td>
</tr>
</tbody>
</table>

8. Study the school calendar. The first column in each month is a Monday. In the calendar of 2016, the first column is a Sunday. Is this a mistake in one of the calendars? Why or why not? Discuss with a classmate.

9. (a) On the school calendar, 8 February is on a Sunday. What other dates in February will also be on a Sunday in this year? Find the answer without looking at the calendar.  
    (b) If 20 June is on a Monday in a certain year, what other dates in June will also be on a Monday?  
    (c) How did you think to get the answer in (b)?

10. (a) Is your school in a coastal or inland province?  
    (b) When does your Second Term start and when does it end?  
    (c) How long are your winter school holidays? Give your answer in weeks and days.  
    (d) When do the summer holidays start?  
    (e) In which school term does Workers' Day fall?

11. Copy and complete the table for your school.

<table>
<thead>
<tr>
<th>Term no. and dates</th>
<th>No. of days</th>
<th>No. of public holidays</th>
<th>Actual no. of school days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Starts: .......... Ends: ............</td>
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<tr>
<td>2 Starts: .......... Ends: ............</td>
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<tr>
<td>3 Starts: 20 July Ends:  2 October</td>
<td></td>
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<tr>
<td>4 Starts: 12 October Ends: 9 December</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
6.2 Measuring time

Mathematical notes
This section helps learners to discover one way in which time was measured in the past, i.e. using water clocks. Learners will make their own water clocks.

Resources
Ask learners to bring empty 2 litre plastic bottles to school. You will need one bottle for every 4 to 6 learners. You will also need cutting knives or other knives, and other sharp implements, for example nails for making a hole in the bottle top. You could also ask learners to make the water clocks at home, following steps 1 to 3.

Possible misconceptions
Most informal measurement depends on counting: we count the number of strides, we count the number of teaspoons or cups, etc. This water clock is divided into time units based on counting. This works if you compare times measured by the same water clock. However, it is not helpful when comparing times measured by two different clocks. This is because people count at different speeds.

In general, most people are not good at estimating and judging time lengths. This is the basis of the English idiom “time flies when you are having fun”.

Teaching guidelines
Learners can follow steps 1 to 6 to make a water clock. You might want to ask unemployed parents to assist during this lesson to prevent learners from hurting themselves or others when using the knives and other sharp implements. Other options are to make the models yourself or to ask learners to make the models at home and to bring them to class.

Answers
1. These are instructions, there are no answers.
Answers

2. The time taken will differ if different water clocks are used. This is because people count at different speeds. These water clocks were based on counting speeds.

3. The marks on the different clocks will be at different heights.

4. Learners' answers will differ.
   Instruction time is legislated at 2$\frac{1}{2}$ hours a week. This is 1 650 minutes. Different schools will break up the time differently.

You can now use the water clock to measure the time it takes to do something in units of 60 counts.

2. Each group uses their water clock to measure how long one of the learners in the class can hold her or his breath. Compare the time taken according to the different water clocks. What do you notice? Explain why this is so.

3. Place all the water clocks next to each other. What do you notice about the marks you made earlier at 60, 120, 180 and 240?

Counting is not a good way to measure time, because some people count faster than others. People decided long ago to use the changing of days to measure time.

The sun appears each day, it disappears later, and it appears again the next day. The period of time that starts when the sun appears on one day, and ends when the sun appears on the next day, is called one day. The day is divided into 24 equal periods which are called hours.

1 day = 24 hours
1 hour = 60 minutes
1 minute = 60 seconds

4. For approximately how many minutes are you in school each day of the week?
**Answers**

5. They take the same time. 65 seconds = 1 minute and 5 seconds

6. They take the same time. 120 minutes = 2 hours

6.3 Understanding the 12-hour clock

**Mathematical notes**

In the Intermediate Phase, learners work with both 12-hour time (using a.m. and p.m.) and 24-hour time. This section focuses on 12-hour time; in the next section learners will work with 24-hour time. Both Sections 6.3 and 6.4 focus on analogue time. Section 6.5 focuses on digital time.

**Teaching guidelines**

You can check that learners understand that watches are worn on wrists and clocks are freestanding or hang on a wall.

You can check whether learners know which is the hour hand and which is the minute hand. Also check whether learners remember how many minutes there are in an hour. Check that they can deduce how many minutes are in \( \frac{1}{2} \) hour, \( \frac{1}{4} \) hour and \( \frac{3}{4} \) hour. You can use the tinted passage to fill in any gaps that learners may have. Learners can also use it to revise this information for tests or exams.

**Notes on questions**

In question 1, make sure that learners understand that they need to start counting from the 12th hour position.

**Answers**

1.

- (d) three quarters of an hour
- (c) 40 minutes
- (f) half an hour
- (a) 10 minutes
- (e) a quarter of an hour
- (b) 25 minutes

---

5. It takes Learner A 65 seconds to write ten words. It takes Learner B 1 minute and 5 seconds to write ten words. Who takes the longest to write ten words?

6. It takes Grandma 120 minutes to walk to the shop. It takes Grandpa 2 hours to walk to the shop. Who takes the longest?
Possible misconceptions
Learners sometimes struggle to understand minutes past the hour, and minutes to the hour. Sometimes it helps to act this out.

Resources
12 sheets of paper with a number from 1 to 12 on each sheet.
Two long sticks or pieces of string.

Teaching guidelines
Let learners sit in a large circle. Place stones to mark every minute, and use the numbers on the pieces of paper to show the hours (1 to 12). One learner sits in the middle of the circle holding a piece of string or a stick while another learner holds the other end of the string or stick. This is the minute hand.

Use another piece of string or a stick to represent the hour hand. Start with the hands positioned at any hour, for example 12 o’clock. Ask learners to say what time the clock shows. Then ask the learner with the minute hand to walk around the inside of the circle while the rest of the class says: “It is . . . minutes past 12 o’clock.” Stop the learner when he/she gets to 12:15 and ask the class what fraction of the circle the learner has walked around. Do this again at 12:30. Then explain that for the rest of the circle, the learner will be walking back towards the 12. So we no longer count minutes past the hour, we count minutes to the next hour. Continue as before but let the class say: “It is . . . minutes to 1 o’clock,” etc.

Answers
2. (a) 1:00 1 o’clock
   (b) 1:15 quarter past 1
   (c) 1:30 half past 1
   (d) 1:45 quarter to 2
3. (a) 8:05 5 past 8
   (b) 8:10 10 past 8
   (c) 8:20 20 past 8
**Notes on questions**
This is quite a long section. You could aim to do questions 1 to 6 in class, and let learners do questions 7 to 12 for additional practice.

Note that there are blank clock faces in the Addendum (page 442) that you could photocopy for learners for question 5, or for further practice.

**Answers**

4. (a) 8:35 25 to 9  
   (b) 8:40 20 to 9  
   (c) 8:45 quarter to 9

5. (a)  
   (b)  
   (c)  
   (d) 

6. (a) 6:00 a.m.  
   (b) 7:15 a.m.  
   (c) 8:00 a.m.  
   (d) 2:10 p.m.
Notes on questions
As suggested earlier, questions 7 to 12 could be used for additional practice.

Answers
7. (a) 10 minutes  (b) 20 minutes  
   (c) 7 minutes  (d) 15 minutes
8. (a) 30 minutes  (b) 15 minutes  
   (c) 120 minutes (d) 150 minutes  
   (e) 10 minutes  (f) (12 × 60) + 7 = 727 minutes  
   (g) (12 × 60) + 20 = 740 minutes  (h) 12 × 60 = 720 minutes
9. 5 hours  
   Here learners can count up: 7:30; 8:30; 9:30; 10:30; 11:30; 12:30. They could also subtract: 12 − 7 = 5.
10. 3:10 p.m.  
    Here learners can count up 2 to 3 and add the minutes.
11. 9:27 a.m.  
    Quarter past 9 = 9:15  15 + 12 = 27
12. Two and a quarter hours = (60 minutes × 2) + 15 minutes = 135 minutes
6.4 Understanding the 24-hour clock

**Mathematical notes**
Both 24-hour time and digital clocks are new in Grade 4.

**Resources**
Sheets of paper or card for each learner.
Sets of cards numbered as shown in the “Teaching guidelines” below.
String or wire.

**Teaching guidelines**
It is useful for learners to see both digital and analogue clocks showing the same time. You can show working examples of both in your classroom. You might also like to make models of both analogue and digital clocks.

To make a model of a digital clock you can do the following:
- Fold a sheet of thick paper or card into quarters lengthwise.

![Folded sheet of paper](image)

- Fold it again to form a triangular prism, to make the stand.
- Make four sets of cards to show hours and minutes.
  - The left-hand set needs cards:
    - 0 1 2
  - The set second from the left needs cards:
    - 0 1 2 3 4 5 to 9
  - The set second from the right needs cards:
    - 0 1 2 3 4 5
  - The set on the far right needs cards:
    - 0 1 2 3 4 5 to 9
- Attach these cards with string to the stand.
Possible misconceptions
Learners may be confused about how to write midday and midnight in 24-hour time. You may need to clarify for them that midday is written 12:00 p.m. or 12:00 (in digital format) and midnight is written 12 a.m. or 00:00 (see the tinted passage on page 85). This is simply a convention that has been adopted for the sake of clarity.

Answers
1. (a) 07:00  (b) 19:00  (c) 00:00
   (d) 12:00  (e) 11:00  (f) 23:00
2. (a) 23:00  (b) 11:00  (c) 02:00
   (d) 14:00  (e) 18:00  (f) 18:00
3. (a) 13:20  (b) 12:40  (c) 15:15  (d) 04:25
4. (a) 10:00 a.m.  10 o’clock in the morning
   (b) 10:15 a.m.  quarter past 10 in the morning
   (c) 10:30 a.m.  half past 10 in the morning
   (d) 10:45 a.m.  quarter to 11 in the morning
   (e) 12:00 a.m.  midday or 12 noon  (f) 12:00 p.m.  midnight
   (g) 8:35 a.m.  25 to 9 in the morning  (h) 4:35 p.m.  25 to 5 in the afternoon

6.5 Hours, minutes and seconds

Resources
For question 1 you will need a stopwatch. Digital stopwatches are usually easier to read than analogue stopwatches. Many cellphones have a stopwatch function, or the possibility of downloading a free stopwatch app. If you have access to more stopwatches, learners can use these in question 4.

Learners will need tennis balls to bounce for question 2.

Teaching guidelines
If you do not have enough tennis balls for the whole class to do question 2 simultaneously, let learners work in groups. Let most of the class complete the other questions while one group is busy with the tennis balls.

Answers
1. Practical activity
2. (a) Learners’ estimates will differ.
   (b) The number of times learners bounce the ball will differ.
Teaching guidelines
If you only have one instrument for measuring seconds (stopwatch, cellphone, watch or clock with seconds hand), let most of the class continue with the other questions while you help groups of learners to complete question 4.

Answers
3. Learners’ answers will differ.
4. Learners’ activities will differ; their estimates will also differ.
5. (a) B  (b) C  (c) A
Data handling

<table>
<thead>
<tr>
<th>Sections in this unit</th>
<th>Content</th>
<th>Pages in Learner Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Collect and organise data</td>
<td>The concept of data as measurements that vary</td>
<td>86 to 89</td>
</tr>
<tr>
<td>7.2 Representing data in tables</td>
<td>Data that are represented in tables can be compared more easily</td>
<td>90</td>
</tr>
<tr>
<td>7.3 Pictographs and bar graphs</td>
<td>Frequency comparisons of data at a glance</td>
<td>91 to 92</td>
</tr>
<tr>
<td>7.4 Information in pie charts</td>
<td>Proportional comparison of data at a glance</td>
<td>92 to 94</td>
</tr>
<tr>
<td>7.5 Information in bar graphs</td>
<td>Length of bars are used to represent frequencies</td>
<td>95</td>
</tr>
</tbody>
</table>

**Mathematical background**

Some ideas that differentiate data handling from mathematics:

- **The answer to data questions is in the information from lots of data gathered.**
  Data handling is necessary where measurements and frequencies vary, and therefore one measurement cannot provide accurate information about a situation. Lots of different data can be confusing, so we organise the data that we collect in different ways to get a “picture” of the situation.

- **The numbers we use in data handling always have some unit of measurement, or some description of a category they belong to.**
  In Mathematics, learners mostly work with abstract numbers. In data handling the numbers must be interpreted in a context. The number 2 can be 2 cm or 2 fish, depending on the question.

- **Data questions are always answered with a story about the context.**
  Data handling starts when we need to answer a question about a situation where the property we look at varies. The numerical answers we get through data handling must be interpreted to answer the question about the situation.

**Resources**

Rulers; cut-out paper circles for folding into quarters.
7.1 Collect and organise data

Mathematical notes
This unit provides a controlled context to work through the complete cycle of data handling. You can use similar problem types to work through the cycle in learners’ own contexts, as the CAPS requires that this be done a few times in a year.

Resources
Rulers.

Teaching guidelines
Aim to spend about 2 hours on this section. Read the story to the class. You must pose the question that will guide the work in this unit: Jabu wants to know the size of the fish so that he can plan how much food he needs, and when to sell his fish. The questions learners will answer are all about the different kinds of fish he has, and their sizes.

Learners will need rulers to take the measurements of 20 fish. Learners work in pairs to answer question 1 on page 87. They will find it easier if one learner keeps his/her book open on page 87 while the other learner keeps his/her book open on pages 88 to 89.

Learners may share the measuring work to save time. Discuss with them how to measure as accurately as possible.

Critical knowledge
Data are about trends. Information is grouped to make it easier to “see” the trends.

Possible misconceptions
Learners tend to answer statistical questions with reference to only one of the data points. For example, when you ask how big the Huna goldfish are, they may give the length of the longest or the shortest fish. Learners are used to giving a single number as an answer when they solve word problems in Mathematics. In Statistics we also want to find a single number to answer a question, but the number must be representative of all the numbers that we gathered as data.

In Grade 4 we prepare learners’ intuitions about representativeness, but they do not yet use a single measurement to represent all measurements. In this unit we develop ways to compare groups of data by using language like “between”, “less than” and “more than”.

Plan ahead
Make a plan so that you will know which measurements are of Huna fish and which are of Hibuna fish.
Plan how to measure accurately. Measure from the nose to the end of the body. Fish don’t keep their tails still, so you can’t measure their tails accurately!
Notes on questions

Observe the ways different pairs of learners use to organise the data informally. Let them discuss which ways are more helpful when they have to answer questions 2 and 3.

Question 2 draws attention to language. For example, there is a difference between saying “the fish are longer than 2 cm” and “the fish are 2 cm and longer”. Sentence B is therefore not true, because some Hibunas are 2 cm long. Sentences A and C are true, but Sentence D best describes the size of the Hibunas.

Please note: Learner Book pages 88 and 89 shown alongside only contain sketches of fish. No questions or instructions appear on these pages, so there are no further teaching notes specifically related to these pages.

Answers

1. (a) Answers will differ. Learners may decide to each measure one type of fish, or each measure all the fish on one page, or split the work in some other way. This is their data gathering plan that they must write down.

(b) Some learners may simply write down the numbers in a jumbled way, others may make separate lists for the measurements of the Hibuna and the Huna fish. Others may start to organise their measurements into simple tables.

Hibunas (gold): 2 cm, 8 cm, 3 cm, 5 cm, 4 cm, 5 cm, 4 cm, 3 cm, 4 cm, 2 cm

Hunas (blue-grey): 2 cm, 6 cm, 5 cm, 7 cm, 6 cm, 7 cm, 2 cm, 6 cm, 5 cm, 5 cm

(c) Learners compare measurements of fish. Where they differ, they decide on the source of the difference. They have to show each other how they measured.

(d) Learners re-do question (b) if necessary.

2. Sentence D: The Hibuna fish are between 2 cm and 8 cm long, but most are between 3 cm and 5 cm long.

3. There are many possible answers. Learners’ answers will differ. Let learners compare and discuss their descriptions. One possible description is:

The Huna fish are between 2 cm and 7 cm long, but most are 5 cm and longer.
7.2 Representing data in tables

Mathematical notes
A well-constructed tally table shows how the data are distributed. If it is done neatly, as on page 90, it looks like a graph.

Teaching guidelines
Aim to spend about 2 hours on this section.

Discuss the structure of the tally table with the class. Draw learners’ attention to the clever plan to group the tallies into fives so that they can be counted quickly.

Notes on questions
The questions aim to make learners aware of the use of words or phrases such as “most”, “same as”, “more than”, “less than”, etc. Other terminology that is used to describe intervals of measurements informally, such as “between”, “up to”, or “longer than” is also important. In question 2, let learners decide which statements are true, and correct those that are not true.

Possible misconceptions
You can expect learners to answer question 1 by giving the exact number of fish for each measurement, for example: “There are 3 fish that are 2 cm long and 7 fish that are 3 cm long ...” Discuss with them that such answers do not help us to understand the situation because we cannot remember all the information.

Learners sometimes use the expression “most of” to describe the category with the most data, or the longest bar in a bar graph. However, a category can have more data than any of the others without this category representing most of the data in the data set. For example, in the tally table we can see that the biggest size category is 4 cm fish. But only 15 fish out of 50 are 4 cm long. Most of the fish in the tank, the other 35 fish, are not 4 cm long. It is important to help learners to understand this distinction.

Answers
1. There are many possible descriptions. Two examples are:
   “The Syubunkin fish are between 2 cm and 8 cm long, but most are between 3 cm and 6 cm long.”
   “The Syubunkin fish are between 2 cm and 8 cm long, and many are 4 cm or 5 cm long.”

Syubunkin in Tank B

<table>
<thead>
<tr>
<th>Length</th>
<th>Tallies</th>
<th>Total number of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 cm</td>
<td>///</td>
<td>3</td>
</tr>
<tr>
<td>3 cm</td>
<td>/////</td>
<td>7</td>
</tr>
<tr>
<td>4 cm</td>
<td>/////</td>
<td>15</td>
</tr>
<tr>
<td>5 cm</td>
<td>/////</td>
<td>11</td>
</tr>
<tr>
<td>6 cm</td>
<td>/////</td>
<td>7</td>
</tr>
<tr>
<td>7 cm</td>
<td>///</td>
<td>3</td>
</tr>
<tr>
<td>8 cm</td>
<td>/////</td>
<td>4</td>
</tr>
</tbody>
</table>

1. What can you tell about the length of the fish from Jabu’s tally table? Write down your story and compare it with that of a classmate.
2. Do you agree or disagree with the following statements? Explain why.
   (a) Most Syubunkins are between 5 cm and 8 cm long.
   (b) Most Syubunkins are 4 cm long.
   (c) The number of Syubunkins that are 3 cm long is the same as the number of Syubunkins that are 6 cm long.
   (d) Half of the Syubunkins are 5 cm up to 8 cm long.
3. Jabu asks you to put together the information about the fish in Tank A (that is, the fish on pages 88 and 89). Make a tally table like the one above to show the lengths of the Hibuna and Huna fish that you measured.
Answers (continued)

2. (a) Disagree, because the same number of fish (25) are between 5 cm and 8 cm long as between 2 cm and 4 cm long.
   Or, disagree, and give another interval that contains more than half of the fish.
(b) Disagree, because only 15 of the 50 Syubunkins are 4 cm long; the majority (35 out of 50) Syubunkins have different sizes.
(c) Agree, because there are 7 Syubunkins that are 3 cm long and 7 Syubunkins that are 6 cm long.
(d) Agree

3. Learners copy and complete one table for the Hibunas and one for the Hunas in Tank A (the fish on pages 88 and 89).

### Hunas (blue-grey) in Tank A

<table>
<thead>
<tr>
<th>Length</th>
<th>Tallies</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 cm</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3 cm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4 cm</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5 cm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6 cm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7 cm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8 cm</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Hibunas (gold) in Tank A

<table>
<thead>
<tr>
<th>Length</th>
<th>Tallies</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 cm</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3 cm</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4 cm</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5 cm</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6 cm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7 cm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8 cm</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

7.2 Representing data in tables

In Tank B Jabu has 50 Syubunkin fish. He measured them and wrote his measurements in this tally table. It helps him to organise his measurements. He makes a mark (tally) in the appropriate place in the table. Have a look at what he did.

### Syubunkin in Tank B

<table>
<thead>
<tr>
<th>Length</th>
<th>Tallies</th>
<th>Total number of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 cm</td>
<td>//</td>
<td>3</td>
</tr>
<tr>
<td>3 cm</td>
<td>//</td>
<td>7</td>
</tr>
<tr>
<td>4 cm</td>
<td>///</td>
<td>15</td>
</tr>
<tr>
<td>5 cm</td>
<td>///</td>
<td>11</td>
</tr>
<tr>
<td>6 cm</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>7 cm</td>
<td>///</td>
<td>3</td>
</tr>
<tr>
<td>8 cm</td>
<td>///</td>
<td>4</td>
</tr>
</tbody>
</table>

1. What can you tell about the length of the fish from Jabu's tally table? Write down your story and compare it with that of a classmate.

2. Do you agree or disagree with the following statements? Explain why.
   (a) Most Syubunkins are between 5 cm and 8 cm long.
   (b) Most Syubunkins are 4 cm long.
   (c) The number of Syubunkins that are 3 cm long is the same as the number of Syubunkins that are 6 cm long.
   (d) Half of the Syubunkins are 5 cm up to 8 cm long.

3. Jabu asks you to put together the information about the fish in Tank A (that is, the fish on pages 88 and 89). Make a tally table like the one above to show the lengths of the Hibuna and Huna fish that you measured.
7.3 Pictographs and bar graphs

**Teaching guidelines**
Aim to spend about 2 hours on this section.

Prepare the frame of the pictograph on the board or on a poster so that you can use it in the class discussion. Alert learners to the heading and the key. These are important aspects of a pictograph. Stress that all the fish must be drawn the same size and must be evenly spaced.

Learners must redraw the frame of the pictograph in their exercise books.

**Critical knowledge**
The pictures must all be the same size and evenly spaced. The heading and key are crucial parts of the graph.

**Answers**

1. **Number of Hunas and Hibunas of different lengths in Tank A**

<table>
<thead>
<tr>
<th>Length of fish</th>
<th>Number of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 cm</td>
<td>2 Hunas</td>
</tr>
<tr>
<td>3 cm</td>
<td>3 Hunas</td>
</tr>
<tr>
<td>4 cm</td>
<td>4 Hunas</td>
</tr>
<tr>
<td>5 cm</td>
<td>5 Hunas</td>
</tr>
<tr>
<td>6 cm</td>
<td>6 Hunas</td>
</tr>
<tr>
<td>7 cm</td>
<td>7 Hunas</td>
</tr>
<tr>
<td>8 cm</td>
<td>8 Hunas</td>
</tr>
</tbody>
</table>

   Key: ❎ One Huna  ❎ One Hibuna

2. (a) **Small**: 6 fish: 2 Hunas and 4 Hibunas
   (b) **Medium**: 8 fish: 3 Hunas and 5 Hibunas
   (c) **Large**: 6 fish: 5 Hunas and 1 Hibuna

---

**Number of Huna and Hibuna of different lengths in Tank A**

<table>
<thead>
<tr>
<th>Length of fish</th>
<th>Number of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 cm</td>
<td>2</td>
</tr>
<tr>
<td>3 cm</td>
<td>3</td>
</tr>
<tr>
<td>4 cm</td>
<td>4</td>
</tr>
<tr>
<td>5 cm</td>
<td>5</td>
</tr>
<tr>
<td>6 cm</td>
<td>6</td>
</tr>
<tr>
<td>7 cm</td>
<td>7</td>
</tr>
<tr>
<td>8 cm</td>
<td>8</td>
</tr>
</tbody>
</table>

Key: ❎ One Huna  ❎ One Hibuna

2. Jabu wants a bar graph of the small, medium and large fish in Tank A.
   (a) If a fish is shorter than 4 cm it is small. How many small fish are there in Tank A?
   (b) A fish that is 4 cm or 5 cm long is medium. How many medium fish are there in Tank A?
   (c) A fish that is 6 cm or longer is large. How many large fish are there in Tank A?
Teaching guidelines

Once learners have completed question 2 they should copy the frame for the bar graph given on page 92 and fill in the data. Emphasise once again that the graph needs a heading, and that each axis needs a label. Once learners have completed the graph for Hunas in Tank A, they should draw a second graph (adapt the graph heading) for Hibunas in Tank A.

Answers

2. (d)

<table>
<thead>
<tr>
<th>Number of Huna fish of different lengths in Tank A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of fish</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Hibuna fish of different lengths in Tank A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of fish</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

7.4 Information in pie charts

Jabu sees an advertisement on the internet of a pet shop owner who wants to sell her tank of fish. She wants R480 for 60 goldfish. The advertisement has only this pie chart.

A pie chart has a **heading** and a **key** to tell the meaning of the pie chart. In a pie chart the parts are **fractions** of the pie (circle). For example, we work out what fraction of the fish are Huna and then we colour the same fraction of the pie.

1. (a) What is the heading of the chart?
   (b) What does the key tell you?
   (c) What does the graph tell you about the fish in this tank?
7.4 Information in pie charts

**Mathematical notes**
Pie charts are useful to compare proportions of data.
- The proportion of each category of data is represented as part of the area of a circle. These areas are called sectors of a circle.
- In Grade 4 learners will compare these proportions by using fractions.

**Resources**
If possible, cut-out paper circles for folding into quarters (see the note about question 3 in “Notes on questions” on the next page).
Large copies of the graphs on posters or drawn on the board.

**Teaching guidelines**
Aim to spend about 2 hours on this section.
- Prepare a pie chart on the board or on a poster to use for class discussions.
- Discuss with learners that these pie charts do not show exact numbers, but show the relative amounts of each grouping as fractions of circles.
- Use class discussions to develop comparisons like “twice as many” and “half as many”.

**Critical knowledge**
Pie charts help us to make comparisons about categories of data. The size of the sector represents the relative proportion of the data. Pie charts do not show the exact numbers. Learners should use their knowledge of fractions to estimate the relative size of the sectors.

**Answers**
1. (a) 60 goldfish for sale
   (b) It tells us what kind of fish each colour represents.
   (c) Half of the fish (30 fish) are Hibunas.
   One quarter of the fish (15 fish) are Hunas.
   One quarter of the fish (15 fish) are Syubunkins.
Notes on questions
For question 3, let learners cut out a circle and fold it in quarters, then cut out the quarter segments to help them estimate the sizes of the sectors of the pie chart.

In question 4 it is important to stress the word “about” – learners are not asked exact numbers. Learners’ estimates may differ and lead them to interpret the statements in questions 4(b), (c) and (d) differently. Whether learners agree or disagree depends on how much difference they are willing to see as “almost the same”.

Answers
2. \( R480 - R240 = R240 \)
   \( R240 \div 60 = R4 \)
   Yes, Jabu is correct.

3. Learners’ answers will differ. A sample answer is provided below. Check all learners’ answers to see which make sense.
   Fish between 7 cm and 9 cm long make up the smallest group in the tank.
   Fish between 4 cm and 6 cm long make up about \( \frac{1}{3} \) of the fish in the tank.
   Fish that are 10 cm to 12 cm long make up the biggest group.

4. (a) Disagree, because the yellow sector is less than half of the circle.
   (b) Agree, the green sector is a little less than one third of the circle.
   (c) Agree, the purple sector is a little more than one third of the circle.
   (d) Disagree, because the yellow sector cannot fit into the purple sector twice.
   As mentioned under “Notes on questions”, whether learners agree or disagree depends on how much difference they are willing to see as “almost the same”.

Jabu says: “A fish tank costs about R240. If the fish tank is part of the sale, then the pet shop owner asks about R4 per fish. That’s a bargain!”

2. Check if Jabu is correct about the price.

Jabu asked the pet shop owner to let him know what size the fish are. She sent this pie chart:

3. What story does the pie chart tell about the sizes of the 60 goldfish? Write the information in your book.

4. Read each statement and say whether you agree or disagree. Explain why.
   (a) More than half of the fish are between 7 cm and 9 cm long.
   (b) About a third of the fish are between 4 cm and 6 cm long.
   (c) About a third of the fish are between 10 cm and 12 cm long.
   (d) The big fish (10 cm to 12 cm) are almost twice as many as the medium fish (7 cm to 9 cm).
Notes on questions

Question 7 is a challenge and an extension question.

Answers

5. Learners’ answers may differ. A sample answer is provided below.

Most of the small fish, about \( \frac{3}{4} \), are Syubunkins. Less than \( \frac{1}{8} \) are Hunas, and slightly more than \( \frac{1}{8} \) are Hibunas.

6. (a) Agree, draw lines or fold another circle to demonstrate.
(b) Disagree, because the blue and yellow sectors, which show fish other than Syubunkins, make up about one quarter of the circle.
(c) Agree, draw lines or fold another circle to demonstrate.
(d) Disagree, the blue sector is smaller than the yellow sector.

7. 15 of the fish are small Syubunkins between 4 cm and 6 cm.
Learners might use different ways to find the answer. Here is one way:
From question 4 (see 4(c)), learners know that about 1 third of all the fish are small.
One third of 60 is 20. So 20 of all the fish are small.
Three quarters of the small fish are Syubunkins.
One quarter of 20 is 5, so 3 quarters of 20 is 15.
7.5 Information in bar graphs

Mathematical notes
The scales on the frequency axes differ between the two bar graphs.

Teaching guidelines
Aim to spend about 2 hours on this section.
- Prepare the bar graphs on the board or on posters for use during class discussions.

Possible misconceptions
Learners may simply look at the visual heights of the bars and ignore the scale. Learners may also struggle to understand that while the scale for the graph of the large fish is counted in twos, they have to infer that the numbers in between can be used to give frequencies. They may also say there are six and a half large Syubunkins, instead of seven.

Critical knowledge
Bar graphs also help us to make comparisons about categories of data. However, you cannot only look at the relative height of the bars, you also need to consider the scale of the graph. The heading of the graph, the labels of the axes and the names of the categories are crucial parts of the graph.

Notes on questions
Question 5 is a challenge and an extension question.

Answers
1. 6
2. 12
3. There are the same number of medium and large Hibunas: 6 of each.
4. There are 8 medium Syubunkins and 7 large Syubunkins.
5. There are 6 medium and 6 large Hibunas. So there are 12 Hibunas that are medium or large. There are 30 Hibunas altogether. This means that the number of small Hibunas is 30 – 12 = 18. There are 18 small Hibunas.
   There is 1 medium Huna and 12 large Hunas. So there are 13 Hunas that are medium or large. There are 15 Hunas altogether. This means that the number of small Hunas is 15 – 13 = 2. There are 2 small Hunas.
Grade 4 Term 1 Unit 8

Properties of two-dimensional shapes

<table>
<thead>
<tr>
<th>Sections in this unit</th>
<th>Content</th>
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**CAPS time allocation**
5 hours

**CAPS page references**
21 to 22 and 59 to 61

**Mathematical background**

Two-dimensional shapes do not exist on their own in the real world. They occur as faces of many three-dimensional objects. They are also found by looking carefully at objects around us, for example the silhouette of a mountain may be triangular; three or more stars in the sky may form the corners of triangles, quadrilaterals, pentagons, etc.; the shadow of a football may be circular or oval. We can draw (i.e. represent) two-dimensional shapes on paper and other flat surfaces. This allows us to focus our mathematical attention on them more easily.

Two-dimensional shapes have properties. Different kinds of shapes may share some properties. For example, squares and rectangles share the property “all four corners look the same”. Different kinds of shapes will also have properties that differ. For example, squares have the property “all four sides look the same, i.e. they are the same length,” but rectangles have the property “opposite sides are the same length”. Identifying properties allows us to relate different shapes to each other. For example, a square is a special kind of rectangle. All the properties of rectangles also apply to squares, but squares have some extra properties. Being able to identify these properties also improves spatial sense.

In the Intermediate Phase learners begin to focus on the properties of shapes and how different shapes are related to each other. Drawing shapes and talking about them is a very important first step. Begin by letting learners draw shapes freehand (using only a pen or pencil). Ask them how they could improve on their freehand drawings. For polygon shapes an extra tool, the straight edge, is very useful. It allows one to make sure that the sides of a drawn polygon are straight, which is a great improvement over freehand drawing.

Ask learners how they could further improve on their drawings. How can one make sure the straight sides of one’s drawings are properly placed? Grid paper is an excellent tool for this. Grid paper is also a very helpful tool for freehand drawing of curved shapes such as circles and ovals (“egg shapes”).

**Note:** The underlying idea in this unit is the properties of two-dimensional shapes. The straight edge and grid paper are tools to help (scaffold) learners to begin identifying and reasoning about these properties. Do not force them into this, but allow them the space to begin asking and answering questions such as: “What makes this figure a rectangle?”, “Why is that a better drawing of a square than this drawing?”, “Have I drawn a circle or is it an egg shape?”, etc. Each learner should begin to develop a few criteria about how well a drawing represents a certain shape. This is the beginning of geometric reasoning.

**Resources**
Scrap paper; boxes with rectangular faces; boxes with square faces; square grid paper; pencils; rulers or straight edges.
8.1 Surfaces with different shapes

Mathematical notes
The focus in this section is on squares and other rectangles.
A square is a special kind of rectangle. Squares have all the properties of rectangles:
- They are closed shapes.
- All four sides are straight.
- All angles are the same size so they look the same.
- Opposite sides are the same length.
Squares have one additional property:
- All sides are the same length.

Teaching guidelines
Aim to cover this section in about 1 to 1 1/2 hours.
In Grade 3 learners should have learnt to recognise triangles, squares, rectangles and circles. However, learners were not expected to group figures according to the number or length of their sides, or to think about the corners (angles) of the figures.
You can introduce the lesson by drawing around the rectangular faces of a box. It is best if you show examples of differently shaped rectangles. If possible, find a cube and draw around the faces of the cube to show squares.
Allow learners to draw freehand squares and rectangles. Let them compare and talk about their drawings in suitable groups. Move around and engage each group in conversation to guide the talking about the properties of the shapes they draw, for example:
- How straight are the sides?
- Are the four sides the same length or different lengths?
- Are the four corners the same size or different sizes? Do they all look the same?

Resources
A piece of paper for each learner: it can be previously used paper.
A box in which all the faces are rectangles (like a cereal box or tea box).
A box in which all the faces are squares (like a hand or facial cream box or a square tissue box).

Answers
1. Learners’ own freehand drawings of squares
Notes on questions
The aim of questions 2 and 3 is to help learners to focus on the features or properties of squares.

In question 4, when the straight edge is introduced, explain that its purpose is to allow us to draw the sides of our shapes as straight as possible. Ask learners what else we could use as a straight edge.

The folded paper straight edge has additional teaching value. If it is folded carefully it forms a rectangle. You may open a rewarding class discussion about this. Why is it a rectangle? How can we fold a square? How can we fold it so it is not a rectangle or a square?

Teaching guidelines
Once learners have completed question 3 you can write a list of the properties of a square on the board.

You can demonstrate to learners how to fold a straight edge from a piece of paper. It is important that you make a sharp crease each time. You can show learners how to rub their fingernail or the side of a pencil over the fold to make a sharp crease.

Answers
2. Learners’ choices of the best square may differ.

3. Any of the following statements are valid. Learners are not expected to provide all of these answers.
   (a) The corners are not the same size and/or the bottom line is not straight and/or it is not closed.
   (b) All sides are not equal in length and/or the corners are not the same size.
   (c) The sides are not straight.
   (d) The sides are not straight and/or not equal in length.

4. Learners fold their own straight edge.
Teaching guidelines

In the Foundation Phase, two-dimensional shapes are treated as completely distinct from each other. Some learners will find it strange to think of a square as a special type of rectangle. Using non-mathematical examples can help learners to think about groupings as sub-sets. For example: All boys are people and all girls are people; boys and girls are special kinds of people. But not all people are boys, nor are all people girls. Or: Cattle, sheep, goats and dogs are all animals, but not all animals are cattle or sheep or goats or dogs, etc.

Once learners have completed question 6, talk to them about the difference between squares and other rectangles: When is a rectangle a square? When is a rectangle not a square?

Possible misconceptions

Some learners may struggle to distinguish squares and rectangles clearly from more general types of quadrilaterals, or to distinguish squares from rectangles. Such learners will have to be supported individually. We suggest letting them draw freehand shapes under your personal guidance to achieve this.

Answers

5. Learners’ own drawings of squares
6. Learners’ own drawings of rectangles

8.2 Surfaces with other shapes

Mathematical notes

When we group figures according to their properties/features, we call this classifying. The focus in this section is on classifying more figures with straight sides according to their shapes.

Polygons are closed figures with straight sides only. Non-polygons are figures with one or more curved side. Learners must know the shapes and names of polygons up to and including hexagons: see the text at the summary bar on page 100. Learners identify, name and describe polygons by counting and referring to their number of sides.

This section also helps learners to distinguish between shape and size – when do two figures (e.g. two triangles) have the same shape and size, when do they have the same shape but different sizes, and when do they have different shapes and sizes.
**Teaching guidelines**

This is a long section: aim to complete it in about 2 hours.

You can start by drawing a range of quadrilaterals of different shapes and sizes on the board. Explain to learners that a **quadrilateral** is a closed figure with four straight sides. This term will be new to them. Ask them if they can think of any figures that they know that are quadrilaterals. Draw examples of figures with four straight sides that are not closed. Explain that because not all the sides meet, we say that the figure is open. Such figures are not quadrilaterals.

**Possible misconceptions**

Some letters of the alphabet have the same shape, but are different because they face different directions, for example p, q, d and b. Sometimes learners think that if figures face a different direction they are different shapes. This misconception often occurs with squares:

These are all squares: 

These are also all squares:

It is important that learners see the same shapes in a range of different positions.

It is also important that learners see a range of shapes that look different. For example, these are all triangles:

Page 60 of the CAPS shows some different examples of quadrilaterals, pentagons and hexagons.

**Notes on questions**

Questions 1, 2, 3, 11 and 12 are about quadrilaterals, including squares and other rectangles.

**Answers**

1. Figures that are not quadrilaterals: A, C, E, F, H, I, J, K, L
2. Figures with four corners looking the same: B, N, O
3. (a) Rectangles: B, N, O
   (b) Rectangles but not squares: O (B and N are squares)

Rectangles and squares are also quadrilaterals. The four corners of a rectangle or a square look the same.

1. Which of these figures are not quadrilaterals?

   ![Diagram of shapes]

   - A
   - B
   - C
   - D
   - E
   - F
   - G
   - H
   - I
   - J
   - K
   - L

   These are all squares:

   These are also all squares:

   It is important that learners see the same shapes in a range of different positions.

   It is also important that learners see a range of shapes that look different. For example, these are all triangles:

   Figure L is not called a quadrilateral because it is open at one place. Only closed figures, such as those below, are called quadrilaterals.

2. The corners of Figure M do not all look the same. In which of all the figures on this page do the four corners look the same?

3. (a) Which of the figures on this page are rectangles?
   (b) Which figures on this page are rectangles but not squares?
**Teaching guidelines**

Pentagons and hexagons are new in Grade 4. You can draw a variety of pentagons on the board (page 60 of the CAPS shows some examples). Ask learners what is the same about each of the figures. Use the summary bar to explain what a pentagon is. You can repeat this with hexagons.

Once learners have completed question 4, you can explain, with illustrations, how figures with the same name can have the same shape but different sizes. You can use the tinted passage on page 100 to guide you. Consider illustrating this with rectangles too, as shown here, so that learners see two different examples.

Then continue to show how figures with the same name, for example rectangles, can have different shapes, as shown alongside.

**Notes on questions**

Questions 5 to 12 are about identifying sameness and difference for a range of figures. Learners will need to identify what is the same and what is different using shape and size. This is an important aspect of developing reasoning in geometry.

If time permits, encourage discussion around these issues. Encourage learners to use drawings during these discussions to resolve differences of opinion and to make themselves better understood. Let learners make freehand drawings as well as drawings using a straight edge. Move around the classroom to check that each group is on track and focused on the important issues.

**Answers**

4. (a) Not a polygon: E, L (E does not have straight sides, L is not closed)  
   (b) Pentagons: A, I  
   (c) Hexagons: C, J  
   (d) Not triangles, quadrilaterals, pentagons or hexagons: H, K, E, L

5. Learners’ own drawings of triangles, for example:
Answers

6. (a)       (b)

(c)       (d)

7. See Learner Book.

8.       

9. The purpose of the question is to make learners think about what they did, not to get a neat, “correct” description, which they are not capable of at this time. Learners may mention that they try to make the angles or corners “the same” or “equal”.

10.       11.       

12.       

13.       

When you make a drawing without using a straight edge or other tool, it is called a freehand drawing. Artists mainly make freehand drawings.

6. Make freehand drawings of the following:
   (a) a triangle    (b) a quadrilateral that is not a rectangle
   (c) a pentagon   (d) a hexagon

7. Make a freehand drawing of three triangles with the same shape, one inside the other.
   Make your drawings large so that they fill a whole page.

8. Draw three triangles, not inside each other, with the same shape but different sizes. Do not use a straight edge.

9. How did you try to make sure that your three triangles have the same shape? Write a short paragraph about it. You may make drawings to help you explain.

10. Now use your straight edge to again draw three triangles with the same shape. Draw your triangles inside each other.

11. Use your straight edge to draw a quadrilateral that is not a square or a rectangle.

12. Draw two more quadrilaterals that are different from each other, and are not squares or rectangles.

13. A figure like this is called a circle.
   Make a good freehand drawing of a circle. You can make a nice circle by going round and round and making it better all the time.
8.3 Make drawings on grid paper

**Mathematical notes**

This section introduces another important and useful tool, namely grid paper. Carefully drawn grid paper is regular, i.e. it is made up of identical squares. This allows one person (or two or more people) to draw exactly the same shape, exactly the same size, as many times as they wish.

**Teaching guidelines**

Aim to spend about 1 hour to 1 1/2 hours on this section.

Be explicit about the role of grid paper as a tool, and not as a separate, new topic in this unit. Allow learners to draw their own grid paper while you draw a larger version on the board. They will watch you and will hopefully try to draw as well as you do. Also make sure that each learner is drawing a regular grid. If the lines are unevenly spaced it will not be a very useful tool. For the best results the grid must have squares.

Try to make time for a discussion around how the grid makes it easier to draw shapes correctly. Ask questions that aim to justify opinions, for example: "Why do we get a rectangle when we join these four points?" or "Why must the circle pass through those points?"

Encourage learners to do extra, self-directed exploration of the grid with some feedback, time permitting. If at all possible, provide learners with copies of a regular grid. You can copy square grid paper from the Addendum (page 433), or ask learners to prepare three grids at home, following the method shown in question 1.

**Possible misconceptions**

If a grid is not regular or at least pretty close to regular, its value as a tool for drawing diminishes. It will be difficult to see the properties of the different shapes on such a grid. Learners who really struggle to draw a regular grid may be provided with a partially drawn grid which they must complete.

**Resources**

Three sheets of square grid paper: one sheet for question 2; one sheet for question 3; one sheet for questions 4, 5 and 6.

**Answers**

1. Learners draw their own grid lines; check as they work that they are forming squares.
Notes on questions
In questions 2(a) and (b) learners will draw the figures by drawing along the grid lines. In question 2(c) one line will not be drawn along the grid lines. When learners draw the seven-sided polygon and the triangles in question 4, some of the sides of the figure will not coincide with grid lines. In questions 5 and 6 the circle and oval will touch the grid lines but not be drawn along them. Check that learners understand that drawing figures on grid paper does not mean that all the sides need to be on grid lines.

Questions 5 and 6 are challenging because learners have to draw freehand. Their circles and ovals (egg shapes) may not be very neat. Engage them in a discussion about how they tried to draw the shapes, even though their drawing skills may not be up to executing their ideas. Ideas in mathematics are often clearer than our representations of them.

Answers
2. (a), (b), (c) Example below. 3. (a), (b) Example below.

When learners have completed question 3(b), you may ask them to individually describe, in writing and with sketches if they prefer, what they did to ensure that the second triangle is the same shape and size as the first one. It would be best if they do this as homework. The purpose of the question is not to obtain any “correct” answer, but to provide each learner with a valuable opportunity to form mathematical ideas based on his/her own actions.

Some learners may explain their work in terms of the relative positions of the vertices of the triangle, for example: “The left corner is four squares left of the top corner, and three squares down.”

Answers for questions 4 to 6 are given on the next page.
**Answers (continued)**

4. (a) and (b). Some of the many ways in which a polygon with 7 sides can be divided into triangles are shown below.
Grade 4 Term 1 Unit 9  
Whole numbers: Multiplication and division

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### CAPS time allocation  
5 hours

### CAPS page references  
13 to 15 and 62 to 65

The first unit of multiplication and division in Term 1 focused on multiplying 1-digit numbers and dividing 1-digit numbers into 2-digit numbers. It built learners' awareness of multiplication facts such as the multiplication tables. The main focus of this unit is on multiplying by 2-digit numbers (by breaking the numbers down into place value parts) and dividing 2-digit and 3-digit numbers by 2-digit and 1-digit numbers. Learners will also be reminded that the order in which we multiply numbers does not impact on the answer we get (the commutative property of multiplication). They will learn that changing the order of the numbers that we multiply can make the multiplication task easier, for example $25 \times 7 \times 4 = 25 \times 4 \times 7 = 100 \times 7 = 700$. This is an easier calculation than $25 \times 7 \times 4 = 175 \times 4$.

### Mathematical background

When we multiply multi-digit numbers, we break down the numbers. Usually we break them down into place value parts and multiply each of the parts separately, for example $476 \times 7 = 400 \times 7 + 70 \times 7 + 6 \times 7 = 2800 + 490 + 42 = 3332$.

We can also break numbers up into factors, as shown in Unit 5 Section 5.6 (pages 71 and 72). For example: $13 \times 8 = 13 \times 2 \times 2 = 26 \times 2 = 52 \times 2 = 104$. Learners can use this to make calculations easier. It is important for them to know that if they are multiplying two or more numbers, they can change the order of the numbers multiplied without changing the answer. The reason for doing this is to make calculations simpler.

In this unit the main focus is on multiplying 2-digit numbers by breaking them down into place value parts, for example $6 \times 54 = 6 \times 50 + 6 \times 4$. In order to do this successfully, learners need to be able to multiply quickly by multiples of 10, for example by 50. This skill is developed and practised in this unit.
9.1 Learn to multiply with bigger numbers

Mathematical notes
This section uses arrays to show that you can break numbers down into place value parts
to multiply them. Two-digit numbers are multiplied after they have been broken down
into a tens part and a units part. In question 1, for example, 7 × 46 is broken down into
7 × 40 + 7 × 6.

Critical knowledge
An array can represent multiplication, for example the array alongside (from
question 1) represents 4 × 10. Learners should not count each ring individually,
but rather count 4 rings in a row and 10 rings in a column and know that this
means “4 times a group of 10”. They could also skip count to get 10 times a row
of 4: 10 × 4.

You can break down a number into place value parts, multiply each part separately and
add the products.
You can split numbers into multiples to make multiplying easier, for example:
60 × 4 = 10 × 6 × 4 = 10 × 24 = 240.

The order in which you multiply numbers does not impact on the answer, for example:
80 × 7 = 8 × 10 × 7 = 8 × 7 × 10 = 56 × 10 = 560.

Teaching guidelines
Try to move quickly through Section 9.1: aim to cover this section in 45 minutes. One
possibility is to use
• questions 1 and 2, and the tinted passage on page 104 for concept development,
• questions 3, 4, 5 and 6 for classwork, and
• questions 7, 8 and 9 for additional practice.
You can start the lesson by focusing on multiplying by 10. You can ask learners to page
back to the multiplication grid on page 69. Ask them to focus on either the ×10 row or the
×10 column. Ask them: “What is the same about all the numbers in that row or column?”,
“What happens to a number when you multiply it by ten?” They can then practise this with
a range of 2-digit numbers, for example 13 × 10; 27 × 10; 39 × 10, etc.

When you multiply by 10, the number becomes 10 times bigger, for example 10 × 4 = 40;
40 is 10 times bigger than 4. Teachers sometimes tell learners that when you multiply by
10 you add a zero onto the number. This is not true, for example 4 × 10 = 4 + 0.

Answers
1. Yes
Teaching guidelines

You can help learners to generalise about multiplying by multiples of 10, for example multiplying by 30. Let learners work through questions 4(a), 5(a), 6, 8 and 9 on page 163. They must understand that multiplying by a multiple of 10 can be done by breaking the number up into factors, for example $11 \times 80 = 11 \times 8 \times 10 = 88 \times 10 = 880$.

Ask learners how many rings there are in each of the repeated larger arrays at the bottom of page 104. Learners can skip count to get to 4 times a column of 10 rings ($4 \times 10$) or 10 times a row of 4 rings ($10 \times 4$). Then ask learners how many of these arrays there are. Ask them to write a number sentence that represents this row of arrays. Repeat these questions but refer to the single columns of rings at the bottom of page 104. Learners can then work through question 2 on page 105.

Then refer learners back to the tinted passage on page 104. Ask them what is the same about the arrays in the tinted passage and those in question 1. Use this to motivate that when we multiply by a 2-digit number we can break the number down into place value parts (tens and units), multiply each part separately and then add the answers. For example, $46 \times 7 = 40 \times 7 + 6 \times 7 = 280 + 42 = 322$. Remind learners that when they see multiplication, addition and/or subtraction in the same expression they should multiply first. Learners can use a similar approach for questions 4, 5 and 6. A template of the table in question 7 is provided in the Addendum (page 443). You can photocopy it to save learners time.

Answers

2. (a) Yes
   (b) $280 + 42 = 322$

3. $30$ $60$ $90$ $120$ $150$ $180$ $210$ $240$ $270$ $300$

4. $6 \times 30 + 6 \times 7 = 180 + 42 = 222$

5. $222$, because it is also $6 \times 37$

6. $402$. Learners’ methods may differ. One option modelled on questions 1 and 2 is: $6 \times 60 + 6 \times 7 = 360 + 42 = 402$

7. |   | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
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9.2 Build knowledge for multiplication

Critical knowledge
Multiplying by multiples of ten, namely 20, 30, 40, 50.

Teaching guidelines
Try to move quickly through Section 9.2: aim to cover this section in 30 minutes. One possibility is to use
- questions 1(c), (k) and (l) for concept development,
- questions 1(a), (b) and (d) to (j), 2, 3 and 4 for classwork, and
- questions 5, 6 and 7 for additional practice.

Learners can begin by skip counting in 20s and completing the 20 times row in question 2. (In order to save time, you can photocopy the template of the table in question 2 – see the Addendum on page 443.) You can work though questions 1(c), (k) and (l) with the whole class. Remind learners that when they see multiplication, addition and/or subtraction in the same expression they should multiply first, for example 4 × 20 + 4 × 6 = 80 + 24 = 104.

Answers
1. (a) 100 (b) 120 (c) 80
   (d) 180 (e) 140 (f) 100
   (g) 60  (h) 160  (i) 200
   (j) 160  (k) 104  (l) 104

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3. (a) 150  (b) 180  (c) 120
   (d) 270  (e) 240  (f) 210
   (g)  90  (h) 190  (i) 190
**Answers**

4. See the 40 times row in the table in question 2.

5. (a) 200  (b) 240  (c) 160  (d) 360
   (e) 280  (f) 200  (g) 120  (h) 320
   (i) 400  (j) 320  (k) 322  (l) 414

6. See the 50 times row in the table in question 2.

7. (a) 250  (b) 300  (c) 200  (d) 450
   (e) 350  (f) 250  (g) 150  (h) 400
   (i) 500  (j) 400  (k) 392  (l) 504

9.3 **Use your knowledge of multiplication facts**

**Teaching guidelines**

Try to move quickly through Section 9.3: aim to cover this section in 30 minutes.

One possibility is to use

- questions 1(e), (f), (i) and (j), 2(a) and (e), and 3 for concept development,
- questions 1(a) to (d), (g), (h), (k) and (l), and 2(b), (c), (d) and (f) for classwork, and
- question 4 for additional practice.

You can demonstrate to learners how they can use the table from question 2 in Section 9.2 to find the answers for questions in this section.

Questions 2(e) and (f) begin to prepare learners for question 3. You can introduce learners to this by showing them how you can split an array to make it easier to multiply. For example, if you want to multiply $6 \times 17$ you can split 17 into $10 + 7$ (as shown in the array) and multiply each part separately: $6 \times 10 + 6 \times 7$. When learners calculate questions 2(e) and (f), ask them to circle the answers to $10 \times 30$ and $10 \times 4$ in their table. They can then circle the answer to $6 \times 30$ in their table. Ask them what they notice. Learners can check whether this works in the other examples in question 2.

**Answers**

1. (a) 9  (b) 9  (c) 6  (d) 3  (e) 5  (f) 40
   (g) 12  (h) 10  (i) 20  (j) 7  (k) 9  (l) 7

2. (a) 160  (b) 270  (c) 460  (d) 160  (e) 180  (f) 180

4. Now complete the 40 times row in your table.

5. How much is each of the following?
   (a) $5 \times 40$  (b) $6 \times 40$  (c) $4 \times 40$
   (d) $40 \times 9$  (e) $40 \times 7$  (f) $5 \times 40$
   (g) $3 \times 40$  (h) $40 \times 8$  (i) $10 \times 40$
   (j) $8 \times 40$  (k) $7 \times 46$  (l) $46 \times 9$

6. Complete the 50 times row in your table.

7. How much is each of the following?
   (a) $5 \times 50$  (b) $6 \times 50$  (c) $4 \times 50$
   (d) $50 \times 9$  (e) $50 \times 7$  (f) $5 \times 50$
   (g) $3 \times 50$  (h) $50 \times 8$  (i) $10 \times 50$
   (j) $8 \times 50$  (k) $7 \times 56$  (l) $56 \times 9$
3. There is a quicker way. Subtract 5 from 9 and multiply the answer, i.e. 4, by 40:
   \((9 - 5) \times 40 = 4 \times 40 = 160\)

4. (a) 120  (b) 250  (c) 138  (d) 138  
   (e) 190  (f) 190  (g) 270  (h) 232

9.4 Build more knowledge of multiplication facts

Teaching guidelines
Try to move quickly through Section 9.4: aim to cover this section in 30 minutes. One possibility is to use
- the summary bar on page 110 for concept development,
- questions 1, 2, 5, 6(a), (b), (c), (g) and (h), and 7(a) and (b) for classwork, and
- questions 3, 4, 6(d), (e) and (f), and 7(c) and (d) for additional practice.

There are no new concepts in this section. Learners merely practice multiplying by different multiples of 10, namely 60, 70, 80, 90, and they also practice multiplying by 100.

Remind learners that they can break numbers down into their place value parts and multiply each part separately, for example \(43 \times 5 = 40 \times 5 + 3 \times 5 = 200 + 15 = 215\).

Templates for the tables in questions 1, 4 and 5 are provided in the Addendum (pages 444 to 446).

Answers
1.

<table>
<thead>
<tr>
<th>(\times)</th>
<th>2</th>
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<th>4</th>
<th>5</th>
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2. (a) 300  (b) 420  (c) 360  (d) 540  
   (e) 560  (f) 200  (g) 270  (h) 480  
   (i) 70   (j) 480  (k) 640  (l) 810

3. (a) 350  (b) 480  (c) 160  (d) 360  
   (e) 490  (f) 400  (g) 540  (h) 560
Notes on questions
Questions 6(a) and (b) prepare learners to answer question 6(c). Learners first copy from the table (in question 5) the answer to \(8 \times R7\) (the units part), then they copy the answer to \(20 \times R7\) (the tens part), and then they use these two answers to write down the answer to \(28 \times R7\). This approach is repeated in questions 6(d), (e) and (f). This models for learners what they should do to get the answers to questions 6(g) and (h), i.e. break the numbers down into a tens part and a units part, then copy the answers from the table in question 5, and then combine the products.

Answers
4.

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<tr>
<th>(x)</th>
<th>10</th>
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5.

<table>
<thead>
<tr>
<th>Number of pancakes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Cost (in rands)</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td>28</td>
<td>35</td>
<td>42</td>
<td>49</td>
<td>56</td>
<td>63</td>
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</table>

<table>
<thead>
<tr>
<th>Number of pancakes</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
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<tr>
<td>Cost (in rands)</td>
<td>70</td>
<td>140</td>
<td>210</td>
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<td>350</td>
<td>420</td>
<td>490</td>
<td>560</td>
<td>630</td>
</tr>
</tbody>
</table>

6. (a) R56 (b) R140 (c) R196 (d) R42
    (e) R350 (f) R392 (g) R602 (h) R301

4. Complete the table.

<table>
<thead>
<tr>
<th>(x)</th>
<th>10</th>
<th>50</th>
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<td>900</td>
<td>810</td>
</tr>
</tbody>
</table>

5. Mia is selling pancakes. One pancake costs R7. Complete this table to help her calculate the cost of any number of pancakes up to 100.

<table>
<thead>
<tr>
<th>Number of pancakes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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<tbody>
<tr>
<td>Cost (in rands)</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td>28</td>
<td>35</td>
<td>42</td>
<td>49</td>
<td>56</td>
<td>63</td>
</tr>
</tbody>
</table>

6. What is the cost of each of the following, if you buy from Mia?
   (a) 8 pancakes
   (b) 20 pancakes
   (c) 28 pancakes
   (d) 6 pancakes
   (e) 50 pancakes
   (f) 56 pancakes
   (g) 86 pancakes
   (h) 43 pancakes

   (a) R56 (b) R140 (c) R196 (d) R42
   (e) R350 (f) R392 (g) R602 (h) R301
7. (a) 216 (b) 312 (c) 312 (d) 567

9.5 Multiplying three or more numbers

Mathematical notes
From questions 1, 2 and 3 it is expected that learners will see that they can swap the order of the numbers that they multiply without changing the answer. This is useful for learners to know because it can sometimes make a calculation easier if the order in which you multiply the numbers is swapped around. For example, in question 2(a) it is easier to multiply $2 \times 5 \times 7 = 10 \times 7$ than it is to multiply $2 \times 7 \times 5 = 14 \times 5$, and similarly $25 \times 7 \times 4$ is easier if you multiply $25 \times 4 \times 7 = 100 \times 7 = 700$.

In Section 5.2 of Unit 5 learners were shown that they can swap the order of two numbers that are multiplied. Swapping the order of three or more numbers being multiplied is an extension of this.

Teaching guidelines
Try to move quickly through Section 9.5: aim to cover this section in 30 minutes. One possibility is to use
- the summary bar and tinted passage on page 111 and questions 4(a) and (b) for concept development,
- questions 1, 2 and 3 for classwork, and
- questions 4(c) to (f) for additional practice.

The numbers and calculations in questions 1, 2 and 3 are easy. Learners can do these as mental calculations. You can read the questions to them, so that they keep up their pace of work. Once learners have completed question 3 you can remind them that they have already seen in Section 5.2 that when you multiply two numbers you can swap the order in which they are multiplied without changing the answer. Remind learners that this can help to make calculations easier. You can use questions 4(a) and (b) to show learners how changing the order in which they multiply numbers can make the calculations easier.

Answers
1. (a) 30 (b) $2 \times 3 \times 5$ (c) Learners check and correct.
2. (a) 30 (b) $3 \times 5 \times 2$ (c) Learners check and correct.
**Answers**

3. (a) 30  
   (b) The answer is still 30.

4. (a) 70  
   Probably easiest to calculate $2 \times 5 \times 7 = 10 \times 7$  
   (b) 700  
   Probably easiest to calculate $25 \times 4 \times 7 = 100 \times 7$  
   (c) 940  
   Probably easiest to calculate $4 \times 5 \times 47 = 20 \times 47$  
   (d) 120  
   Probably easiest to calculate $2 \times 5 \times 12 = 10 \times 12$  
   (e) 850  
   Probably easiest to calculate $10 \times 17 \times 5 = 170 \times 5$  
   (f) 770  
   Probably easiest to calculate $2 \times 55 \times 7 = 110 \times 7$

9.6 Use your knowledge in a different way

**Mathematical notes**

This section links multiplication and division for learners. It also focuses their attention on using multiplication to solve division. Learners are only introduced to the word *division* and the symbol for division towards the end of this section. This is deliberate so that they focus on the connection between the two operations and using multiplication to solve the division problems.

**Teaching guidelines**

Try to move quickly through Section 9.6: aim to cover this section in 30 minutes. One possibility is to use

- questions 1(b), 2(a), 3(a), 4(a) and (b), and 5(a) for concept development,
- questions 1(a), (c) and (d), 2(b), (c) and (d), 5(b), 7 and 8 for classwork, and
- questions 3(b), (c) and (d), 6 and 9 for additional practice.

Learners can use question 1 to solve the calculations in questions 2 and 3. Encourage them to always ask themselves: "*What have I done before that can help me here?*" Model this by asking learners which calculation in question 1 can help them to answer questions 2(a), 3(a) and 5(a).

**Answers**

1. (a) 420  
   (b) 320  
   (c) 420  
   (d) 450

2. (a) 4 (The answer can be seen in 1(b).)  
   (b) 6 (The answer can be seen in 1(c).)  
   (c) 9 (The answer can be seen in 1(d).)  
   (d) 7 (The answer can be seen in 1(a).)
Answers
3. (a) 80 (The answer can be seen in 1(b).) (b) 70 (The answer can be seen in 1(c).)
   (c) 50 (The answer can be seen in 1(d).) (d) 60 (The answer can be seen in 1(a).)

Notes on questions
Once learners have completed question 4(a), remind them that in Sections 9.3 and 9.4 they have often multiplied two numbers by the same number, for example $3 \times 40 + 3 \times 6$, and that they have found this was the same as multiplying $3 \times 46$.

They can use this when they multiply to divide. For example, they know that $4 \times 80 = 320$ and this can help them to find $4 \times \square = 360$. This can be shown on a number line. From the number line alongside they can see that there is still 40 that needs to be shared amongst 4: $4 \times \square = 40$.

In question 5(b), help learners to understand that because R40 is half of R80, the answer to 5(b) must be twice that of 5(a).

Answers
4. (a) R90 ($R320 = 4 \times R80$ and $R40 = 4 \times R10$, so $R360 = 4 \times R90$)
   (b) R95 ($R360 = 4 \times R90$ and $R20 = 4 \times R5$, so $R380 = 4 \times R95$)
5. (a) 4 books
   (b) 8 books
6. (a) 10 pencils
   (b) 20 pencils
   (c) 5 pencils
   (d) 10 pencils
   (e) 12 pencils
Answers
7. 4 Learners do not have to show the answer on a number line.
8. (a) 4
   (b) 4
9. (a) 8
   (b) 90

9.7 Practise and use your skills

Teaching guidelines
Try to move quickly through Section 9.7: aim to cover this section in 1 hour. One possibility is to use
- questions 1, 4 and 10 for concept development,
- questions 2, 3, 7, 9 and 11 for classwork, and
- questions 5, 6 and 8 for additional practice.

Possible misconceptions
This unit is about multiplying and dividing. The assumption is that learners will use multiplication to divide. However, in question 2 learners will need to use adding on or subtracting to find the answers. Learners may wrongly assume that question 3 can be solved by multiplication because they have been working with multiplication in this unit.

Answers
Note: Learners should estimate first and write down their estimate.
1. R438. Learners can either multiply the price of each item by 6, or add the prices of the three items and then multiply by 6.
2. R229. Learners could add on or subtract to get the answer.
3. R19. Learners need to find \( \square \times 4 = \text{R76} \).
Notes on questions
In question 9 learners can use doubling to get the answers to (a) and (b). In question 9(a), 6 = double 3 or $2 \times 3$, so in 6 hours Werner earns double what he earns in 3 hours. In question 9(b), what Werner earns in 12 hours is double what he earns in 6 hours, or 4 times what he earns in 3 hours. Learners should try to use what they already know with each sub-question in question 9.

In question 10 learners can use a number line and multiply in stages.

In question 11 learners can also use a number line and multiply in stages.

Answers
4. $6 \times 4 \times 5 = 6 \times 20 = 120$ cookies
5. The Lucky Store: R6 per avocado
   The Big Grocer: R7 per avocado
   The Lucky Store gives the best deal.
6. $20 + 30 + 36 + 56 = 142$ bananas
7. (a) 3 bottles. This is because $3 \times R25 = R75$.
    (b) R10
8. 5 T-shirts. This is because $5 \times R16 = R80$.
9. (a) R180
    Because 6 hours is double 3 hours. He earned R90 for 3 hours. $2 \times R90 = R180$.
    (b) R360
    Because 12 hours is 4 x 3 hours. He earned R90 for 3 hours. $4 \times R90 = R360$.
    (c) R30
    Because $3 \times R30 = R90$. He earned R90 in 3 hours, so in 1 hour he earned 1 third of R90.
    (d) R120
    Because $4 \times R30 = R120$. 4 hours is 4 x 1 hour.
10. (a) 20 crates
    Because $20 \times 12 = 240$.
    (b) 10 bottles
11. (a) 11 bags
    Because $8 \times 11 = 88$.
    (b) 6 gem squashes

4. Mrs Jacobs is baking cookies. She places 6 rows of cookies on a baking tray. There are four cookies in one row. If she fills five baking trays, how many cookies is she baking?
5. The Lucky Store charges R90 for a box of 15 avocado pears. The Big Grocer charges R63 for a bag of 9 avocado pears. Which is the best deal?
6. Mr Zweli bought one large box of bananas. He saw that there were
   5 bunches with 4 bananas in a bunch,
   6 bunches with 5 bananas in a bunch,
   12 bunches with 3 bananas in a bunch and
   7 bunches with 8 bananas in a bunch.
   How many bananas did Mr Zweli buy?
7. Kholeka has saved R85. She wants to buy bottles of juice for her birthday party. Each bottle costs R25.
   (a) How many bottles can she buy?
   (b) How much money will she have left?
8. Suzi buys T-shirts on a sale. Each T-shirt costs R16. Suzi has R90. How many T-shirts can she buy?
9. Werner is paid R90 for three hours’ work. How much will he get paid for the following number of hours?
   (a) 6 hours
   (b) 12 hours
   (c) 1 hour
   (d) 4 hours
10. Dirkie packs bottles into crates. He packs 12 bottles in each crate. There are 250 bottles.
    (a) How many crates can he fill?
    (b) How many bottles will be left over?
11. Mr Daniels sells gem squashes in bags of 8. He has a large box with 94 gem squashes.
    (a) How many bags can he fill?
    (b) How many gem squashes are left over?
9.8 Dividing into equal parts

Mathematical notes
Question 1 provides examples of different sorts of situations that can be solved using multiplication.

In this section learners are also introduced to the concept of remainders. Remainders are parts that remain undivided, for example $60 \div 8 = 7$ remainder 4 (the 4 has not been divided by 7). This implies that $(8 \times 7) + 4 = 60$. Questions 1(e), (f) and (g) lay the basis for understanding remainders.

Teaching guidelines
Try to move quickly through Section 9.8: aim to cover this section in 45 minutes.

One possibility is to use
- questions 1, 2(c) and (e), and 3(a) for concept development,
- questions 2(a), (b), (d) and (f) to (i), 3(b), 4, 5 and 8 for classwork, and
- questions 6, 7 and 9 for additional practice.

Once you have worked through question 1 with the class, you can show them how question 2(c) helps them to get the answer to question 2(e) and how question 2(e) provides the answer to question 3(a).

Answers
1. (a) R64
   (b) R16
   (c) 64 quarter-apples
   (d) 16 tables
   (e) 16 blue beads
2. (a) 77  (b) 63  (c) 56
   (d) 42  (e) 60  (f) 53
   (g) 34  (h) 84  (i) 35
3. (a) 7 loaves with R4 change
   (b) 9 rows
**Answers**

4. (a) 7 remainder 4  (b) 8 remainder 2  (c) 21  (d) 11
5. (a) 8  (b) 6  (c) 8 remainder 2  (d) 9  (e) 10  (f) 6  (g) 5 remainder 8  (h) 11 remainder 3  (i) 9  (j) 7  (k) 20  (l) 4  (m) 15  (n) 4  (o) 26 remainder 2  (p) 3  (q) 30  (r) 15
6. 13 minutes
7. 7 rubber bands
8. 12 times
9. (a) 8 remainder 1  (b) 16 remainder 1  (c) 4  (d) 6  (e) 9  (f) 7  (g) 12  (h) 6 remainder 3  (i) 3 remainder 2  (j) 8  (k) 14  (l) 19 remainder 1

---

Your answer for question 3(a) can be written like this: $60 \div 8 = 7 \text{ remainder } 4$. 

4. How much is each of the following?  
   (a) $53 \div 7$  (b) $34 \div 4$  (c) $84 \div 4$  (d) $77 \div 7$
5. How much is each of the following?  
   (a) $48 \div 6$  (b) $48 \div 8$  (c) $50 \div 6$  (d) $81 \div 9$  (e) $100 \div 10$  (f) $60 \div 10$  (g) $58 \div 10$  (h) $58 \div 5$  (i) $63 \div 7$  (j) $63 \div 9$  (k) $80 \div 4$  (l) $80 \div 20$  (m) $60 \div 4$  (n) $60 \div 15$  (o) $80 \div 3$  (p) $75 \div 25$  (q) $90 \div 3$  (r) $90 \div 6$
6. Devin takes 65 minutes to wash 5 cars.  
   How long does it take him to wash one car?
7. The teacher has 35 rubber bands. The learners sit and work in 5 equal groups. How many rubber bands will each group get if the teacher gives every group the same number of rubber bands?
8. Rico is 7 years old. His grandpa is 84 years old.  
   How many times older is Rico’s grandpa than Rico?
9. Calculate:  
   (a) $65 \div 8$  (b) $65 \div 4$  (c) $36 \div 9$  (d) $54 \div 9$  (e) $27 \div 3$  (f) $42 \div 6$  (g) $60 \div 5$  (h) $45 \div 7$  (i) $20 \div 6$  (j) $24 \div 3$  (k) $98 \div 7$  (l) $58 \div 3$
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**CAPS time allocation**  
1 hour

**CAPS page references**  
14 and 67 to 68

In this unit learners develop and consolidate a sense of numbers into the thousands. Learners use place value cards to build up numbers and to break numbers down into place value parts. The former lays the basis for writing number symbols and the latter lays the basis for expanded notation. Once learners have a good sense of numbers into the thousands, it is easy for them to order and compare these numbers. This is done in the last section of this unit.

**Mathematical background**
Apart from knowing the number names and other ways to represent numbers, learners need to develop a sense of the quantities represented by bigger numbers. Learners do not often experience quantities (collections) beyond 1 000 in their everyday lives, hence learning activities need to provide them with experiences of such collections. This helps learners to develop, for numbers beyond one thousand, an intuitive sense of “how many” the numbers represent.

Since counting collections of 1 000 or more objects one by one is not practical, the structure of larger numbers – the way they are built up with parts of ten, hundred and thousand – needs to be used.

In most classrooms it is not feasible to provide each learner with structured apparatus to count beyond 1 000. Instead we provide images of objects grouped in tens and hundreds. In Term 1 Unit 1 of the Learner Book, learners have already encountered images of 100 as 10 groups of 10. This is reinforced in the images in this unit. Learners also see 10 groups of 100 making 1 000. Focus learners’ attention on being able to recognise 10 groups of 10 as 100, and 10 groups of 100 as 1 000, rather than counting each object separately. This lays an important basis for understanding the value of large numbers.

**Resources**
Each learner should have their own set of place value cards. A master copy for place value cards is given in the Addendum (pages 416 to 418).
In addition, you should have a set of large place value cards for demonstration purposes as given in the Addendum (pages 419 to 432).
1.1 Compare bigger numbers

**Mathematical notes**

This section deals with number concept, number names and number symbols for numbers just beyond 1,000. The remaining sections in this unit deal with numbers up to 9,999. All the concepts raised here will form the basis of the rest of the number work in Grade 4. These concepts will be touched on repeatedly throughout the year. Try to keep the pace of work moving so that you complete this unit within the allocated time.

**Critical knowledge**

Learners need to move beyond an understanding of counting as counting one by one to a more sophisticated sense of counting: counting in groups. Counting forwards and backwards in twos, threes, fives and other small counting units is useful and promotes knowledge of basic addition and subtraction facts, and skills such as filling up to the nearest multiple of ten. However, counting in tens, hundreds and thousands is specifically important to develop a sense of larger numbers.

**Teaching guidelines**

To help learners to move away from the idea of counting one by one, you can ask questions like: “How many cubes are there in each of the yellow groups?” and “Do all the yellow groups have the same number of cubes?” Repeat these types of questions for the heaps of sticks (i.e. the groups of 10 bundles) on page 120: “How many bundles of sticks are there in each heap?”, “How many sticks are there in each bundle inside each heap?”, “How many sticks are there altogether in a heap?”, “Do all the heaps have the same number of sticks?” The aim is for learners to count the groupings in hundreds.

To allow learners to compare the number of cubes and sticks (as asked in question 2) more easily, you can ask one learner to keep page 119 open and the learner next to him or her page 120.

**Notes on questions**

The summary bar tells learners that 10 hundreds = 1,000. Question 1 then asks them to recognise that this also means that 100 tens = 1,000. This is an application of the commutative property of multiplication: 10 × 100 = 100 × 10 = 1,000.

Question 2 may prompt learners to consider the group sizes and numbers of groups.

**Answers**

1. 100 tens
2. The number of cubes and sticks is the same.
3. one thousand and thirteen
4. one thousand and thirteen
Possible misconceptions

Remember to ask learners to always state the full number name, for example “one thousand and thirteen” rather than saying “one-oh-one-three”.

Some numbers that we deal with in everyday life, such as phone numbers, car registration numbers or ID numbers, comprise a set of single unit digits. These kinds of numbers are really labels and their digits do not have place value. For these kinds of numbers it is appropriate to say zero-seven-two-four-nine-nine-seven-four-seven-three.

When we are dealing with numbers (rather than a label made up of digits), it is important to say numbers correctly out in full: the way we would write out the number name.

It helps learners to understand place value and the value of numbers better if they say the number out in full, for example “one thousand and fourteen”, “three thousand four hundred and twenty-seven”.

Teaching guidelines

One possible way to organise this section is to use

- pages 119 to 121 for concept development,
- questions 5 and 7 for classwork, and
- question 6 for additional practice.
Mathematical notes
What are place value parts? What are place value cards? This is explained in the summary bar and tinted passage on page 12, and repeated below:

The parts that are mentioned in the name of a number are called the place value parts. For example, the place value parts of thirty-seven are 30 and 7.

Teaching guidelines
Show learners how to use place value cards to build up the number 998. Demonstrate how to place the 90 over the zeros of the 900, and the 8 over the zero of the 90. Explain that this shows the way we write the symbol 998.

Break down 998 into its place value parts by separating the place value cards. Explain that this is the way we say the number: nine hundred and ninety-eight. Explain that this is the basis of expanded notation and write the expansion 900 + 90 + 8 on the board.

Repeat this process for 1 001, 1 002 and 1 020.

Answers
5.  | Number symbol | Number name            | Expanded notation |
    |               |                       |                  |
    | 1 003         | one thousand and three| 1 000 + 3        |
    | 1 004         | one thousand and four | 1 000 + 4        |
    | 1 005         | one thousand and five | 1 000 + 5        |
    | 1 006         | one thousand and six  | 1 000 + 6        |
    | 1 007         | one thousand and seven| 1 000 + 7        |
Possible misconceptions

Some learners may write 1 000 1 instead of 1 001; 1 000 13 instead of 1 013.

This shows that learners have not yet mastered our way of writing numbers. They are writing the numbers as we say them.

It also shows that learners have a good sense of the numbers beyond 1 000. These learners are writing the numbers in an unconventional expanded notation: they write 1 000 1 to mean 1 000 + 1 and 1 000 13 to mean 1 000 + 13. Acknowledge that this is the way we say numbers and that they understand the parts of the numbers well; also that they can use this when writing the expanded notation. However, also use the way we show the numbers with place value cards, i.e. placing the 1 over the last zero of the 1 000 (in the case of 1 001), and the 10 over that last two zeros of 1 000 and the 3 over the zero of the 10 (in the case of 1 013). Explain that this shows how we make and write the number symbol.

Answers

6. | Number symbol | Number name                  | Expanded notation |
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<tr>
<td>1 013</td>
<td>one thousand and thirteen</td>
<td>1 000 + 10 + 3</td>
</tr>
<tr>
<td>1 014</td>
<td>one thousand and fourteen</td>
<td>1 000 + 10 + 4</td>
</tr>
<tr>
<td>1 015</td>
<td>one thousand and fifteen</td>
<td>1 000 + 10 + 5</td>
</tr>
<tr>
<td>1 016</td>
<td>one thousand and sixteen</td>
<td>1 000 + 10 + 6</td>
</tr>
<tr>
<td>1 017</td>
<td>one thousand and seventeen</td>
<td>1 000 + 10 + 7</td>
</tr>
<tr>
<td>1 018</td>
<td>one thousand and eighteen</td>
<td>1 000 + 10 + 8</td>
</tr>
<tr>
<td>1 019</td>
<td>one thousand and nineteen</td>
<td>1 000 + 10 + 9</td>
</tr>
<tr>
<td>1 020</td>
<td>one thousand and twenty</td>
<td>1 000 + 20</td>
</tr>
<tr>
<td>1 021</td>
<td>one thousand and twenty-one</td>
<td>1 000 + 20 + 1</td>
</tr>
<tr>
<td>1 022</td>
<td>one thousand and twenty-two</td>
<td>1 000 + 20 + 2</td>
</tr>
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7. (a) 1 001   1 000 + 1
   (b) 1 010   1 000 + 10
   (c) 1 020   1 000 + 20
   (d) 1 100   1 000 + 100
Teaching guidelines for Sections 1.2 to 1.4
One possible way to organise the next three sections is to use:

- page 123 and the tinted passage on page 124 for concept development,
- questions 1, 2, 3, 4 of Section 1.4 for mental mathematics,
- question 3 on page 124, questions 1 and 2 on page 125, and questions 5, 6, 7 and 8(a) to (e) on page 127 for classwork, and
- questions 4 and 5 on page 124, questions 3, 4 and 5 on page 126, and questions 8(f) to (o) on page 127 for additional practice.

1.2 Counting thousands

Mathematical notes
Each small red mark on pages 123 and 124 is called a stripe.

An array is a systematic arrangement of similar objects, usually in rows and columns. The stripes are arranged in ten rows of 10, to make arrays of 100. There are 10 arrays of 100 across the pages – these make arrays of 1 000.

Notes on questions
The first sentence, first array and question 1 are intended to focus learners’ attention on the array with 1 000 stripes. The aim is for learners to use a thousand as a counting unit in question 2, and in question 5 on page 124.

Teaching guidelines
Observe as many learners as possible when they do question 2. There may be learners who do not count in thousands, but in hundreds. Support such learners by making them aware that it is not necessary to count hundred by hundred before they reach the last row in the array.

Some learners may see that there are 3 full arrays of 1 000 and that the last one has 4 hundred arrays less than 1 000. They may calculate that the last row is 1 000 – 400 = 600. So overall there are 3 600 stripes.

Answers
1. 10
2. 3 600
Teaching guidelines
It will be good to ask learners to represent the numbers in question 3 with place value cards as well, and especially to represent their answer for question 5 with place value cards.

Possible misconceptions
Note that some learners may try to represent 2 747 (question 5) with the place value cards 2, 7 and 4, and then be frustrated because they do not have a second place value card 7 available. Such learners may have a number concept that is interpreting a number as only a collection of digits and they may have poor understanding of the meaning of the digits as used in the number symbol. Remind them that every digit in a number has a specific place value with respect to the position of the digit in the number. Further, that the correct way of representing 2 747 with place value cards is with the 2 000, 700, 40 and the 7.

Answers
3. (a) 2 700
   (b) 5 300
4. seven thousand two hundred; three thousand eight hundred
5. 2 747
1.3 Represent numbers in different ways

**Teaching guidelines**
You may once again demonstrate how numbers are represented with place value cards, and may use the example in the tinted passage for this purpose. After the demonstration you may ask learners to represent different 4-digit numbers with place value cards by packing the cards out on their desks. Make sure that learners know that they can do this in two different ways, for example:

6000  300  00  4

or by putting the cards correctly on top of each other to show what the number symbol looks like.

**Possible misconceptions**
Again monitor learners to check if there are learners who make a mistake, like using the cards to represent 6 384.

**Answers**
1. (a) 3 000, 800, 70, 4
   (b) 6 000, 200, 50, 9
   (c) 9 000, 400, 20, 3

2. (a) 3 874  3 000 + 800 + 70 + 4
   (b) 6 259  6 000 + 200 + 50 + 9
   (c) 9 423  9 000 + 400 + 20 + 3
3. (a) 6 000, 200, 80, 5  (b) 5 000, 800, 60, 2
   (c) 2 000, 500, 60, 8  (d) 8 000, 600, 50, 2
   (e) 3 000, 40, 6  (f) 1 000, 500, 4

4. (a) six thousand two hundred and eighty-five  6 000 + 200 + 80 + 5
   (b) five thousand eight hundred and sixty-two  5 000 + 800 + 60 + 2
   (c) two thousand five hundred and sixty-eight  2 000 + 500 + 60 + 8
   (d) eight thousand six hundred and fifty-two  8 000 + 600 + 50 + 2
   (e) three thousand and forty-six  3 000 + 40 + 6
   (f) one thousand five hundred and four  1 000 + 500 + 4

5. (a) four thousand eight hundred and sixty-three  4 863
   (b) three thousand six hundred and eighty-four  3 684
   (c) six thousand three hundred and forty-eight  6 348
   (d) eight thousand four hundred and thirty-six  8 436
   (e) six thousand and sixty-four  6 064
   (f) three thousand and eight  3 008

1.4 Count beyond 1 000

Teaching guidelines
Learners should find questions 1 and 2 (counting in hundreds) fairly easy. In question 3, and in general with counting, the difficulty is crossing the tens, hundreds and thousands barrier. So learners may stumble particularly when they count back and get to 7 000, 6 999.

Answers

1. 900  1 000  1 100  1 200  1 300  1 400  1 500  1 600
   1 700  1 800  1 900  2 000  2 100  2 200  2 300  2 400
   2 500  2 600  2 700  2 800  2 900  3 000
2. 2 000  1 900  1 800  1 700  1 600  1 500  1 400  1 300
   1 200  1 100  1 000  900  800
3. (a) Learners count on in twos from 4 995 to 5 023:
4 995 4 997 4 999 5 001 5 003 5 005 5 007 5 009 5 011
5 013 5 015 5 017 5 019 5 021 5 023
(b) Learners count back in twos from 7 012 to 6 996:
7 012 7 010 7 008 7 006 7 004 7 002 7 000 6 998 6 996

Teaching guidelines
For question 5 you can make photocopies of templates of the number lines provided in the Addendum (page 447).

In question 8(a) help learners to see that there are 10 small intervals between each larger interval (just like on a ruler). Focus them first on 8(c): once they have seen that this is 4 010, they can go back to (b) and then (a), and then forward to (d) and (e).

Answers
4. (a) 3 850 3 950 4 050 4 150 4 250 4 350 4 450 4 550
   4 650 4 750 4 850 4 950 5 050 5 150 5 250
(b) 3 950 3 850 3 750 3 650 3 550 3 450 3 350 3 250 3 150
   3 050 2 950 2 850 2 750 2 650 2 550 2 450 2 350 2 250
   2 150 2 050 1 950 1 850 1 750 1 650
5. (a) 8 630  (b) 8 640  (c) 8 650
   (d) 8 660  (e) 8 670  (f) 8 680
   (g) 1 394  (h) 1 385  (i) 1 379
6. 3 365 4 777 5 423 6 152 9 899 9 987
7. 9 356 6 553 5 121 4 001 3 499 2 710
8. The number symbols are given below. Note that the question requires learners to write
   the number symbols and the number names so do check learners’ answers by asking
   them to read their answers to each other to confirm.
   (a) 3 970  (b) 3 990  (c) 4 010  (d) 4 050  (e) 4 080
   (f) 3 967  (g) 3 993  (h) 4 012  (i) 4 036  (j) 4 077
   (k) 6 700  (l) 6 900  (m) 7 130  (n) 7 400  (o) 7 770
Grade 4 Term 2 Unit 2    Whole numbers: Addition and subtraction

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**CAPS time allocation**
4 hours

**CAPS page references**
14 to 15 and 69 to 71

**Mathematical background**
In Term 2, learners continue to engage with the three methods of addition prescribed for Grade 4:
A. Adding by filling up multiples of 10 and 100.
B. Adding by breaking down one number (the smaller one) into place value parts and adding the parts one by one.
C. Adding by breaking down both numbers, rearranging and adding up the answers of the parts.

Methods A and B are addressed in this unit, and method C in Unit 9.

Learners engage with two methods of subtraction in Grade 4:
A. Subtracting by filling up multiples of 10 and 100 (subtraction by addition).
B. Subtracting by breaking down both numbers, rearranging and adding up the answers of the parts.

Method A is addressed in this unit, and method B in Unit 9.

**Resources**
Learners need sets of place value cards.
You need two sets of large place value cards for teaching purposes.
Play money made from scrap paper.

Using place value cards when doing addition is a powerful way of consolidating understanding of the role of place value parts, and of the commutative and associative properties of addition.
2.1 Add and subtract with money

Mathematical notes
In this section learners break down and build up numbers in multiples of 100 and 10. The use of money as a context helps to make this practical.

Learners continue to use calculation strategies from Term 1, but the number range has increased to include calculating with thousands.

Teaching guidelines
Aim to complete Section 2.1 in 1 hour. One possibility is to use
- questions 1, 2, 3, 4(c) to (h), and 8 for concept development,
- questions 4(a), (b), (i) and (j), 5, 6, 7, 9, 11(d) and (h), and 12 for classwork, and
- questions 4(k) to (n), 10, and 11(a), (b), (c), (e), (f) and (g) for additional practice.

Resources
When doing the concept development, it might be useful to have play money that learners can use to demonstrate other ways in which R460 (question 2) can be broken up. This does not need to be commercially made play money. Learners can quickly make 10 copies each of R200, R100, R50, R20 and R10 notes by writing the amounts on pieces of scrap paper.

Notes on questions
Question 1 requires learners to count on or add on in multiples of 100, 10 and 1, i.e. in place value parts. In question 2 learners are only asked to describe their answers. In question 3 they are shown how to write their descriptions down as number sentences.

Answers
1. (a) R812
   (b) R1 212
2. Some, but not all possibilities are provided below. Learners’ answers may differ. Check whether they are correct.
   One R200 note, four R50 notes, three R20 notes
   One R100 note, six R50 notes, six R10 notes
   One R200 note, four R50 notes, one R20 note, four R10 notes
   Four R100 notes, three R20 notes
   One R200 note, one R100 note, three R50 notes, one R10 note
   Eight R50 notes, three R20 notes

(b) Simanga adds another R400 to his savings. How much has he now saved in total?
2. The school fee at a certain school is R460.
   Manare’s mother pays with one R200 note, two R100 notes and three R20 notes.
   Elizabeth’s father pays with four R100 notes, one R50 note and one R10 note.
   Describe three other ways in which R460 can be made up from different banknotes.
Teaching guidelines

You can use the worked examples in question 3 to show learners how to write their answers as number sentences. You can ask learners: “How much more than 1 000 is 1 200?” You can do at least one example to show learners how to use their answers in question 3(a) to get answers in 3(b) by adding 200 to their answers in 3(a). In general it is important that you help learners to try to think about what they already know that can help them with what they are doing. Learners think about: “What do I already know that can help me here?”, particularly in questions 4, 7(b) and (c), 8, 9, 10, 11 and 12.

You may suggest to learners that are challenged by question 4 to use place value cards to make the initial numbers in questions 4(b), (c) and (e) to (k). Learners can then remove the cards that show the subtracted amounts. For example, in 4(e):

\[
\begin{array}{cccc}
4 & 3 & 2 & 7 \\
\hline
& & & \\
\end{array}
\]

Once learners have completed question 4(c): 4 327 \( - \) 4 000 = 327, they can use this to find 4(d): 4 327 \( - \) 2 000 = 2 327. In 4(d) they subtracted 2 000 less than in 4(c), so the answer must be 2 000 more. They will use this kind of reasoning with pairs of questions in questions 9 and 10.

Possible misconceptions

If some learners find question 3 difficult, let them first write number sentences that add up to 10 and 12, and then adapt their answer to 1 000 and 1 200.

Check to see that learners are using zero as a placeholder to correctly write the answers to questions 4(b) and (e) to (k). For example, in 4(e) the answer is 4 007 and not 47. Working with the place value cards will help learners to understand this.

Answers

3. (a) Example: 100 + 200 + 700; 100 + 400 + 500
   (b) Example: 700 + 300 + 200; 600 + 500 + 100; 500 + 400 + 300

4. (a) 283  (b) 503  (c) 327  (d) 2 327
   (e) 4 007  (f) 6 024  (g) 6 004  (h) 724
   (i) 6 020  (j) 900  (k) 5 032  (l) 1 111
   (m) 10  (n) 6 997

5. (a) No, it adds up to R900.
   There are many possible answers to 5(b) and (c). One solution to each is provided below.
   (b) Three R200 notes, five R20 notes, five R10 notes
   (c) Two R200 notes, nine R20 notes, seventeen R10 notes
Answers (continued)

6. A range of solutions are possible. Two sample solutions are:
   \[ R200 + R200 + R200 + R100 + R50 + R20 + R20 + R10 = R800 \]
   
   \[ R200 + R200 + R100 + R100 + R50 + R50 + R50 + R20 + R10 + R10 + R10 = R800 \]

7. (a) R700 (b) R4 000 (c) R4 000
   
   Note that learners can use the answer in 7(b) to get the answer to 7(c).

Teaching guidelines

Most of the strategies required on page 130 were developed in Term 1 Unit 3 Section 3.4. Learners are now applying what they know to a higher number range. You can refer back to the tinted passages on pages 34 and 35.

Encourage learners to ask themselves: “What do I already know that can help me to answer this?”

For example, in 8(a) learners know that \( 4 + 6 = 10 \) and \( 10 - 4 = 6 \), therefore \( 4 \text{ thousand} + 6 \text{ thousand} = 10 \text{ thousand} \), and \( 10 \text{ thousand} - 4 \text{ thousand} = 6 \text{ thousand} \).

This reasoning will help learners with questions 9(a), (c) and (g), and questions 10(a) and (c).

Check that learners understand how much each small space represents on the number lines in question 8 (each small space represents 100). You can help them to see that the two detailed number lines in question 8 show how you can use the answer to question 8(a) to get the answers to question 8(b). This can be done using transfer, i.e.

\[ 4000 + 6000 = 10000 \text{ so } 4600 + 5400 = 10000 \]

The idea of transfer can be used as a support for answering questions 9(b), (d), (h), (i) and (j), and questions 10(b), (d) and (f).

In question 11 learners can use filling up to the nearest multiples of 10, 100 and 1 000.

They can show this with number lines or arrow diagrams. For example:

\[ 4287 + 3 \rightarrow 4290 + 10 \rightarrow 4300 \quad \text{or} \quad 4287 + 3 \rightarrow 4290 + 10 \rightarrow 4300 \]

This strategy is further developed in Section 2.2. You can read the tinted passage on page 131.

In question 12(b) learners should look back to see which sub-questions in question 11 can help them to see the answer immediately without calculating. If learners struggle to find these sub-questions, ask them to rewrite questions 12(a) and (b) as addition number sentences.
Answers

8. (a) 6 000 m  
   (b) 5 400 m
9. (a) 6 000  
   (b) 5 400  
   (c) 4 000  
   (d) 4 000  
   (e) 4 000  
   (f) 3 365  
   (g) 4 000  
   (h) 4 010  
   (i) 3 990  
   (j) 2 990
10. (a) 10 000  
    (b) 10 000  
    (c) 10 000  
    (d) 10 000  
    (e) 9 000  
    (f) 10 000  
    (g) 7 000  
    (h) 6 100
11. (a) 13  
    (b) 310  
    (c) 376  
    (d) 2 376  
    (e) 937  
    (f) 2 937  
    (g) 3 337  
    (h) 3 374
12. (a) 2 376  
    (b) 3 374

8. (a) Lea has already run 4 000 m of a 10 000 m race. How far does she still have to run?
   (b) Ben has already run 4 600 m of a 10 000 m race. How far does he still have to run?

9. How much is each of the following? Try to be smart and find the answers with as little work as possible.
   (a) 10 000 – 4 000  
    (b) 10 000 – 4 600
    (c) 7 000 – 3 000  
    (d) 7 500 – 3 500
    (e) 7 267 – 3 267  
    (f) 8 365 – 5 000
    (g) 6 000 – 2 000  
    (h) 6 000 – 1 990
    (i) 6 000 – 2 010  
    (j) 6 000 – 3 010

10. Calculate each of the following.
    (a) 4 000 + 6 000  
    (b) 4 600 + 5 400
    (c) 7 000 + 3 000  
    (d) 6 800 + 3 200
    (e) 5 000 + 4 000  
    (f) 5 300 + 4 700
    (g) 3 000 + 4 000  
    (h) 2 060 + 4 040

11. Find the missing number in each case. You can do it in steps, and use arrows to show your thinking if you wish.
    (a) 4 287 + ... = 4 300
    (b) 4 690 + ... = 5 000
    (c) 5 624 + ... = 6 000
    (d) 5 624 + ... = 8 000
    (e) 3 063 + ... = 4 000
    (f) 3 063 + ... = 6 000
    (g) 3 063 + ... = 6 400
    (h) 3 063 + ... = 6 437

12. How much is each of the following? You can use the work you did in the previous question.
    (a) 8 000 – 5 624
    (b) 6 437 – 3 063
2.2 Methods to add and subtract

Mathematical notes

Three calculation strategies are shown in this section:

- Adding on to reach the next multiple of 10, 100 and then 1000.
- Adding to subtract (this uses the inverse relationship between addition and subtraction).
- Adding on by breaking down the number added into place value parts.

Teaching guidelines

Aim to complete Section 2.2 in 2 hours.

Focus on adding by filling up and subtraction by adding on in one lesson. In the second lesson you can do addition by adding on place value parts.

One possibility is to use

- the tinted passage on page 131, along with question 1, and the first tinted passage on page 132, along with question 3(a), for concept development during the first lesson,
- questions 2 and 3(b) to (f) for classwork during the first lesson,
- the second tinted passage on page 132 for concept development during the second lesson, and
- questions 4, 5, 6, 7 and 8 for classwork during the second lesson.

Explain how to use both arrow number sentences and number lines when recording how to fill up to multiples of 10, 100 and 1 000. In the example in question 1, check that learners understand that each small space represents 10 on the number line.

Answers

1. (a) 2 (b) 30 (c) 200 (d) 244
   (e) The red lines represent 6 768 and 7 244. They are 476 apart.
   \[ \text{[Step 1 (+2) + Step 2 (+30) + Step 3 (+200) + Step 4 (+244) = 476]} \]

2. (a) 5 876 + 4 \rightarrow 5 880 + 20 \rightarrow 5 900 + 100 \rightarrow 6 000 + 344 = 6 344
   (b) 7 783 + 7 \rightarrow 7 790 + 10 \rightarrow 7 800 + 200 \rightarrow 8 000 + 456 = 8 456
   (c) 3 364 + 6 \rightarrow 3 370 + 30 \rightarrow 3 400 + 411 \rightarrow 3 811
   (d) 4 849 + 1 \rightarrow 4 850 + 50 \rightarrow 4 900 + 100 \rightarrow 5 000 + 482 = 5 482

2.2 Methods to add and subtract

Add by filling up multiples of 10 and 100 and 1 000

This method is useful when one number is smaller than the other one, for example when 6 768 + 476 has to be calculated.

In this case, part of the second number is added to reach the next multiple of 10:
6 768 + 2 \rightarrow 6 770 \quad \text{(Step 1)}

Since 476 = 2 + 474, we must still add 474.
Part of the 474 is now added on to reach the next multiple of 100:
6 768 + 2 \rightarrow 6 770 + 30 \rightarrow 6 800 \quad \text{(Step 2)}

Since 474 = 30 + 444, we must still add 444.
Part of the 444 is added on to reach the next multiple of 1 000:
6 768 + 2 \rightarrow 6 770 + 30 \rightarrow 6 800 + 200 \rightarrow 7 000 \quad \text{(Step 3)}

Since 444 = 200 + 244, there is still 244 to be added:
6 768 + 2 \rightarrow 6 770 + 30 \rightarrow 6 800 + 200 \rightarrow 7 000 + 244 = 7 244 \quad \text{(Step 4)}

If you look back at the steps, you will notice that the 476 was broken down into four parts:
2 + 30 + 200 + 244 = 476

1. (a) What part of 476 was added on to 6 768 in Step 1?
   (b) What part of 476 was added on in Step 2?
   (c) What part of 476 was added on in Step 3?
   (d) What part of 476 was added on in Step 4?
   (e) The steps are shown on this number line. What are the numbers at the two red lines, and how far apart are they?

2. Use the filling-up method to calculate the following.
   (a) 5 876 + 468
   (b) 7 783 + 673
   (c) 3 364 + 447
   (d) 4 849 + 633
Teaching guidelines

When you buy goods at a shop without an electronic till, such as a spaza shop, mobile shop or school tuck shop, you will experience *adding on to subtract* in real life.

You can start by role-playing this kind of situation before showing learners how to record it with arrow number sentences or on number lines. You can give one learner a script that explains she should give her daughter R20 (play money on scrap paper) and ask her to buy a litre of milk at the spaza shop. Have some play money coins (circles cut from scrap paper) ready.

**At the shop**

**Learner:**

Learner gives R20.

**Shopkeeper:**

That will be R12.

Learner gives R1.

Shopkeeper: *Gives R1. Says:*

Learner gives R2.

Shopkeeper: *Gives R2. Says:*

Learner gives R5.

Shopkeeper: *Gives R5. Says:*

Recording with an arrow number sentence:

R12 + R1 → R13 + R2 → R15 + R5 → R20

Recording on a number line:

Then demonstrate these ways of recording using question 3(a) or other 4-digit numbers.

**Answers**

Learners should first check their answers to question 3 by doing question 5 before you mark them.

3. (a) 2 875 + 5 →

2 880 + 20 →

2 900 + 100 →

3 000 + 4 236

= 7 236

5 + 20 + 100 + 4 236 = 4 361

7 236 − 2 875 = 4 361

(b) 2 218

(c) 7 766

(d) 2 595

(e) 4 223

(f) 3 123

---

Subtract by adding on

Subtraction can also be done by filling up multiples of 10, 100 and 1 000.

For example, 7 234 − 4 876 can be calculated by finding out how much should be added to 4 876 to reach 7 234, as shown below.

We add on in steps from 4 876 until we reach 7 234, and then check how much we had to add on in total:

4 876 + 24 → 4 900 + 100 → 5 000 + 2 234 = 7 234.

In total we added on 24 + 100 + 2 234 which is 2 358.

So, 4 876 + 2 358 = 7 234 and 7 234 − 4 876 = 2 358.

3. Use the add-on method of subtraction to calculate the following.

(a) 7 236 − 2 875

(b) 6 721 − 4 503

(c) 9 000 − 1 234

(d) 8 187 − 5 592

(e) 7 386 − 3 163

(f) 8 396 − 5 273

Add by adding on place value parts

To calculate 3 465 + 4 574 the number that is to be added can be broken down into its place value parts. The place value parts can then be added one by one to the first number:

4 574 = 4 000 + 500 + 70 + 4

So, 3 465 + 4 574 = 3 465 + 4 000 + 500 + 70 + 4 and it can be calculated like this:

3 465 + 4 000 = 7 465

7 465 + 500 = 7 965

7 965 + 70 = 8 035

8 035 + 4 = 8 039

The work can also be shown like this:

3 465 + 4 000 → 7 465 + 500 → 7 965 + 70 → 8 035 + 4 = 8 039

---

UNIT 2: WHOLE NUMBERS: ADDITION AND SUBTRACTION
Teaching guidelines
You can use the second tinted passage on page 132 and a number line to show learners how to break the number that is to be added down into place value parts and add them one by one.

Questions 3 and 5 allow learners to think about and reflect on the calculation strategies. Once learners have done these questions they should discuss their answers and methods.

Answers
4. (a) \(4,628 + 2,000 \rightarrow 6,628 + 700 \rightarrow 7,328 + 70 \rightarrow 7,398 + 5\)
   \[= 7,403\]
(b) \(4,775 + 2,000 \rightarrow 6,775 + 600 \rightarrow 7,375 + 20 \rightarrow 7,395 + 8\)
   \[= 7,403\]
5. Learners check their answers for question 3 by adding on place value parts.
6. No, it does not matter.
   (a) \(3,465 + 4 \rightarrow 3,469 + 70 \rightarrow 3,539 + 500 \rightarrow 4,039 + 4,000\)
      \[= 8,039\]
(b) \(3,465 + 70 \rightarrow 3,535 + 4 \rightarrow 3,539 + 4,000 \rightarrow 7,539 + 500\)
      \[= 8,039\]
(c) \(3,465 + 500 \rightarrow 3,965 + 4,000 \rightarrow 7,965 + 4 \rightarrow 7,969 + 70\)
      \[= 8,039\]
7. Learners write the instruction: \(3,465 + 70 \rightarrow \ldots + 500 \rightarrow \ldots + 4 \rightarrow \ldots + 4,000 = \ldots\)
8. Learners may choose different orders. The answers should, however, be the same.
   (a) Example: \(5,374 + 4 \rightarrow 5,378 + 20 \rightarrow 5,398 + 800 \rightarrow 6,198 + 2,000 = 8,198\)
(b) Example: \(5,374 + 2,000 \rightarrow 7,374 + 20 \rightarrow 7,394 + 800 \rightarrow 8,194 + 4 = 8,198\)
(c) Example: \(6,785 – 3,000 \rightarrow 3,785 – 200 \rightarrow 3,585 – 40 \rightarrow 3,545 – 1 = 3,544\)
(d) Example: \(6,785 – 200 \rightarrow 6,585 – 1 \rightarrow 6,584 – 40 \rightarrow 6,544 – 3,000 = 3,544\)
### 2.3 Round off and estimate

**Mathematical notes**
In this section learners use rounding off and estimating as a calculation strategy. In Term 1 Unit 3 Section 3.7 learners rounded off 3-digit numbers to the nearest 10 and 100. (You might like to read those “Teaching guidelines”.) Now for the first time they are rounding off to the nearest thousand.

**Teaching guidelines**
As in Term 1 Unit 3, rounding off is used as a calculation aid. Aim to complete Section 2.3 in 1 hour. One possibility is to use
- the tinted passage and questions 1(a), 2(a), 3(a) and 4 for concept development,
- questions 1(b) to (g), 2(b) to (g), 3(b) to (g), 5(a) and (b), and related parts of questions 6, 7, 8 and 9 for classwork, and
- questions 5(c) and (d), and related parts of questions 6, 7, 8 and 9 for additional practice.

Continue to stress that rounding to the nearest multiple involves seeing which multiple is closest to that number, but that numbers halfway between are rounded up. Number lines show which multiple is closest. You can use the tinted passage on page 134, but also use number lines. For example, the number lines alongside show 4 445 rounded to the nearest 10, 100 and 1 000.

**Answers**
1. (a) 6 000    (b) 7 000    (c) 4 000    (d) 4 000
   (e) 3 000    (f) 3 000    (g) 7 000    (h) 7 000
   (i) 8 000    (j) 7 000    (k) 6 000    (l) 6 000
2. (a) 6 500    (b) 6 500    (c) 4 450    (d) 4 450
   (e) 3 240    (f) 3 230    (g) 7 250    (h) 7 250
   (i) 7 500    (j) 7 500    (k) 6 010    (l) 6 020
3. (a) 6 500    (b) 6 500    (c) 4 500    (d) 4 400
   (e) 3 200    (f) 3 200    (g) 7 200    (h) 7 300
   (i) 7 500    (j) 7 500    (k) 6 000    (l) 6 000
4. (a) R4 000 – R2 000 = R2 000    (b) R4 400 – R2 400 = R2 000

Numbers can be rounded off to make estimates of the answers for calculations before you do the calculations accurately.
- 3 567 rounded off to the nearest 10 is 3 570
- 3 567 rounded off to the nearest 100 is 3 600
- 3 567 rounded off to the nearest 1 000 is 4 000
- 3 565 rounded off to the nearest 10 is 3 570
- 3 564 rounded off to the nearest 10 is 3 560
- 3 580 rounded off to the nearest 100 is 3 600
- 3 549 rounded off to the nearest 100 is 3 500
- 3 500 rounded off to the nearest 1 000 is 4 000
- 3 499 rounded off to the nearest 1 000 is 3 000

1. Round each of these numbers off to the nearest 1 000, in the same way as in the above examples.
   (a) 6 499    (b) 6 500
   (c) 4 450    (d) 4 449
   (e) 3 235    (f) 3 234
   (g) 7 249    (h) 7 250
   (i) 7 500    (j) 7 499
   (k) 6 008    (l) 6 015

2. Round each number in question 1 off to the nearest 10.
3. Round each number in question 1 off to the nearest 100.
4. Jana has already paid back R2 386 of the R4 437 she borrowed from Petra.
   (a) Round the numbers off to the nearest 1 000 and make an estimate of how much Jana still has to pay back.
   (b) Also make an estimate by rounding off to the nearest 100.
**Mathematical notes**

When we round off numbers before calculating, our answers will not be accurate. The difference between the accurate answer and the approximate answer is called the estimation error.

If you round off to the nearest 1 000, you will have a larger estimation error than if you round off to the nearest 100. If you round off to the nearest 100, you will have a larger estimation error than if you round off to the nearest 10.

**Answers**

5. (a) 4 000 litres + 5 000 litres = 9 000 litres
   (b) 9 000 packets − 2 000 packets = 7 000 packets
   (c) 9 000 bricks − 2 000 bricks = 7 000 bricks
   (d) 7 000 metres − 6 000 metres = 1 000 metres

6. (a) 3 500 litres + 4 900 litres = 8 400 litres
   (b) 8 600 packets − 2 000 packets = 6 600 packets
   (c) 8 700 bricks − 2 400 bricks = 6 300 bricks
   (d) 7 300 metres − 5 700 metres = 1 600 metres

7. (a) 3 520 litres + 4 850 litres = 8 370 litres
   (b) 8 560 packets − 2 050 packets = 6 510 packets
   (c) 8 680 bricks − 2 360 bricks = 6 320 bricks
   (d) 7 350 metres − 5 680 metres = 1 670 metres

8. (a) 8 376 (b) 6 516 (c) 6 318 (d) 1 666 m

9. **Question 5**
   (a) (b) (c) (d)
   Error when rounding to the nearest 1 000  624 more 484 more 682 more 666 less

   **Question 6**
   (a) (b) (c) (d)
   Error when rounding to the nearest 100  24 more 84 more 18 less 66 less

   **Question 7**
   (a) (b) (c) (d)
   Error when rounding to the nearest 10  6 less 6 less 2 more 4 more

---

5. Give approximate answers for the questions below, by first rounding off the numbers to the nearest 1 000.
   (a) Selina uses 3 524 litres of water from the tank to water her small field of maize. If there is then 4 852 litres water left, how much water was in the tank?
   (b) A store sold 8 563 packets of chips during a month. Of these, 2 047 were sold during the last week. How many packets were sold during the first three weeks of the month?
   (c) Willem has to lay 8 675 bricks. So far he has laid 2 357 bricks. How many bricks must he still lay?
   (d) Lerato walked 5 683 m. In the same period of time, Sipho walked 7 349 m. How much further than Lerato did Sipho walk?

6. Give better approximate answers to the above questions, by rounding off the numbers to the nearest 100.

7. Give even better approximate answers to the above questions, by rounding off the numbers to the nearest 10.

8. Calculate the accurate answers to the above questions.

9.  Find out by how much your estimates in question 5 differed from your accurate answers. Report your errors in a table like the one below.

Also find the estimation errors for your estimates in question 6 and in question 7, and report them in your table.
Grade 4 Term 2 Unit 3  Common fractions

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**CAPS time allocation**  6 hours

**CAPS page references**  16 and 71 to 72

**Mathematical background**

It is widely assumed that fractions were invented for accurate measurement, to facilitate the measuring of objects or parts of objects smaller than the commonly used unit of measurement. This is reflected in the Latin names of our current units of measurement, for example centimetres (hundredths of a metre) and millimetres (thousandths of a metre). If the brown strip below is measured with the yellow strip as a unit, its length is 3 and 3 fifths of the yellow unit (5 green units are equal to 1 yellow unit). This example demonstrates how fractions are used as measures.

Mathematically, the fraction concept is critical to the understanding of decimals, because the place value parts after the decimal comma are fractions. The expanded notation for the number 23.47 is $20 + \frac{3}{10} + \frac{4}{100}$ or 2 tens + 3 units + 4 tenths + 7 hundredths. A good understanding of common fractions will lay a sound basis for decimal fractions when learners work with them in Grade 6. Decimal fractions are not a topic in Grade 4. Grade 4 learners only work with decimals in the context of measurement.

Fractions are also used to describe parts of collections and parts of non-physical quantities, for example “3 eighths of the learners in a school” or “63 hundredths of the available marks”. In a case like the latter, the percentage notation (% for hundredths) is normally used.

In everyday life and language certain fractions, such as “half” and “quarter”, are sometimes used to indicate approximate parts of whole objects. People may, for example, refer to a “quarter of an apple” or “a half-loaf of bread”. Although this everyday use of fraction language differs from the mathematical use in the sense that the fraction words are not used to indicate precise parts, the everyday use provides a starting point for learning about fractions. You can also use what learners know about fractions of time, for example the position of the clock hands at a quarter past the hour, half past the hour, and quarter to the hour.

A fraction is a number of equal parts of the same object or measurement unit, for example 7 hundredths of a metre.

Learners’ concept of fractions is often undermined by the idea that a fraction consists of two numbers, for example that “3 fifths” is made up of the numbers 3 and 5, without understanding the entirely different roles of the two numbers. This misconception is often supported by misleading language, such as referring to $\frac{3}{5}$ as “three over five” instead of “3 fifths”. The use of the proper fraction name, for example “3 fifths”, is essential.
3.1 Equal sharing into fractions

Teaching guidelines
This is a long unit. You could plan to spend 2 hours on Section 3.1. One possible way to organise the section is to use
- questions 1, 2, 3, 11 and 12 for concept development (you can use questions 1 and 2 to assess whether learners remember how to name fractions),
- questions 4, 5 and 7 for classwork, and
- questions 6, 8, 9 and 10 for additional practice.

In Grade 4 learners are not expected to learn arithmetic rules and procedures for how to add or subtract fractions, how to make equivalent fractions or how to divide wholes into fraction parts. The expectation is rather that learners work with apparatus, diagrams and visual images. This is reflected in the solutions modelled in this unit.

Notes on questions
It is really important that each learner makes their own drawing in question 2 to show how a sausage can be cut into six equal parts. Making the drawing and calling each part a sixth provides the learner with an opportunity to consolidate understanding of the relationship between fractions and dividing into equal parts.

While it is important that learners think about dividing into six equal parts when they make the drawing, there is no need to make an accurate drawing. It is best to suggest to learners that they do not use a ruler, but just try to make a neat drawing.

Critical knowledge and skills
It is critical that learners acquire the skill to demonstrate their understanding of fractions with simple drawings that they can make quickly (fraction strips).

This skill will prove valuable when learners work at tasks relating to fractions, for example to find equivalent fractions. Making their own drawings to illustrate fractions will also empower learners to follow your explanations, or the explanations in the textbook, where fractions concepts are explained through different kinds of diagrams.

Answers
1. One fifth of the loaf
2. One sixth of the sausage
Teaching guidelines

Ensure that learners do not spend inordinate time to try to make neat, pretty sketches. The making of sketches here is just a vehicle for thinking. Sketches like the ones below are good enough.

Answers

3. Learners may draw it in different ways, for example:

4. Learners may draw it in different ways, for example:
   (a) or
   (b) or

5. (a) or
   (b) or

6. (a) or
   (b) or

7.
Teaching guidelines
Suggest to learners that for question 8 they make simple sketches like the example in the tinted passage on page 137 of the Learner Book.

Answers
8. (a) 8 equal parts                      (b) 4 equal parts
   ![Sketch of 8 equal parts]
   ![Sketch of 4 equal parts]

   (c) 5 equal parts                       (d) 10 equal parts
   ![Sketch of 5 equal parts]
   ![Sketch of 10 equal parts]

9. Photograph B: quarters Photograph D: eighths

10. ![Sketch of loaves divided into different parts]

11. Half a loaf and another eighth of a loaf

12. Half a loaf and another sixth of a loaf

Some learners may divide each of the last two loaves into 12 slices and give each person 2 out of 12 slices. The answer: half a loaf and 2 twelfths of a loaf is also acceptable.
3.2 Naming fractions

Critical knowledge
It is critical that learners know that 1 whole equals 2 halves, 3 thirds, 4 quarters, 5 fifths, 6 sixths, 7 sevenths, 8 eighths, etc.

It is critical that learners learn to pronounce the fraction names. Taking verbal feedback from many learners for question 1 will promote this.

Possible misconceptions
Learners sometimes acquire the damaging misconception that a fraction is a name for a certain shape. For example, learners may have the idea that a quarter, a half and three quarters are always shapes like those shown alongside.

This misconception arises when there is an overemphasis on cutting up circular objects such as cakes or pizzas when learners are introduced to fractions. To combat this misconception, a variety of other contexts for fractions are used in this unit, including loaves of bread, spherical objects (oranges), collections of objects and measurement (fractions as smaller units of measurement). The photographs on page 138 show eighths in different ways, and the photographs on page 140 show halves and quarters in different ways. The solutions in Section 3.1 questions 3, 4, 5 and 6 also show different representations of common fractions.

Teaching guidelines
In question 1 you could draw the loaves on the board.

You could ask learners to count in halves as they look at a diagram showing halves: 1 half, 2 halves. Stress that 2 halves is 1 whole. Repeat this for thirds, quarters, fifths, sixths, sevenths and eighths.

Answers
1. (a) fifths  (b) thirds  (c) tenths
2. 7 pieces
3. One fifth. If the cake is cut into 5 equal pieces, each piece will be larger than when it is cut into 6 pieces. If 5 people share a cake equally, the pieces will be bigger than when 6 people share the same cake.
Mathematical notes
Questions 4 and 5, in conjunction with questions 6, 7 and 8 on the next page, are intended to promote the understanding that an object can be divided in different ways into the same fraction parts.

Teaching guidelines
Stress that we get halves when we divide a whole into two equal parts and that there are many ways to show halves. Stress that we get quarters when we divide a whole into four equal parts and that there are many ways to show quarters. Give each learner three pieces of scrap paper and ask them to show quarters in different ways by folding or cutting the paper.

Answers
4. No
5. Yes
Teaching guidelines

The stacks in question 9 refer to the groups of 4 slices of bread.

In question 9(a) you can ask learners to count in fifths to 5 fifths as they point to each successive stack of 4 slices of bread. In question 9(b) learners are only expected to add (1 stack plus 2 stacks is 3 stacks) or count (1 stack, 2 stacks, 3 stacks), and translate this into 3 fifths.

Many learners do not connect different parts of mathematics. As a teacher it is important that you train learners to do this. Help learners to develop the practice of thinking: “What have I learnt before that can help me here?” Some learners do not even connect different questions with each other. Question 9 on page 141 lays the basis for questions 4 and 5 on page 143.

Answers

6. quarters
7. Photograph A or Photograph B
8. Photograph B
9. (a) Learners can count the stacks as fifths:
   - 1 fifth, 2 fifths, 3 fifths, 4 fifths, 5 fifths or
   - 1 whole is equal to 4 slices, 8 slices, 12 slices, 16 slices, 20 slices
   (b) 3 fifths
   (c) 2 loaves with 4 fifths left over
   (d) From question (a), the whole loaf is 20 slices. So 1 quarter is 5 slices. So 3 quarters is 15 slices.
   (e) From question (a), the whole loaf is 20 slices, and 1 fifth is 4 slices. So 3 fifths is $3 \times 4$ slices = 12 slices. From question (d), 3 quarters is 15 slices. So 3 quarters is more than 3 fifths.
   (f) 4 quarters (of a loaf) makes 1 whole (loaf), so 8 quarters is 2 whole loaves.
   (g) 4 quarters (of a loaf) makes 1 whole (loaf), so 20 quarters is 5 whole loaves.
3.3 Comparing fractions

Mathematical notes
This section focuses on fractions as parts of collections. It also addresses the connection between fractions and division as sharing. Note that the connection between fractions and division as grouping is more complicated and is not addressed here.

Critical knowledge
If we divide a whole into more parts, each part is smaller. If we take a smaller fraction of the same whole, then we get less (see Section 3.2 question 3: If a cake is cut into 5 pieces, each piece will be bigger than if the same sized cake is cut into 6 pieces).

However, if the wholes are not the same then the smaller fraction is not necessarily less. For example, in question 2(b) of this section: a quarter of R100 is more than half of R40.

Answers
1. (a) The whole group is 15 people.

   1 fifth of 15 people is 3 people.

   3 fifths of 15 people is 9 people.

(b) Make 3 groups from 15, i.e. $15 \div 3 = 5$

(c) From question 1(b), 1 third of 15 people is 5 people.

(d) $\frac{1}{5}$ group of 20 people

(e) 4 people. In question 1(d), 20 people were divided into 5 groups. Each group of 4 people is 1 fifth of the group of 20 people.

2. (a) A quarter of R40 is R10, half of R100 is R50. Lizzie spent more money.

(b) A quarter of R100 is R25, half of R40 is R20. Maggie spent more money.

(c) A quarter of R40 is R10, half of R40 is R20. Lizzie spent more money.
Notes on questions
Questions 3, 4 and 5 address fractions of a whole (the loaf), as well as fractions of collections (the 20 slices).

The illustrations of loaves of bread between questions 3 and 4 relate to question 4. In question 4, learners may say many things about the loaves of bread, for example: “They are loaves of white bread.” “They are sliced loaves of bread.” Focus learners’ attention on the slices as parts of the whole loaf, and how these slices are grouped and what fraction each group of slices is of the whole.

Help learners to connect what they did in Section 3.2, especially question 9 on page 141, with questions 4 and 5 on page 143.

Answers

3. 

4. (a) The loaf is cut into 20 slices. Slices are grouped into 5 groups with 4 slices in a group. Each group is one fifth of the loaf.
   (b) 20 slices
   (c) 4 slices
   (d) 3 groups of 4 slices = 12 slices
   (e) The whole loaf is 20 slices. If you divide the loaf into 4 equal groups, each group is a quarter. 1 quarter of the loaf is 5 slices.
   (f) From question (e), 1 quarter of the loaf is 5 slices. So 3 quarters of the loaf is 15 slices.
   (g) Each loaf can be made into 4 quarters. So, 5 loaves give $5 \times 4$ quarters = 20 quarters.
   (h) 1 loaf is 4 quarters, 2 loaves are 8 quarters, 3 loaves are 12 quarters.
   (i) 3 quarters, because a quarter loaf is 1 of four equal parts, and 1 fifth of a loaf is one of five equal parts. If you divide the same thing into more parts, each part is smaller.

5. (a) 9 slices. If you divide this loaf into 4 equal parts each part has 3 slices. A quarter of this loaf is 3 slices, so 3 quarters of this loaf is 9 slices.
   (b) 4 slices. If you divide this loaf into 6 equal parts each part has 2 slices. A sixth of this loaf is 2 slices, so 2 sixths of this loaf is 4 slices.
   (c) 4 slices. If you divide this loaf into 3 equal parts each part has 4 slices. A third of this loaf is 4 slices.
   (d) 2 thirds. 1 third is 4 slices, so 8 slices are 2 thirds.
3.4 Using fractions to measure

**Mathematical notes**
Fractions as parts of wholes and collections was addressed in Sections 3.1 and 3.2. This section is about fractions as parts of measuring units, to facilitate accurate measurement. It also introduces equivalent fractions. This is further explored in Term 3 Unit 1 Section 1.2.

**Teaching guidelines**
You could plan to spend 2 hours on Section 3.4. One possible way to organise this section is to use
- questions 1, 2, 3, 11, 12 and 13 for concept development,
- questions 4, 5 and 6 for classwork, and
- questions 7, 8, 9 and 10 for homework.
You might like to read Section 1.2 of Term 3 Unit 1 in this Teacher Guide, which deals with equivalent fractions, before you teach questions 9 to 12. Note that question 3 raises the issues that are dealt with in questions 4, 5, 6, 7 and 8.

**Answers**
1. (a) Yes
   (b) The green and purple sticks are subdivided into smaller equal parts, the grey stick is not.
   (c) The green stick is divided into 8 equal parts and the purple stick into 5 equal parts.
   (d) 5
   (e) fifths
   (f) eighths
2. (a) Yes, I can say it is 2 sticks long.
   (b) No, I cannot say exactly. I can only say it is 2 and a bit sticks long.
   (c) No, I cannot say exactly. I can only say it is about 2 and a half sticks long.
   (d) No, I cannot say exactly. I can only say it is a little bit more than 2 sticks long.
3. Accept any reasonable plans. Some learners may say that we can divide the grey stick into smaller parts of equal size.
**Answers**

4. (a) Yes, 2 and 1 eighth of a stick  
   (b) Yes, 2 and 2 fifths of a stick  

5. 5 sixths  

6. (a) Two and 1 eighth of a stick  
   (b) Two and 2 fifths of a stick  

7. Wall (d)  

8. (a) One and 3 fifths of a stick long  
   (b) One and 3 sixths of a stick long  
   (c) One and 3 tenths of a stick long  

9. Yes, because 3 sixths is the same length as 1 half.  
   3 is half of 6, so 3 sixths is “halfway”, or half of a stick divided into sixths.  

**Notes on questions**  
Questions 9 to 13 serve to develop awareness of the fact that the same quantity can be described as a fraction in different ways, in other words the concept of equivalent fractions. This is critically important work.

**Critical knowledge**  
Equivalence is probably the most important topic in fractions in the Intermediate Phase. It is the basis of many of the calculations done with fractions in the Intermediate Phase and beyond.  

Recognising equivalent fractions is the focus of fractions in Term 3 Unit 1 Section 1.2. It is also the focus of a large part of the work on fractions in Grade 5 and 6.
Teaching guidelines

Grade 4 learners are not expected to use arithmetic rules to find equivalent fractions (or to do calculations). They should rather work with diagrams and apparatus when comparing, ordering and finding equivalent fractions.

For question 11 you can draw two bars of the same length on the board. Divide one into 4 equal parts and shade 3 of these parts. Also divide the second bar into 4 equal parts and shade 3 of these parts. Then halve each of the 4 parts in the second bar. Ask learners: “How many parts are shown now?”, “What do we call each part?”, “How many parts are shaded?”, “What fraction of the second bar is shaded?”, “Can you see that 3 quarters is the same amount as 6 eighths?”

In question 12 learners are asked to find a wall that is two and 3 fifths of a stick long. Here they need to find a stick divided into parts equivalent to fifths. Let them first find a stick that is divided into fifths that is not at a wall that is 2 and 3 fifths of a stick long. The top stick at Wall (a) and the bottom stick at Wall (b) are divided into fifths. Then learners need to find a wall that is 2 and 3 fifths long. The easiest way for them to do this is to use a ruler or any object with a straight edge (a piece of paper will do). They can place the straight edge against 3 fifths on the stick in Wall (a), and look down to see which wall has this length (2 and 3 fifths of a stick). They will see that Wall (e) has this length and that its length coincides with 2 sticks and 6 tenths.

In question 13 learners are only expected to know that double 5 is 10 or $5 + 5 = 10$ or $2 \times 5 = 10$. It does not matter whether they are adding 5 sweets and 5 sweets, 5 cm and 5 cm or 5 eighths and 5 eighths, all they need to do is say 5 + 5 or double 5 or 2 × 5 = 10.

Answers

10. (a) Two and 4 fifths of a stick long
   (b) Two and 4 tenths or two and 2 fifths of a stick long
   (c) Two and 6 eighths of a stick long
   (d) Two and 5 tenths or 4 eighths or 3 sixths of a stick long
   (e) Two and 6 tenths of a stick long
11. (a) Wall (c)  (b) Wall (c)
12. Wall (e) is two and 6 tenths long. 6 tenths is the same length as 3 fifths.
13. 10 eighths
Grade 4 Term 2 Unit 4  

Length

### Learner Book Overview

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### CAPS time allocation

7 hours

### CAPS page references

25 and 73 to 75

### Mathematical background

Length, mass, capacity/volume, perimeter and area are different properties of objects. When we measure these properties we are describing how much of the property objects have; we are describing the property in terms of a numerical value.

When we measure the length of objects or spaces we are allocating a number value to how long or wide the object or space is. This allows us to compare and order objects in terms of their length. For example, the teacher’s desk is wider than the classroom door. It also allows us to do calculations. For example, if a roll of string is 500 m, is this enough string to give each Grade 4 learner 2 m of string if there are 4 classes of 40 learners?

Learners go through four stages when learning to measure:

1. Identifying and understanding the property they are measuring.
2. Comparing and ordering examples of a particular measure (see question 1 of Section 4.1).
3. Using informal or non-standard units to measure (see question 6 of Section 4.1).
4. Using formal or standard units to measure (see Sections 4.2, 4.3 and 4.5).

When you use an informal unit to measure length you can compare the lengths of many objects to the length of the same object. For example, using a match as your informal unit means that you can compare the lengths of different objects by saying how many match lengths each object is. A standard unit allows many people to compare the lengths of many objects to the same lengths, for example metric units of length. A difficulty with standard units is that the instruments are often complex to read (see Sections 4.3 and 4.5).

### Resources

String; matches; new pens or pencils all of the same length; rulers; measuring tapes; builder’s tape measures; trundle wheel.
4.1 Comparing and measuring length

**Mathematical notes**
In this section learners first compare lengths without any units, then they use an informal unit (a match) to measure. The section ends by motivating the need for standard units.

**Resources**
A piece of string about 2,5 m for each pair of learners; matches; new pencils or pens all of the same length.

**Teaching guidelines**
All the principles of measuring can be learnt from informal measuring. In this section learners are not expected to use standard units and formal measuring instruments.

In question 1 learners can first just estimate which of the pairs of measurements are longer. Then they can check using a piece of string for 1(a), (b), (c) and (f). In 1(d) learners can pace out the distance between the classroom and the office. While they will agree on which classroom is furthest from the office, they may not agree on the number of paces or strides. This is because the length of their legs will differ. You can use this, and the tinted passages on pages 147 and 148, to motivate the need for standard units.

Learners might find measuring curved lines (see question 4) more complicated than measuring straight lines. This might only become an issue when they measure with rulers.

**Answers**

1. (a) Height of the classroom door  (b) Width of the chalkboard  
   (c) Height of the teacher, unless the teacher is very short.  
   (d) Answers will differ from school to school.  
   (e) Length of foot  (f) Distance between ears

2. Learners’ methods will differ: accept all reasonable methods. For 1(a), (b), (c) and (f) they might use a piece of string, as outlined in question 4. They might put their hand directly against their foot in 1(e). They might pace out the distances in 1(d).

3. Accept any reasonable answers. Also see the answer to question 4.

4. Learners place a piece of string along the line and then measure the length of the string. They may measure it with finger or thumb widths, or use matches: the line is just less than $2 \frac{1}{2}$ match lengths. Learners have measured in centimetres with rulers in Grade 3. Some learners may use rulers: accept answers from $9 \frac{1}{2}$ cm to 11 cm.
Answers

5. There are too many possible answers to list all of them. Accept any reasonable answers.
   (a) Length: length of a room; length of a skirt, etc.
   (b) Distance: distance between towns; distance from home to school, etc.
   (c) Height: own height; height of a window (before buying curtains), etc.
   (d) Width: width of a room; width of a window (before buying curtains), etc.
   (e) Depth: depth of hole; pool; cupboard; drawer, etc.

6. Pencil

7. (a) Themba’s answer is an estimate.
   (b) Take a matchstick and measure the pencil with it.
   (c) Measure the length of the pencil and the length of the matchstick. Divide the length of the matchstick into the length of the pencil to get your answer.

Possible misconceptions
Sometimes when learners measure with informal units they leave gaps between the units.

Explain to learners that units, in this case matches, need to be placed end to end, as shown in the second photograph on page 148.
4.2 Standard units of measurement

Mathematical notes
This section introduces the four standard units that we commonly use to measure length in everyday life, namely millimetres, centimetres, metres and kilometres.

Learners choose appropriate units to measure different lengths. They also find common referents of particular lengths in centimetres and use these to estimate other lengths in centimetres. Learners will focus on using instruments for measuring in later sections.

Resources
Rulers. If you don’t have rulers you can photocopy the examples provided in the Addendum (pages 414 and 415). Learners can also use a piece of string and mark off centimetres using the illustration in the tinted passage at the bottom of page 150.

Possible misconceptions
In the Intermediate Phase, learners measure and calculate length using only millimetres, centimetres, metres and kilometres. This may lead to the misconception that these are the only units of length. In Section 4.4 of this Teacher Guide we introduce more units of measurement (also see “Mathematical Notes” on the next page) and show how these can help learners to convert between units.

Teaching guidelines
You can use the first tinted passage on page 149 to introduce the notion of standard units. Learners should already have measured in metres and centimetres in Grade 3, but they were not required to know the relationship between the two. You can check with learners which standard units of length they know and whether they have a sense of how long a metre and a centimetre is. Use the summary bar to explain the relationship between millimetres, centimetres, metres and kilometres. You can demonstrate the size of a metre and ask learners to imagine how far 1 000 metres, or 1 kilometre, is. Let learners see the size of a millimetre and centimetre by looking at their rulers or at the illustration in the tinted passage on page 150.

Ask learners to choose the appropriate units for the lengths given in question 2. They should motivate their answers.

In questions 3 to 6 learners name objects with specific lengths. They use these to estimate other lengths. We call these informal referents. Learners can check their answers to questions 3 to 7 by measuring with a ruler.

Answers
1. Standard units are the same all over the world. Non-standard units are not the same.
**Mathematical notes**

Although the relationship between metres and millimetres, centimetres and kilometres is stated in this section, learners are not expected to do conversions between units here.

As mentioned before, there are many standard units of length that we do not commonly use to measure in everyday life. A more complete list ranging from kilometres to millimetres is kilometres, hectametres, decametres, metres, decimetres, centimetres and millimetres. This is described further in Section 4.4 of this Teacher Guide.

**Answers**

2. (a) centimetres
   (b) metres
   (c) millimetres
   (d) kilometres

---

A millimetre (mm) is one of the parts that is formed when 1 m is divided into 1 000 equal parts.

There are 1 000 mm in 1 m.

Milli- in millimetre means thousandth.

There are 10 mm in 1 cm.

A kilometre (km) is 1 000 times as long as 1 m.

Kilo- in kilometre means thousand.

2. Which of the units will you use if you have to measure the length of each of these objects?
   (a) the length of your textbook
   (b) the length of the classroom
   (c) the thickness of your pencil
   (d) the distance between two towns

Most rulers have centimetres (cm) and millimetres (mm) as their units. We use rulers to measure shorter lengths such as the length of a book or the length in a geometric figure.

On measuring tapes you will see millimetres, centimetres and metres (m). We use measuring tapes to measure longer lengths, such as the height of a person or the length of a skirt. For even longer distances, such as the length of a wall in a building, there are builder’s tape measures and surveyor’s tape measures.

Now look at the ruler below. There are 1 cm spaces on the ruler.
**Answers**

3. Answers will differ. Examples include: the width of some learners' fingers, width of some pens, width of the ear of a cup, width of an AAA battery.

4. Answers will differ. Examples include: a cellphone, width of an envelope, width of a sheet of A4 paper folded lengthwise, width of some learners' palms.

5. Answers will differ. Examples include: length of a ruler, length of an A4 sheet of paper, width of a chopping board.

6. Answers will differ. One answer is an A4 sheet of paper.

7. Estimates will differ.

**4.3 Measuring short lengths accurately**

**Mathematical notes**

In the previous section learners estimated lengths and chose suitable instruments. The focus here is on measuring in centimetres and millimetres using a ruler, and on how to place the object measured against the ruler.

**Possible misconceptions**

Learners may think that they simply read the length from where the end of the object aligns with the ruler. This is only true if they place one end of the object against zero on their ruler.

If learners do not place the end of the object against zero, they need to subtract the number at the beginning of the object from the number at the end of the object: see questions 1 and 5.

**Resources**

Rulers that are at least 15 cm long (you can photocopy the examples provided in the Addendum on pages 414 and 415); lengths of string or cotton, about 15 cm long.

**Teaching guidelines**

In the first eight questions, learners use rulers to measure straight lines or straight edges. In question 9 learners measure curved lines and curved edges; this is more complicated than measuring straight lines. Question 4 on page 147 explains how to do this. You can cut lengths of string or cotton of about 15 cm long for each learner.

**Answers**

1. (a) No
   (b) 3 cm. She should have started measuring from 0 or she should have subtracted 1 cm (the beginning of the bar) from 4 cm (the end of the bar).
Teaching guidelines
Allow time for learners to share their answers and explanations of their answers.

Answers
2. (a) No
   (b) It is 3 cm long. The blue bar extends slightly past the 0 on the left. It stops just before the 3 cm mark.
3. Put one end of the blue bar on the 0 mark of the ruler. Read the measurement where the end of the bar is.
4. 7 cm
5. (a) 5 cm
   (b) Subtract 2 cm from 7 cm.
Mathematical notes
On page 152 learners only read measurements in centimetres.

The focus here is on measuring in centimetres and millimetres using a ruler. In Grade 4 learners do not work with decimal fractions. This means that they can only state their measurements in millimetres, centimetres and millimetres, or centimetres and fractions of centimetres (expressed as common fractions) – see the tinted passage. Page 73 of the Intermediate Phase Mathematics CAPS states the following about Grade 4 learners:

“Once learners have learned from reading commercial mass and capacity that 2 1/2 is the same as 2,5 they will also be able to use the decimal 5 in their recordings i.e. 2,5 cm long.”

This means that from early on in Term 3 learners can use the decimal 5. While learners are not required to use the decimal form or teachers expected to teach it, if learners happen to know how to write a decimal half it should not be marked as incorrect.

Answers
6. (a) 55 mm (b) 5 1/2 cm or 5,5 cm
7. Learners will express their reasoning differently but essentially 5 cm = 50 mm, so 5 cm and 7 mm = 50 mm + 7 mm = 57 mm.

8.

<table>
<thead>
<tr>
<th>Bar</th>
<th>Estimated lengths</th>
<th>Measured lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td></td>
<td>10 cm</td>
</tr>
<tr>
<td>Blue</td>
<td>Estimated lengths will differ</td>
<td>6 cm and 3 mm</td>
</tr>
<tr>
<td>Purple</td>
<td></td>
<td>2 cm and 2 mm</td>
</tr>
<tr>
<td>Light green</td>
<td></td>
<td>6 cm and 3 mm</td>
</tr>
<tr>
<td>Dark green</td>
<td></td>
<td>4 cm and 7 mm</td>
</tr>
<tr>
<td>Grey</td>
<td></td>
<td>8 cm and 5 mm or 8 1/2 cm</td>
</tr>
</tbody>
</table>

6. (a) What is the length of this grey bar in millimetres?

(b) What is the length of the grey bar in centimetres?

We can also record the length of an object with a combination of two different units. The length of the grey bar in question 6 can be given as 5 cm and 5 mm, or 5 1/2 cm.

The bar above is more than 5 cm but less than 6 cm long. It is 7 mm longer than 5 cm. We can therefore say that the bar is 5 cm and 7 mm. Or we can record it as 57 mm.

7. Discuss with one or two classmates why we can also record the length of the purple bar as 57 mm.

8. First estimate the centimetre length of each of the bars on the next page. Then measure each bar with your ruler. Complete this table.
Notes on questions
In question 9, learners measure curved lines and curved edges. This is more complicated than measuring straight lines. Question 4 on page 147 explains how to do this. You can cut lengths of string or cotton of about 15 cm long for each learner.

Answers
9. (a) Answers will differ.

(b) | Object                          | Estimated length          | Measured length       |
    |--------------------------------|---------------------------|-----------------------|
    | The length of the purple       | Estimated lengths         | 9 cm and 8 mm or 9\frac{8}{10} cm |
    | curved bar                     | will differ               |                       |
    | The length of the green        | 15 cm                     |                       |
    | curved bar                     |                           |                       |
    | The distance around the         | 12 cm                     |                       |
    | red circle                     |                           |                       |

9. Estimate the lengths below and then measure them.
(a) First discuss with a friend how you can use a piece of string to measure the lengths.
(b) Complete this table.

<table>
<thead>
<tr>
<th>Object</th>
<th>Estimated length</th>
<th>Measured length</th>
</tr>
</thead>
<tbody>
<tr>
<td>The length of the purple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>curved bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The length of the green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>curved bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The distance around the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>red circle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4 Writing lengths in different units

Mathematical notes
Here learners convert between commonly used standard units of length. Learners can learn these conversion factors off by heart. However, as with everything learnt off by heart, learners will sometimes forget it and use the wrong conversion factor. It may be better for them to understand how the relationship between metric units works in general – see next page.

Possible misconceptions
Learners might think that millimetres, centimetres, metres and kilometres are the only units of length. On the following page we introduce more units of measurement and show how these can help learners to convert between units.

Answers
1. (a) 50 mm  
   (b) 2 cm  
   (c) 2,5 cm or 2\(\frac{1}{2}\) cm  
   (d) You multiply by 10.  
   (e) You divide by 10.  
   (f) Learners’ own work
2. (a) 6 000 m  
   (b) 3 km  
   (c) 7 km and 500 m or 7 \(\frac{500}{1000}\) km or 7\(\frac{1}{2}\) km  
   (d) You multiply by 1 000.  
   (e) You divide by 1 000.
3. (a) 20 mm  
   (b) 230 mm  
   (c) 5 mm  
   (d) 200 mm  
4. (a) 5 cm  
   (b) 230 cm  
   (c) 700 cm  
   (d) 7 200 cm  
   (e) \(\frac{1}{2}\) cm  
   (f) 1 000 cm

Teaching guidelines
In our base-10 place value system, each unit of a higher power is ten times the value of an adjacent unit of a lower power: 10 units make 1 ten; 10 tens make 1 hundred; 10 hundreds make 1 thousand, etc. We can show this using numbers only – see next page.

The metric system also works on groupings or powers of tens. This is why, from the 1790s, it was called the decimal metric system.
Teaching guidelines

<table>
<thead>
<tr>
<th>Millions</th>
<th>Hundred Thousands</th>
<th>Ten Thousands</th>
<th>Thousands</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Units</th>
<th>tenths</th>
<th>hundredths</th>
<th>thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 × 10⁷</td>
<td>1 × 10⁶</td>
<td>1 × 10⁵</td>
<td>1 × 10⁴</td>
<td>1 × 10³</td>
<td>1 × 10²</td>
<td>1</td>
<td>1/10</td>
<td>1/100</td>
<td>1/1000</td>
</tr>
</tbody>
</table>

Page 143 of the Grade 5 Learner Book (Term 2 Unit 4 Section 4.1) shows a table of standard metric units for measuring length. Each unit of a higher power is ten times the value of an adjacent unit of a lower power. Learners can use a table like the one below to do conversions.

<table>
<thead>
<tr>
<th>Kilometre (km)</th>
<th>Hectometre (hm)</th>
<th>Decametre (dam)</th>
<th>Metre (m)</th>
<th>Decimetre (dm)</th>
<th>Centimetre (cm)</th>
<th>Millimetre (mm)</th>
</tr>
</thead>
</table>

Learners simply follow these steps:

1. They write the number under the correct unit of measurement.
2. They mark which unit they are converting to.
3. If converting from a unit of a higher power to a unit of a lower power, they multiply by 10 each time they move to a unit of a lower power.
   Example: 6 km = 6 × 10 × 10 × 10 m = 6 000 m
4. If converting from a unit of a lower power to a unit of a higher power, they divide by 10 each time they move to a unit of a higher power.
   Example: 7 500 m = 7 500 ÷ 10 ÷ 10 ÷ 10 km = 7 km and 500 m. 500 m ÷ 10 ÷ 10 ÷ 10 km = 1/100 km = 1/100 km

If you want learners to be able to work with all the metric units between milli- and kilo-, then teach them a mnemonic to help them remember the units (names and order). The Department of Basic Education* provides the following mnemonic for learners to remember the order of the units of measurement: “Kids Have Dreams Making Dad Chocolate Muffins”. However, you can make any sentence you like with words that start with the letters k, h, d, m, d, c, m. You will find many examples on the internet.

Answers
5. (a) 4 m  
   (b) 4 m  
   (c) $10\frac{1}{2}$ m or 10.5 m  
   (d) 100 m  
6. 2 m 7 cm and 3 mm  
7. (a) 25 000 m  
   (b) 14 000 m  
   (c) 3 500 m  
   (d) 1 250 m  
8. (a) 7 km  
   (b) 26 km  
   (c) $1\frac{1}{2}$ km or 1.500 km  
   (d) 10 km  

4.5 Measuring distances accurately

Mathematical notes
Learners often measure with rulers. However, it is inconvenient to use a ruler for measuring distances longer than 30 cm.

When measuring distances longer than 1 m you need to think about more than the number that you read off the measuring tape, builder’s tape measure, etc. at the end of the distance. You also need to consider how many whole metres have preceded it.

Teaching guidelines
Remind learners to always estimate the distance before measuring (this is different to rounding off the measurement after measuring) and to always state the units that they are using (not just to give the number).

Possible misconceptions
When using measuring tapes or builder’s tape measures, learners sometimes assume that the distance is the number they read off the tape at the end of the distance. For example, if the width of the classroom is 8 m and 85 cm, they may just state or write 85. They may forget to take into account how many full metres there are in addition to the 85 cm.

Answers
1. (a) Learners’ answers will differ. Learners can measure up to the end of their ruler or measuring tape, mark the point on the floor, write down the distance and then start measuring at the mark from zero again. At the end, add up all the distances.  
   (b) Learners’ estimates will differ.  
   (c) Comparisons will also differ from class to class.  
   (d) Learners’ measurements will differ. Comparisons will differ from class to class.
Mathematical notes
Here the main focus is on using a trundle wheel. Some trundle wheels are called metre wheels.

The second focus is on choosing suitable units of length for measuring different distances and lengths.

Resources
Trundle wheel. If you don’t have a trundle wheel, try to get builder’s or surveyor’s tape measures or 1 m lengths of string and some measuring tapes.

Teaching guidelines
If you have a trundle wheel, let learners first check how far it is when the wheel makes a full turn, for example one full turn may be 1 metre. Explain to learners that they need to count the number of clicks as they measure, and multiply this by the distance of one full turn. For example, if they count 27 clicks this would represent 27 metres. If the wheel does not click at the end of the distance that they measure, they will need to check what part of a metre was covered after the last click. This will be shown by the pointer on the wheel, for example 6 centimetres.

If you can’t access either a trundle wheel or builder’s tape measure, cut metre long lengths of string for each learner. Let them use these lengths of string to measure long distances. Use a ruler or tape measure to measure the final bit of the distance, which may be less than a whole metre. For example, the total distance may be 27 m 6 cm.

Answers
2. Learners’ estimates will differ. The distances measured will also differ.
3. (a) Builder’s tape measure
   (b) Trundle wheel
   (c) Ruler
   (d) Ruler
   (e) Measuring tape

4.6 Rounding off
Teaching guidelines
You can use the tinted passage to motivate the need for rounding off.
Mathematical notes
Measurement provides a useful context for learners to understand estimation and rounding off. Questions that ask: “Is it closer to ... or ... ” help learners to understand rounding off.

Teaching guidelines
Pages 14 to 16 of the Grade 6 Learner Book illustrate how to use a number line to show rounding off (an extract is shown alongside). You can use this, together with the tinted passage on pages 43 to 44 in the Grade 4 Learner Book, to explain rounding to the nearest 10 to learners.

You can show the numbers on a number line or measuring tape so that learners can actually see which ten the number is closer too. Learners can use their rulers to see the nearest 10 in questions 3(a) and (b).

Some teachers tell learners to underline the power they are rounding to, and circle the digit that follows. For example, if rounding 142 to the nearest 10, they would say underline the digit 4 and circle the digit 2, i.e. 142. This is not recommended. It does not help learners to understand the meaning of rounding off. It is also confusing from Grade 5 onwards, when learners need to start rounding off to the nearest 5.

Answers
1. (a) Possible answers include: the number of people in a crowd, such as at a sports match, or the hours spent studying for a test of exam.
   (b) Possible answers include: when baking or when a pharmacist mixes medicines.
2. No, it was probably an estimate.
3. (a) 30 cm (b) 140 mm (c) 1 230 mm (d) 50 340 mm (e) 10 km (f) 10 km

Sometimes it is not necessary to give the exact number or measurement, even if it is possible. For example: The annual school fun walk has an exact distance of 5 km 346 m. If someone asked you the distance of the fun walk, you will probably answer (about) 5 km.

1. Discuss these questions with one or two classmates.
   (a) When do you think it would be a good thing to round off a number or a measurement?
   (b) When do you think it is necessary to give the exact number or quantity?
2. The newspaper said there were 30 000 people at the soccer game. Do you think that is the exact number of people that attended the game?

To round a number usually means to find a multiple of 10, 100 or 1 000 that is close to the number. We say that we round up or down to the nearest 10 or 100 or 1 000.

Examples:
142 is closer to 140 than to 150, so 142 rounded to the nearest 10 is 140.
147 is closer to 150 than to 140, so 147 rounded to the nearest 10 is 150.
145 is the same distance from 140 and 150. “Halfway” numbers are usually rounded up to the larger of the possibilities. So, 145 rounded to the nearest 10 is 150.

3. Round off to the nearest 10:
   (a) 26 cm   (b) 144 mm
   (c) 1 231 m   (d) 50 335 mm
   (e) 6 km   (f) 5 km
Teaching guidelines

Learners can use a measuring tape to see the nearest 100 in questions 4(a) and (b).

**Answers**

4.  
(a) 100 cm  (b) 100 cm  (c) 1 000 mm
(d) 56 100 km  (e) 300 mm  (f) 23 500 km

5.  
(a) 2 000 mm  (b) 6 000 km  (c) 4 000 cm
(d) 3 000 m  (e) 1 000 mm  (f) 2 000 m

6.  
500 km

7.  
Total distance = 87 720 m + 887 m = 88 597 m
Rounded to the nearest 100 m = 88 600 m

**4.7 Apply your skills**

**Teaching guidelines**

In question 1, learners first need to convert the measurements to a common unit before ordering the lengths.

In question 2, let learners discuss and motivate the calculation plans. The serviettes may need a 2 cm seam on each side. This means cutting squares with sides 23 cm + 4 cm = 27 cm.

**Answers**

1. First convert all measurements to millimetres, then arrange.
   (a) 900 cm; 2 m; 1 000 mm  (b) one quarter of a km; 39 m; 100 cm; 395 mm
   (c) 2 km; 500 m; 125 cm; 248 mm  (d) 449 m; 944 cm; 4 944 mm

2. You can cut 7 squares with side length 27 cm along the 2 m width (7 \times 27 \text{ cm} = 189 \text{ cm}). You can cut 18 squares with side length 27 cm along the 5 m length (18 \times 27 \text{ cm} = 486 \text{ cm}). So you can make 7 \times 18 = 126 serviettes (there will be a little material left over).

3. There are several solutions (but only one answer). Learners could work out the height of 100 floors: 100 \times 3\frac{1}{2} \text{ m} = 350 \text{ m}. The height of 10 floors: 10 \times 3\frac{1}{2} \text{ m} = 35 \text{ m}. So the height of 90 floors = 350 \text{ m} – 35 \text{ m} = 315 \text{ m}.

4.  
Round off to the nearest 100:
   (a) 78 cm  (b) 145 cm  (c) 991 mm
   (d) 56 072 km  (e) 301 mm  (f) 23 450 km

5.  
Round off to the nearest 1 000:
   (a) 1 991 mm  (b) 6 072 km  (c) 4 490 cm
   (d) 2 500 m  (e) 690 mm  (f) 1 932 m

6. Mr Bengu is driving to Cofimvaba this weekend. The distance is 543 km. How far is the distance to the nearest 100 km?

7. The course for the Comrades marathon race varies from year to year. In 2015 the official distance was 87 720 m. But, there were road works on the course. So, the organisers were forced to add another 877 m to the course. What was the total distance to the nearest 100 m?

**4.7 Apply your skills**

1. Arrange from the longest to the shortest:
   (a) 1 000 mm; 900 cm; 2 m
   (b) 39 m; 395 mm; one quarter of a km; 100 cm
   (c) 125 cm; 248 mm; 2 km; 500 m
   (d) 449 m; 944 cm; 4 944 mm

2. Mrs Tailor bought 5 m of material with a width of 2 m. She wants to make serviettes. The serviettes are squares with side length 23 cm. How many serviettes will she be able to make? Allow 2 cm for seams around each serviette.

3. A skyscraper has 90 floors. Each floor is 3 m 50 cm high. About how high is the building?
Teaching guidelines
For questions 4(c), (d) and (e), learners can measure the distance with a ruler and then find a similar length on the map for which the distance is provided alongside the map. For example, the distance on the map from Johannesburg to Kimberley is about the same as the distance from Musina to Pretoria, i.e. about 460 km.

Answers
4. (a) 1 400 km
   (b) 700 km
   (c) About the same as the distance between Musina and Pretoria: 460 km
   (d) About three-quarters of the distance between Port Elizabeth and Cape Town: 560 km
   (e) About the same as distance between East London and Beaufort West: 575 km
Grade 4 Term 2 Unit 5          Whole numbers: Multiplication

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**CAPS time allocation** 6 hours
**CAPS page references** 13 to 15 and 76 to 77

**Mathematical background**

Multiplication with two 2-digit numbers, for example 26 × 43, can be done as follows:

1. Break down one number into place value parts, for example 43 = 40 + 3.
   \[26 \times 43 = 26 \times (40 + 3)\]

2. Distribute multiplication over addition. This means that both parts (or all, if there are more than two parts) of the number are multiplied. In this example 40 is multiplied by 26 and 3 is multiplied by 26.
   \[= 26 \times 40 + 26 \times 3\]

3. Break down the other number into place value parts, for example 26 = 20 + 6.

4. Distribute multiplication over addition again. In this example 40 is multiplied by both 20 and 6, and 3 is multiplied by both 20 and 6.
   \[= 20 \times 40 + 6 \times 40 + 20 \times 3 + 6 \times 3\]

5. Apply known multiplication facts.

6. Build up the answer.
   \[= 800 + 240 + 60 + 18\]
   \[= 1118\]

This method can only be used effectively if learners have sound knowledge of basic multiplication facts. Sections 5.1 and 5.2 are devoted to such knowledge (mental mathematics).

Multiplication can be distributed over addition as shown above: 26 × (40 + 3) = 26 × 40 + 26 × 3. This means that all the parts, or terms in the brackets, are multiplied by the number.

Multiplication can also be distributed over subtraction, for example 51 × 17 = 51 × (20 – 3) = 51 × 20 – 51 × 3: all the parts, or terms in the brackets, are multiplied by the number.
5.1 Revision

**Mathematical notes**
This section revises what was done in multiplication in Term 1. The focus is on multiplying by units and by multiples of 10. It includes some examples of multiplying multiples of 10 by multiples of 10, for example: $20 \times 30$.

**Notes on questions**
Flow diagrams are employed as a vehicle to develop knowledge of basic multiplication facts.

The input numbers in the flow diagram and function table are deliberately not in counting sequences. This makes it more difficult for learners to get to the answer by skip counting. The aim is to encourage learners to multiply and not to skip count.

**Teaching guidelines**
Try to move quickly through Section 5.1: aim to cover this section in 45 minutes. One possibility is to use
- question 4 for mental mathematics,
- questions 1, 2, 3(a) and 5 for concept development,
- questions 3(b), 6 and 7 for classwork, and
- questions 3(c) and (d), 8 and 9 for additional practice.

Continue to encourage learners to think: “What have I done before that can help me here?”

You can start by asking learners to complete the flow diagrams in question 1. To save time you can copy the templates of the flow diagrams and function table in the Addendum (page 448). Encourage learners to use the answers in 1(a) to complete 1(b) (where possible), for example: what $\times 7 = 70$ is shown in the flow diagram. Explain to learners the link between the flow diagrams and the function tables.

**Answers**

1. (a) Output numbers from top to bottom: 49; 63; 70; 42; 21
   (b) Input numbers from top to bottom: 10; 5; 4; 9; 6

2. | Number | 7 | 9 | 10 | 6 | 3 | 10 | 5 | 4 | 9 | 6 |
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<tr>
<td>Number $\times 7$</td>
<td>49</td>
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<td>42</td>
<td>21</td>
<td>70</td>
<td>35</td>
<td>28</td>
<td>63</td>
<td>42</td>
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</table>

Division is called the inverse of multiplication, and multiplication is called the inverse of division.
Teaching guidelines
In Term 1 learners multiplied by multiples of 10, so this continues to be revision. Ask them what happens when you multiply a number by 10. Ask them what is an easy way to multiply by a multiple of 10. (In Term 1 they saw that you break the number down into two factors, one of which is 10, for example $50 \times 15 = 5 \times 10 \times 15 = 5 \times 150$.) If learners cannot do this calculation, then work through questions 6(a) and (b) with them.

Note that learners do not have to copy the flow diagrams in question 3. If they do not know what $20 \times 7$ is, ask them which multiplication fact from questions 1 and 2 can help them. If they double $10 \times 7$, they will get $20 \times 7$. Ask them what the relationship is between 20 and 40. This will enable them to double the answer to $20 \times 7$ to get the answer to $40 \times 7$. They can repeat this process with $80 \times 7$. Ask learners which multiplication facts from questions 1 and 2 will help them to fill in the other answers in question 3(a): $7 \times 7$; $3 \times 7$; $10 \times 7$; $5 \times 7$.

Templates for the tables in question 3 are provided in the Addendum (page 449).

Critical knowledge
Multiplying a number by 10.
Multiplying a number by a multiple of 10.

Answers
3. (a) | Number | 20 | 40 | 80 | 70 | 30 | 100 | 50 |
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<tbody>
<tr>
<td>Number × 7</td>
<td>140</td>
<td>280</td>
<td>560</td>
<td>490</td>
<td>210</td>
<td>700</td>
<td>350</td>
</tr>
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</table>

(b) | Number | 30 | 60 | 90 | 80 | 50 | 40 | 70 |
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<td>Number × 6</td>
<td>180</td>
<td>360</td>
<td>540</td>
<td>480</td>
<td>300</td>
<td>240</td>
<td>420</td>
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(c) | Number | 100 | 60 | 50 | 40 | 80 | 90 | 70 |
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<td>Number × 8</td>
<td>800</td>
<td>480</td>
<td>400</td>
<td>320</td>
<td>640</td>
<td>720</td>
<td>560</td>
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(d) | Number | 40 | 80 | 60 | 50 | 100 | 70 | 60 |
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<tr>
<td>Number × 9</td>
<td>360</td>
<td>720</td>
<td>540</td>
<td>450</td>
<td>900</td>
<td>630</td>
<td>540</td>
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</table>

3. Do not copy these flow diagrams. Copy the tables below and write the missing input and output numbers in the tables.
Teaching guidelines

Encourage learners to count in 30s up to 360. They can use this to complete question 4. It is important that learners do not just skip count from 30 each time in 4(b) and (c). They can rather either count on 30 from 4(a) to get 4(b), and count on 30 from 4(b) to get 4(c), or use multiplication.

Learners should use the answer in 4(a) to write down the answer to 5(a). Show learners how they can use the answer in 5(a) to get the answer in 5(b); the answer in 5(b) to get the answer in 5(c); the answer in 5(c) to get the answer in 5(d). Remind learners that when multiplication occurs in the same expression as addition and/or subtraction, you always do the multiplication first. Ask learners which answers in 5(a) to (d) they can use to get the answer in 5(e), and how 5(e) relates to 5(f). Repeat this for 5(g) and 5(h).

Once learners have completed question 6, ask them what they noticed about 6(a) and 6(b). How were they the same and how did they differ? What does this tell you about multiplying by a multiple of 10? Does it always work?

Answers

4. (a) 300 (b) 330 (c) 360
5. (a) 300 (b) 600 (c) 1 200 (d) 2 400 (e) 1 800 (f) 1 800 (g) 2 700 (h) 2 700
6. (a) 280; 160; 360 (b) 280; 160; 360
7. (a) 7; 2; 8 (b) 7; 2; 8
8. (a) 350; 300; 450 (b) 350; 300; 450
9. (a) 4; 8; 16 (b) 4; 8; 16

4. How much is each of the following?
   (a) 30 + 30 + 30 + 30 + 30 + 30 + 30
   (b) 30 + 30 + 30 + 30 + 30 + 30 + 30
   (c) 30 + 30 + 30 + 30 + 30 + 30 + 30

5. Calculate.
   (a) 10 \times 30 (b) 20 \times 30
   (c) 40 \times 30 (d) 80 \times 30
   (e) 20 \times 30 + 40 \times 30 (f) 60 \times 30
   (g) 10 \times 30 + 80 \times 30 (h) 90 \times 30

6. Write the missing output numbers in each case.

7. Write the missing input numbers in each case.

8. Write the missing output numbers in each case.

9. Write the missing input numbers in each case.
5.2 Learn more multiplication facts

Mathematical notes
This section continues to prepare learners to multiply 2-digit numbers by 2-digit numbers, by focusing on multiplying multiples of ten by multiples of ten.

Teaching guidelines
Try to move quickly through Section 5.2: aim to cover this section in 1 hour. One possibility is to use
- questions 2 and 3 for mental mathematics,
- questions 1, 4, 5 and 6 for concept development,
- questions 7, 8 and 9(a) to (h) for classwork, and
- questions 9(i) to (r) for additional practice.

Continue to encourage learners to think: “What have I done before that can help me here?”, by modelling how you can draw on one question to answer another, and draw on work done in Section 5.1 and in Term 1 to do calculations here.

You can read out the sequence in question 3(a) and ask learners to write down the next five numbers in their exercise books. Ask learners which row in the multiplication grid is the same as their answers to question 3(a). Then you can ask them what is the same about questions 3(a) and 3(b), what is the same about 3(b) and 3(c). Learners can use the patterns in 3(a) to help them to complete 3(b) and 3(c). You can read question 4 to them. Remind them that they have already used doubling to get from \( \times 1 \) to \( \times 2 \), to \( \times 4 \), to \( \times 8 \). Learners can write down the answers to questions 5 and 6 as you read these to them.

Ask learners what patterns they notice in the multiplication grid. Ask them what they notice about the answers (products) when they multiply a multiple of 10 by a multiple of 10. You can use the examples of breaking down numbers into factors shown under the heading “Critical knowledge” below to explain to learners why this works. You can show this using flow diagrams:

Critical knowledge
Multiplying multiples of 10 by multiples of 10.
If you change the order in which you multiply two or more numbers, the answer remains the same.
You can break numbers down into factors to make multiplication easier, for example:
\[
20 \times 10 = 2 \times 10 \times 10 = 2 \times 100 = 200 \\
20 \times 40 = 2 \times 10 \times 4 \times 10 = 2 \times 4 \times 10 \times 10 = 2 \times 4 \times 100 = 8 \times 100 = 800
\]
Answers to questions 1, 2, 4, 5, 6 and 7

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5.2 Learn more multiplication facts

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2. Complete the rows for 2, 3, 4, 5, 6, 7, 8, 9 and 10. If you know the answers for some other cells, you can fill them in too.
Notes on questions
Ask learners to compare the answers in the ×2 row with the answers in the ×20 row; the ×3 row with the ×30 row, the ×4 row with the ×40 row. They can use the patterns they see to complete other rows.

Ask learners what is the same and what is different about questions 8(a) and 9(b); 8(b) and 9(c); 8(c) and 9(d); 8(d) and 9(e); 8(e) and 9(f); 8(f) and 9(h). Ask how this can help them to get the answers to 9(b), (c), (d), (e), (f) and (h).

Answers
3. (a) 140; 160; 180; 200; 220
   (b) 280; 300; 320; 340; 360
   (c) 380; 400; 420; 460; 480

4. (a) 200; 400
   (b) Learners fill in the cells for 20 × 10 and 20 × 20.
   (c) 800 = cell 20 × 40. Learners might realise that they can fill in 40 × 20 from this.

5. (a) 300
   (b) 400
   (c) 600
   (d) 900

6. (a) Learners fill in more of the cells in the table.
   (b) Doubled: 600; 800; 1 200; 1 800
        Doubled again: 1 200; 1 600; 2 400; 3 600
   (c) 600 = 20 × 30; 30 × 20
        800 = 20 × 40; 40 × 20
        1 200 = 40 × 30; 30 × 40; 20 × 60; 60 × 20
        1 800 = 20 × 90; 90 × 20; 60 × 30; 30 × 60

7. Learners complete the table.

8. (a) 3 × 3 = 9
   (b) 4 × 4 = 16
   (c) 5 × 5 = 25
   (d) 6 × 6 = 36
   (e) 7 × 7 = 49
   (f) 9 × 9 = 81

9. (a) 400
   (b) 900
   (c) 1 600
   (d) 2 500
   (e) 3 600
   (f) 4 900
   (g) 6 400
   (h) 8 100
   (i) 3 000
   (j) 1 200
   (k) 4 200
   (l) 4 800
   (m) 6 300
   (n) 5 400
   (o) 7 200
   (p) 5 600
   (q) 1 800
   (r) 2 000

3. Write the next five numbers in each pattern.
   (a) 20 40 60 80 100 120
   (b) 200 220 240 260
   (c) 300 320 340 360

4. (a) How much is 20 × 10 and how much is 20 × 20?
   (b) Write your answers in the correct places in the table you made in question 1.
   (c) Double your answer for 20 × 20. Can you use this to fill in another cell in your table?

5. How much is each of the following?
   (a) 10 × 30
   (b) 10 × 40
   (c) 10 × 60
   (d) 10 × 90

6. (a) Enter your answers for question 5 in your table.
   (b) Double each of your answers, and double them again.
   (c) Can you use this to fill in more cells in your table?

7. Complete your table. You may see some patterns that can help you. (This is an investigation.)

8. How much is each of the following?
   (a) 3 × 3
   (b) 4 × 4
   (c) 5 × 5
   (d) 6 × 6
   (e) 7 × 7
   (f) 9 × 9
Write your answers as number sentences, such as 8 × 8 = 64.

9. How much is each of the following?
   (a) 20 × 20
   (b) 30 × 30
   (c) 40 × 40
   (d) 50 × 50
   (e) 60 × 60
   (f) 70 × 70
   (g) 80 × 80
   (h) 90 × 90
   (i) 60 × 50
   (j) 40 × 30
   (k) 60 × 70
   (l) 60 × 80
   (m) 70 × 90
   (n) 60 × 90
   (o) 80 × 90
   (p) 70 × 80
   (q) 60 × 30
   (r) 40 × 50
   (s) 50 × 60
5.3 Multiplying with bigger numbers

Notes on questions
In questions 1 and 2 learners first apply knowledge of basic multiplication facts and then combine the answers (products) to multiply with 2-digit numbers.

In question 3 the order is reversed: learners now have to break down 2-digit numbers to convert the task into smaller tasks that can be done by applying knowledge of basic facts.

The aim is to develop sound understanding of the logic of the breaking down and building up method of multiplication.

Teaching guidelines
You can visually illustrate this to help learners further to understand the logic of breaking down numbers into place value parts when multiplying. This can be done before question 3. Give learners square grid paper. Ask them to shade or mark with crosses 7 rows of 17. Ask them to repeat this on another grid.

They can paste one of the grids into their exercise books and show that it represents $17 \times 7$. This is not easy to multiply mentally.

They can then cut or tear the second grid to form two grids. One grid with 7 rows of 10, representing $7 \times 10$, and the other grid with 7 rows of 7, representing $7 \times 7$. These are easier to multiply and learners should be able to see that this gives them 70 and 49, so 119 in total.

Answers
1. (a) 1 161; 1 161 (b) 840; 840 (c) 1 058; 1 058 (d) 966; 966
2. (a) 918 (b) 1 118 (c) 924 (d) 783
3. (a) $7 \times 30 + 7 \times 6 = 210 + 42 = 252$
   (b) $30 \times 30 + 30 \times 6 = 900 + 180 = 1 080$
   (c) $1 080 + 252 = 1 332$
   (d) Yes, add 1 080 from (b) and 252 from (a) to get 1 332.
Teaching guidelines

You can remind learners that they have already seen, in Section 5.1, an example of what it looks like when you represent 2-digit by 2-digit multiplication as an array broken down into place value parts. You can copy the array on page 60 and ask learners to draw lines breaking the array down into \((10 + 6) \times (10 + 8)\). Then calculate each of the parts.

You can show learners how to imagine multiplying 2-digit numbers by 2-digit numbers using a simpler grid. For example, \(36 \times 37\) can be shown as alongside.

Learners can learn to draw these simple grids to show how to multiply each part of each number separately.

Notes on questions

In questions 5(a) to (j), pairs of questions have the same numbers multiplied; only the order of the numbers is swapped around. Ask learners what is the same about questions 5(a) and 5(b); 5(c) and 5(d); 5(e) and 5(f); 5(g) and 5(h); 5(i) and 5(j). Learners only have to calculate once for each pair.

Learners should look for the patterns of halving and doubling in the numbers multiplied in question 6. In question 6(a), 60 is double 30, so \(60 \times 53\) is double \(30 \times 53\).

Mathematical notes

Although it need not be mentioned explicitly, this work amounts to application of the distributive property.

Answers

4. (a) \(40 \times 30 = 1200; 40 \times 4 = 160; 6 \times 30 = 180; 6 \times 4 = 24\)
   (b) \(70 \times 60 = 4200; 70 \times 8 = 560; 3 \times 60 = 180; 3 \times 8 = 24\)
   (c) \(50 \times 90 = 4500; 50 \times 3 = 150; 4 \times 90 = 360; 4 \times 3 = 12\)
   (d) \(80 \times 20 = 1600; 80 \times 9 = 720; 2 \times 20 = 40; 2 \times 9 = 18\)

5. (a) 1472 (b) 1472 (c) 884 (d) 884
   (e) 2666 (f) 2666 (g) 1472 (h) 1472
   (i) 574 (j) 574 (k) 240 (l) 810
   (m) 420 (n) 1375

6. (a) Double 1590 = 3180 (b) Half of 1700 = 850
   (c) Half of 1840 = 920 (d) Double 1720 = 3440
   (e) Add one more 67 to 2412 = 2479

4. Write the four multiplication facts that will make it easy to calculate each of the following.
   (a) \(46 \times 34\)  (b) \(73 \times 68\)
   (c) \(54 \times 93\)  (d) \(82 \times 29\)

43 \(\times 57\) can be calculated as follows:
   \(43 = 40 + 3\) hence \(43 \times 57 = 40 \times 57 + 3 \times 57\)

40 \(\times 57\) and \(3 \times 57\) are now calculated separately:
   \(40 \times 57 = 40 \times 50 + 40 \times 7 = 2000 + 280\)
   \(3 \times 57 = 3 \times 50 + 3 \times 7 = 150 + 21\)

To get the answer for \(43 \times 57\) all the parts now have to be added up:
   \(43 \times 57 = 2000 + 280 + 150 + 21\)
   \(= 2280 + 150 + 21\)
   \(= 2430 + 21 = 2451\)

When you do your own calculations you need not write it in so much detail.

5. Calculate each of the following:
   (a) \(23 \times 64\)  (b) \(64 \times 23\)
   (c) \(26 \times 34\)  (d) \(34 \times 26\)
   (e) \(62 \times 43\)  (f) \(43 \times 62\)
   (g) \(32 \times 46\)  (h) \(46 \times 32\)
   (i) \(41 \times 14\)  (j) \(14 \times 41\)
   (k) \(15 \times 16\)  (l) \(45 \times 18\)
   (m) \(12 \times 35\)  (n) \(25 \times 55\)

6. (a) If \(30 \times 53 = 1590\), how much is \(53 \times 60\)?
   (b) If \(50 \times 34 = 1700\), how much is \(17 \times 50\)?
   (c) If \(80 \times 23 = 1840\), how much is \(23 \times 40\)?
   (d) If \(40 \times 43 = 1720\), how much is \(43 \times 80\)?
   (e) If \(36 \times 67 = 2412\), how much is \(37 \times 67\)?
5.4 Apply your knowledge

Notes on questions
In all these questions learners practise multiplying 2-digit numbers by 2-digit numbers.
In questions 9(b), (c) and (d) learners first have to calculate the time Lebogang walks for,
before multiplying this by her walking speed.

Teaching guidelines
Aim to cover this section in 45 minutes. One possibility is to use

- questions 1 and 9(d) for concept development,
- questions 2, 4(c) and (d), 5, 7 and 9(a) and (b) for classwork, and
- questions 3, 4(a) and (b), 6, 8 and 9(c) for additional practice.

You can use question 1 to model for learners how they can use a grid to see the parts of the numbers to multiply.

In question 9(d) you can model for learners how to calculate the time elapsed from 11:48 a.m. to 1:18 p.m.

Answers
1. 3 080 oranges (88 × 35 oranges)
2. R 2 774 (R38 × 73)
3. 2 814 seats (67 × 42 seats)
4. (a) R925 (b) R1 702 (c) R2 738 (d) R3 293
5. 1 260 cm (45 × 28 cm)
6. 874 beads (38 × 23 beads)
7. 952 turns (56 × 17 turns)
8. 2 025 bricks (45 × 45 bricks)
9. (a) 1 092 m (26 × 42 m)
(b) 1 554 m (From 10:17 to 10:54 is 37 minutes. 37 × 42 m)
(c) 1 848 m (From 10:54 to 11:38 is 38 minutes + 6 minutes. 44 × 42 m)
(d) 3 780 m (From 11:48 to 12:48 is 60 minutes. From 12:48 to 13:00 is 12 minutes. From 13:00 to 13:18 is 18 minutes. [60 + 12 + 18] minutes = 90 minutes. 90 × 42 m)
5.5 Difference, ratio and rate

**Mathematical notes**

Quantities can be compared in two ways:

Example: Susan earns R36 000 per month and William earns R12 000 per month.

- We can state the difference: how much more the one quantity is than the other, for example: “Susan earns R24 000 more than William each month.”
- We can state the ratio: by what the one quantity must be multiplied to get the other quantity, for example: “Susan earns 3 times as much as William each month.”

Both difference and ratio are used to compare two quantities of the same kind.

**Rate** is something entirely different. Rate is used to compare two quantities of different kinds. A rate describes how much of one quantity (e.g. money) corresponds to one unit (e.g. volume of petrol) of another quantity: R10,40 may correspond to 1 litre of petrol.

In many situations, for example in question 2, two rates are compared by stating the ratio between the rates.

**Notes on questions**

Question 2 provides learners with an opportunity to learn about and distinguish between difference, ratio and rate. The various parts of question 2 are intended to induce learners to take note of different aspects of the given information, with a view to empower them for the introduction of the idea of rate on the next page.

**Teaching guidelines**

To help learners who may be challenged by question 2, you may suggest that they start by making a more complete table, with entries for 4, 6, 7 and 9 seconds too. This will help them to answer questions 2(a), (d) and (f). Note that in 2(a) learners are not asked to say how long it will take each machine to produce 100 m, just which machine will produce 100 m first.

**Answers**

1. 212 oranges
2. (a) Machine B, it produces more rope per second.
   (b) 6 metres (16 m – 10 m)
   (c) 9 metres (24 m – 15 m)
   (d) A: 60 m (From column 1, Machine A makes 10 m every 2 s. 50 m + 10 m = 60 m)
     B: 96 m (From column 1, Machine B makes 16 m every 2 s. 80 m + 16 m = 96 m)
   (e) 16 m
   (f) 80 m
Mathematical notes
The concept of ratio is introduced at the top of the page, although the word “ratio” can still be withheld for a while. (It is better to withhold the word till the concept has been experienced in at least one other context.) Ensure that learners relate the statement to what they have done in question 2.

Notes on questions
Question 3 is critical. You may extend it by asking learners to check for other periods of time too (multiples of 5 seconds).

Questions 4 and 5 provide learners with experiences of ratio in different contexts.

Teaching guidelines
Try to complete this section in $1\frac{1}{2}$ hours. One possibility is to use

- questions 2, 3, 7, 8 and 9 for concept development,
- questions 1, 4, 6 and 10 for classwork, and
- questions 5 and 11 for additional practice.

At this stage you do not need to show learners procedures for calculating ratios. You just need to encourage them to work sensibly with the information.

Learners could use a range of different methods to find solutions. One approach in question 4 is to produce a table similar to the one in question 2.

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<th>Cups of concentrate</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
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<tr>
<td>Cups of water</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
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They can then count in 3s to complete the top row, and in 5s to complete the bottom row.

Another approach is to say: for every 3 cups of concentrate she uses 5 cups of water. 6 cups concentrate is $2 \times 3$ cups, so you need $2 \times 5$ cups water; 12 is $4 \times 3$ cups, so you need $4 \times 5$ cups of water; 20 cups of water is $4 \times 5$ cups, so you need $4 \times 3$ cups of concentrate.

Learners can use skip counting to produce tables for questions 5, 6 and 7, but this is not efficient as they are not asked to provide lots of examples. It is less time-consuming for learners to think about the isolated multiples required.

See the next page for notes on questions 5 and 6.

Answers
3. The statement is true.
4. (a) 10 cups (b) 20 cups (c) 25 cups (d) 12 cups
5. 36 red beads
6. (a) 16 cups of white flour (b) 36 cups of wholewheat flour
Notes on questions
In question 5 learners can calculate that 24 blue beads are 12 groups of 2 blue beads, so they need 12 groups of 3 red beads = 36 red beads.

In question 6(a), 24 cups of wholewheat flour are 8 times 3 cups, so he needs $8 \times 2 = 16$ cups of white flour. In question 6(b), 24 cups of white flour are 12 times 2 cups, so he needs $12 \times 3 = 36$ cups of wholewheat flour.

Teaching guidelines
Question 8 alerts learners to the possibility that two ratios may be equivalent. It is not necessary to dwell on this in Grade 4.

The concept of rate is introduced by means of question 10.

Answers
7. (a) 16 cups of white flour
   (b) 36 cups of wholewheat flour

8. The answers in questions 6 and 7 are the same.
   All questions use 24 cups of the one kind of flour.
   The ratios are equivalent, i.e. the ratio 2 to 3 is the same as the ratio 4 to 6.
   This makes sense because $2 \times 2 = 4$ and $2 \times 3 = 6$.

9. (a) The ratio between the distance run by Athlete A and the distance run by Athlete B is 3 to 4. However, learners may look to the first column of the table and give the ratio as 300 to 400. This answer is also acceptable at this stage. However, it is easier for learners to work with 3 to 4 to check the other ratios.
   (b) Learners check their answer in (a) against the distances given in the table. Learners can check their answers by dividing each distance for Athlete A by 3, and for Athlete B by 4. This will give them the same distance for each athlete, for example 100 m after 5 minutes; 160 m after 8 minutes; 200 m after 10 minutes; 280 m after 14 minutes. They could also divide each column by the number of minutes to get a ratio of 60 to 80 each time.

10. (a) Yes, because 300 m in 5 minutes means $300 \div 5 = 60$ m per minute.
    (b) 80 m
        ($400 \div 5 = 80$ m per minute)

11. 1 489 cm
    ($1 387 \text{ cm} + 34 \text{ cm} + 34 \text{ cm} + 34 \text{ cm} = 1 387 \text{ cm} + 102 \text{ cm}$)
### 5.6 Breaking down in a different way to multiply

**Mathematical notes**

In previous sections, learners broke down numbers into place value parts and used the distributive property to convert multiplication tasks into smaller tasks. Multiplication can also be done by breaking down numbers into factors. This method is useful where numbers have lots of simple factors, for example $27 \times 36$. The aim is to break at least one of the numbers down into factors which are easy to multiply by, for example 2, 3, 5, 10. This method is not useful where numbers have few factors, for example $37 \times 34$, because $37 \times 2 \times 17$ does not make the calculation easier.

Learners have already encountered breaking down numbers into factors to multiply in Section 5.1 questions 6, 7, 8 and 9 (page 163) and in Term 1 in Section 5.6 (pages 71 and 72).

Learners will sometimes use this method of breaking down numbers when multiplying to divide: see Term 2 Unit 10 Section 10.1.

**Teaching guidelines**

Try to complete this section in 1 hour.

Once learners have completed question 1, ask them what is the same about questions 1(a), (b) and (c). Learners may express this differently, but all the answers are equal to $20 \times 2 \times 2 \times 2$. Ask them what it is about the numbers multiplied that allow the answers to be the same. Repeat this for questions 1(d), (e) and (f). Learners may express this differently, but all the answers are equal to $10 \times 3 \times 3 \times 2$.

Use the tinted passage to explain to learners how to do multiplication by breaking numbers down into factors.

**Answers**

1. (a) 160  
   (b) 160  
   (c) 160  
   (d) 180  
   (e) 180  
   (f) 180

2. Learners’ answers might differ. (a), (c), (e) and (f) have the same answer.

3. (a) 960  
   (b) 1 020  
   (c) 960  
   (d) 880  
   (e) 960  
   (f) 960

4. (a) 4  
   (b) 12  
   (c) 36  
   (d) 24  
   (e) 18  
   (f) 54

5. (a) Question 4(c)  
   (b) Question 4(f)

6. Learners follow the prescribed method. The answers are:

   (a) 972  
   (b) 516  
   (c) 888  
   (d) 1 242  
   (e) 1 809  
   (f) 2 784
Grade 4 Term 2 Unit 6  
Properties of three-dimensional objects

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**CAPS time allocation**
5 hours

**CAPS page references**
22 and 78 to 79

**Mathematical background**
All real objects are three-dimensional. Spheres, cylinders, prisms and pyramids are solid geometrical objects. In order to focus on the properties of geometrical objects we can build models of the objects. In this unit we build models from paper and card. Such models and drawings become our references as we develop an understanding of the properties and relationships between different three-dimensional objects. Sometimes we also use real-life, everyday objects to represent geometrical objects. These everyday objects, and models of the objects, may have some, but not necessarily all the properties of geometrical objects. For example, an open box may represent a rectangular prism, but you will need to ask learners to imagine that it is a closed box.

We can also represent the objects in a drawing. We follow mathematical conventions when we try to draw three-dimensional objects, for example using solid lines to show edges of faces that we can see (these are on the front of the object as we see it) and broken lines to show the edges of the faces at the back of the object (edges that we cannot see as we view the object).

Three-dimensional objects can be grouped according to their properties (once the properties are grasped). This is called classification. Classification systems are all based on sameness and difference. Questions such as: “Compare these objects. What is the same about them?”, “Which properties of these two objects differ?”, “Is this object a special form of that object?”, etc. help learners to focus on the properties of the object, and can be used as the basis for grouping like objects (classification).

Grade 4 learners first focus on the surfaces of objects. These surfaces can be flat (polygons, circles, etc.) or curved (cones, cylinders or spheres). The surfaces of objects are one way to identify and compare different objects. Learners then look at the shape of the flat surfaces (or faces) of the objects. In Grade 4 learners look for circular faces, triangular faces and rectangular faces (including squares).

**Resources**
This topic involves a number of practical activities for which various resources are needed. These resources are listed in the various sections.
6.1 Objects with different shapes

Mathematical notes
A flat surface of a 3-D object is called a face. On page 174 a rectangular prism is described as an object with flat surfaces that are all in the shape of rectangles. In the units on two-dimensional shapes it was explained that a square is a special kind of rectangle. This means that faces of rectangular prisms can be square. So a cube is a special kind of rectangular prism.

A cylinder has one curved surface and two flat, circular surfaces of the same size. A paper cup or a plant pot is not a cylinder.

Some everyday objects, for example cylindrical tubes, are open at one or both ends. The face(s) need(s) to be imagined. Technically these are not cylinders, but models of cylinders.

Similarly, an open box is shaped like a rectangular prism; it is a model of a rectangular prism. Learners will need to imagine that the open face is closed (or they can take a sheet of paper and close it).

Resources
Objects with curved surfaces including, but not limited to, spheres, for example balls, oranges, marbles, etc.

Objects with flat surfaces including, but not limited to, rectangular prisms, for example boxes, bricks, etc.

Objects with flat and curved surfaces including, but not limited to, cylinders, for example cardboard tubes, cylindrical piping, cans, caps of some spray bottles, glue sticks, shoe polish tins, snuff or mentholated ointment tins, etc.

A sheet of paper (can be scrap paper) for each learner; sticky tape; scissors.

Encourage learners to bring objects with as many different shapes as possible to class. Learners can also make spheres and cylinders from clay, or roll cylinders from paper.

Explain to learners that a cylinder must be the same width all along.

You can also make square-based pyramids and rectangular prisms from the templates provided in the Addendum (pages 451 and 452).

Teaching guidelines
Aim to spend about 1 hour on this section.

It is much easier to learn about three-dimensional objects when working with real objects than when working with pictures and descriptions of the objects.
If you have sufficient objects, let learners work in groups to sort the objects into three groups: objects with flat surfaces only; objects with curved surfaces only; objects with flat and curved surfaces. If you have too few objects, find an open space where you can place the objects on the ground. Label areas for objects with flat surfaces only; objects with curved surfaces only; objects with flat and curved surfaces. Let learners each choose an object and place it in the correct group.

Explain to learners that they need to imagine that all objects are closed. So they need to imagine surfaces on, for example, the open ends of tubes.

Allow time for discussion about whether everyone agrees with the groupings.

Ask learners whether any of the objects are shaped like three-dimensional geometric objects. If so, let them hold these up and give their names. In Grade 3 learners will have called spheres ball-shapes and rectangular prisms box-shapes. You will need to introduce the correct terminology. Check that learners can identify rectangular prisms, spheres and cylinders. You can introduce them to triangular prisms, but they don’t need to be assessed on their knowledge thereof.

You can read questions 1 and 2 to learners while they look at the pictures on page 175. Ask them to write down the answers.

Give each learner a piece of scrap paper and some sticky tape, and ask them to roll a cylinder. Keep these cylinders in a safe place. Learners will work with them over the next few days.

Possible misconceptions
Some learners may not distinguish clearly between three-dimensional objects and the two-dimensional figures that form their faces. This can only be properly addressed with a stock of objects and a focused discussion. In Term 4 learners will make objects from cardboard cut-outs – this will further help to clarify this.

Sometimes learners think that a cylinder must be taller than it is wide. This is not true. The photograph of the two wooden cylinders on page 173 clearly shows that the smaller cylinder is wider than it is tall. Try to collect other examples, such as shoe polish tins, snuff tins, ointment tins, and coins.

Critical knowledge
Learners must be able to identify and name rectangular prisms, spheres and cylinders. They should know that:

- rectangular prisms have flat surfaces (faces)
- spheres have curved surfaces
- cylinders have two circular faces and a curved surface.
Mathematical notes
The roof of the house and the skeleton of the triangular prism on page 174 are shaped like triangular prisms, but because they do not have five faces, they are not actually triangular prisms. They are models of triangular prisms.

Notes on questions
Question 3 is more difficult than questions 1 and 2 because learners are working from abstract language and have to imagine the geometrical objects. Give learners examples of spheres, cylinders and rectangular prisms. Read the question while they try to find the object described. They should write the answers in their exercise books.

Answers
1. (a) Potato
   (b) Cooking pot, battery
   (c) Brick
   (d) Brick, pyramid
   (e) Potato
   (f) Cooking pot, clay pot, battery
2. Circle
3. (a) Sphere
   (b) Rectangular prism
   (c) Cylinder

1. Look at the objects in the photographs.
   (a) Which of the objects have the shape of a sphere?
   (b) Which of the objects have the shape of a cylinder?
   (c) Which of the objects have the shape of a rectangular prism?
   (d) Which of the objects have flat surfaces only?
   (e) Which of the objects have curved surfaces only?
   (f) Which of the objects have curved and flat surfaces?

2. What is the shape of the face of the glass that touches the table?

3. In each case state what kind of 3-D object it can be.
   (a) It has only one surface, and the surface is curved.
   (b) It has six surfaces, and the surfaces are all flat.
   (c) It has two flat surfaces and one curved surface.
6.2 Make prisms, pyramids and cones

Mathematical notes
In this section learners fold rectangular prisms, pyramids and cones. The aim is for learners to have three-dimensional objects that they can work with and use to further explore their properties.

In Term 1 learners used drawings of two-dimensional shapes to explore their properties by talking about their similarities and differences. Similarly learners will use the prisms, pyramids and cones to look at what is the same about them and what is different. This helps learners to learn the properties of these objects.

Critical knowledge
Identify and name rectangular prisms, cones and square-based pyramids from real objects and drawings.

- Prisms and pyramids have flat faces.
- Cones have a flat, circular face and a curved surface.

Resources
- The paper cylinders folded in the previous lesson.
- Three sheets of paper (can be scrap paper) for each learner.
- Sticky tape.
- Scissors.

Teaching guidelines
Aim to spend about 2 hours on this section.

One of each pair of learners can use their cylinders to fold a rectangular prism. When learners fold the second set of creases, it is important that the first set of creases line up exactly. Check that all the corners of the prism are right angles; the imagined faces should be square. Remind learners that they should imagine that the prism is closed. Focus learners’ attention on key features of the prism by asking questions like: “Are all faces of my prism the same?”

Help learners to compare prisms with cylinders by asking questions like: “How do the surfaces of cylinders and prisms differ?”, “What is the same about prisms and cylinders?” (Answers: Cylinders’ surfaces are rounded, prisms’ surfaces are flat. They both have a constant width.)

Answers
1. Learners fold their own rectangular prism.
Possible misconceptions
Some learners may struggle with cutting and folding. These are important skills. Use peer support as far as possible and step in to assist where necessary. A good strategy is to show a struggling learner a few of the steps they need to follow and then ask them to redo these steps, and also the remaining steps.

Teaching guidelines
Give each learner a piece of scrap paper and some sticky tape, and ask them to roll a cone. You can demonstrate how to do it.

Remind learners that they should imagine the cone is closed. Focus learners’ attention on key features of cones by asking questions like: “Are the surfaces of cylinders and cones the same or different?”, “What is the same about cones and cylinders?”, “What is different about cones and cylinders?” (Answers: A cylinder has two flat surfaces and one curved (rounded) surface. A cone has only one flat surface and a curved surface. Cones and cylinders both have one curved surface. A cone has a vertex and one circular edge, while a cylinder has no vertices but two identical circular edges.)

Mathematical notes
The paper model of the cone is open at its base: it does not have a circular base. We can say that it is shaped like a cone. Technically it is not a cone, only a model of a cone. The template of the cone provided in the Addendum (page 466) does make a closed cone.

Answers
2. Learners fold their own cones.
Teaching guidelines

One of each pair of learners can use their cones to fold a pyramid. When learners fold the second set of creases, it is important that the first set of creases line up exactly. Check that all the corners of the pyramid are right angles: the imagined face should be square.

Remind learners that they should imagine that the pyramid is closed. Focus learners’ attention on key features of the pyramid by asking questions like: “Are all faces of my pyramid the same?” “Do the surfaces of the cone and pyramid differ?” “How do they differ?” “What is the same about the pyramid and cone?” (Answers: A pyramid has triangular and square faces. A cone has flat and curved surfaces. A pyramid has only flat faces. They are both wide at one end and come to a point at the other end.)

Help learners to compare:

- the cone and the cylinder: How are they the same? How do they differ?
- the rectangular prism and the pyramid: How are they the same? How do they differ?

Remind learners to imagine that the pyramid and prism are closed: “What shape are most of the faces of the square-based pyramid?”, “What shape are most of the faces of the rectangular prism?” (Answers: Most of the faces of any pyramid are triangles. All the faces of a rectangular prism are rectangles.)

Mathematical notes

All squares are rectangles: a square is a special kind of rectangle with all the sides the same length.

There are many different kinds of prisms and pyramids. Grade 4 learners only need to be able to identify and name rectangular prisms and square-based pyramids.

A prism has flat faces, most of which are rectangles. Two faces are identical and opposite each other, and they could be triangles, pentagons, hexagons, etc.

A pyramid has flat faces, most of which are triangles. It has one face that can be any polygon: triangle, square, pentagon, hexagon, etc.

Answers

3. (a) Cones and pyramids are wide at one end and come to a point at the other end. Cylinders and rectangular prisms have a constant width.

(b) Pyramids and rectangular prisms have only flat faces. Cones and cylinders have one curved surface and one or two flat surfaces.

Rectangular prisms and pyramids have rectangular bases. Cones and cylinders have circular bases.

4. Learners fold their own pyramids.
6.3 Put faces together

Mathematical notes
Question 2 of this section asks learners to do a freehand drawing of a square-based pyramid, a cone, a cylinder and a rectangular prism. In primary school learners are shown drawings of geometrical and everyday objects from many angles, but these drawings are always shown using the same rules of perspective. There are, however, different kinds of perspectives, each with their own rules of construction. These different perspectives are called projections. Since learners have not yet been shown how to draw objects according to the standard rules of perspective, you cannot expect their drawings to follow these rules. Question 2 simply prepares learners for the drawings that they will see in Section 6.4.

Resources
Learners should have the prisms, pyramids, cones and cylinders that they built earlier on their desks.

Teaching guidelines
The questions ask learners to work “in their heads” with the given shapes. This is a challenging activity. Let learners work with the 3-D objects and try to match the faces of the objects with the shapes in question 1. Aim to spend about 1 hour on this section.

Possible misconceptions
Learners who are not successful in meeting the challenge posed by the questions will have to be given paper cut-outs to work with to support their spatial reasoning: use the templates provided for Term 4 Unit 4 Section 4.1 in the Addendum (pages 463 to 466). Let learners work in pairs to make the objects from the faces.

Some learners may struggle to represent three-dimensional objects as flat drawings. Allow them to come back to this (i.e. question 2) after they have completed Section 6.4.

Notes on questions
Question 2 requires some support. It will be useful to introduce the convention of showing edges that are out of the line of sight as broken lines.

Answers
1. (a) Square-based pyramid  (b) Cone  
   (c) Cylinder  (d) Rectangular prism
2. Learners’ own drawings. Do not expect learners’ drawings to follow the standard conventions of perspective.
6.4 Differences between shapes

Mathematical notes
This section consolidates the kinds of reasoning learners have developed in the previous three sections. It also shows the conventional way we represent three-dimensional objects as two-dimensional drawings (because it is impossible to draw a 3-D object on a flat piece of paper).

Resources
Learners should have the prisms, pyramids, cones and cylinders that they built earlier on their desks. They should also have a sphere.

Teaching guidelines
Let learners have access to all the objects listed in question 1. Remind learners that they must think of all the objects as closed.

Once they have completed question 1, let learners take turns to explain their answers to the class, using the models of the objects. This can also be done after question 4.

Let learners first attempt questions 2 and 3, then show them how the lines in the drawings represent the edges of the shapes that they have built. Show learners how to draw a rectangular prism. Aim to spend about 1 hour on this section.

Answers
1. (a) Rectangular prisms and square-based pyramids  (b) Spheres  
   (c) Cylinders, cones  (d) Rectangular prism  
   (e) Square-based pyramids
2. Rectangular prisms: (c), (f)
3. Square-based pyramids: (a), (e)
4. | Number of faces | Shapes of faces | Number of curved surfaces |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular prism</td>
<td>6 rectangles</td>
<td>0</td>
</tr>
<tr>
<td>Sphere</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cylinder</td>
<td>2 circles</td>
<td>1</td>
</tr>
<tr>
<td>Cone</td>
<td>1 circle</td>
<td>1</td>
</tr>
<tr>
<td>Square-based pyramid</td>
<td>5 square triangles</td>
<td>0</td>
</tr>
</tbody>
</table>

6.4 Differences between shapes

1. You know about spheres, cylinders, rectangular prisms, cones and square-based pyramids. Which of these objects have 
   (a) only flat surfaces?  (b) only curved surfaces?  
   (c) flat and curved surfaces?  (d) only rectangular surfaces?  
   (e) triangular and rectangular surfaces?
2. Which drawings below show rectangular prisms?
   (a)  
   (b)  
   (c)  
   (d)  
   (e)  
   (f)  
3. Which of the above drawings show square-based pyramids?
4. Complete this table.

<table>
<thead>
<tr>
<th>Number of faces</th>
<th>Shapes of faces</th>
<th>Number of curved surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular prism</td>
<td>6 rectangles</td>
<td>0</td>
</tr>
<tr>
<td>Sphere</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cylinder</td>
<td>2 circles</td>
<td>1</td>
</tr>
<tr>
<td>Cone</td>
<td>1 circle</td>
<td>1</td>
</tr>
<tr>
<td>Square-based pyramid</td>
<td>5 square triangles</td>
<td>0</td>
</tr>
</tbody>
</table>
Grade 4 Term 2 Unit 7  |  Geometric patterns

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<td>Visual recognition of repeating units</td>
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<td>Writing calculation plans</td>
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<td>Introduction to continuing geometric patterns</td>
<td>184 to 185</td>
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<tr>
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<td>7.6 Writing our plans as flow diagrams</td>
<td>Expressing patterns as flow diagrams</td>
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**CAPS time allocation**

4 hours

**CAPS page references**

19 and 80 to 82

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**Mathematical background**

Below we describe the principles and guidelines underlying our work on geometric patterns.

Given a geometric situation in which some repetition occurs, people often immediately make a table, and then handle it exactly as they handle a numeric pattern (using common differences, etc. to find a rule). However, the approach here is to use the *visual* aspects of geometric patterns to find rules based on the *structure* of the situation.

To enable learners to use the *structure* of the situation, it is vital that learners progress from counting the objects in ones to counting in larger units – what we call *clever counting*. Clever counting should reinforce learners’ number concepts and number knowledge. For example, instead of counting these beads one by one, we can identify units of 4 and rather count in fours: 4, 8, 12 … while keeping track of how many fours we have counted.

However, in this unit we want to encourage learners not to count at all, but rather to write a numerical expression (calculation plan) and start to use *calculation*, for example:

\[ 10 \times 4 \text{ (the yellows)} + 2 \times 4 + 8 \text{ (the greens)} \quad \text{or} \quad 12 \times 4 + 8 \quad \text{or} \quad 14 \times 4 \]

This process of using the *structure* forms the basis of developing algebra – the counting unit will later become the *variable* in the situation; the counting *method* will become a numerical and later an *algebraic expression*.

A second example: given this rectangular array of beads, learners should not *count* 1, 2, 3, … but should see larger units and *calculate* the number of objects as, for example, \( 3 + 3 + 3 + 3 + 3 \) or \( 5 + 5 + 5 \) or \( 3 \times 5 \) or \( 5 \times 3 \). This type of work will then also reinforce the properties of operations, for example the commutativity of multiplication.

---

*"The mathematician's patterns, like the painter's or the poet's, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way. Beauty is the first test.”*  
GH Hardy
7.1 Our geometric art heritage

Mathematical background (continued)

In growing patterns such as the one below, such a structural approach using appropriate counting units means that we do not try to generalise the number sequence (the numbers) 3, 8, 15, 24, ... but it helps us to generalise the numeric expressions (our clever counting method, the structure): 3×1, 4×2, 5×3, 6×4, ...

![Pictures](image)

We will not introduce any symbols like x and y for the formulation of the rules, but we use the words Number and Picture Number as our variables. We will use flow diagrams and number expressions to formulate our rules – these are both calculation procedures (we call them plans) that help learners to find input and output values.

The emphasis in this work should not be on getting a numerical answer, but on seeing, writing and using the structure in the situation, as in this example:

![Pictures](image)

They love geometric patterns! Do you?

A geometric pattern is a repeated decorative design.

In this unit we will not focus on the types of figures (such as triangles, rectangles, and so on) but on the number of figures or beads in such repeating patterns.
7.2 Clever counting

**Mathematical notes**
The objective in this section is to get learners away from counting in ones or twos towards identifying convenient larger units, so that they can count more efficiently.

**Teaching guidelines**
We suggest that instead of letting learners read question 1(b), you rather teach question 1 live in class through questions and answers (with different content if needed). This involves that learners will attempt to count the number of beads and that you will identify the different strategies used by learners and discuss these strategies, focusing on their advantages and disadvantages.

The advantage of “clever counting” should be clear – it is faster and less error-prone. However, you should allow learners enough time to engage with the questions. It will be good if you encourage them to not jump into counting, but to first analyse the structure of the drawings (to think before they jump) and to mark their units on a copy of the bracelets (see Addendum page 453) to make counting easier. Here are some examples of learners’ work on question 2:

2(a): Count in fives:
5, 10, 15, ..., 45, 50
And then 54, 56

Count in fours:
4, 8, 12, ..., 48
And then 50, 52, 54, 56

2(b): Count in fours:
4, 8, 12, 16, ..., 60, 64

Count in tens and fives:
10, 20, 30, 40, 45, 50
Then 52, 54, 56, 58, 60, 64

**Answers**
1. (a) 32
   (b) Mia and Thea. Both use larger units; it is faster than counting in ones.
2. (a) 56
   (b) 64
**Answers**

Here are some examples of learners' work on questions 2(c) and (d):

2(c): Count in twenties:
20, 40, 60, 80, 100
and then 104

2(d): Count in sixes and threes:
6, 12, 18, ..., 54, 60
63, 66, 69, 72, ..., 111, 114

7.3 Do not count – calculate!

**Mathematical notes**

In this section we use the same drawings as in the previous section, but it is very important that learners now progress to not actually counting the units, but to write down the calculation plan as a numeric expression.

Note that we are not calculating the number of beads, but just saying what our plan is – how we would calculate it if required. It is important that learners learn to withhold calculation and make the expression (plan) the object of reflection. This uncalculated plan will become the rule or formula in our work on numeric patterns, and the algebraic expression in algebra in high school. Structure, and not number, is the basis of algebra!

Here are some examples of learners' calculation plans for the total number of beads (see Diagrams 1, 2 and 3 on page 184).

1. Calculation plan: $10 \times 5 + 4 + 2$
2. Calculation plan: $16 \times 4$
3. Calculation plan: $10 \times 6 + 18 \times 3$
**Answers**

The following are examples of many possibilities. You should encourage different plans.

1. (a) $10 \times 4$  
   (b) $2 \times 4 + 8$  
   (c) $12 \times 4 + 8 = 14 \times 4$

2. (a) $10 \times 4$  
   (b) $6 \times 4$  
   (c) $10 \times 4 + 6 \times 4 = 16 \times 4$

3. (a) $10 \times 6$  
   (b) $18 \times 3$  
   (c) $10 \times 6 + 18 \times 3 = 19 \times 6$

### 7.4 Growing patterns

#### Mathematical notes

In this section we build on the ideas developed in the previous sections, i.e. not counting in ones and identifying appropriate larger units, and we continue to develop the know-how to articulate and write our calculation plans as arithmetic expressions (rules or formulas), and then analysing the expression, instead of jumping to calculation.

We very briefly illustrate the process of using structure to deduce a rule for the geometric sequence in question 1. We represent the number of squares numerically in the table below, with colours clearly showing the structure of beads in each picture.

<table>
<thead>
<tr>
<th>Picture no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>60</th>
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<tr>
<td>Top row</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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</tbody>
</table>

Whether the process is recorded in a table or not, the process and structure should definitely be part of discussing and formulating in class. Here are two different approaches:

**No. of squares** in Picture 6 = 2 rows with 6 green squares each + 1 pink square = $2 \times 6 + 1 = 13$

**No. of squares** in Picture 7 = 7 in top row + 6 in bottom row = $7 + 6 = 13$

It is clear that we should understand the importance of the relationship between numbers in order to see structure and generalise the rule, e.g. in Picture 6, 7+6 are not random numbers, but 7 is one more than 6 (the Picture no.), and this relationship applies to all the pictures.

#### Answers (questions 1(a) and (b))

**Picture 6:** A row of 6 green squares with a pink square at the end, on top of a row of 6 green squares.

- $2 \times 6 + 1 = 13$
- $7 + 6 = 13$

**Picture 7:** A row of 7 green squares with a pink square at the end, on top of a row of 7 green squares.

- $2 \times 7 + 1 = 15$
- $8 + 7 = 15$

**Picture 60:** 60 green squares and one pink square, on top of 60 green squares.

The total number of squares is $2 \times 60 + 1 = 121$

**Picture 70:** 70 green squares and one pink square, on top of 70 green squares.

The total number of squares is $2 \times 70 + 1 = 141$
**Teaching guidelines**

Alert learners to question 2(b) before they start working on question 2(a). In question 2(b) they will have to determine the numbers of squares in pictures 60 and 70 of each pattern without drawing the pictures, and without counting. The way in which they do question 2(a) will enable them to find a way of doing question 2(b). Impress on learners that they should not determine the number of squares in pictures 6 and 7 by counting, since this will leave them helpless when they come to question 2(b).

You should encourage different learners to use different methods, and give them the opportunity to explain their methods to their classmates, so that the classmates can decide if it is correct or not. If different methods are correct (give the same answers), the different calculation plans are equivalent expressions. For example in Pattern A:

Picture 60: 2 rows with 60 green squares each + 2 pink squares = $2 \times 60 + 2 = 122$

Picture 60 = 2 rows with 61 squares each = $2 \times 61 = 122$

This demonstrates that $2 \times 60 + 2 = 2 \times 61$.

Explaining why these two plans give the same answer can lead to more interesting mathematical discussions based on the properties of operations, in this case adding multiples of 2 (60 twos + 1 two = 61 twos): $2 \times 60 + 2 \times 1 = 2 \times (60+1) = 2 \times 61$

**Answers** (questions 2(a) and (b))

<table>
<thead>
<tr>
<th>Pattern A, Picture 6</th>
<th>Pattern B, Picture 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 rows, each with 6 green squares and one pink square at the end.</td>
<td>2 rows, each with a pink square followed by 6 green squares and ending with another pink square.</td>
</tr>
<tr>
<td>$2 \times 6 + 2 \times 1 = 14$</td>
<td>$2 \times 1 + 2 \times 6 + 2 \times 1 = 16$</td>
</tr>
<tr>
<td>$2 \times 7 = 14$</td>
<td>$2 \times 8 = 16$</td>
</tr>
</tbody>
</table>

**Pattern A, Picture 60**: 2 rows, each with 60 green squares and a pink square at the end. The total number of squares is $2 \times 60 + 2 \times 1 = 122$

**Pattern A, Picture 70**: 2 rows, each with 70 green squares and a pink square at the end. The total number of squares is $2 \times 70 + 2 \times 1 = 142$

**Pattern B, Picture 60**: 2 rows, each with a pink square followed by 60 green squares and ending with another pink square. The total number of squares is $2 \times 1 + 2 \times 60 + 2 \times 1 = 124$

**Pattern B, Picture 70**: 2 rows, each with a pink square followed by 70 green squares and ending with another pink square. The total number of squares is $2 \times 1 + 2 \times 70 + 2 \times 1 = 144$

The answers for patterns C and D are on the next page.
**Pattern C, Picture 6**: 2 pink squares in the middle on top of row of 7 green squares, and a row with 6 green squares in the middle below.

\[ 2 + 7 + 6 = 15 \]

**Pattern D, Picture 6**: 6 rows of green squares with 6 squares in each row.

\[ 6 \times 6 = 36 \]

**Picture 7**: 2 pink squares in the middle on top of a row of 8 green squares, and a row with 7 green squares in the middle below.

\[ 2 + 8 + 7 = 17 \]

**Pattern C, Picture 60**: 2 pink squares in the middle on top of row of 61 green squares, and a row with 60 green squares in the middle below. The total number of squares is 2 + 61 + 60 = 123

**Pattern C, Picture 70**: 2 pink squares in the middle on top of row of 71 green squares, and a row with 70 green squares in the middle below. The total number of squares is 2 + 71 + 70 = 143

**Pattern D, Picture 60**: 60 rows of green squares with 60 squares in each row. The total number of squares is 60 \times 60 = 3600

**Pattern D, Picture 70**: 70 rows of green squares with 70 squares in each row. The total number of squares is 70 \times 70 = 4900

2. Simphiwe is making these growing patterns of pictures with squares.

**Pattern A**

- Picture 1
- Picture 2
- Picture 3
- Picture 4
- Picture 5

**Pattern B**

- Picture 1
- Picture 2
- Picture 3
- Picture 4
- Picture 5

**Pattern C**

- Picture 1
- Picture 2
- Picture 3
- Picture 4
- Picture 5

**Pattern D**

- Picture 1
- Picture 2
- Picture 3
- Picture 4

Answer questions (a) and (b) for each of Patterns A, B, C and D.

(a) Describe Picture 6 and Picture 7 in words. Then draw Picture 6 and Picture 7.

How many squares are there in Picture 6 and how many in Picture 7?

(b) Describe Picture 60 and Picture 70 in words. Do not draw them! Imagine them; “see” them in your head! Calculate the number of squares in Picture 60 and in Picture 70.
7.5 From pictures to tables

**Mathematical notes**

Going from pictures to tables here is not a goal in itself, but a vehicle to help learners to deduce general formulae (rules) that will enable them to *easily* calculate the number of triangles in *any* figure.

What should therefore be recorded is not the *number* of triangles in the given figures, but the *structure* of the figures. Here is an example for the number of green triangles:

<table>
<thead>
<tr>
<th>Green 1</th>
<th>Green 2</th>
<th>Green 3</th>
<th>Green 4</th>
<th>Green 5</th>
<th>Green 6</th>
<th>Green 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>2+1</td>
<td>3+2</td>
<td>4+3</td>
<td>5+4</td>
<td>6+5</td>
<td>7+6</td>
<td>31+30</td>
</tr>
</tbody>
</table>

Generalising this structure requires that we formulate the *relationships* between numbers in words, for example:

“*The number of green triangles in the bottom row is equal to the Figure number, and there is one more green triangle in the top row than in the bottom row.*”

This formulation then enables learners to say that in Figure 100 there will be 100 green triangles in the bottom row and 101 in the top row, for a total of 100 + 101 green triangles.

**Answers**

1. Complete this table and describe your methods.

<table>
<thead>
<tr>
<th>Figure number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. of pink triangles</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td><strong>No. of green triangles</strong></td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total no. of triangles</strong></td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>16</td>
<td>19</td>
<td>31</td>
</tr>
</tbody>
</table>

2. **Pink sequence:** consecutive numbers  
   **Green sequence:** the odd numbers, starting from 3.  
   **Total sequence:** start with 4 and count on in threes.

3. 30 pink triangles, 30 green triangles in the bottom row and 31 green triangles in the top row  
   (a) 30  
   (b) 2\times30 + 1 = 61  
   (c) 3\times30 + 1 = 91

4. 31 + 32 = 2\times31 + 1 = 63

5. (31 – 1) + 2 = 15

---

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7.6 Writing our plans as flow diagrams

Mathematical notes
Learners should have adequate background knowledge to engage with the work in this section. But instead of learners reading the page, you may present it as a lesson, and interactively with learners deduce the calculation plan and its representation as a flow diagram. Learners can then practise what they have learnt in the rest of the questions.

Note on flow diagrams and BODMAS
You should make sure that learners understand the flow diagram notation.

The flow diagram representation carries an intuitive left-to-right procedure: the first input produces the first output, the second input produces the second output. If you find that it is not so intuitively clear to your learners, you may wish to show them the flow diagram with the intermediate input-output values filled in, like this:

2
3 × 2
4 + 4
8
10
12

The left-to-right convention means that there is no need to learn rules like BODMAS for the order of operations (e.g. first multiply before you add). BODMAS does not apply in these diagrams. For example, the following flow diagram is equivalent to the above.

2
3 + 2 × 2
5 × 2
8
10
12

The flow diagram left-to-right procedure plays the same role as brackets. To calculate the output value for the input 3, the first diagram uses the arithmetic expression (3 × 2) + 4, and the second diagram uses (3 + 2) × 2, and of course (3 × 2) + 4 = (3 + 2) × 2 = 10.

Note that due to space limitations we will in some answers use this alternative one-line notation for the above two flow diagrams, intended only for teachers, not for learners:

2, 3, 4 - × 2+ 4 ® 8, 10, 12
2, 3, 4 - + 2 × 2 ® 8, 10, 12

You may think of the input numbers moving from left to right into the operator one at a time.

Answers
1. Learners should check if it is true that 1 × 2 + 4 = 6, 2 × 2 + 4 = 8, 3 × 2 + 4 = 10 ...
Teaching guidelines

Again, describing the structure in words is very important for the development of understanding. Indeed, the language carries the underlying relationships and allows us to generalise away from the specific example to any Picture number. Note that with “any” we do not mean that we should introduce algebraic notation for variables. With “any” we here mean any specific number, for example the 100th, or that we may use words as names for variables, for example in Picture no. = 2 × No. of squares + 1.

Here are examples of how to describe the pictures (the number of squares) in question 5(a):

Picture 4: 2 rows of 4 squares plus 1 pink or 4 squares on top and 5 at the bottom
Picture 5: 2 rows of 5 squares plus 1 pink or 5 squares on top and 6 at the bottom

It is this relationship (between the Picture number and the number of squares, and the relationship between the two sentences) that must now be extended and generalised. There is no need to draw:

Picture 6: 2 rows of 6 squares plus 1 pink or 6 squares on top and 7 at the bottom
Picture 60: 2 rows of 60 squares plus 1 pink or 60 squares on top and 61 at the bottom

It should be clear that it is vital to distinguish between the constants (2 rows, 1 pink) and the variables (the Picture no. and the No. of squares per row).

This generalisation then serves as a calculation plan that enables us to calculate the number of squares for any Picture number in the sequence, for example:

Picture 60: 2×60 + 1 = 121 squares or 60 + 61 = 121.

Answers

2. 6×2 + 4 = 16
   60×2 + 4 = 124
   87×2 + 4 = 178

3. Yes, we can calculate instead of count.

4. One alternative is −12 + 2 × 2

5. (a) Picture no. −x²−1 → No. of squares
   Picture 6: 6×2 + 1 = 13
   Picture 60: 60×2 + 1 = 121
   Picture 87: 87×2 + 1 = 175

   (b) Picture no. −x²−1 → No. of squares
   Picture 6: 6×2 + 2 = 14
   Picture 60: 60×2 + 2 = 122
   Picture 87: 87×2 + 2 = 176

6. Learners’ own work
Grade 4 Term 2 Unit 8  

Symmetry

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**Learner Book Overview**

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<th>Sections in this unit</th>
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<th>Pages in Learner Book</th>
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</thead>
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<td>8.1 Identical parts that fit onto each other</td>
<td>Introducing symmetry and lines of symmetry</td>
<td>189</td>
</tr>
<tr>
<td>8.2 Lines of symmetry</td>
<td>Focusing on lines of symmetry, seen as “fold lines”</td>
<td>190 to 192</td>
</tr>
</tbody>
</table>

**CAPS time allocation**

2 hours

**CAPS page references**

23 and 82

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**Mathematical background**

Symmetry occurs when a two-dimensional figure can be divided into two halves that are “mirror images” of each other. One cannot talk about symmetry without referring to a line of symmetry. A line of symmetry is an imaginary line through a two-dimensional figure that can act as a “fold line”. If we imagine folding the two-dimensional figure along the line of symmetry we will find that the two halves fit perfectly on top of each other. If we imagine that our figures are drawn on a transparent sheet and cut along the line of symmetry, we will see that when we place the two halves on top of each other, they are exactly the same (both the overall shape and any features drawn inside the outlines of the two figures).

Some figures have two or more lines of symmetry (e.g. a rectangle has two, a square has four and a circle has more lines of symmetry than can be counted). If a figure does not have at least one line of symmetry we say that it is not symmetrical (or asymmetrical).

Symmetry, or lack of symmetry, are very important properties of two-dimensional figures. They provide another way to compare different figures (instead of just saying which sides or corners are the same, or not). Symmetry is touched on again in Term 3 Unit 6, question 1, page 255.

**Resources**

Photocopies of templates mentioned in “Teaching guidelines” on the next page.

Sheets of paper and scissors.
8.1 Identical parts that fit onto each other

Mathematical notes
A two-dimensional figure may not be symmetrical as a whole. However, certain parts of the figure may be symmetrical. It is important to be able to see what is symmetrical in a figure even though the figure may not be symmetrical as a whole. Identifying symmetry is equivalent to identifying a line of symmetry. The two go hand in hand. Symmetry is a very important concept and needs to be given as much attention as is practically possible.

Teaching guidelines
Aim to spend about 1 hour on this section.

You can start with some paper folding activities to help learners to begin to see lines of symmetry in figures. Learners can trace and cut out any of the figures on pages 306, 307, 308 and 338 (or you could photocopy pages 463 to 466 or pages 469 to 474 in the Addendum). Once learners have cut out the figures, they should fold them so that the top and bottom half fit exactly on top of each other. When learners open out the figure, the fold line will be the line of symmetry.

You can use the tinted passage on page 189 to explain that as a whole, a two-dimensional figure may not be symmetrical. However, certain parts of the figure may be symmetrical. You may, time permitting, provide additional examples of diagrams that have, or do not have, symmetry “hidden” in them.

In the face alongside the mouth, nose, each ear and each eye are symmetrical, but the whole face is not because the one eye is open and the other closed.

You will have to provide lines that may or may not be lines of symmetry.

Possible misconceptions
Learners may see symmetry only as a “total” property of a figure or object. Such learners will need support to realise that they can choose to ignore parts that are not symmetrical in order to be able to “see” the parts of the figure or object that are symmetrical. They need to be able to describe what they are focusing on in such cases.

Answers
1. No
2. Yes
3. Because each set of windows is not symmetrical and the two sets of windows are not symmetrical to each other.
8.2 Lines of symmetry

Mathematical notes
The key to this section is being able to identify all lines of symmetry in each of the figures.

Teaching guidelines
Aim to spend about 1 hour on this section.

Encourage learners to always identify the line of symmetry when they deal with symmetrical objects. Ask questions that justify opinions, ideas, etc. For example: “You say this object is symmetrical – show me the line of symmetry.”, “Is everything in this figure symmetrical or are only some parts symmetrical?”, “How many lines of symmetry does that object have?”, etc.

If time permits, allow for some group discussion. Moderate the discussions to ensure that the focus remains on the important issues: justifying symmetry or the lack thereof, using the idea of line of symmetry (“fold line”), and individual parts that are symmetrical around the line.

Possible misconceptions
Some learners may struggle to see that two parts are not symmetrical. Question 2 is meant to help address this matter. To assist such learners, you may have to provide additional cut-outs of figures with a fold line and have them fold the halves together to see whether parts overlap exactly or not.

Notes on questions
If learners find any part of question 4 difficult or get it wrong, ask them to trace the figures (including the broken lines) and cut them out. Then they should fold the figures on the lines to see which one(s) is/are the line(s) of symmetry.

Answers
1. (a) Flag of Georgia  
   (b) Flag of Jamaica
1. (c) Flag of Sweden  
   (d) Flag of Switzerland

2. Learners' drawings should look something like the illustration below (or the one shown on page 191). Note that the fold line is the line of symmetry.

3. Learners' own drawings. There are too many possibilities to illustrate. Check that the two drawings make a symmetrical image on the page.
Answers
4. (a) The red line
   (b) The green line
   (c) The red and blue lines
   (d) The red, blue and green lines
   (e) The red, blue and green lines
   (f) None
   (g) None
   (h) The red line
Mathematical background

Addition can be performed by breaking down one number and adding its place value parts one by one to the other number, for example:

\[
3726 + 2348 = 3726 + 2000 + 300 + 40 + 8
\]
\[
= 5726 + 300 + 40 + 8
\]
\[
= 6026 + 40 + 8
\]
\[
= 6066 + 8
\]
\[
= 6074
\]

As an alternative, adding on may proceed from the smaller parts to the bigger parts.

Addition can also be performed by breaking down both numbers into place value parts, rearranging the parts (commutative and associative properties), and building up the answer:

\[
3726 + 2348 = 3000 + 700 + 20 + 6 + 2000 + 300 + 40 + 8
\]
\[
= 3000 + 2000 + 700 + 300 + 20 + 40 + 6 + 8
\]
\[
= 5000 + 1000 + 60 + 14
\]
\[
= 6000 + 70 + 4
\]
\[
= 6074
\]
9.1 Another way to add

**Mathematical notes**
In Unit 2 of this term learners used a range of methods to add and subtract. Amongst these were breaking down only the number that is added, and breaking down both numbers.

In this section learners revise adding by breaking down numbers into place value parts, rearranging the parts, and building up the answer. The work on this page serves as revision and builds up towards addition by breaking down both numbers on the next page.

**Teaching guidelines**
Aim to cover this section in 1 hour. One possibility is to use
- the tinted passage on page 193 and question 1(a), and the tinted passage on page 194 and question 4(a) for concept development,
- questions 1(b), (d) and (f), 2, 3, 4(b), 5 and 6 for classwork, and
- questions 1(c) and (e), and 4(c) and (d) for additional practice.

You can start by counting on in multiples of tens, hundreds and thousands for mental mathematics. Start with numbers that are not multiples of what you are counting in, for example, count on in multiples of 4 000 from 1 234.

Learners have used rounding off for calculating. In this unit and subsequent units you can help learners to use rounding off and estimating as a way of checking whether their answers are reasonable. At first it is useful to give learners a range of estimated answers to choose from, ask them to choose the best one and then to explain their choice. For example, for question 1 they can choose the best estimate from the following:

**Question 1(a):**
(i) about 9 000
(ii) about 8 000
(iii) about 10 000
(iv) about 2 000

**Question 1(b):**
(i) about 7 000
(ii) about 5 000
(iii) about 8 000
(iv) about 9 000

**Question 1(c):**
(i) about 4 000
(ii) about 8 000
(iii) about 9 000
(iv) about 6 000

**Question 1(d):**
(i) about 7 000
(ii) about 2 000
(iii) about 8 000
(iv) about 9 000

**Question 1(e):**
(i) about 5 000
(ii) about 8 000
(iii) about 10 000
(iv) about 9 000

**Question 1(f):**
(i) about 6 000
(ii) about 7 000
(iii) about 2 000
(iv) about 2 500

**Answers**

1. (a) 9 900  
   (b) 8 820  
   (c) 9 072  
   (d) 9 041  
   (e) 9 263  
   (f) 2 455

2. (a) 5 878  
   (b) Yes  
   (c) 5 878

3. 5 000 + 3 000 + 800 + 500 + 60 + 70 + 4 + 3
Mathematical notes

The rearrangement of the place value parts of the two numbers is possible because of the commutative and associative properties of addition.

Most of this section focuses on addition. However, it is important that learners don’t close their minds to the possibility of other operations. That is why question 1(f) on page 193 is a subtraction calculation. It is also important that learners continue to keep the relationships between operations in mind. This is one reason why question 5 uses repeated addition and question 6 uses multiplication and division related to the repeated addition in question 5.

Notes on questions

Question 5 uses repeated addition of 387. Once learners have calculated the answer to question 5(a), they can use this answer (1 935) and add another 387 to get the answer to 5(b). They do not need to add up all the 387s again. Similarly, in question 5(c) learners can just add 387 to the answer to question 5(b).

Learners do not need to calculate any answers in question 6. They should rather use their knowledge of multiplication as repeated addition and the answer in 5(a) for question 6(a), and the answer in 5(c) for question 6(b). Learners can use question 6(a) to answer questions 6(c) and (d), because multiplication and division are inverse operations.

Teaching guidelines

While doing the examples on the board, explain that the task of adding the two numbers is replaced with the task of doing several easy additions separately and then combining the answers by adding them up.

Continue to help learners to estimate answers before calculating. This will help them to judge whether their answers are reasonable. For example, you can ask learners to choose the best estimated answers from:

Question 4(a): (i) about 9 000 (ii) about 8 000 (iii) about 10 000 (iv) about 2 000
Question 4(b): (i) about 500 (ii) about 5 000 (iii) about 8 000 (iv) about 9 000
Question 4(c): (i) about 400 (ii) about 4 000 (iii) about 3 000 (iv) about 2 500
Question 4(d): (i) about 2 000 (ii) about 3 000 (iii) about 3 500 (iv) about 4 000

It is very important that learners explain why they had chosen one of the estimated answers.

Answers

4. (a) 8 305 (b) 8 166 (c) 2 511 (d) 3 722
5. (a) 1 935 (b) 2 322 (c) 2 709
6. (a) 1 935 (b) 2 709 (c) 5 (d) 387
9.2 Another way to subtract

Teaching guidelines
Aim to cover this section in 1 hour. One possibility is to use
- the tinted passage on page 196 and questions 8(c) and (d), and the tinted passage on page 197 and question 10 for concept development,
- questions 1, 2, 3, 4(a), (c) and (e), 5, 6, 7 and 12(a) to (e) for classwork, and
- questions 4(b), (d) and (f), 8(a) and (b), 9, 11 and 12(f) for additional practice.

Allow learners to engage with the questions on page 195 on their own. This provides them with opportunities to activate their own ideas. These questions are designed to develop understanding of subtraction situations (in this case taking away), as well as to develop skills for subtraction. You could, however, ask learners a few questions before they start, for example:
- Will Vusi have more or less money in his purse after he has bought the shoes?
- Will Tebogo have more or less than R3 787 after she has bought the washing machine?
- About how much money will she have:
  (i) about R5 000  (ii) about R6 000  (iii) about R2 000  (iv) about R1 000?
- Will Sarah have more or less than R4 958 after she has bought the refrigerator?
- About how much money will she have:
  (i) about R5 000  (ii) about R8 000  (iii) about R2 000  (iv) about R3 000?

The breaking-down and building-up method of subtraction is introduced on the next page.

Answers
1. (a) R3 000 + R700 + R80 + R7 = R3 787
   (b) R 2 428
2. R1 242
3. R2 622
Notes on questions
Questions 4 and 5 serve to develop the idea of subtraction as the inverse of addition. Question 5 revises a method of subtraction that learners have used previously.

Teaching guidelines
Once learners have completed question 7, ask them why the answers to questions 5 and 6(b) are the same. If they cannot answer you, use simpler examples such as:

Why will the answers to the following be the same?

\[\begin{align*}
3 + \square &= 10 \quad \text{and} \quad 10 - 3 &= \square \\
411 + \square &= 800 \quad \text{and} \quad 800 - 411 &= \square
\end{align*}\]

Do one or two examples of the breaking-down and building-up method of subtraction on the board. While doing this, explain that the given subtraction task is replaced with the task of doing several easy subtractions separately and then combining the answers by adding them up.

Answers
4. (a) \(2\ 137 + 63 = 2\ 200\)  
   (b) \(3\ 437 + 63 = 3\ 500\)  
   (c) \(2\ 364 + 36 = 2\ 400\)  
   (d) \(4\ 917 + 83 = 5\ 000\)  
   (e) \(4\ 286 + 14 = 4\ 300\)  
   (f) \(5\ 324 + 76 = 5\ 400\)

5. \(2\ 644\). Some learners may use some or all of the following stages:

\[3\ 324 + 6 \rightarrow 3\ 330 + 70 \rightarrow 3\ 400 + 600 - 4\ 000 + 1\ 000 \rightarrow 5\ 000 + 968 \rightarrow 5\ 968\]

However, in this example it is not necessary and learners can write down the missing number directly.

\[3\ 324 + 2\ 644 \rightarrow 5\ 968\]

6. (a) \(2000; 600; 40; 4\)  
   (b) \(2\ 644\)

7. Learners check and make corrections if necessary.

4. Find the missing number in each case.
   (a) \(2\ 137 + \ldots = 2\ 200\)
   (b) \(3\ 437 + \ldots = 3\ 500\)
   (c) \(2\ 364 + \ldots = 2\ 400\)
   (d) \(4\ 917 + \ldots = 5\ 000\)
   (e) \(4\ 286 + \ldots = 4\ 300\)
   (f) \(5\ 324 + \ldots = 5\ 400\)

5. Calculate \(5\ 968 - 3\ 324\) by adding on.
   \[3\ 324 + \ldots = \ldots\]

6. (a) How much is each of the following?
   \[5\ 000 - 3\ 000; 900 - 300; 60 - 20; 8 - 4\]
   (b) Calculate \((5\ 000 - 3\ 000) + (900 - 300) + (60 - 20) + (8 - 4)\).

7. If your answers for questions 5 and 6(b) are not the same, you have made a mistake. Correct it if this is the case.

To calculate \(6\ 878 - 4\ 465\) you can break both numbers down into place value parts, work with the parts of the same kind, and then build the answer up.

Break down:
\[6\ 878 = 6\ 000 + 800 + 70 + 8\]
\[4\ 465 = 4\ 000 + 400 + 60 + 5\]

Work with the parts:
\[6\ 000 - 4\ 000 = 2\ 000\]
\[800 - 400 = 400\]
\[70 - 60 = 10\]
\[8 - 5 = 3\]

Build up the answer:
\[6\ 878 - 4\ 465 = 2\ 000 + 400 + 10 + 3 = 2\ 413\]

The above actions can also be described by using brackets:
\[6\ 878 - 4\ 465 = (6\ 000 + 800 + 70 + 8) - (4\ 000 + 400 + 60 + 5)\]
\[= (6\ 000 - 4\ 000) + (800 - 400) + (70 - 60) + (8 - 5)\]
\[= 2\ 000 + 400 + 10 + 3\]
\[= 2\ 413\]
Teaching guidelines

Once you have worked through question 8(a) on the board with learners using the breaking-down method, you can ask them: “What is the same about questions 8(c) and 8(d)?” Learners should realise that the same amount (3 325) is subtracted from both numbers, and that the starting numbers are nearly the same. The difference between 6 559 and 6 552 is only 7. This means that learners do not need to calculate 6 559 – 3 325; they only need to calculate 3 234 (the answer to 8(c)) – 7. Remind learners that they should develop the habit of thinking: “What do I already know that can help me here?”

Do examples of subtraction that require transfer on the board. Emphasize the idea of replacing the expanded notation of the bigger number with a different way of breaking it down, to make the subtraction by parts possible.

You can ask learners: “What is the same about the numbers in question 12?” They should see that the starting numbers in 12(a) to (e) are the same, but that the numbers subtracted are different. Ask learners questions like: “Which answer will be the smallest?”, “Which answer will be the biggest?” Ask them to arrange the answers to 12(a) to (e) from the biggest to the smallest before they do the calculations. If learners cannot do this, then start by giving them easier calculations, for example 75 – 9; 75 – 18; 75 – 27; 75 – 36.

Notes on questions

Questions 10 and 11 are more easily done using “transfers”; they motivate the need for doing transfers. You may like to first show learners how to do transfers before they do questions 10 and 11. In questions 12(a) to (e) the initial number is the same (5 346). Learners can use this to estimate the sizes of answers relative to each other.

Possible misconceptions

If learners do not understand the logic of the subtraction method properly, they may make the mistake of subtracting the smaller of the two place value parts.

Answers

8. (a) 5 344  (b) 2 424  (c) 3 234  (d) 3 227

9. 7 698 – 2 354 = (7 000 – 2 000) + (600 – 300) + (90 – 50) + (8 – 4)
   = 5 000 + 300 + 40 + 4
   = 5 344

10. R1 557

11. 3 378

12. (a) 2 218  (b) 3 072  (c) 3 521
    (d) 2 169  (e) 2 787  (f) 3 478
9.3 Solve problems

Mathematical notes
In this section learners solve problems that involve addition and subtraction. The section also focuses on addition and subtraction as inverse operations, i.e. if the numbers used are the same then what the one operation does the other undoes. Inverse operations can be used to check calculations: see questions 1 to 4; 5 to 7; 8 and 9.

Teaching guidelines
Aim to cover this section in 2 hours. One possibility is to use
- questions 1, 2, 3, 4 and 10 for concept development,
- questions 5, 6, 7, 8, 9 and 12 for classwork, and
- questions 11, 13, 14 and 15 for additional practice.

Remind learners to always ask themselves: “What have I learnt or done before that can help me here?” Using information, number facts and strategies that they have used before will not only boost learners’ confidence and independence, but will also save them a lot of time.

Using questions for concept development does not mean writing out the calculations on the board as worked examples. Rather read the questions to learners and ask them: “What will you do now?” Once you have completed question 1, ask learners where they have seen the numbers in questions 2 and 3 before. Ask learners to match the number sentences in questions 2 and 3 with questions 1(a), (b) and (c).

Learners can use the fact that addition and subtraction are inverse operations, for example 248 – 128 = \(c\); \(c\) + 128 = 248. Learners should do this for all calculations in question 1.

Notes on questions
The number sentences in questions 6 and 7 are the same as the calculations learners do in question 5. Learners can use the answers from question 5 for questions 6 and 7.

Answers
1. (a) 120  (b) 90  (c) 158
2. (a) 120  (b) 90  (c) 158
3. 128 + 120 = 248
4. The answers to question 1 should be the same as the answers to question 2.
5. (a) 3 132  (b) 1 113  (c) 4 366
6. (a) 3 132  (b) 1 113  (c) 4 366

9.3 Solve problems

1. There are 128 lemons in the red box.
   There are 248 lemons in the two boxes together.
   (a) How many lemons are there in the green box?
   (b) 38 lemons are moved from the red box to the green box. How many lemons are left in the red box?
   (c) How many lemons are there in the green box now?

2. Calculate.
   (a) 248 – 128  (b) 128 – 38  (c) 120 + 38

3. Find the number that makes the number sentence true:
   128 + \ldots = 248

4. Check to make sure that your answers for question 1 are correct.

5. Farmer Cele has two farms. He calls them Farm A and Farm B. He has 2 347 goats on Farm A. Altogether, there are 5 479 goats on the two farms.
   (a) How many goats are there on Farm B?
   (b) Farmer Cele takes 1 234 goats from Farm A to Farm B. How many goats are left on Farm A?
   (c) How many goats are there on Farm B now?

6. Calculate.
   (a) 5 479 – 2 347  (b) 2 347 – 1 234  (c) 3 132 + 1 234
**Notes on questions**

If learners realise that the calculations in question 9 are different versions of the calculation in question 8, it will save them time. They can use the answer for question 8 to get the answers in question 9 (without doing calculations).

In question 11 it is much easier to find the answer by adding on than by breaking up the numbers, i.e. R5 775 + R200 → R5 975 + R20 → R5 995 + R4 → R5 999

**Answers**

7. \(2347 + 3132 = 5479\)

8. \(4397\)

9. (a) \(4397 + 2176 = 6573\)
   (b) \(2176 + 4397 = 6573\)
   (c) \(6573 - 2176 = 4397\)

10. \(4397\) people

11. R224

12. (a) 922 learners
   (b) 8654 learners

13. 2908 chickens

14. 2899 toilets

15. R7 928

7. Find the number that makes this number sentence true: \(2\underline{347} + \underline{□} = 5479\)


9. Find the numbers that are missing from these number sentences.
   (a) \(\underline{□} + 2176 = 6573\)
   (b) \(2176 + \underline{□} = 6573\)
   (c) \(6573 - 2176 = \underline{□}\)

10. Between 10 o’clock and 11 o’clock 2 176 people enter a soccer stadium. At 11 o’clock there are 6 573 people in the stadium. How many people were there at 10 o’clock?

11. A refrigerator costs R5 775 at a shop. The same model costs R5 999 at another shop. What is the difference between the two prices?

12. There are 4 788 Grade 4 learners in School District A and 3 866 learners in School District B.
   (a) How many more Grade 4 learners are there in District A than in District B?
   (b) How many Grade 4 learners are there in the two districts together?

13. On five consecutive days a supermarket sold 657, 358, 724, 547 and 622 chickens. How many chickens were sold altogether?

14. A contractor has to build 8 276 flush toilets in a township. He has completed 5 377. How many are still outstanding?

15. An airline charges a fare of R4 480 for a return flight from Johannesburg to Nairobi. There are also additional fees and taxes of R3 448. What is the total cost of the air ticket?
Grade 4 Term 2 Unit 10  Whole numbers: Division

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### CAPS time allocation

- 4 hours

### CAPS page references

- 14 to 15 and 84 to 85

### Mathematical background

Multiplication and division both relate to two very different kinds of situations, which are briefly described below.

1. **Situations in which quantities are made up of equal parts**
   
   The statement $23 \times 37 = 851$ can be used to describe 23 objects (e.g. planks) of 37 measurement units (e.g. cm) each, which is a total of 851 units. The statement $23 \times 37 = 851$ can also be used to describe the cost of 23 objects at R37 each, which is R851.

   Situations like these have the form $\text{number of parts} \times \text{size of each part} = \text{total quantity}$ or $\text{number of parts} \times \text{rate} = \text{total quantity}$.

   Any of the three quantities can be unknown:

   - A situation in which the total quantity is unknown, i.e. when the situation can be described by a number sentence of the form $\text{number of parts} \times \text{size of each part (or rate)} = ?$ is called a **multiplication situation**. To find the unknown total, you have to multiply.
   - A situation in which the number of parts is unknown, i.e. when the situation can be described by a number sentence of the form $? \times \text{size of each part (or rate)} = \text{total quantity}$ is called a **grouping situation**. To find the unknown number of parts, you have to divide.
   - A situation in which the size of each part is unknown, i.e. when the situation can be described by a number sentence of the form $\text{number of parts} \times ? = \text{total quantity}$ is called a **sharing situation**. To find the unknown rate or part size, you have to divide.

2. **Ratio situations**

   In a ratio situation two quantities are compared by using multiplication or division, not by stating the difference between the two quantities. For example, if you stick to a cake recipe that states 2 parts of sugar for 5 parts of cake flour, your amount of cake flour will always be $2 \frac{1}{2} \times$ your amount of sugar, and your amount of sugar will always be your amount of cake flour $+ 2 \frac{1}{2}$. Ratio situations were dealt with in Term 2 Unit 5. The challenge at the end of this unit (page 207) also involves a ratio situation.
10.1 What is division?

Mathematical notes
It is very empowering to understand division as the inverse of multiplication, in other words to interpret $90 \div 6$ as the question: "What must 6 be multiplied by to get 90?", or $6 \times ? = 90$.

Somebody who doesn't know the answer immediately can find it in steps, for example $6 \times 10 = 60$ and $6 \times 5 = 30$, so $6 \times 10 + 6 \times 5 = 90$, so $90 \div 6 = 15$.

Teaching guidelines
Explain to learners that they can always rewrite a division number sentence as a multiplication number sentence. For example, in question 1 you need to know how many bags or groups of 8 apples is 72 apples. We can write this as $72 \div 8 = \square$ or $\square \times 8 = 72$.

Ask learners what multiplication facts for 8 they know. Record these on the board. If learners do not know the answer immediately, they can build it up in steps. For example, a learner might know $5 \times 8 = 40$. This can be recorded on an empty number line.

Learners can then see that 72 is 32 more than 40. Ask them: "What times 8 is 32?" Some learners may know that it is 4. Others might try $2 \times 8$ and get 16. If they add 16 to 40, it will give them 56. They can try and add another $2 \times 8$: $56 + 16 = 72$. Now ask them how many times they needed to multiply by 8 to get 72. In this example the answer is $5 + 4$ times, or $5 + 2 + 2$ times, in other words 9 times. So, $9 \times 8 = 72$. Mzwi bought 9 bags of 8 apples each.

It is important that you complete all four sections in the 4 hours allocated to this topic. Build learners' knowledge conceptually, but try to move quickly through Section 10.1. Aim to cover it in 1 hour. One possibility is to use

- questions 1, 4(a) to (c), 5(a) to (c), 6(a) and (b), and 7 for concept development,
- questions 2, 3, 4(d) to (f), 5(d) to (g), 6(c) to (f), and 7 for classwork, and
- questions 5(h) to (k), 6(g) and (h), and 7 for additional practice.

Answers
1. $72 \div 8 = \square$ or $\square \times 8 = 72$.
   See possible solution under “Teaching guidelines” above.
   The answer is 9 bags.
Mathematical notes

When you multiply numbers, you can change the way they are grouped without changing the answer, for example $4 \times 2 \times 9 = (4 \times 2) \times 9 = 4 \times (2 \times 9)$. So $8 \times 9 = 4 \times 18$. This is known as the associative property of multiplication. It is also sometimes called the grouping property of multiplication. Learners do not need to know the name of the property. They only need to know how to use it to make multiplication easier. This grouping property of multiplication is useful in question 4, and in a lot of other mathematics.

Critical knowledge

You can always change division into multiplication. For example, to find $63 \div 3$ you can multiply $3 \times \square$ to get 63. Here $\square = 21$.

The order in which two numbers are multiplied does not affect the answer, for example $3 \times 24 = 24 \times 3$.

Teaching guidelines

We have already mentioned the importance of linking concepts, ideas, strategies and even questions in mathematics. Remind learners to ask themselves: “What do I already know that can help me here?” Learners use the multiplication facts they already know to build up multiples to get the answers to the division calculations. However, learners should also see where they can use solutions or parts of solutions from one question to make the calculations in another question easier.

In Term 2 Unit 5 Section 5.6 learners broke numbers down into factors to make multiplication more manageable. They can use this strategy in question 4. In question 5 learners should look for answers they can take directly from question 4.

In question 6 learners can use both these strategies, i.e. factorising and seeing which answers they have already worked out.

In question 4, remind learners how to break numbers down into factors. For example, in question 4(a): $8 \times 9 = 4 \times 2 \times 3 \times 3 = 8 \times 3 \times 3 = 24 \times 3 = 72$. This gives the answer to question 4(b) as well: $4 \times 18 = 4 \times 2 \times 3 \times 3$, so the answer is also 72. And question 4(c): $3 \times 24 = 24 \times 3 = (4 \times 3 \times 2) \times 3 = 72$, as before.

Show learners how to use their calculations (and answers) from question 4 to answer question 5. For example, in question 5(a) uses the multiplication facts from question 4(a), so $72 \div 8$ can be calculated as $\square \times 8 = 72$. The answer is given in 4(a): $9 \times 8 = 72$. Question 4(a) then also gives the answer to question 5(b). The answer to question 5(c) is provided by question 4(b): $4 \times 18 = 72$. In fact, only questions 5(i), (j) and (k) need to be calculated. Here learners should use the answer in (i) to get (j), and the answers in (i) and (j) to get (k).
Teaching guidelines

While learners work on questions 1 to 6, you may advise individual learners and the whole class from time to time to use two strategies:

- Use multiplication facts you know.
- Build the answer up in steps.

Notes on questions

Questions 1 and 5 demonstrate grouping situations. The question in each case is: “How many groups of a given size?” Questions 2 and 3 demonstrate sharing situations. The question in each case is: “How many items in each group?”

Answers

2. \( 90 \div 10 = \square \), so \( \square \times 10 = 90 \). So the answer is 9 cups.
3. \( 90 \div 5 = \square \), so \( \square \times 5 = 90 \). So the answer is 18 teaspoons.

Learners can use the answer in question 2 to get the answer in question 3:

If \( 9 \times 10 = 90 \), then \( 9 \times 5 \times 2 = 90 \) and \( (9 \times 2) \times 5 = 90 \), so \( 18 \times 5 = 90 \).

4. (a) 72 (from question 1)
   (b) 72 (because \( 4 \times 18 = 4 \times (2 \times 3) = (4 \times 2) \times (3 \times 3) = 8 \times 9 = 72 \) from questions 1 and 4(a))
   (c) 72
   (d) 36
   (e) 72 (because \( 6 \times 12 = 6 \times 6 \times 2 = 36 \times 2 = 72 \))
   (f) 72 (because \( 18 \times 4 = (6 \times 3) \times 4 = 6 \times (3 \times 4) = 6 \times 12 = 72 \) from question 4(e))

5. (a) 9 bags (from questions 1 and 4(a))
   (b) 8 bags (from questions 1 and 4(a))
   (c) 4 bags (from question 4(f))
   (d) 12 bags (from question 4(e))
   (e) 6 bags (from question 4(e))
   (f) 3 bags (because \( 12 \times 6 = 72 \), i.e. \( (3 \times 4) \times (2 \times 3) = 72 \), so \( 3 \times (4 \times 2) \times 3 = 72 \), i.e. \( 24 \times 3 = 72 \))
   (g) 24 bags (from question 5(f))
   (h) 18 bags (from question 4(f))
   (i) 7 bags with 2 apples remaining unbagged (because \( 7 \times 10 = 70 \))
   (j) 14 bags with 2 apples remaining unbagged (because if \( 7 \times 10 = 70 \), \( 7 \times (2 \times 5) = 70 \), so \( 7 \times 2 \times 5 = 70 \))
   (k) 4 bags with 12 apples remaining unbagged (because \( 4 \times 15 = 60 \))

2. Cindy bought 90 plastic cups. The cups came in 10 small boxes. How many cups were in each box?

3. Cindy also bought 90 plastic teaspoons. The teaspoons came in 5 boxes. How many teaspoons were in each box?

4. Calculate each of the following.
   (a) \( 8 \times 9 \)
   (b) \( 4 \times 18 \)
   (c) \( 3 \times 24 \)
   (d) \( 6 \times 6 \)
   (e) \( 6 \times 12 \)
   (f) \( 18 \times 4 \)

5. 72 apples must be put into bags.

   (a) How many bags of 8 apples each can be made?
   (b) How many bags of 9 apples each can be made?
   (c) How many bags of 18 apples each can be made?
   (d) How many bags of 6 apples each can be made?
   (e) How many bags of 12 apples each can be made?
   (f) How many bags of 24 apples each can be made?
   (g) How many bags of 3 apples each can be made?
   (h) How many bags of 4 apples each can be made?
   (i) How many bags of 10 apples each can be made?
   (j) How many bags of 5 apples each can be made?
   (k) How many bags of 15 apples each can be made?
Teaching guidelines

Ask learners how many rows of cubes they see in Diagram B. Then ask how many columns they see.

Explain that we can write two multiplication number sentences that can describe Diagram B, i.e.

\[ 8 \times 9 = \square \text{ and } 9 \times 8 = \square \]

Explain that we can also write two division number sentences for Diagram B, i.e.

\[ \square \div 8 = 9 \text{ and } \square \div 9 = 8 \]

Ask learners to write two multiplication number sentences and two division number sentences for each diagram.

Answers

6. (a) 24 \hspace{1cm} (24 \times 3 = 72: \text{from question 4(c)})
   (b) 3 \hspace{1cm} (24 \times 3 = 72: \text{from question 4(c)})
   (c) 6 \hspace{1cm} (12 \times 6 = 72: \text{from question 4(e)})
   (d) 12 \hspace{1cm} (12 \times 6 = 72: \text{from question 4(e)})
   (e) 4
   (f) 18
   (g) 8
   (h) 9

7. A represents 6(a) and (b).
   B represents 6(g) and (h).
   C represents 6(c) and (d).
   D represents 6(e) and (f).
10.2 Remainders

Teaching guidelines
It is important to complete up to Section 10.4 in the 4 hours allocated to this topic. Build learners’ knowledge conceptually, but try to move quickly through Section 10.2. Aim to cover this section in 1 hour. One possibility is to use

- questions 1, 4(a) and (b), 5(a), 6(a) and (b), and 7(a), as well as the tinted passage on page 203 for concept development,
- questions 2, 3, 4(c) and (d), 5(b) and (c), 6(c) to (f), 7(b) and 8 for classwork, and
- questions 7(c) and 9 for additional practice.

Explain that \(72 \div 10 = 7\) with 2 remaining, because \(10 \times 7 = 70\). So, \(10 \times 7 + 2 = 72\).

Remind learners that they already know that when an expression or number sentence contains multiplication and addition and/or subtraction, they should do the multiplication first. Use the tinted passage on page 204 to explain this again.

Answers
1. Yes
2. (a) 53 (because \(6 \times 8 = 48\) and \(48 + 5 = 53\))
   (b) No, it is 6 remainder 5. (\(6 \times 8 = 48\) and \(48 + 5 = 53\))
3. By doing \(5 \times 7 + 3 = 38\). Therefore it is not true.
4. (a) False. \(44 \div 7 = 6\) rem 2 (because \(6 \times 7 = 42\) and \(42 + 2 = 44\))
   (b) False. \(67 \div 7 = 9\) rem 4 (because \(9 \times 7 = 63\) and \(63 + 4 = 67\))
   (c) True
   (d) True
5. (a) 14 pencils with R2 remaining unspent. Because \(10 \times 7 = 70\) and \(4 \times 7 = 28\)
   (b) 28 with R4 remaining unspent. With double the money, you can buy twice as many pencils. \(28 \times 7 = 196\)
   (c) 42 pencils with R6 remaining unspent. \(R300 = R200 + 100\). So you can buy 14 pencils + 28 pencils = 42 pencils. Learners may use different methods to get to the answer.
Teaching guidelines
Remind learners to keep thinking: “What have I done before that can help me here?”
The answers to question 6 will help learners with the answers to questions 7, 8 and 9.
When learners do question 8, suggest that they start with (b), then do (c), and then (a).

Answers
6. (a) 56  (b) $56 + 5 = 61$  (c) $54 + 3 = 57$
   (d) $63 + 5 = 68$  (e) $120 + 13 = 133$  (f) $132 + 5 = 137$
7. (a) 9 rem 5  (from 6(d) above)
   (b) 6 rem 3  (from 6(c) above)
   (c) 7 rem 5  (from 6(b) above)
8. (a) 12  (11 full cartons and one carton with only 5 eggs)
   (b) 11  (from 6(f) above: $11 \times 12 = 132$.  $132 + 5 = 137$)
   (c) 5 eggs
9. (a) 6 pens  (with R13 unspent; from 6(e) above: $120 + 13 = 133$)
   (b) 6 remainder 13
10.3 Dividing bigger numbers into equal parts

**Critical knowledge**
Learners need to know how to multiply by units, multiples of 10 and multiples of 100. In particular, learners need to be able to make multiples of 10 from multiples of units.

**Teaching guidelines**
In Sections 10.3 and 10.4 learners divide numbers in the hundreds by units. They should not make dots or stripes and count in ones, or attempt to skip count in intervals of the divisor until they get the answer. Both of these approaches will take too long and learners are more likely to make mistakes. Remind learners to use known multiplication facts.

Aim to complete this section in 45 minutes. You can use question 1 for concept development, questions 2 to 5 for classwork and questions 6 to 8 for additional practice.

Learners should first count how much money there is (R600 + R30 + R18 = R648). You can show learners how to make clue boards of easy multiples. Ask learners what are the easiest numbers to multiply by. They will probably say 1, 2 and 10 (zero is also an easy number to multiply by, but it does not help with division). Learners can first write out $1 \times 3$, and $10 \times 3$. They can double both of these to get $2 \times 3$ and $20 \times 3$. Double again to get $4 \times 3$ and $40 \times 3$. Double again to get $8 \times 3$ and $80 \times 3$. They can find $5 \times 3$ by halving $10 \times 3$. They can use these values and an empty number line to calculate the answer. You can find an example of a clue board on page 85 of CAPS.

Using this method for question 1:

<table>
<thead>
<tr>
<th>1 × 3</th>
<th>10 × 3</th>
<th>100 × 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>2 × 3</td>
<td>60</td>
<td>600</td>
</tr>
<tr>
<td>4 × 3</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>8 × 3</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>5 × 3</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

R648 ÷ 3 = R200 + R10 + R5 + R1 = R216

**Notes on questions**
Questions 1, 4 and 5 involve equal sharing, and questions 2, 3 and 6 involve grouping.

**Answers**
1. R216 ($\square \times 3 = R648$) 2. 162 pears
3. 108 lemons 4. R129, or R129.60 if they have access to change.
5. R81 6. 64 pies (with R8 change)
Answers
7. R73, or R73.40 if they have access to change.
8. 45 tins of juice

10.4 Use multiplication facts to solve problems

Teaching guidelines
Learners may have some good ideas of their own about finding out how many peaches at R3 each one can buy with R776. Put this question to them at the beginning of the lesson, before they start working on question 1, to allow them to activate their own ideas. Take feedback on their approaches to solving the problem. This will also ensure that they understand the situation and the question when they work on question 1.

Question 1 is critically important. It introduces learners to dividing by building up the total in steps, using known multiplication facts.

Use the second tinted passage on page 206 to explain how to work out how many peaches of R3 each you can buy for R776. You can use this in conjunction with the method outlined in Section 10.3. Learners can use this method for the rest of the questions in this section.

Aim to complete this section in $1 \frac{1}{4}$ hour. One possibility is to use
- question 1 and the second tinted passage for concept development,
- questions 2, 3, 5, 7, 8(a), (b), (g) and (h), 10, 12 and 13 for classwork, and
- questions 4, 6, 8(c), (d), (e), (f), (i) and (j), 9(a) and (b), 15 and 16 for additional practice.

Note: Questions 11 and 14 are challenging questions; not all learners need to do them. You could decide to do question 14 in Term 4 Unit 6: Whole numbers: Division.

Answers
1. (a) 600; 300
   (b) Yes, because 200 × R3 is R600, which is less than R776.
   (c) No, because R600 + R300 = R900, which is more than R776.
   (d) Yes, because 50 × R3 is half of 100 × R3 = R150. R600 + R150 = R750, which is R26 less than R776.
   (e) 8 peaches. Because 8 × R3 = R24. R24 + R750 = R774. You will have R2 left.
2. 116 tins of juice
3. R116 (using the information from question 2)
Notes on questions
In questions 8(d) and (i) the hundreds part, the tens part and the units part are all divisible by the divider without leaving a remainder. In such questions it may be more efficient to break numbers down into place value parts and divide each part separately.

Note: From question 4 onwards, learners should multiply out to check answers.

Answers
4. 34 bags

\[
\begin{align*}
34 \times 4 &= 136 \\
1 \times 4 &= 4 \\
10 \times 4 &= 40 \\
= 120 + 16 \\
2 \times 4 &= 8 \\
20 \times 4 &= 80 \\
= 136 \\
4 \times 4 &= 16 \\
40 \times 4 &= 160 \\
8 \times 4 &= 32 \\
80 \times 4 &= 320 \\
5 \times 4 &= 20 \\
50 \times 4 &= 200
\end{align*}
\]

5. 119 loaves

\[
\begin{align*}
1 \times 8 &= 8 \\
10 \times 8 &= 80 \\
100 \times 8 &= 800 \\
2 \times 8 &= 16 \\
20 \times 8 &= 160 \\
200 \times 8 &= 1600 \\
4 \times 8 &= 32 \\
40 \times 8 &= 320 \\
8 \times 8 &= 64 \\
80 \times 8 &= 640 \\
5 \times 8 &= 40 \\
50 \times 8 &= 400
\end{align*}
\]

6. 16 tables Use the clue board of easy multiples in question 5 above.

7. 24 rows

\[
\begin{align*}
1 \times 7 &= 7 \\
10 \times 7 &= 70 \\
100 \times 7 &= 700 \\
2 \times 7 &= 14 \\
20 \times 7 &= 140 \\
200 \times 7 &= 1400 \\
4 \times 7 &= 28 \\
40 \times 7 &= 280 \\
8 \times 7 &= 56 \\
80 \times 7 &= 560 \\
5 \times 7 &= 35 \\
50 \times 7 &= 350
\end{align*}
\]

8. (a) 34 Use the clue board of easy multiples of 8 in question 5 above.
Answers (continued)

8. (b) 119

\[
\begin{align*}
1 \times 6 &= 6 & 10 \times 6 &= 60 & 100 \times 6 &= 600 \\
2 \times 6 &= 12 & 20 \times 6 &= 120 & 200 \times 6 &= 1200 \\
4 \times 6 &= 24 & 40 \times 6 &= 240 & \\
8 \times 6 &= 48 & 80 \times 6 &= 480 & \\
5 \times 6 &= 30 & 50 \times 6 &= 300 & \\
\end{align*}
\]

(c) 36  Use the clue board of easy multiples of 7 in question 7 above.

(d) 48

Learners can divide each place value part by 5. 240 = 200 + 40. 200 ÷ 5 is the same as \( \square \times 5 = 200 \). \( \square = 40 \). 40 ÷ 5 is the same as \( \square \times 5 = 40 \). \( \square = 8 \). So 240 ÷ 5 = 48

(e) 73

\[
\begin{align*}
1 \times 5 &= 5 & 10 \times 5 &= 50 & 100 \times 5 &= 500 \\
2 \times 5 &= 10 & 20 \times 5 &= 100 & 200 \times 5 &= 1000 \\
4 \times 5 &= 20 & 40 \times 5 &= 200 & \\
8 \times 5 &= 40 & 80 \times 5 &= 400 & \\
5 \times 5 &= 25 & 50 \times 5 &= 250 & \\
\end{align*}
\]

(f) 121  Use the clue board of easy multiples of 5 in (e) above.

(g) 238  Draw a clue board of easy multiples of 3.

(h) 72  Use the clue board of easy multiples of 7 in question 7 above.

(i) 50

Learners can divide each place value part by 5. 250 = 200 + 50. 200 ÷ 5 is the same as \( \square \times 5 = 200 \). \( \square = 40 \). 50 ÷ 5 is the same as \( \square \times 5 = 50 \). \( \square = 10 \). So 250 ÷ 5 = 50

(j) 250  Use the clue board of easy multiples of 3 in (g) above.

9. (a) 22 beads  Draw a clue board of easy multiples of 9.

(b) 34 rows  Use the clue board of easy multiples of 7 in question 7 above.

10. 86 trees  Use the clue board of easy multiples of 8 in question 5 above.

11. Answers on next page.
11. (a) 36
   There is an equal number of groups of red and blue beads. 72 blue beads = □ groups of 6 blue beads. That is 12 groups. 12 groups of 3 red beads = 36.

   (b) 540
   There is an equal number of groups of red and blue beads. 270 red beads = □ groups of 3 red beads. That is 90 groups. 90 groups of 6 blue beads = 540.

12. (a) 17 rows    (b) 18 rows

13. (a) R18    (b) 27 spoons

Note about question 14
In this question learners can use the strategies of factorising and seeing which answers they have already worked out (e.g. the clue boards). Note that it is a challenging question. It could be extension work for faster learners.

Another possibility is to let learners work in pairs or in small groups (not more than four learners). You could ask them to find at least two ways (instead of “all the possible answers”) but challenge them to see how many ways they can find. Remind learners how to break numbers down into factors (see the “Teaching guidelines” for question 4 in Section 10.1 earlier in this unit).

14. (a) □ × □ × □ = 288. Lists of three numbers that will give the answer 288 when multiplied, for example 1 × 2 × 144 = 288, 2 × 3 × 48 = 288, 3 × 8 × 12 = 288, etc.

   \[
   \begin{array}{ccc}
   1 & 2 & 144 \\
   1 & 3 & 96 \\
   1 & 4 & 72 \\
   1 & 6 & 48 \\
   1 & 8 & 36 \\
   1 & 9 & 32 \\
   1 & 12 & 24 \\
   1 & 18 & 16 \\
   \end{array}
   \begin{array}{ccc}
   2 & 3 & 48 \\
   2 & 4 & 36 \\
   2 & 6 & 24 \\
   2 & 8 & 18 \\
   2 & 9 & 16 \\
   \end{array}
   \begin{array}{ccc}
   3 & 4 & 24 \\
   3 & 6 & 16 \\
   3 & 8 & 12 \\
   \end{array}
   \begin{array}{ccc}
   4 & 6 & 12 \\
   4 & 8 & 9 \\
   \end{array}
   \]

   (b) Consider learners’ plans. A sample explanation is given below.
   Divide 288 by one of its factors. Then divide the answer you get by another of its factors. Example: \( 288 \div 2 = 144 \) and \( 144 \div 4 = 36 \)
   So \( 36 \times 4 = 144 \times 2 = 288 \)
   Carla could have multiplied the numbers 2 and 12 and 144.

15. 112 bags

16. Each child will get 16 coins, and 2 coins will remain.
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**CAPS time allocation**
5 hours

**CAPS page references**
16 and 91

**Mathematical background**
Like whole numbers, fractions can be represented by number names as well as number symbols.

*Twenty-three* is the number name and 23 the number symbol for a certain number. Similarly, *three eighths* or *3 eighths* is the number name and \( \frac{3}{8} \) the number symbol for a certain number.

The correct way to read a number symbol aloud is to say and think the number name. For example, 723 should be read as *seven hundred and twenty-three*, and not as “seven two three”. Similarly, the number symbol \( \frac{3}{8} \) should be read as *three eighths* and not as “three over eight”.

The widespread practice of referring to a fraction as “a number over another number” should be strictly avoided and strongly discouraged whenever it appears. The language a person uses often strongly influences his/her thinking. Learners who consistently refer to fractions incorrectly, who, for example, refer to or think of \( \frac{2}{3} \) as “2 over 3” and \( \frac{4}{5} \) as “4 over 5”, easily end up believing that \( \frac{2}{3} + \frac{4}{5} = \frac{6}{8} \) because 2 + 4 = 6 and 3 + 5 = 8.

Worse, such learners may not even realise that \( \frac{2}{3} \) represents 2 thirds (more than half) and \( \frac{4}{5} \) represents 4 fifths (also more than half), hence \( \frac{2}{3} + \frac{4}{5} \) is more than 1, and \( \frac{6}{8} \) is a ridiculous answer for \( \frac{2}{3} + \frac{4}{5} \).
1.1 Compare fractions

Teaching guidelines
This section is three pages long, but much of the space is taken up by illustrations. Aim to complete it in 1 hour.

Consolidate the fraction name related to different equal parts of different loaves, i.e. thirds, fifths, sixths and tenths. Also ask learners how many half loaves, quarter loaves, thirds of a loaf, fifths of a loaf, etc. make a whole loaf.

Notes on questions
Learners should place the models of the bread cut into pieces next to each other when comparing fraction pieces. For example in question 2(b), if the loaves cut into sixths and fifths respectively are put next to each other you can see the answer.

Answers
1. one third
2. (a) 1 sixth (b) 3 sixths (c) 1 third
   (d) equal (e) equal (f) equal
3. (a) 5 tenths (b) 3 fifths (c) 8 eighths (d) 4 eighths

1. Which is more, one third of a loaf or one fifth of a loaf?
2. In each case state which is more.
   (a) 1 sixth or 1 tenth of a loaf (b) 2 fifths or 3 sixths of a loaf
   (c) 1 third or 1 quarter of a loaf (d) 2 sixths or 1 third of a loaf
   (e) 4 fifths or 8 tenths of a loaf (f) 3 thirds or 5 fifths of a loaf
3. (a) Willem eats 5 tenths of a loaf of bread. What part of the loaf is left over?
   (b) Moshanke eats 2 fifths of a loaf of bread. What part of the loaf is left over?
   (c) How many eighths make up a whole loaf?
   (d) How many eighths make up a half of a loaf?
Critical knowledge
Learners need to know that fractions are equal-sized subdivisions. They need to be able to name different fraction parts, and to know that one whole is 2 halves, 3 thirds, 4 quarters, 5 fifths, 6 sixths, 7 sevenths, 8 eighths, 10 tenths, etc.

Mathematical notes
The images and models of the loaves of bread on page 211 are now translated into fraction bars.

In Grade 4 learners are not expected to learn arithmetic rules and procedures for how to add or subtract fractions, how to make equivalent fractions or how to divide wholes into fraction parts. The expectation is rather that learners work with apparatus, diagrams and visual images. This is reflected in the structure of this unit and the solutions modelled in this unit.

Fraction walls are introduced in Section 1.6 on page 222. These are useful tools for visually comparing fractions. However, many Grade 4 learners are confused when given a printed fraction wall with fraction bars showing many different fractions, such as the one alongside. For this reason this kind of fraction wall is only introduced in the Grade 5 Learner Book. In Grade 4 learners are first exposed to loaves of bread cut into different fraction pieces. This image is then translated into fraction bars and fraction measuring strips (rulers). Learners are only introduced to a mini fraction wall towards the end of this unit.

Teaching guidelines
Learners are instructed to draw fraction strips. Encourage them to work quickly but neatly when making the drawings. While it is important that learners think about dividing each bar into equal-size parts (whether quarters, fifths, sixths, etc.), there is no need for their drawings to be 100% accurate. It is not necessary for learners to use a ruler, measure the size of each part or make the lines 100% straight. In fact, it is better if learners do the drawings freehand.

Answers
4. (a) to (d)
Observe whether learners are able to follow instructions given to produce drawings like those in the Learner Book. Note that the rectangles drawn should be about the same length.
Notes on questions

In questions 6(a) and 7(a) and (b) learners compare fractions that are one fraction part less than 1 whole, i.e. 2 thirds, 4 fifths, 5 sixths, 6 sevenths, 3 quarters. It might be more obvious to learners that 1 third is bigger than 1 fifth than that 2 thirds is smaller than 4 fifths. You can help learners to think by how much each fraction is less than 1, for example 2 thirds is 1 third less than 1; 4 fifths is 1 fifth less than 1.

Answers

5. (a) At this point, learners should have a drawing like the one shown alongside.

(b) 10 equal parts; 1 tenth

(c) At this point learners should have a drawing such as the one in question 5(c) of the Learner Book, and shown alongside.

(d) a quarter

(e) an eighth

(f) 8 tenths

(g) 8 eighths

6. (a) 4 fifths

(b) 4 fifths

(c) 2 sixths

7. (a) 7 eighths

(b) 5 sixths

8. (a) 3 sevenths

(b) 3 fifths

(c) 5 sevenths
1.2 Measure with fractions

Mathematical notes
This section builds on all the work done previously on fractions, but takes a similar format to Term 2 Unit 3 Section 3.4, pages 144 to 146.

Teaching guidelines
You can use question 1 to assess whether learners can identify and name fractions.
You can use question 2 and the tinted passage on page 215 for the concept development part of the lesson. Learners can do questions 3, 4, 5(a) and (b), and 6(a) and (b) as classwork. Questions 5(c) to (f) and 6(c) to (f) can be used for additional practice. It may be easier for learners to work with the larger copy of the measuring sticks in the Addendum (pages 454).
Aim to complete this section in 1 hour.

Notes on questions
From question 2 onwards, the ribbons have a whole part and a fraction part.

Answers
2. (a) Yes (b) 2 eighths (c) 4 eighths (d) 8 eighths
3. (a) 2 and 3 fifths of a stick long or 2 and 6 tenths of a stick long (b) 3 fifths
4. (a) A ribbon that is 2 and 7 tenths of a stick long (b) 4 tenths (c) 5 eighths
1.3 Equivalent fractions

**Mathematical notes**
Equivalent fractions are fractions that have different names and look different (the way they are written, the way they are represented in diagrams or objects) but have the same value. For example, 1 half and 3 sixths may look different but they have the same value.

**Notes on questions**
In question 1 the grey bar represents one whole. Each green bar also represents one whole (the different green bars are divided into different fractions). This means that the blue ribbon is more than 1.

**Teaching guidelines**
You can use question 1, including the diagrams and the information next to the summary bar, as the concept development part of the lesson. Aim to complete this section in 1 hour.

**Answers**

1. ten sixths or \( \frac{10}{6} \) or \( 1 \frac{4}{6} \)

5. (a) \( \frac{1}{5} \)  (b) \( \frac{3}{4} \)
   (c) \( \frac{4}{5} \)  (d) \( \frac{2}{7} \)
   (e) \( \frac{2}{10} \)  (f) \( \frac{7}{8} \)

6. (a) five sixths  (b) one third
   (c) five sevenths  (d) four eighths
   (e) five eighths  (f) nine tenths

6. Write the following numbers in fraction notation:
   (a) one fifth  (b) three quarters
   (c) four sixths  (d) two thirds
   (e) nine tenths  (f) seven eighths

5. Write the following numbers in fraction notation:
   (a) one half  (b) one third
   (c) five sevenths  (d) four eighths
   (e) five eighths  (f) nine tenths

A short way to write **one half** is \( \frac{1}{2} \).
This way of writing is called the **fraction notation**.
The fraction notation for **two sevenths** is \( \frac{2}{7} \).
The fraction notation for **one quarter** or **one fourth** is \( \frac{1}{4} \).
The fraction notation for **five sixths** is \( \frac{5}{6} \).
Teaching guidelines
In Grade 4 learners are not expected to learn arithmetic rules and procedures for how to make equivalent fractions. The expectation is rather that learners work with apparatus, diagrams and visual images. Learners should use the diagrams at the top of page 216 to answer questions 2 and 3; the diagram at the top of page 214 to answer question 4 and the fraction wall at the top of page 223 to answer question 5.

If you have access to a photocopier you can copy the diagrams on pages 214, 216 and 223 for learners to use (also see Addendum pages 454 to 456). Let them write the names of the fraction parts next to each strip. If you don’t have a photocopier, let one learner have their book open to page 214 and another learner to page 216 and later page 223.

Learners could do questions 4(b), (d) and (f), and 5(b) for additional practice.

Mathematical notes
We often compare fractions of the same size wholes. Sometimes we compare fractions of different size wholes, as in question 6.

Answers
2. (a) Not equivalent (use Diagram A) (b) Not equivalent (use Diagram A)
   (c) Equivalent (use Diagram A) (d) Equivalent (use Diagram F)
   (e) Equivalent (use Diagram D) (f) Not equivalent (use Diagram C)
   (g) Not equivalent (use Diagram E) (h) Not equivalent (use Diagram G)
   (i) Equivalent (use Diagram C)

3. None. In all cases the first fraction is smaller than or equivalent to the second fraction.

4. (a) \[
\frac{2}{3}\div\frac{4}{5}
\]  (b) \[
\frac{6}{8}\div\frac{5}{6}
\]  (c) \[
\frac{3}{8}\div\frac{5}{7}
\]
   (d) \[
\frac{3}{5}\div\frac{4}{5}
\]  (e) \[
\frac{2}{3}\div\frac{7}{3}
\]  (f) \[
\frac{5}{8}\div\frac{4}{3}
\]

5. (a) Any three of the following: \[
\frac{2}{4},\frac{3}{6},\frac{4}{8},\frac{5}{10}
\]
   (b) Any of the three alongside.

6. 3 fifths of the blue ribbon
1.4 Calculate with fractions

**Teaching guidelines**

Learners can use diagrams and/or counting in fractions to calculate the answers to questions 1, 2, 3 and 4. In question 5 they can use fraction bars and colour in pieces as they add. In questions 6 and 7 they can draw pictures and use the relationship between fractions and division.

**Possible misconceptions**

In question 5 and similar questions, when learners do not have a good fraction concept they sometimes add both numerator and denominator. For example, in question 5(a) a learner may mistakenly write \( \frac{2}{8} + \frac{4}{8} = \frac{6}{16} \). If learners make this mistake, ask them to draw a fraction bar with eighths and to colour in as they add. They can also change the symbols to words and add 2 eighths plus 4 eighths to see that it gives 6 eighths.

**Notes on questions**

Question 4 is more challenging as learners must first find the fraction of rope that is left over, i.e. 4 sevenths. Then they can work out what 1 seventh of 140 cm is, i.e. 140 cm \( \div 7 = 20 \) cm, and then multiply 20 cm \( \times 4 = 80 \) cm to get 4 sevenths of the rope.

In question 6 learners can draw the 12 sweets, and then for (a) and (b) make 3 groups from 12, for (c) make 4 groups from 12, and for (d) make 6 groups from 12.

**Answers**

1. 5 eighths. Learners could draw a fraction strip to show eighths and colour and count each part – see the diagram alongside.
2. (a) 10 tenths of a metre, or 1 metre  (b) 7 eighths of a metre  (c) 1 and 2 quarters of a metre; 1\( \frac{1}{2} \) metres  (d) 2 and 4 fifths of a metre
3. 7 sevenths of a metre = 1 metre 4. 80 cm (1 seventh is 20 cm, so 4 sevenths is 80 cm)
4. (a) \( \frac{6}{8} \)  (b) \( \frac{8}{6} \)  (c) \( \frac{4}{5} \)  (d) \( \frac{5}{10} \)
5. (a) 4 sweets  (b) 4 sweets  (c) 3 sweets  (d) 2 sweets
6. Accept any of the following: (a) \( \frac{10}{30} \), 10 thirtieths, \( \frac{1}{3} \), 1 third  (b) \( \frac{20}{30} \), 20 thirtieths, \( \frac{2}{3} \), 2 thirds  (c) \( \frac{5}{30} \), 5 thirtieths, \( \frac{1}{6} \), 1 sixth
Teaching guidelines

One way to organise your lesson is to let learners do questions 8(a), (b) and (f), 9, 10(a) and 11(a) and (e) as classwork. Questions 8(c) to (e), 10(b), 11(b) to (d), and question 12 can be used for additional practice.

Possible misconceptions

When learners do not have a good fraction concept, they sometimes add both numerator and denominator. In question 11, let learners count in the fraction units to get to the answers.

Notes on questions

Question 9 could be a challenge. Learners need to work out the whole if 1 fifth is 7. One way to do this is to make five groups and first place 7 in one group and then place 7 in each of the other 4 groups. This allows them to see that the class must have $5 \times 7 = 35$ learners.

In question 11 learners can simply count in the fraction unit.

In questions 8 and 10 learners can draw the objects and make groups. These questions link fractions and division.

In question 8 learners need to realise that one fifth means one out of 5 groups, one third means one out of 3 groups, etc. Two sample solutions are provided below:

8. (a) If you divide 30 biscuits into 5 groups, each group is 1 fifth of the biscuits. Each fifth is 6 biscuits.
   (f) If you divide 20 chocolates into 5 groups, each group is 1 fifth of the chocolates. One fifth is 4 chocolates. Two fifths is 8 chocolates.

Answers

8. (a) 6 biscuits  (b) 12 marbles  (c) 10 children  (d) 4 minutes  (e) 4 eggs  (f) 8 chocolates

9. 35 learners

10. (a) 1 quarter or $\frac{1}{4}$  (b) 1 third or $\frac{1}{3}$

11. (a) $\frac{3}{3} = 1$  (b) $\frac{5}{6}$  (c) $\frac{5}{7}$  (d) $\frac{6}{6} = 1$  (e) $\frac{8}{4} = 2$

12. (a) 4 eighths  (b) 3 eighths  (c) 1 eighth
1.5 Fraction parts

**Teaching guidelines**
This is a long section. Aim to complete it in 1 hour. One possibility is to use
- questions 1, 2(d), 3(a), 4, 8 and 10 for concept development,
- questions 2(a) to (c), 3(b) and (c), 5, 7, 9 and 11 for classwork, and
- questions 2(e) to (g), 3(d) to (f) and 6 for additional practice.

You can use the tinted passage on page 219 to introduce this lesson. You can ask learners to
count how many rectangles the bar is divided into, and then ask them what fraction of the
bar is red and what fraction is yellow.

Then draw their attention to the red lines that divide the bar. Ask learners into how
many sections do the red lines divide the bar. Ask what fraction each of these divisions is.
Then ask how many quarters are red and how many quarters are yellow. Use this to explain
that 3 quarters is equivalent to 6 eighths, and that 1 quarter is equivalent to 2 eighths.

**Notes on questions**
The bar in question 2(d) has the same proportion of red and yellow as the bar in question
2(c). Although it does not have the same division lines, the same fraction parts are red and
yellow.

**Answers**

1. (a) Yes  
(b) 6 eighths  
(c) 2 eighths

2. (a) five sevenths; \(\frac{5}{7}\)  
(b) four sixths; \(\frac{4}{6}\)  
(c) four sixths; \(\frac{4}{6}\)  
(d) four sixths; \(\frac{4}{6}\)  
(e) three fifths; \(\frac{3}{5}\)  
(f) three fifths; \(\frac{3}{5}\)  
(g) six tenths; \(\frac{6}{10}\)
Notes on questions
In question 3 on page 220 and questions 10 and 11 on page 221, string or rope is placed against different kinds of rulers. These help learners to make a transition from understanding fractions as bars or strips to understanding fractions on a number line. In Term 4 Unit 5 learners work with fractions on a number line.

In questions 4, 5 and 6 learners need to link division with making fraction parts.

Teaching guidelines
In question 3, focus learners’ attention on counting how many “spaces” each piece of string is divided into. Then ask learners how many of these “spaces” are green parts of the string and how many are red parts of the string.

In question 5 learners could use a combination of drawings and division, as it may be too time-consuming to draw 60 apples.

60 apples packed into 5 boxes \( \rightarrow \) 60 apples ÷ 5 = 12 apples

(a) Each box represents \( \frac{1}{5} \) of the whole.
(b) There will be 12 apples in each box.

Answers
3. (a) five sixths; \( \frac{5}{6} \) (b) four eighths; \( \frac{4}{8} \)
   (c) four eighths; \( \frac{4}{8} \) (d) three sevenths; \( \frac{3}{7} \)
   (e) three sixths; \( \frac{3}{6} \) (f) three tenths; \( \frac{3}{10} \)
4. (a) 24 ÷ 6 = 4 people (b) 4 litres
5. (a) one fifth; \( \frac{1}{5} \) (b) 12 apples
6. (a) 8 people (b) one eighth; \( \frac{1}{8} \)

3. What part of each piece of string is red? Write your answers in words and in fraction notation.

(a) \[ \text{Answer: } \frac{4}{6} \text{ or four sixths} \]
(b) \[ \text{Answer: } \frac{3}{8} \text{ or three eighths} \]
(c) \[ \text{Answer: } \frac{7}{5} \text{ or seven fifths} \]
(d) \[ \text{Answer: } \frac{1}{2} \text{ or one half} \]
(e) \[ \text{Answer: } \frac{3}{10} \text{ or three tenths} \]
(f) \[ \text{Answer: } \frac{2}{3} \text{ or two thirds} \]

4. 24 \( \ell \) of water is shared equally between a number of people. Each person gets one sixth of the water.
   (a) How many people share the water?
   (b) How much water does each person get?
5. 60 apples are packed into 5 boxes. The same number of apples are put into each box.
   (a) What fraction of the apples is put into each box?
   (b) How many apples are put into each box?
6. R40 is divided equally between a number of people. Each person gets R5.
   (a) How many people share the money?
   (b) What fraction of the money does each person get?
Notes on questions
These questions are challenging. Learners will need substantial time and some learners may need individual support.
There is a strong focus on the relationship between fractions and division.

Teaching guidelines
Learners might find questions 10 and 11 easier than questions 7, 8 and 9, partly because they provide visual support. You could start with questions 10 and 11.
Grade 4 learners are not expected to learn how to simplify fractions by “cancelling”. Instead they could use the connection between division and fractions.
Encourage learners to ask: “What do I already know that can help me here?” This will help them to link different sub-sections of questions, link previous questions with later questions, and link different parts of mathematics.
In questions 8(c) and 9(a) and (b) learners need to recognise what the whole is. For example, in question 8(c) the whole is 700 g, in question 9(a) the whole is 800 kg, in question 9(b) the whole is 200 kg.

Answers
7. (a) $2 \times 8 \text{ kg} = 16 \text{ kg}$
(b) one eighth; $\frac{1}{8}$ (because there are 8 equal portions)
8. (a) 700
(b) 140 (Learners are expected to realise that $140 + 140 + 140 + 140 + 140$ is five equal groups of 140, so each group is 1 fifth.)
(c) Learners need to recognise that you could divide the total amount of flour, i.e. 560 g + 140 g = 700 g by the amount of white bread flour, i.e. 140 g. Once learners see that the total amount of flour is 700 g they should recognise from 8(b) that 140 g is one fifth ($\frac{1}{5}$). If not, learners can find how many portions of 140 g you get in 700 g by dividing $700 \div 140 = 5$. So 140 g is one part out of five, or 1 fifth ($\frac{1}{5}$).
9. (a) Altogether the mixture is 200 kg + 600 kg = 800 kg. Some learners may recognise that there are 4 lots of 200 kg in 800 kg; if not, they can divide $800 \div 200 = 4$. So 200 g is one part of 4 parts, or one quarter ($\frac{1}{4}$).
(b) The total mass of the mixture is 200 kg. 200 kg $\div$ 25 kg = 8. So 25 kg is one eighth ($\frac{1}{8}$) of 200 kg.
10. Learners could take a number of approaches here.

They can convert the millimetres to centimetres and think of the green part as 2 cm out of 8 cm, or two eighths ($\frac{2}{8}$).

They can think of the ruler as a number line and ask: “How many 20 mm in 80 mm?”

There are four 20s in 80, so 20 mm is one quarter ($\frac{1}{4}$) of 80 mm.

11. (a) The green part is 15 mm out of 60 mm. There are 4 groups of 15 in 60. 15 mm is a quarter ($\frac{1}{4}$) of 60 mm.

(b) The green part of the rope is 25 mm out of 100 mm. There are four 25s in 100. You can show this on a number line.

You could also simply divide $100 \div 25 = 4$. So 25 mm is one out of 4 parts. The green part of the rope is $\frac{1}{4}$ of the length of the rope.

(c) There are three 30s in 90. So 30 mm is $\frac{1}{3}$ of 90 mm.

(d) Here learners can convert millimetres to centimetres.

The green part is 3 cm out of 8 cm. This is $\frac{3}{8}$ of the length of the rope.
1.6 Compare fractions

Notes on questions

Questions 1 and 2 are revision of diagrammatic representation of fractions. The aim is that they help to prepare learners to compare fractions in the later questions.

Question 9 deals with fractions of collections of objects. Show learners how to use diagrams and the relationship between division and fractions to make sense of the sub-questions. Worked solutions using this approach are provided alongside question 9 in this guide.

Teaching young learners rules to find fractions of collections generally confuses them and often makes them fearful of fractions as a topic. The curriculum does not require the teaching of rules to do calculations with fractions in Grade 4.

Question 10 is a challenge. Learners need to construct their own diagrams. Perhaps not all learners need to attempt this question or all parts of this question.

Teaching guidelines

This is a long unit. If you run out of time, you can defer Section 1.6 until the fourth term.

In question 1 learners should be kept focused on the fact that fractions are equal divisions, for example quarters are 4 equal parts, sevenths are 7 equal parts, etc. However, their drawings do not need to be 100% accurate. So learners should work neatly but quickly and not worry about using a ruler to measure or draw the lines.

In question 2 learners should refer to the fraction wall they have drawn to get their answers.

Answers

1. Practical preparation of a fraction wall
2. 4 sevenths; 3 fifths; 5 eighths; 3 quarters
Teaching guidelines

Grade 4 learners are not expected to use formulae or arithmetic procedures to find equivalent fractions. They are expected to use diagrams as an aid to identifying equivalent fractions.

Learners should use the fraction wall on page 223 (or the larger copy in the Addendum on page 456) to answer questions 3 to 8. In order to find equivalent fractions or to compare fractions, they can place a ruler or anything with a straight edge against the end of one of the fraction parts and read off which fractions are equivalent, or whether the fraction they are comparing to is more or less than the one against which the ruler is placed. For example, in the diagram alongside a piece of paper is placed against 1 half. This allows learners to see that 1 half is equal to 2 quarters, 4 eighths, 3 sixths and 5 tenths.

Answers

3. Learners use the accurate fraction wall to check their answer to question 2.
4. (a) $\frac{3}{6}$  (b) three quarters  (c) equal  (d) seven eighths
   (e) $\frac{2}{5}$  (f) equal  (g) $\frac{2}{3}$  (h) two thirds
5. (a) $\frac{3}{8}$; $\frac{1}{2}$; $\frac{5}{4}$; $\frac{3}{4}$  (b) $\frac{3}{7}$; $\frac{3}{6}$; $\frac{3}{3}$; $\frac{3}{4}$  (c) $\frac{3}{4}$; $\frac{2}{6}$; $\frac{2}{5}$  (d) $\frac{2}{7}$; $\frac{2}{6}$; $\frac{3}{8}$; $\frac{3}{7}$
6. (a) Yes  (b) $\frac{4}{5}$
7. (a) $\frac{4}{6}$  (b) $\frac{2}{6}$  (c) $\frac{2}{8}$  (d) $\frac{1}{2}$ or $\frac{4}{8}$ or $\frac{3}{6}$ or $\frac{5}{10}$
8. Any three of: $\frac{2}{4}$; $\frac{4}{8}$; $\frac{3}{6}$; $\frac{5}{10}$

Mathematical notes

In Section 1.4 learners started working with fractions of collections of objects such as sweets, marbles, biscuits, children in a class, eggs in a tray and cattle in a herd. In question 9 on page 224 learners continue to work with fractions of collections of objects. This is further extended in Term 4 Unit 5. You may like to read Term 4 Unit 5 before you teach question 9.

In question 9 learners work with beads arranged in rows and columns to form an array. Learners have worked with arrays when doing multiplication and division. In question 9 they link taking a fraction of a collection of objects with division and multiplication.
**Teaching guidelines**

You can introduce question 9 by focusing learners’ attention on the rows and columns. Ask: “How many rows of beads are there in the picture?”, “How many columns of beads are there in the picture?”, “How many beads are there altogether?”, “What fraction is one row of the beads?”, “What fraction is two rows of the beads?”, “What fraction is three rows of the beads?”, “What fraction is four rows of the beads?”, “What fraction is five rows of the beads?”.

Then turn the question around and ask: “How many beads is \( \frac{1}{5} \) of the beads, \( \frac{2}{5} \) of the beads?”, etc. Each row is 1 out of 5 rows, or 1 fifth of the beads. So \( \frac{1}{5} \) of the beads is 8 beads.

Repeat this for the columns. Each column is 1 out of 8 columns, or 1 eighth of the beads.

Learners can use division to work out the unit fraction, i.e. \( \frac{1}{5} \), \( \frac{1}{8} \), \( \frac{1}{4} \), and then multiply to get the other fractions required.

**Answers**

9. (a) \( \frac{1}{8} \) of 40 beads = 5 beads (1 column of beads in the picture/array)

(b) \( \frac{3}{8} \) of 40 beads = \( 3 \times 5 \) beads = 15 beads (3 columns of beads in the picture)

(c) \( \frac{3}{5} \) of 40 beads = \( 3 \times \frac{1}{5} \) of the beads = \( 3 \times 8 \) beads = 24 beads (3 rows of beads)

(d) \( \frac{3}{4} \) of 40 beads, i.e. 24 beads, is 9 more beads than \( \frac{3}{5} \) of 40 beads, i.e. 15 beads.

(e) \( \frac{5}{8} \) of 40 beads = \( 5 \times 5 \) beads = 25 beads. \( \frac{5}{8} \) of 40 beads is more than \( \frac{3}{2} \) of 40 beads (24 beads). \( \frac{1}{2} \) of 40 beads is 1 more bead than \( \frac{3}{2} \) of 40 beads.

(f) \( \frac{1}{4} \) of 40 beads = 10 beads. \( \frac{3}{4} \) of 40 beads = \( 3 \times 10 \) beads = 30 beads. \( \frac{5}{8} \) of 40 beads = \( 5 \times 5 \) = 25 beads.

\( \frac{3}{4} \) of 40 beads is more than \( \frac{5}{8} \) of 40 beads.

\( \frac{3}{4} \) of 40 beads is 5 more beads than \( \frac{5}{8} \) of 40 beads.
Notes on questions

Question 10 is a challenge. Perhaps it is not necessary for all learners to attempt this question or all sub-sections of this question.

A diagram of the 80 beads is not provided in the Learner Book. You could alert learners to the fact that 80 beads are double 40 beads, and encourage them to use this when they do their drawing and also when they do the calculations.

It is useful for learners to first work out a unit fraction of the collections, for example $\frac{1}{8}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{3}$ and then to multiply to get other fractions, for example $\frac{3}{8}$, $\frac{6}{5}$, $\frac{2}{3}$.

In 10(d) and (e) learners might not want to draw the collections of 120, 90 and 150 beads. They could instead use the relationship between division and fractions to find unit fractions and then multiply as needed. In question 10(d) they can also use the fact that 120 is $3 \times 40$ beads. In 10(e) they can use the fact that 150 beads is $3 \times 50$ beads.

Answers

10. (a) $\frac{3}{8}$ of 80 = 30 beads and is 15 more than $\frac{3}{8}$ of 40 beads, which is 15 beads.

Learners already know from question 9(d) above that $\frac{3}{8}$ of 40 beads = $3 \times 5$ beads = 15 beads.

Learners could draw pictures to work this out. They could draw an $8 \times 10$ array to work out what $\frac{1}{8}$ of 80 beads is (=10 beads) and multiply by 3 to get $\frac{3}{8}$ of 80 beads (= 30 beads).

Learners could also calculate as follows: $\frac{1}{8}$ of 80 = $80 \div 8 = 10$.

So $\frac{3}{8}$ of 80 beads = $3 \times 10 = 30$ beads. So $\frac{3}{8}$ of 80 beads is 15 more beads than $\frac{3}{8}$ of 40 beads.

Another approach is to say we know (from question 9(b)) that $\frac{3}{8}$ of 40 beads = 15 beads. 80 is double 40, so $\frac{3}{8}$ of 80 beads = 30 beads. So $\frac{3}{8}$ of 80 beads is 15 more beads than $\frac{3}{8}$ of 40 beads.
Answers (continued)

10. (b) Learners already know from question 9(e) that \( \frac{5}{8} \) of 40 beads = 25 beads.
   Learners can work out that \( \frac{1}{5} \) of 50 beads = 50 ÷ 5 = 10 beads, or they could draw a picture to show this. So \( \frac{3}{5} \) of 50 beads = 3 × 10 beads = 30 beads.
   So \( \frac{3}{5} \) of 50 beads is 5 more beads than \( \frac{5}{8} \) of 40 beads.

(c) Learners already know from question 9(e) that \( \frac{1}{8} \) of 40 beads = 5 beads.
   So \( \frac{7}{8} \) of 40 beads = 7 × 5 beads = 35 beads.
   \( \frac{1}{5} \) of 80 beads = 80 ÷ 5 = 16 beads. So \( \frac{4}{5} \) of 80 beads = 4 × 16 beads = 64 beads.
   So \( \frac{4}{5} \) of 80 beads is 29 more beads than \( \frac{7}{8} \) of 40 beads.

(d) \( \frac{1}{8} \) of 120 beads = 120 ÷ 8 = 15 beads. So \( \frac{5}{8} \) of 80 beads = 5 × 15 beads = 75 beads.
   \( \frac{1}{3} \) of 120 beads = 120 ÷ 3 = 40 beads. So \( \frac{2}{3} \) of 80 beads = 2 × 40 beads = 80 beads.
   So \( \frac{2}{3} \) of 120 beads is 5 more beads than \( \frac{5}{8} \) of 120 beads.

(e) \( \frac{1}{6} \) of 90 beads = 90 ÷ 6 = 15 beads. So \( \frac{5}{6} \) of 90 beads = 5 × 15 beads = 75 beads.
   \( \frac{1}{5} \) of 150 beads = 150 ÷ 5 = 30 beads. So \( \frac{4}{5} \) of 150 beads = 4 × 30 beads = 120 beads.
   So \( \frac{4}{5} \) of 150 beads is 45 more beads than \( \frac{5}{6} \) of 90 beads.
Grade 4 Term 3 Unit 2  
Capacity and volume

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**CAPS time allocation**  
6 hours

**CAPS page references**  
26 and 88 to 90

**Mathematical background**

Capacity/volume, length, mass, perimeter and area are different properties of objects. When we measure these properties of objects we are describing how much of that property they have; we are describing the property in terms of a numerical value.

When we measure the capacity of containers we are allocating a numerical value to how much that container can hold. This allows us to compare and order containers in terms of what they can hold, for example a 2 ℓ milk bottle can hold more than a 1 ℓ milk bottle. Giving numerical values to capacity/volume allows us to do calculations, for example to calculate how many 150 ml cups of juice you can pour from a 2 ℓ bottle of juice.

Learners go through four stages when learning to measure:

1. Identifying and understanding the property they are measuring. This is done with capacity in the Foundation Phase.
2. Comparing and ordering examples of a particular measure (see Section 2.1). This is done with capacity in the Foundation Phase.
3. Using informal or non-standard units to measure (see question 1 of Section 2.1). This is done with capacity in the Foundation Phase.
4. Using formal or standard units to measure (see Section 2.1 from question 2 onwards, and Sections 2.2 to 2.4). This is the focus of this unit.

Millilitres and litres are the standard units of capacity/volume for Grade 4 learners. Learners sometimes find it difficult to read formal measuring instruments calibrated in standard units (see Section 2.4).

**Resources**

This topic involves a number of practical activities for which various resources are needed. These resources are listed in the various sections.
2.1 Measure in millilitres

Mathematical notes
Learners often see containers that hold 1 ℓ, so they may have a sense of how much 1 ℓ is. However, learners seldom see 1 ml, so they have a poor sense of how much 1 ml is. Learners see 750 ml, 500 ml, 330 ml and 200 ml containers much more frequently, but may not link the capacity of the containers with the products.

Resources
Measuring or medicine teaspoons, preferable one for each group of learners.
Clay or play dough. You can find recipes for play dough on the internet.
Water, sand, salt, sugar, flour, etc.
Mugs that can hold 250 ml. (You can also cut the top off small plastic bottles that can hold more than 250 ml to make “cups” that can hold 250 ml.)
Empty 1 ℓ bottles or boxes.

Teaching guidelines
It is best to do the activities in this section practically. Since learners will be working with water (or sand, salt, sugar, flour, etc.) you might want to do the activities outside rather than in the classroom.
In all the questions in this section, let learners estimate first, then do the activity, i.e. measure. In question 1 learners can also use sand, salt, flour or water.
You can ask learners to make small cubes of clay with sides 1 cm each. This is 1 ml of clay.

Answers
1. If learners do this practically, accept any number close to 50. Learners can calculate the answer afterwards: 250 ml ÷ 5 = 50 ml, since 5 × 50 ml = 250 ml.
Teaching guidelines
It is best to do questions 2, 3 and 4 practically. As stated earlier, since learners will be working with water (or sand, salt, sugar, flour, etc.) you might want to do these activities outside rather than in the classroom.

Remind learners always to estimate first. Then they do the activity and measure.

In questions 2 and 3 learners can first make a 5 ml lump of clay (using a teaspoon as a measure). Then they can make a clay pencil. Then ask them to break the pencil up into lumps of approximately 5 ml to assess how accurate their estimate was. In question 3 learners do not have to make a model of the whole book to check their answer. They can make a model of a fraction of the book, for example $\frac{1}{8}$. Then they can work out how much clay it would take to make a model of the whole book.

In question 4 learners can pour from a 1 ℓ bottle into a 200 ml cup to check their answer. They can also use a 250 ml mug and mark off approximately $\frac{4}{5}$ of it.

Possible misconceptions
A measuring cup and a large mug hold 250 ml. Most teacups hold less than this: some hold less than 200 ml.

Answers
2. About 20 ml to 50 ml
3. About 750 ml to 1 000 ml
4. 5 glasses ($5 \times 200 \text{ ml} = 1 000 \text{ ml}$)
5. (a) Some learners may write 100 ml because they are thinking about the 200 ml glass in question 4. Some may write 125 ml because they are thinking about a 250 ml cup (see page 225). An approximate answer could be 100 ml.
   (b) Some learners may write 400 ml because they are thinking about the 200 ml glass in question 4. Some may write 500 ml because they are thinking about a 250 ml cup (page 225). Approximate answers could be 400 ml to 500 ml.
2.2 Volume and capacity

Mathematical notes
In this section learners continue to work with millilitres. They distinguish between volume and capacity.

The initial focus is on everyday objects that do not have gradation lines (also called graduation lines). Then learners read the volume of liquids in millilitres at numbered gradation lines. The capacity and shape of the measuring containers illustrated vary.

Resources
Empty 330 ml can.
Food colouring or ink.
Small glass.

Teaching guidelines
In questions 1 to 3 learners are shown a shorter, wider can that holds more than a taller, narrower glass. They are expected to read the capacity of the can, and to judge that the glass is half-filled, and then work out how much juice this is in millilitres.

You can demonstrate this situation. Bring a 330 ml can to class. Fill it with water coloured with food colouring or ink. Try to find a small glass. It does not have to be a 100 ml glass. Tell learners the capacity of the glass. Half fill the glass. Ask learners how much liquid is in the glass and how much is left in the can.

Ask learners how much juice the can in the picture can hold. Let them answer the rest of the questions on page 227.

Possible misconceptions
Young learners often think that taller containers hold more. They often do not take the width of the container into account. It is useful to let learners have repeated experience of short, wide containers that hold more than tall, thin containers. This is illustrated on pages 229 and 230.

Answers
1. About 50 ml (since it is about half of 100 ml).
2. About 280 ml (because 330 ml − 50 ml = 280 ml).
3. 3 glasses of juice, and 30 ml will be left in the tin.
Mathematical notes

“Capacity is the amount of substance that an object can hold or the amount of space inside the object.

Volume is the amount of space that an object occupies.

So a bottle can have a 1 litre capacity, but it may not be filled to its full capacity. It could for example, only contain a volume of 250 ml.”


Teaching guidelines

Here you want to teach and stress the difference between volume and capacity.

Learners can do a practical activity. You might prefer them to work outside as they will be working with water. Give each group a syringe (without a needle) filled with coloured liquid and a small bowl with a layer of coloured liquid. It is cheaper to use syringes than measuring jugs. There must be more water in the bowl than in the syringe. Ask learners which has more water. Let them check by emptying the syringe and then using it to work out how much liquid is in the bowl.

Talk with learners about what is the same and what is different about the two measuring jugs shown on page 228. Both jugs are the same size; they have the same capacity. Both jugs have the same number of gradation lines. Jug A has each gradation line numbered. On Jug B every fifth gradation line is numbered (50, 100, 150, 200). The jugs hold different amounts of juice: they have different volumes of juice.

Point out that the container at the bottom of the page also has a capacity of 200 ml.

Notes on questions

How can learners establish that the squat container at the bottom of the page has less juice than jug B? They should work out that it is half-filled. They can first estimate and then use their rulers to measure that it is 2 cm high and filled to 1 cm. So it is half-filled. Half of 200 ml is 100 ml. There is 110 ml of juice in Jug B.

Answers

4. Less or the same as in Jug B
Teaching guidelines
Here the focus is on the difference between volume and capacity. All the jugs on page 229 have the same volume of juice, but they have different capacities. If they were filled to the top mark, they would hold different amounts of liquid.

Also point out to learners that although Jug D is taller than Jug C, it has a smaller capacity.

Answers
5. Jug C: 150 ml
   Jug D: 150 ml
   Jug E: 150 ml
6. Jug C: 200 ml
   Jug D: 150 ml
   Jug E: 250 ml
Teaching guidelines
Once learners have answered questions 7 and 8, you can again point out that in this case the shorter jug has the larger capacity.

Answers
7. 250 ml
8. 200 ml
9. (a) Yes
   (b) 100 ml
10. Jug F
11. 860 ml of juice (150 ml + 110 ml + 150 ml + 150 ml + 150 ml + 150 ml)
12. Jugs A, C, D, E and G (they all contain 150 ml of juice)
13. Jugs E and F

7. What is the capacity of Jug F?
8. What is the capacity of Jug G?
9. (a) Can all the juice in Jug G be poured into Jug F?
   (b) How much more juice can be poured into Jug F?
10. Which jug is bigger,
    Jug F or Jug G?
11. How much juice is there altogether in Jugs A to G?
12. Which of the jugs contains the biggest volume of juice?
13. Which of the jugs have the biggest capacity?
2.3 Litre and millilitre

Mathematical notes
In this section learners work with the relationship between litres and millilitres. Note that while Foundation Phase learners ought to have worked with millilitres and have worked with litres, they were not expected to know the relationship between these units of measurement.

Milli means “one thousandth of”: 1 litre contains 1 000 millilitres.

Many learners leave the Intermediate Phase without a good understanding of measurement. This is reflected in the Annual National Assessments (ANAs). Proposed interventions listed include:

“Carry out practical demonstrations to show the relationship between a litre and a millilitre ... For instance the relationship between a litre and millilitres can be demonstrated by practically allowing learners to measure the same volume of water using two containers calibrated differently: one container calibrated in millilitres and the other calibrated in litres and then allow them to make conclusions.”


Teaching guidelines
Page 231 states that 1 000 ml is 1 litre. Learners easily forget this when they are only told it.

You can let learners work in groups and fill a jug calibrated in litres to the 1 ℓ mark. Then let them pour this water into a jug calibrated in millilitres. If the second jug has a capacity of 1 000 ml they will see that 1 ℓ is 1 000 ml. However, if the jug holds less than 1 000 ml, learners will have to fill it and pour out the water repeatedly while making notes of how many times they fill it. The same effect can be achieved by learners repeatedly filling a 200 ml cup or a 500 ml bottle, and pouring this into a 1 ℓ bottle.

The picture on page 231 is a visual reminder of the relationship between litres and millilitres.

Possible misconceptions
In Grade 4 learners are only expected to work with litres and millilitres. These are the units of capacity/volume that they are most likely to encounter in their daily lives. Because learners are not exposed to other units they may wrongly assume that these are the only units of capacity/volume in the metric system.
In the unit on length in this Teacher Guide (Term 2 Unit 4 Section 4.4) we showed that there are a range of units between kilometres and millimetres. A range of units also exist between kilolitres and millilitres, namely hectolitres, decalitres, litres, decilitres and centilitres. Each unit of a higher power contains 10 of the adjacent unit of a lower power.

Teaching guidelines
Here learners work with parts and fractions of litres. This helps to consolidate the relationship between litres and millilitres.

You might want to suggest that learners work in pairs. One learner keeps page 231 of their Learner Book open while the other keeps the questions on page 232 open.

Answers

1. (a) 250 ml (a quarter is half of a half; half a litre is 500 ml)
   (b) 125 ml
2. 3 quarters of a litre (Learners can estimate this off the jug on page 231, or they can add 3 quarters of a litre, i.e. 250 ml + 250 ml + 250 ml.)
3. (a) 3 000 ml  (b) 2 250 ml  (c) 3 500 ml  (d) 1 750 ml
4. 5 portions
5. (a) 500 ml (125 ml + 125 ml + 125 ml + 125 ml = 500 ml and 1 000 ml – 500 ml = 500 ml)
   (b) 4 portions
   (c) 125 ml (1 000 ml ÷ 8 = 125 ml)
      (Learners have seen in (a) that 4 × 125 ml = 500 ml, so 8 × 125 ml = 1 000 ml.
      So, 125 ml = \( \frac{1}{8} \) of 1 000 ml, or = \( \frac{1}{8} \) of 1 litre.)
   (d) 375 ml
   (e) 375 ml
   (f) 16 portions (16 eighths = 2 wholes)
Teaching guidelines
Most bits of mathematics are connected. Learners sometimes do not connect bits of information, or bits from one question with another question. This slows down their work rate, and their success rate in Mathematics.

In the questions on page 233, encourage learners to use the answers they get to help them with subsequent questions.

Answers
6. 200 (because 1 000 ml ÷ 5 ml = 200)
7. Consider and discuss learners’ estimates.
   Spoon A: 25 ml (given)
   Spoon B: about 15 ml
   Spoon C: about 10 ml
   Spoon D: about 5 ml
   Spoon E: about 2 ml
8. (a) 100 spoonfuls of 10 ml
   (Learners can use the information in question 6, and note that if there are 200 × 5 ml in 1 ℓ, then there are 100 × 10 ml in 1 1 ℓ, or they can say 1 000 ml ÷ 10 = 100 ml)
   (b) 20 spoonfuls of 10 ml (200 ml ÷ 10 ml = 20)
   (c) 25 spoonfuls of 10 ml (Using the information in (b): 20 + 5; or 250 ml ÷ 10 ml = 25)
   (d) 40 spoonfuls of 5 ml (Using the information in (b): if 20 spoonfuls of 10 ml make 200 ml, then 40 spoonfuls of 5 ml make 200 ml; or 200 ml ÷ 5 ml = 40)
   (e) 20 tablespoonfuls (300 ml ÷ 15 ml = 20)
Teaching guidelines
There are many questions here. Learners could do questions 9, 10(a), (b), (e) and (g), 11(a), (d), (e) and (h), 12(a), (c) and (e), and 13(a), (c), (e), (g) and (i) in class. The rest can be used for additional practice.

Note that in questions 13(g) to (i) and in question 14 learners will need to convert litres to millilitres, or millilitres to litres.

Answers
9. No
10. (a) 2 000 ml (b) 5 000 ml (c) 9 000 ml (d) 3 000 ml (e) 1 500 ml (f) 250 ml (g) 3 750 ml (h) 2 250 ml

11. (a) 3 ℓ (b) 8 ℓ (c) 2 1 2 ℓ (d) 1 1 2 ℓ (e) 4 1 4 ℓ (f) 3 4 ℓ (g) 6 ℓ (h) 5 1 4 ℓ

12. (a) 1 ℓ and 750 ml (b) 3 ℓ and 503 ml (c) 8 ℓ and 649 ml (d) 4 ℓ and 50 ml (e) 9 ℓ and 98 ml (f) 12 ℓ and 5 ml

13. (a) 1 ℓ and 397 ml (b) 2 ℓ and 40 ml (c) 1 ℓ and 210 ml (d) 0 ℓ and 247 ml (e) 1 ℓ and 221 ml (f) 0 ℓ and 970 ml (g) 1 ℓ and 442 ml (h) 1 ℓ and 609 ml (i) 1 ℓ and 531 ml (j) 3 ℓ and 376 ml

14. 3 ℓ and 750 ml
Teaching guidelines
There are many questions here. Learners could do questions 18 and 19 in class, and questions 15, 16 and 17 for additional practice.

Answers
15. 8 ℓ and 100 ml  \((2 \frac{1}{2} \text{ litres} + 2 \frac{1}{2} \text{ litres} + 750 \text{ ml} + 750 \text{ ml} + 750 \text{ ml} + 850 \text{ ml})\)
16. 1 ℓ and 50 ml  \((150 \text{ ml} \times 7 = 1050 \text{ ml})\)
17. 10 chocolate cakes  \((2000 \text{ ml} + 200 \text{ ml} = 10)\)
18. (a) 10 ℓ and 621 ml  
   (b) 10 ℓ and 620 ml  \((550 \text{ ml} + 6250 \text{ ml} + 3820 \text{ ml} = 10620 \text{ ml})\)
   (c) 10 ℓ and 600 ml  \((500 \text{ ml} + 6300 \text{ ml} + 3800 \text{ ml} = 10600 \text{ ml})\)
   (d) 11 ℓ  \((1 \text{ litre} + 6 \text{ litres} + 4 \text{ litres} = 11 \text{ litres})\)
   (e) The answer in (b).
   (f) Rounding off to the nearest 10 is closer to the exact calculation than rounding off to the nearest 100 or 1000.
19. (a) 1006 ℓ + 942 ml  
   (b) 4777 ℓ and 58 ml

15. On a Monday morning Katy sold milk in the farm stall. The buyers brought their own containers. She filled two containers with \(2 \frac{1}{2}\) ℓ milk each, three containers with 750 ml each and one container with 850 ml milk. How many litres + millilitres milk did she sell?
16. Peter makes milk puddings. He needs 150 ml milk for each pudding. How many litres + millilitres milk does he need for 7 puddings?
17. Jacob has 2 ℓ milk. For one chocolate cake he needs 200 ml milk. How many chocolate cakes can he bake?
18. (a) Add these volumes: 545 ml + 6253 ml + 3823 ml. Write the answer as ℓ + ml.
   (b) Round the volumes in (a) off to the nearest 10 ml. Add the rounded numbers.
   (c) Round the volumes in (a) off to the nearest 100 ml. Add the rounded numbers.
   (d) Round the volumes in (a) off to the nearest litre. Add the rounded numbers.
   (e) Which one of the three additions with rounded numbers in (b), (c) and (d) is closest to your answer in (a)?
   (f) Discuss what you can learn from your answer in (e).
19. There is 5784 ℓ water in the tank. Dadla uses 1006 ℓ to water the vegetable garden and the fruit trees. He uses another 942 ml to water a pot plant.
   (a) How much water does he use?
   (b) How much water is left in the tank? Write your answer in litres + millilitres.
2.4 Measuring and reading capacity and volume

Mathematical notes
This section helps to prepare learners to read the volume of liquids at unnumbered intervals on graduated containers.

Comments on the Grade 6 Mathematics 2013 ANAs include:
“Majority of learners could not determine the correct intervals on calibrations of a jug. From their responses it is evident that they were mainly exposed to the intervals of 10 and/or 20 and not 25.”

Proposed interventions include:
“Use a number line to enable learners to understand and determine intervals other than 10 and 20.”


Page 89 of the CAPS also encourages the use of number lines.

Possible misconceptions
Because there are 10 unnumbered intervals between each numbered interval on a ruler (10 millimetres to each centimetre), learners sometimes think that there are 10 unnumbered intervals between any numbered interval on measuring jugs and scales.

Teaching guidelines
Learners are taught to count the unnumbered intervals and then work out the value of each of these intervals.

Answers
1. Example for Container C:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
<th>1 000 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>1 ℓ</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
<td>1/10</td>
</tr>
</tbody>
</table>

2.4 Measuring and reading capacity and volume

Measuring containers are marked in different ways.

Container A is marked to show 6 equal parts. The top mark reads 3 ℓ. We can calculate what the other marks should read by dividing 3 ℓ into 6 equal parts.

3 ℓ = 3 000 ml and 3 000 ÷ 6 = 500
The lowest mark would therefore indicate 500 ml or 1/6 ℓ.

1. Use a ruler to draw the right side of Container C horizontally in your book.

Here is the line for Container C:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>500</th>
<th>1 000</th>
<th>1 500</th>
<th>2 000</th>
<th>2 500</th>
<th>3 000</th>
<th>ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1/2</td>
<td>1</td>
<td>1 1/2</td>
<td>2</td>
<td>2 2/3</td>
<td>3</td>
<td>ℓ</td>
</tr>
</tbody>
</table>

Write what each mark on your line indicates, in litres and in millilitres, as in the above example.
Teaching guidelines
Remind learners of the method shown in the tinted passage on page 236: to find the value of each unnumbered interval you count the total number of intervals and then divide it into the total capacity. For example, in question 2(a):
1 000 ml ÷ 5 = 200 ml. You can say 1 ℓ ÷ 5 = 1 5 ℓ, so each interval is 1 5 ℓ.

Question 2(f) is more complicated as the number line does not start at 0. Learners first need to subtract 400 from 2 000: 2 000 – 400 = 1 600. They then count the number of intervals, which is 8. Then they divide: 1 600 ml ÷ 8 = 200 ml.

Answers
2. (a) \(x = 200 \text{ ml} = \frac{1}{5} \ell\) 
   \(y = 400 \text{ ml} = \frac{2}{5} \ell\) 
   \(z = 600 \text{ ml} = \frac{3}{5} \ell\)
(b) \(x = 250 \text{ ml} = \frac{1}{4} \ell\) 
   \(y = 500 \text{ ml} = \frac{2}{4} \ell\) 
   \(z = 750 \text{ ml} = \frac{3}{4} \ell\)
(c) \(x = 600 \text{ ml} = \frac{6}{10} \ell\) 
   \(y = 1 200 \text{ ml} = \frac{12}{10} \ell \text{ or } 1 \frac{2}{10} \ell\) 
   \(z = 1 600 \text{ ml} = \frac{16}{10} \ell \text{ or } 1 \frac{6}{10} \ell\)
(d) \(x = 500 \text{ ml} = \frac{1}{2} \ell\) 
   \(y = 1 500 \text{ ml} = 1 \frac{1}{2} \ell\) 
   \(z = 4 500 \text{ ml} = 4 \frac{1}{2} \ell\)
(e) \(x = 250 \text{ ml} = \frac{1}{4} \ell\) 
   \(y = 750 \text{ ml} = \frac{3}{4} \ell\) 
   \(z = 1 500 \text{ ml} = 1 \frac{1}{2} \ell\)
(f) \(x = 800 \text{ ml} = \frac{8}{10} \ell \text{ or } \frac{4}{5} \ell\)
   \(y = 1 400 \text{ ml} = \frac{14}{10} \ell \text{ or } 1 \frac{2}{10} \ell\)
   \(z = 1 800 \text{ ml} = \frac{18}{10} \ell \text{ or } 1 \frac{8}{10} \ell\)

3. (a) \(1 125 + 125 \rightarrow 1 250 + 125 \rightarrow 1 375 + 2 125 = 3 500 \text{ ml} = 3 \frac{1}{2} \ell\)
(b) \(500 + 250 + 150 + 250 = 1 150 \text{ ml} = 1 \ell \text{ and } 150 \text{ ml}\)

4. (a) \(\frac{1}{2} + \frac{1}{2} \rightarrow 1 + \frac{1}{2} \rightarrow 1 \frac{1}{2} + \frac{1}{2} \rightarrow 2 + \frac{1}{2} = 2 \frac{1}{2} \ell = 2 500 \text{ ml}\)
(b) \(\frac{1}{4} + \frac{1}{4} \rightarrow \frac{2}{4} \text{ or } \frac{1}{2} \rightarrow 1 + \frac{1}{4} \rightarrow \frac{3}{4} + \frac{1}{4} + \frac{1}{4} = 1 \frac{1}{4} \ell = 1 250 \text{ ml}\)
(c) \(1 \frac{1}{2} + \frac{1}{4} \rightarrow 1 \frac{3}{4} + \frac{1}{4} = 2 \ell = 2 000 \text{ ml}\)
(d) \(\frac{3}{4} + \frac{3}{4} \rightarrow 1 \frac{1}{2} + \frac{3}{4} \rightarrow 2 \frac{1}{4} + \frac{3}{4} \rightarrow 3 \ell = 3 000 \text{ ml or}\)
   \(\frac{3}{4} + \frac{3}{4} \rightarrow \frac{6}{4} + \frac{3}{4} \rightarrow \frac{9}{4} + \frac{3}{4} \rightarrow \frac{12}{4} \text{ or } 3 \ell = 3 000 \text{ ml}\)
Grade 4 Term 3 Unit 3    Whole numbers

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</tr>
</thead>
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<tr>
<td>3.2 Represent, order and compare numbers</td>
<td>Counting verbally and on number lines, and representing numbers in symbols and words</td>
<td>240 to 241</td>
</tr>
<tr>
<td>3.3 Even and odd numbers</td>
<td>Exploring even and odd numbers</td>
<td>241 to 242</td>
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**CAPS time allocation**  
1 hour

**CAPS page references**  
14 and 92

**Mathematical background**
Counting grouped objects, or in this case grouped objects in a picture, helps learners to develop a sense of numbers up to and beyond 1 000. Working with the structure of larger numbers, i.e. the way they are built up of thousands, hundreds, tens and units, also allows learners to develop a sense of larger numbers.

Once learners have a feel for larger numbers, it is easy for them to order and compare these numbers.
3.1 Counting

**Teaching guidelines**

Only 1 hour is allocated to this topic in Term 3. Try to cover this section in 15 minutes. There are only two questions. If learners count objects in ones, they will waste a lot of time, and also not develop a sense of bigger numbers.

To help learners to focus on counting in groups, you can ask them: “How many apples are in each tray?” “Do all the trays have the same number of apples?” The aim is for learners to count in 10s to 110 and add the extra 6 apples (in question 1(a)). Learners can also count in 20s up to 100 and add the extra 10 and 6 apples.

Making up or bridging to the next 10, 100 and 1 000 develops learners’ sense of numbers and operations. One way for learners to imagine getting from 116 apples to 1 000 apples in question 1(b) is to add on using an empty number line. This is illustrated below:

![Number line illustration](image)

**Answers**

1. (a) 116 apples          (b) 884 apples
Teaching guidelines

In question 2(a) trays of 10 apples are shown. Check that learners understand that each tray has 10 apples. Ask them how many trays of apples are in each row. This will allow them to count rows in 50s until they reach 500. Learners can group the remaining trays into two more groups of 100 and 50 respectively (or they can count in groups of 10 and get 150) to get 650 apples on trays. They can then add the 7 loose apples. Learners might also count two rows at a time, i.e. count in 100s until they reach 500.

One way for learners to imagine getting from 657 apples to 3000 apples is to add on using an empty number line and filling up or bridging to the next 10, 100 and 1000. This can develop learners’ sense of numbers and operations. This is illustrated below:

Answers

2. (a) 657 apples (b) 2343 apples
3.2 Represent, order and compare numbers

Teaching guidelines
Try to move quickly through Section 3.2: aim to cover this section in 20 minutes. One possibility is to use
- questions 1, 2 and 3 for mental mathematics,
- question 8 for concept development,
- questions 4(a), (c) and (f), 5, 6(c), (e) and (f), and 7(a), (b) and (d) for classwork, and
- questions 4(b), (d) and (e), 6(a), (b) and (d), and 7(c) for additional practice.

To save time for learners, you can copy the number lines provided in the Addendum (page 457). They can use these number lines for question 1.

Answers
1. (a) 3 000 4 000 5 000 6 000 7 000 8 000 9 000 10 000
   (b) 4 000 4 100 4 200 4 300 4 400 4 500 4 600
   (c) 7 000 7 010 7 020 7 030 7 040 7 050 7 060 7 070
   (d) 9 665 9 670 9 675 9 680 9 685 9 690 9 695
2. (a) 783 883 983 1 083 1 183 1 283 1 383 1 483 1 583
   (b) 1 875 1 900 1 925 1 950 1 975 2 000 2 025 2 050
   (c) 2 883 2 908 2 933 2 958 2 983 3 008 3 033 3 058 3 083
   (d) 2 983 2 986 2 989 2 992 2 995 3 001 3 004 3 007
       3 010 3 013
3. (a) 4 288 (b) 3 860 (c) 1 009 (d) 5 997
   (e) 3 981 (f) 956 (g) 4 200 (h) 2 468
4. (a) six thousand one hundred and fifty-four
   (b) nine thousand six hundred and fifty
   (c) eight thousand and thirty
   (d) one thousand three hundred and eleven
   (e) two thousand two hundred and twenty-two
   (f) nine thousand and nine

3.2 Represent, order and compare numbers

1. Which numbers are missing on the number lines below? Write them in the correct order in your book.
   (a) 1000 2000 9000
   (b) 3800 3900 4700
   (c) 6980 6990 7060
   (d) 9655 9660 9700

2. In each case write the numbers as you count.
   (a) Count in hundreds from 783 to 1 583.
   (b) Count in 25s from 1 875 to 2 050.
   (c) Count in 25s from 2 883 to 3 083.
   (d) Count in 3s from 2 983 to 3 013.

3. Write the numbers.
   (a) 1 more than 4 287 (b) 2 less than 3 862
   (c) 10 more than 999 (d) 3 less than 6 000
   (e) 2 000 more than 1 981 (f) 500 less than 1 456
   (g) half of 8 400 (h) double 1 234

4. Write the number names.
   (a) 6 154 (b) 9 650
   (c) 8 030 (d) 1 311
   (e) 2 222 (f) 9 009
Teaching guidelines
When doing question 8, first alert learners to the fact that there are 10 small intervals between each large interval (just as there are on a ruler). Learners can first count in 10s to work out the numbers at the larger intervals. This will give them the answers to questions (a), (b), (f) and (i). Learners can then count the smaller intervals to work out the answers to the other questions: (c), (d), (e), (g), (h) and (j).

Possible misconceptions
Some learners may still write 9 000 9 instead of 9 009 for question 6(c), and 7 000 50 instead of 7 050 for question 6(f), and 5 000 20 instead of 5 020 for question 7(d).

Acknowledge that this is the way we say the numbers and that learners understand the parts of the numbers well, and that they can use this when writing the expanded notation. However, also use place value cards, for example placing the 9 over the last zero of the 9 000, and explain that this shows how we make and write the number symbol.

Answers
5. 9 650; 9 009; 8 030; 6 154; 2 222; 1 311
6. (a) 9 657 (b) 1 311 (c) 9 009 (d) 5 329 (e) 2 909 (f) 7 050
7. (a) 3 763 (b) 7 205 (c) 2 936 (d) 5 020
8. (a) 6 720 (b) 6 740 (c) 6 756 (d) 6 793 (e) 6 826 (f) 6 850 (g) 6 875 (h) 6 901 (i) 6 910 (j) 6 924

3.3 Even and odd numbers
Answers
1. (a) 4 (b) 6 (c) 8 (d) 10
2. (a) 5 (b) 7 (c) 9 (d) 11

Teaching guidelines
You could ask 12 learners to come to the front of the classroom and stand in two rows of 6 each. Ask each learner to stand opposite a learner in the other row without stepping out of line. Ask them to take the hand of the learner opposite them. Ask the class whether each learner has a partner. Add learners to one or both lines and repeat the question. For example, ask one more learner to join one line and ask again whether each learner has a partner. Explain that if each learner is paired off, then there is an even number of learners. If one learner is not paired off, he/she is the odd one out; the number is odd.
Follow this with the explanation provided in the tinted passage on page 241. Ask two more learners to join the other line, and repeat the question. Keep adding or taking away learners from one or both lines. Each time ask the class whether there is an even or odd number of learners.

**Notes on questions**

Question 8 is a challenge. Learners who complete questions 1 to 7 before the rest of the class can work on this. Ask learners to explore a number of possibilities, which they can share with the class. However, we cannot prove something is true just by giving many cases where it is true. Ask learners to give reasons why they think it is always true or not always true.

In preparation for working with learners on this question, you can watch a video clip (see web address below) from a Grade 3 Mathematics class in Michigan, showing 10 minutes of a longer discussion about even and odd numbers. A boy named Sean comments that he has noticed something special about the number six. He claims that it could be even and it could be odd. Sean explains his idea and the class goes on to discuss it, raising other perspectives, counter-arguments and questions. Watch until the end of the video to see a girl named Ofala produce a definition of what an odd number is. This definition resonates with the one provided in the tinted passage at the bottom of page 241. Note that this video will not interest most Grade 4 learners, but should interest you as a teacher.

http://hdl.handle.net/2027.42/65013 or http://deepblue.lib.umich.edu/handle/2027.42/65013 Mathematics Teaching and Learning to Teach, University of Michigan. (2010). In Sean Numbers-Ofala [Online].

**Answers**

3. Learners count in twos and write all the numbers down:

   2 460 2 462 2 464 2 466 2 468 2 470 2 472 2 474
   2 476 2 478 2 480 2 482 2 484 2 486 2 488 2 490

4. Learners’ own answers, e.g. 2 461; 2 459; 2 465; 2 483 (odd numbers)

5. 20 22 24 26 28 30 32 34 36 38

6. 19 21 23 25 27 29 31 33 35 37

7. (a) 7 231 7 233 7 235 7 237 7 239 7 241 7 243 7 245 7 247 7 249

   (b) 7 232 7 234 7 236 7 238 7 240 7 242 7 244 7 246 7 248

8. Yes
Learner Book Overview

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CAPS time allocation 4 hours
CAPS page references 14 to 15, 69 to 71 and 93

Mathematical background

Learners continue to engage with three methods of addition in Grade 4:

A. Adding by filling up multiples of 10 and 100.
B. Adding by breaking down one number (the smaller one) into place value parts and adding the parts one by one.
C. Adding by breaking down both numbers, rearranging and adding up the answers of the parts.

Learners also engage with two methods of subtraction in Grade 4:

A. Subtracting by filling up multiples of 10 and 100 (subtraction by addition).
B. Subtracting by breaking down both numbers, rearranging and adding up the answers of the parts.

Learners can only use these methods effectively if they know the addition and subtraction bonds for units and for multiples of ten and hundred well, or can quickly reconstruct these facts.

Learners should develop confidence to make new number facts from number facts they know or are given. They will do this when they reconstruct number facts, when they change subtraction number sentences to addition number sentences and vice versa (to check calculations or to make them easier) and when they use transfer (carrying or borrowing).

Learners should also continue to use estimation to check whether their answers are reasonable.
4.1 Addition and subtraction facts and skills

Teaching guidelines
Aim to cover this section in 2 hours. One possibility is to use
- questions 1 to 4, 10 and 12 for mental mathematics,
- the tinted passages on pages 243 to 245 for concept development,
- questions 5(a) and (b), 6, 7(a), (c), (e) and (g), 8(a), (c), (e) and (g), 9(a), (b), (e) and (f), and 13 for classwork, and
- questions 5(c) to (e), 7(b), (d), (f) and (h), 8(b), (d), (f) and (h), 9(c) and (d), and 11 for additional practice.

Use the tinted passages on page 243 to help learners understand how to break numbers down into multiples of 100.

Possible misconceptions
Learners may think that multiples of 10 are limited to 10, 20, 30, 40, 50, 60, 70, 80, 90, 100. But 11 × 10, 12 × 10, 15 × 10, 32 × 10, etc. are also multiples of 10.

Answers
Remember that the numbers can be added in any order.
1. 100 + 900; 200 + 800; 300 + 700; 500 + 500
2. Any five of the following:
   100 + 2 400, 600 + 1 900, 1 000 + 1 500
   200 + 2 300, 700 + 1 800, 1 100 + 1 400
   300 + 2 200, 800 + 1 700, 1 200 + 1 300
   400 + 2 100, 900 + 1 600, 1 300 + 1 200
   500 + 2 000
3. Any five of the following (there are many other possibilities):
   3 000 = 100 + 900 + 2 000, 3 000 = 400 + 700 + 1 900
   3 000 = 200 + 800 + 2 000, 3 000 = 500 + 600 + 1 900
   3 000 = 300 + 700 + 2 000, 3 000 = 300 + 900 + 1 800
   3 000 = 400 + 600 + 2 000, 3 000 = 400 + 800 + 1 800
   3 000 = 500 + 500 + 2 000, 3 000 = 500 + 700 + 1 800
   3 000 = 200 + 900 + 1 900, 3 000 = 600 + 600 + 1 800
   3 000 = 300 + 800 + 1 900, 3 000 = 600 + 700 + 1 700

3 000 can be formed in different ways by adding two multiples of 100, for example:
   3 000 = 1 400 + 1 600
   3 000 = 2 000 + 1 000

We can also say:
3 000 can be expressed as the sum of two multiples of 100.
**Possible sources of error**

When learners break down the second number to add, especially when adding on to the next multiple of 1 000, 100 or 10, they may lose track of parts of the number. It can help them to keep an image of the whole, the parts they have added, and what remains to be added. For example, in question 7(f) they add 590. They can make an arrow diagram to show that first they add 500, then 60, then 30. You can combine this with using a number line.

**Answers**

4. There are many correct possibilities. Consider learners’ number sentences.

5. (a) \(870 + 130 \rightarrow 1 000 + 2 600 \rightarrow 3 600 + 400 \rightarrow 4 000 + 3 234 = 7 234\)
(b) \(1 700 + 300 \rightarrow 2 000 + 4 000 \rightarrow 6 000 + 1 450 \rightarrow 7 450 + 550 = 8 000\)
(c) \(920 + 280 \rightarrow 1 200 + 1 800 \rightarrow 3 000 + 1 700 \rightarrow 4 700 + 200 = 4 900\)
(d) \(900 + 800 \rightarrow 1 700 + 70 \rightarrow 1 770 + 60 \rightarrow 1 830 + 8 = 1 838 + 5 = 1 843\)
(e) \(900 + 70 \rightarrow 970 + 8 \rightarrow 978 + 800 \rightarrow 1 778 + 60 \rightarrow 1 838 + 5 = 1 843\)

6. Learners may set out this calculation in many different ways, for example:

\[
230 + 400 \rightarrow 630 + 20 \rightarrow 650 + 80 \rightarrow 730 + 130 \rightarrow 860 + 60 = 920 \quad \text{or} \\
230 + 420 + 80 + 130 + 60 = 200 + 400 + 100 + 30 + 20 + 80 + 30 + 60 = 700 + 30 + 100 + 30 + 60 = 800 + 120 = 920
\]

7. (a) \(670 + 280 \rightarrow 670 + 200 \rightarrow 870 + 30 \rightarrow 900 + 50 = 950\)
(b) \(870 + 460 \rightarrow 870 + 400 \rightarrow 1 270 + 30 \rightarrow 1 300 + 30 = 1 330\)
(c) \(740 + 690 \rightarrow 740 + 600 \rightarrow 1 340 + 60 \rightarrow 1 400 + 30 = 1 430\)
(d) \(1 240 + 690 \rightarrow 1 240 + 600 \rightarrow 1 840 + 60 \rightarrow 1 900 + 30 = 1 930\)
(e) \(8 460 + 330 \rightarrow 8 460 + 300 \rightarrow 8 760 + 30 = 8 790\)
(f) \(5 940 + 590 \rightarrow 5 940 + 500 \rightarrow 6 440 + 60 \rightarrow 6 500 + 30 = 6 530\)
(g) \(6 660 + 840 \rightarrow 6 660 + 800 \rightarrow 7 460 + 40 = 7 500\)
(h) \(3 780 + 770 \rightarrow 3 780 + 700 \rightarrow 4 480 + 20 \rightarrow 4 500 + 50 = 4 550\)
Teaching guidelines

We can’t know every number fact off by heart. People who are good at mathematics are good at making new number facts from given or known number facts.

Use the first tinted passage on page 245 to show learners how to form subtraction facts from addition facts. This is possible because addition and subtraction are inverse operations.

Use the second tinted passage on page 245 to show learners how they can make new number sentences from those that are given by adding or subtracting a multiple of a thousand to or from one of the numbers, and to or from the answer, for example $800 + 700 = 1500$ means that $800 + 700 = 6500$. Learners can also add multiples of a hundred or ten to one number and to the answer, for example $820 + 700 = 1520$. This extends work done in previous terms; see for example Term 1 Unit 3 Section 3.2, page 29.

Remember, learners have already worked with making new addition and subtraction number facts by changing all units to tens or hundreds or thousands, for example $3$ tens $+ 5$ tens $= 8$ tens, $3$ hundreds $+ 5$ hundreds $= 8$ hundreds, $3$ thousands $+ 5$ thousands $= 8$ thousands; see Term 1 Unit 3 Section 3.4, page 34.

Answers

8. (a) $950 - 670 = 280$  
   $950 - 280 = 670$
(b) $1330 - 870 = 460$  
   $1330 - 460 = 870$
(c) $1430 - 740 = 690$  
   $1430 - 690 = 740$
(d) $1930 - 1240 = 690$  
   $1930 - 690 = 1240$
(e) $8790 - 8460 = 330$  
   $8790 - 330 = 8460$
(f) $6530 - 5940 = 590$  
   $6530 - 590 = 5940$
(g) $7500 - 6660 = 840$  
   $7500 - 840 = 6660$
(h) $4550 - 3780 = 770$  
   $4550 - 770 = 3780$

9. (a) $800 + 700 = 1500$  
   $1500 - 800 = 700$  
   $1500 - 700 = 800$
(b) $1800 + 700 = 2500$  
   $2500 - 1800 = 700$  
   $2500 - 700 = 1800$
(c) $2800 + 500 = 3300$  
   $3300 - 2800 = 500$  
   $3300 - 500 = 2800$
(d) $4600 + 900 = 5500$  
   $5500 - 4600 = 900$  
   $5500 - 900 = 4600$
(e) $5970 + 50 = 6020$  
   $6020 - 5970 = 50$  
   $6020 - 50 = 5970$
(f) $5700 + 500 = 6200$  
   $6200 - 5700 = 500$  
   $6200 - 500 = 5700$

10. (a) $4900$  
    (b) $800$
    (c) $700$  
    (d) $600$
Mathematical notes
Learners will use their skill at making new number facts from given or known number facts when they use transfer (see e.g. page 248). It is even more useful when doing subtraction.

Notes on questions
Before doing question 12, remind learners that they should always think: “What do I already know that can help me here?” For example, the answer to 12(f) should help them with the answer to 12(g); the answer to 12(i) should help them to answer 12(j). Likewise the answer to 12(j) will help them find the answer to 12(k); 12(k) will help with 12(l); 12(l) with 12(m); 12(m) with 12(n), etc.

Answers
11. There are many, many more possible answers. Check all learners’ calculations.

(a) 1 000 – 400 = 600  
1 200 – 600 = 600  
2 000 – 600 = 1 400  
1 400 – 600 = 800  
2 100 – 600 = 1 500
(b) 1 000 – 500 = 500  
1 200 – 500 = 700  
1 900 – 500 = 1 400  
2 000 – 500 = 1 500  
1 400 – 500 = 900
(c) 1 000 – 200 = 800  
1 100 – 200 = 900  
1 200 – 200 = 1 000  
2 000 – 200 = 1 800  
2 100 – 200 = 1 900
(d) 1 600 – 1 100 = 500  
1 700 – 1 100 = 600  
1 800 – 1 100 = 700  
1 900 – 1 100 = 800  
2 100 – 1 100 = 1 000
(e) 1 600 – 600 = 1 000  
1 500 – 600 = 900  
1 400 – 600 = 800  
1 300 – 600 = 700  
1 200 – 600 = 600
(f) 3 400 – 3 000 = 400  
3 300 – 400 = 2 900  
3 200 – 400 = 2 800  
3 100 – 400 = 2 700  
2 900 – 400 = 2 500

12. (a) 2 600  
(e) 7 700  
(i) 6 700  
(m) 3 100  
(q) 8 500
(b) 4 200  
(f) 7 300  
(j) 6 500  
(n) 3 000  
(r) 3 800
(c) 5 100  
(g) 6 300  
(k) 3 500  
(o) 3 800  
(s) 2 800
(d) 6 900  
(h) 2 500  
(l) 3 200  
(p) 4 800  
(t) 3 800

13. Learners complete the number sentences they have written down. See question 12 above for the answers.
4.2 Practise addition and subtraction

**Teaching guidelines**

Aim to cover this section in 1 hour. One possibility is to use

- questions 1(a) and (h), and the tinted passages on page 248 for concept development,
- questions 1(b) and (f), 2, 3, 4, 6 and 7 for classwork, and
- questions 1(c), (d), (e) and (g), and 5 for additional practice.

Learners should be able to check addition calculations by doing subtraction, and subtraction calculations by doing addition. They should be asked to do this regularly, so that it becomes a habit. Question 5 does this. Learners should also estimate their answers by rounding off to the specified place value parts before adding or subtracting. Estimated answers will help them to see whether their answers are reasonable.

**Answers**

1. Estimated answers: (a) 8 000  (b) 8 000  (c) 9 000  (d) 10 000  
   (e) 2 000  (f) 3 000  (g) 0  (h) 3 000

   Learners may use other methods when calculating the answers, such as breaking down both numbers into place value parts (and using transfer): see pages 248, 197 and 194.
   
   (a) $3 \, 467 + 5 \, 231 \rightarrow 3 \, 467 + 5 \, 000 \rightarrow 8 \, 467 + 200 \rightarrow 8 \, 667 + 30 \rightarrow 8 \, 697 + 1 = 8 \, 698$
   
   (b) $4 \, 736 + 3 \, 263 \rightarrow 4 \, 736 + 3 \, 000 \rightarrow 7 \, 736 + 200 \rightarrow 7 \, 936 + 60 \rightarrow 7 \, 996 + 3 = 7 \, 999$
   
   (c) $4 \, 891 + 4 \, 119 \rightarrow 4 \, 891 + 4 \, 000 \rightarrow 8 \, 891 + 100 \rightarrow 8 \, 991 + 10 = 9 \, 001 + 9 = 9 \, 010$
   
   (d) $3 \, 714 + 6 \, 156 \rightarrow 3 \, 714 + 6 \, 000 \rightarrow 9 \, 714 + 100 \rightarrow 9 \, 814 + 50 \rightarrow 9 \, 864 + 6 = 9 \, 870$
   
   (e) $9 \, 653 - 7 \, 643 \rightarrow 9 \, 653 - 7 \, 000 \rightarrow 2 \, 653 - 600 \rightarrow 2 \, 053 - 40 \rightarrow 2 \, 013 - 3 = 2 \, 010$
   
   (f) $6 \, 487 - 3 \, 397 \rightarrow 6 \, 487 - 3 \, 000 \rightarrow 3 \, 487 - 300 \rightarrow 3 \, 187 - 87 \rightarrow 3 \, 100 - 3 \rightarrow 3 \, 097 - 7 = 3 \, 090$
   
   (g) $8 \, 345 - 7 \, 558 \rightarrow 8 \, 345 - 7 \, 000 \rightarrow 1 \, 345 - 300 \rightarrow 1 \, 045 - 200 \rightarrow 845 - 50 \rightarrow 795 - 5 \rightarrow 790 - 3 = 787$
   
   (h) $5 \, 352 - 1 \, 963 \rightarrow 5 \, 352 - 1 \, 000 \rightarrow 4 \, 352 - 300 \rightarrow 4 \, 052 - 52 \rightarrow 4 \, 000 - 600 \rightarrow 3 \, 400 - 11 = 3 \, 389$

2. Estimated answers: (a) 3 000  (b) 3 000  
   Calculated answers: (a) 3 002  (b) 2 992

3. Yes. If not, learners should redo their calculations.

4. 60 written mistakenly as 80 (line 2 expansion).
   100 and 1 000 were not transferred to their correct places (line 4). (See next page.)
Answers (continued)

4.  
\[2376 = 2000 + 300 + 70 + 6\]
\[5669 = 5000 + 600 + 60 + 9\]
\[2376 + 5669 = 7000 + 900 + 130 + 15 = 7000 + 900 + 100 + 30 + 15 = 8045\]

5. Responses depend on their initial calculations.

Teaching guidelines

Although there are only two questions, this page involves a substantial amount of work in the classroom. The first tinted passage consolidates learners’ understanding of the breaking-down and building-up method of addition. The second tinted passage introduces a more effective way of recording the calculation. This recording format is also a step towards adding in columns (which learners will do in Grade 5).

Answers

6.  
\[4758 + 2765\]
\[4758 = 4000 + 700 + 50 + 8\]
\[2765 = 2000 + 700 + 60 + 5\]
\[4000 + 2000 = 6000\]
\[700 + 700 = 1400\]
\[50 + 60 = 110\]
\[8 + 5 = 13\]
\[= 6000 + 1400 + 110 + 13\]
\[= 6000 + 1400 + 120 + 3\]
\[= 6000 + 1500 + 20 + 3\]
\[= 7000 + 500 + 20 + 3\]
\[= 7523\]

7.  
\[4758 + 2765 = (4000 + 700 + 50 + 8) + (2000 + 700 + 60 + 5)\]
\[= (4000 + 2000) + (700 + 700) + (50 + 60) + (8 + 5)\]
\[= 6000 + 1400 + 110 + 13\]
\[= 6000 + 1400 + 120 + 3\]
\[= 6000 + 1500 + 20 + 3\]
\[= 7000 + 500 + 20 + 3\]
\[= 7523\]
4.3 Find some real information

Teaching guidelines
Aim to cover this section in 1 hour. One possibility is to use
- questions 4 and 5 for concept development,
- questions 2, 3 and 6 for classwork, and
- questions 1, 7 and 8 for additional practice.

As suggested, you can use questions 4 and 5 for concept development. This does not mean writing out the calculations on the board as worked examples. Rather read the questions to learners and ask them to explain the question in their own words. Ask questions like: “What does this question ask you to do?” “What useful information have you been given?” “What will you do now?” Let learners do the actual calculations.

Possible misconceptions
Learners may not understand that when trees in a timber plantation are harvested, it means that they are cut down. In question 3 you can help learners to focus on the fact that they are asked: “How many trees are still standing,” which implies that some trees are not still standing, i.e. they have been cut down so that their wood can be used.

Notes on questions
In question 4 check that learners understand that kudu (like cattle) are cows (adult female), bulls (adult male) or calves (juvenile, i.e. not yet adult).

Encourage learners to always ask if there are any words that they do not know or understand.

Answers
1. 9 km and 920 m
2. R1 882
3. 5 058 trees
4. 898 kudu bulls
5. R9 810
6. (a) 6 541 people
   (b) 1 595 people
7. 1 171 learners
8. 2 175 students

4.3 Find some real information
1. While practising, an athlete ran 5 253 m on a Saturday and 4 667 m on a Sunday. How far did he run during the weekend? Give your answer in kilometres + metres.
2. Riana invested R7 755 for 10 years. Then she was paid out R9 637. How much money did she receive as interest? (In other words, how much more than R7 755 did she receive?)
3. In a plantation, 3 492 of the 8 550 trees have been harvested. How many trees are still standing?
4. At the last count, there were 3 104 kudus in a provincial nature reserve. The cows and calves made up 2 206. How many of the kudus were bulls?
5. Bobby withdrew R6 025 from his savings account, leaving him with R3 785 in the account. How much money did he have before the withdrawal?
6. On a Friday evening, 2 473 people attended a music festival and on the Saturday 4 068 people attended.
   (a) How many people went to the festival during that weekend?
   (b) How many more people were at the festival on Saturday than on Friday?
7. This year, 9 104 learners will be writing the ANA tests in the primary schools of a certain town. Last year, 7 933 learners wrote the tests. How many more learners will write the test this year than last year?
8. At Sun College, Zulu is the home language of 5 879 of the 8 054 students. How many students do not speak Zulu as their home language?
Grade 4 Term 3 Unit 5  
Viewing objects

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**CAPS time allocation**
2 hours

**CAPS page references**
23 and 94

**Mathematical background**
This unit is about noticing how the same object can look very different when it is viewed from different positions. This awareness is important for developing spatial sense of three-dimensional objects. When working with three-dimensional objects, learners need to be able to imagine the whole object from a drawing that shows only part of the object. This unit starts to focus learners’ attention on the fact that objects look different from different positions. This lays the foundation for being able to interpret the whole object from the features that are shown in a drawing or photograph that is taken from a particular position.

It is also important when one has to draw a three-dimensional object, especially if the object is not a simple one. One will then draw the object as seen from a number of different positions. Together the drawings become a useful tool to understand the total spatial form of the object. Such diagrams are routinely used in the technical fields (e.g. civil and mechanical engineering) during the design process.

**Critical knowledge**
It is critical that learners can imagine the whole object from drawings or photographs of particular views of the object.
It is also critical that learners can link, with reasons, particular views with the position of the viewer relative to the object.

**Resources**
Everyday objects such as teapots, mugs, teacups and milk jugs.
5.1 What you see from where you are

Mathematical notes
This section introduces the importance of being able to imagine what an object looks like from different positions. In this section it is only necessary to be able to decide which of a given set of drawings corresponds to a particular viewing position.

Resources
Everyday objects such as teapots, mugs, teacups and milk jugs. It is better to use objects that look different from the front, back and sides. It is difficult to distinguish a back view from a front and side view in objects such as drinking glasses, bottles, bricks, etc.

Teaching guidelines
Spend about 1 hour on this section.

You could begin by asking learners to draw an object from different positions. You could set the learners up in small groups around a table on which you place an object. Some may stand over the object and some may sit below it, while others sit around it. Ask each learner to draw the object as they see it. Once all learners have done their drawings, let them compare their drawings. Let learners shift positions to allow them to confirm the view seen by other members in the group.

An alternative or additional activity is to go into the school’s parking lot and let learners stand in front, behind and on each side of a car. Different groups of learners can stand around different cars. Each learner draws the view they see. In the classroom you can collect all the drawings and hand them to different learners. Then ask all those with front views to stand in front of the classroom, showing the drawing they have. All those with drawings done from the right of the car (driver’s side) can stand on the right-hand side of the classroom, etc. Choose particular drawings and ask learners to explain how they know that it is a front, back or side view. This helps learners to focus on how the features look different from certain angles. It also develops the language necessary to talk about it.

You can use the tinted passage on page 250 to confirm that what you see of an object or creature looks different from different positions.
Always ask learners to explain why they have linked a particular person with a particular view.

Answers
1. (a) Drawing B          (b) Drawing A
Possible misconceptions
Some views are easier to distinguish than others. For example, in question 4 it is easy to see that Nathi stood at the end of the house where the whole chimney shows along the wall (a side view) and that Miriam stood at the other side (she can only see the chimney sticking out above the roof). It is much more difficult to work out who was standing in front of the house and who was standing behind it. To place Peter and Lebogang correctly, learners need to think about whose view has the chimney on the right-hand side and whose view has it on the left-hand side.

Notes on questions
If learners struggle to identify Lebogang’s view and Peter’s view correctly, ask them questions like: “When Lebogang looks at the house, is the chimney on her left or right?”, “Where can you place her around the top view of the house so that the chimney will be on that side?”

Answers
2. Mary and Jane are sitting on opposite sides of the table looking at the teacup.
3. Sibu was sitting on the floor on the same side of the table as Mary, looking up at the cup or Sibu is small enough to be standing with his head below the table. He is close to the table and on the same side of it as Mary.
4. Nathi, Lebogang, Peter and Miriam all look at the same house. This is what each one sees:
5.2 Looking from different positions

**Mathematical notes**
The ideas in the previous section are formalised here. There are certain views that are more useful than others. Top and bottom views are helpful, as well as side views showing each face, or side views that show the symmetry of the object. Sometimes we may have to portray an object from a less obvious position. In this case the properties of the object will not necessarily show up.

**Teaching guidelines**
You should spend about 1 hour on this section.

Again, time and resources permitting, allow learners to draw actual objects. However, now engage them about which positions are the most useful to show up the properties of the object (its faces, symmetry, etc.). Alternatively, engage them about how an object may appear from a particular position (a greater challenge).

When learners link a particular person with a particular view, always ask them to explain how they know that this person saw that view. For example, how do you know that Peter saw view (b) (the back view) of the teapot, or how do you know that the person in the tree saw the view of the bakkie shown in question 2.

Try to bring similar objects to class. If learners find it difficult to link pictures to the position of the viewer, you can use your cell phone to photograph objects from the suggested views. This will help learners to develop the skill of linking views with the position of the viewer.

**Possible misconceptions**
As mentioned in the previous section, some views are easier to distinguish than others. In questions 1 and 3 the side views are more difficult. For example, to place Nathi and Lebogang correctly in question 1, learners need to think about whose view of the teapot has the handle on the right-hand side and the spout on the left-hand side, and whose view has the handle on the left-hand side and the spout on the right-hand side.

Similarly, in question 3 learners need to think about who will see the side view of the bakkie as portrayed.

In question 4 learners will need to think carefully about whether they will see the cup handle on the left from the position of the yellow dot or the position of the green dot.

**Answers**
1. (a) Nathi  
(b) Peter  
(c) Miriam  
(d) Lebogang
Answers

2. Person number 5

Five people look at a bakkie.

2. Which person sees the bakkie like this?
**Answers**

3. (a) Person number 1  
(b) Person number 4  
(c) Person number 2  
(d) Person number 3

4. (a) From the red dot view

![Diagram of red dot view](image)

(b) From the blue dot view

![Diagram of blue dot view](image)

(c) From the yellow dot view

![Diagram of yellow dot view](image)

(d) From the green dot view

![Diagram of green dot view](image)
Grade 4 Term 3 Unit 6  Properties of two-dimensional shapes

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**CAPS time allocation**
4 hours

**CAPS page references**
21 to 22, 59 to 61 and 94

**Mathematical background**
The mathematical work here extends and consolidates the work done on two-dimensional shapes in Term 1 Unit 8, and the concept of symmetry covered in Term 2 Unit 8.

All two-dimensional figures (2-D figures) are made up of sides. These sides may be straight or curved lines. Many figures also have one or more corners. These are where two sides meet to form a pointed part. Although we are focusing on closed figures, we sometimes encounter figures that have gaps between their sides. These are called open figures.

The sides of 2-D figures may have specific lengths. It is easy to use grid paper to mark off lengths in units along the two grid directions. For this to be sensible, the grid has to consist of squares. This is called a square grid.

**Resources**
Learners will need 2 or 3 sheets of square grid paper. If you have a photocopier, you can copy the square grid paper provided in the Addendum (page 433).
6.1 Classify 2-D figures

Mathematical notes
This section focuses on the sides of 2-D figures: these can be curved or straight and may form corners where they meet.

Teaching guidelines
Spend about 1\(\frac{1}{2}\) hours on this section.

The skills being developed in this section are important. In question 1 learners practise the skills developed in Term 2 Unit 8 Symmetry. Allow time (if at all possible) to discuss symmetry in detail again. Some shapes may have symmetrical properties while others may be “almost symmetrical”. In real life, objects are usually “almost symmetrical”, but not perfectly symmetrical, for example the human body, a car seen directly from the front or from behind, etc. We often pretend that these objects are perfectly symmetrical even though they are not.

The other important skill is classifying or grouping figures according to their properties. In the previous units on two-dimensional figures, classification was always in the background. In this unit we are being more explicit about it. Classification is about properties that are the same and properties that differ. Engage your learners in discussions about properties that are shared by two or more shapes, and properties that are specific to certain shapes. Pose questions such as: “What is the same about these figures?”, “How do these figures differ?”, “What shape does the figure have?”, “Is this shape a special form of that shape?”, etc. Learners should be encouraged to justify their responses to such questions by referring to specific properties (shape, lengths of sides, symmetry, etc.).

When learners do question 2, let one learner have their book open on page 255 and the learner sitting next to him or her have it open on page 256. This way they will be able to see the questions and the figures they refer to at the same time.

Answers
1. (a) Learners make their own sketches of the lines and figures on page 255.
   (b) Line A: symmetry line is a perpendicular straight line through the midpoint of the line.
   Line B: no line of symmetry
   Figure C: no line of symmetry
   Figures D and Figure E: see alongside.
   (c) Figure C. Learners can measure the pairs of sides marked in red or green alongside, to see that they are different lengths.

2. State which of the figures on the next page
   (a) have curved sides only. (b) have straight sides only.
   (c) are triangles. (d) are hexagons.
   (e) are pentagons. (f) are quadrilaterals.
   (g) have straight and curved sides.
**Answers (continued)**

2. (a) Figures A, E
(b) Figures B, C, D, F, G, H, K, L, O, P, R
(c) Figures O, R
(d) Figure L
(e) Figures B, H, K
(f) Figures C, D, F, G
(g) Figures I, J, N, M, Q

**Answers to Section 6.2: questions 2(a), (b), (c), (d) and (e)**
6.2 Draw 2-D figures

**Mathematical notes**
In order to draw figures correctly, learners need to be familiar with the properties of the most common shapes. Remember that a square is a special rectangle: see “Mathematical notes” on page 104 and “Teaching guidelines” on page 106 of this Teacher Guide.

**Resources**
Learners will need 2 or 3 sheets of square grid paper. If you have a photocopier, you can copy the square grid paper provided in the Addendum (page 433).

**Notes on questions**
Spend about \(\frac{2}{7}\) hours on this section: the discussions in question 1 and the drawing of the figures will take long. The explanations in question 1 are important. Learners may produce a range of different but equivalent instructions. Discussing and comparing the different instructions for a particular shape will be a very rewarding activity. Once learners have discussed and agreed on the best instructions, they can look back to the descriptions of figures given in the summary bar on page 100. They can write down the best descriptions in their exercise books.

In question 2 it is essential that each learner has access to well-drawn square grids. Drawing the grids may prove very time-consuming, so it would be a good idea to have plenty of extra copies of grid paper available, if at all possible.

In questions 2(j) to (n) ask learners to draw the lines of symmetry. It might be challenging for learners to draw the figures with the required lines of symmetry, but they have already seen similar examples on page 192.

Encourage a group discussion about the different approaches followed by learners. It is very important to let them compare drawings and to check if they agree with the different ways a drawing has been done.

**Answers**
1. (a) Draw a closed shape with three straight sides.
(b) Draw a closed shape with four straight sides and with all corners the same size.
(c) Draw a closed shape with four straight sides and with opposite sides equal.
(d) Draw a closed shape with five straight sides.
(e) Draw a closed shape with four straight sides where the length of the sides and the size of the corners differ.

2. (a) to (n) Learners’ own drawings. Some examples were provided on the previous page, and some are on the following page. Note that figures can be arranged in different orientations, i.e. face different directions (see 2(c)). There are many more possible answers for 2(e), (f), (h) to (l) and (m), and the squares in 2(n) could be different sizes.
Grade 4 Term 3 Unit 7

Data handling

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CAPS time allocation 7 hours

CAPS page references 30 to 31 and 95 to 96

Mathematical background

There is a difference between opinions and facts. The numbers we give are facts; the way we interpret the numbers is opinion. We must use the facts to support our opinions.

Most of the mathematics that learners have done requires them to give a single number as an answer. In statistics we try to find a single number to answer a question, but the number must be representative of all the numbers that we have gathered as data. In data handling we are looking at trends. Different representations help us to analyse these trends.

To reiterate what was stated in Term 1, data handling differs from mathematics in several ways:

- **The answer to data questions is in the information from lots of data gathered.**
  Data handling is necessary where measurements and frequencies vary, and therefore one measurement cannot provide accurate information about a situation. Lots of different data can be confusing, so we organise the data that we collect in different ways to get the “picture” of the situation.

- **The numbers we use in data handling always have some unit of measurement, or some description of a category they belong to.**
  In mathematics, learners mostly work with abstract numbers. In data handling the numbers must be interpreted in a context. The number 2 can be 2 cm or 2 rhinos, depending on the question.

- **Data questions are always answered with a story about the context.**
  Data handling starts when we need to answer a question about a situation where the property we are looking at varies. The numerical answers we get through data handling must be interpreted to answer the question about the situation.
7.1 Reading data in tables

Teaching guidelines
Prepare the table on the board or on a poster for use in class discussions.

Aim to spend about 2 hours on this section.

In questions 1(a) and (b) it is important to stress the word “about”: learners are not asked exact numbers. Learners’ estimates may differ and lead them to interpret the statements in questions 1(a) and (b) differently. Whether learners agree or disagree depends on how much difference they are willing to see as “almost the same”.

Notes on questions
The data are realistic. You may visit www.wessa.org.za or other relevant websites to get the latest data. Adapt the answers to fit the new data.

Answers
1. (a) Agree – Reason: 15 + 52 + 17 + 57 + 4 + 3 + 38 + 1 = 187. In total 333 (146 + 187) rhinos were killed in 2010. Half of 333 is about 167. The 146 killed in the Kruger National Park is 21 less than 167. So it is fair to say that about half of all the rhinos killed in 2010 in South Africa were killed in the Kruger National Park.

Some learners may differ as they may feel that the difference between 146 and 167 is too big to say “about half”. What is important is the reason they give for their opinion.

(b) Learners’ opinions may differ, because some learners may feel that 52 and 57 are about the same, while others may feel that 52 and 57 are not about the same. What is important is the reasons learners give for their answers.

Agree – Reason: Because the range of rhinos killed is from 0 to 146, 52 and 57 can be considered to be similar amounts, or almost the same, or about the same.

Disagree – Reason: There were 52 rhinos killed in Limpopo and 57 rhinos killed in North West; the numbers clearly differ.

(c) Opinions may differ. Reason: Since 2012 the Western Cape seems to be fighting rhino poaching successfully. Killings seem to be on the increase in the Northern Cape. Overall the killings in these two provinces are less than in the other provinces.
Answers

2. (a) Number of rhinos killed per year. Add the numbers in each column.

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2011</td>
<td>2012</td>
<td>2013</td>
<td>2014</td>
<td></td>
</tr>
</tbody>
</table>

(b) Number of rhinos killed per province between 2010 and 2014. Add the numbers in each row.

<table>
<thead>
<tr>
<th>Province</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kruger National Park</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gauteng</td>
<td>0</td>
<td>00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Limpopo</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North West</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free State</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Cape</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Cape</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(c) The problem is getting worse. More and more rhinos are killed every year. The biggest increase was between 2012 and 2013. In 2014 there were almost four times as many rhinos poached as in 2010.
7.2 Reading data in bar graphs

**Mathematical notes**
Bar graphs are not as accurate as the data in the tables. Use the scale to estimate as accurately as possible.

**Teaching guidelines**
Aim to spend about 1 hour on this section. Prepare the graphs on the board or on posters for use in class discussions. Demonstrate how to compare lengths of bars by fitting shorter bars over longer bars to estimate proportions.

**Notes on questions**
Learners should use the data from Section 7.1, question 2 and Section 7.2, question 1 to write their paragraphs. They should look for trends in the data. For example, they should look to see whether the data is increasing or decreasing and if there were any dramatic increases or decreases over any period. They can also state what the maximum and/or minimum data points are.

**Possible misconceptions**
Learners may think bars that end between scale markings are read in fractions, e.g. 2010: 200 and a half. Help them to understand the scale.

**Answers**
1. (a) Number of rhinos killed in South Africa between 2010 and 2014
   (b) 2010: about 350
       2011: about 450
       2012: about 650
       2013: about 1,000
       2014: about 1,200
   (c) Using the estimates above: about 3,650.
   (d) Using the estimates above: about 200 more.
   (e) We can expect even more killings in 2015 than in 2014. If you compare the 2013 and 2014 numbers, you could estimate 1,400. If you look back to 2012 you could estimate this to be more, perhaps in the region of 1,500.

2. The number of rhinos poached from 2010 to 2014 increased each year. The biggest increase, 350 more killings, occurred between 2012 and 2013. In 2014, the number of rhinos poached was almost four times the number of rhinos poached in 2010.
7.3 Reading data in pie charts and in bar graphs

**Mathematical notes**
In pie charts we estimate the bigger fractions as best we can, while we report the very small fractions just as “very small”. The comparisons we can make at a glance is the important information. The information about exact numbers is not represented in the pie chart.

**Teaching guidelines**
Aim to spend about 2 hours on this section.
- Prepare the charts/graphs on a poster for use in the class discussion.
- Use cut-outs that you can fit onto each other to demonstrate how to compare circle sectors.
- Allow learners to use their own words to write answers and to discuss their opinions.

**Critical knowledge**
Pie charts help us to make comparisons about categories of data. The size of the sector represents the relative proportion of the data. Pie charts do not show the exact numbers. Learners should use their knowledge of fractions to estimate the relative size of the sectors (in later grades learners will use percentages to express the relative size of the sectors).

**Notes on questions**
In question 1(d) learners are asked to state provinces in which few rhinos were killed. They will look for the narrow sectors. They should also look to see whether any province appears to be missing. For example, the Western Cape does not appear, because the proportion of rhinos killed there was so small.

**Answers**
1. (a) Most rhinos killed in SA in 2014 were killed in the Kruger National Park.
   (b) Trace and cut out the blue sector and fit it into the yellow sector. Or draw lines. You should notice that the blue sector is about one third of the circle.
   (c) North West, Limpopo, KwaZulu-Natal, Mpumalanga
   (d) Free State, Western Cape, Northern Cape, Gauteng
   (e) It is the largest nature reserve in South Africa and has many animals, including rhinos. If there are more rhinos in the Kruger National Park than in other reserves, we can expect more killings there.
   (f) About half of all rhinos killed in 2014 were killed in Mpumalanga and Limpopo.
   (g) KwaZulu-Natal and Limpopo
Answers

2. (a) Limpopo: more than 40 killed, while in KwaZulu-Natal there were fewer than 40 killed.
(b) KwaZulu-Natal
(c) In Limpopo the number of rhinos killed in 2014 was more than double the number in 2010. The highest number of killings occurred in 2013. In 2012 and 2014 there were fewer killings than the year before.
(d) In KwaZulu-Natal more than twice the number of rhinos were killed in 2014 than in 2010. In 2011 slightly fewer rhinos were killed than in 2010. In all other years the number of rhinos killed increased each year.
(e) KwaZulu-Natal
(f) Opinions may differ. Overall it is increasing, although the numbers decreased between 2011 and 2012, and also between 2013 and 2014.
Grade 4 Term 3 Unit 8  

Numeric patterns

<table>
<thead>
<tr>
<th>Sections in this unit</th>
<th>Content</th>
<th>Pages in Learner Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Patterns in times tables</td>
<td>Diagonal sequences, i.e. patterns with an increasing difference</td>
<td>262 to 264</td>
</tr>
<tr>
<td>8.2 Tables, rules and flow diagrams</td>
<td>Families of sequences with a constant difference</td>
<td>265 to 266</td>
</tr>
<tr>
<td>8.3 Computer sequences</td>
<td>Equivalence between tables, rules and flow diagrams</td>
<td>267</td>
</tr>
</tbody>
</table>

CAPS time allocation 4 hours
CAPS page references 18 to 19 and 97 to 99

Mathematical background

While providing opportunities to develop understanding of patterns, continuing the sequences or completing the tables according to a pattern also contributes to the development of the Mental Mathematics section of the CAPS.

Numerical patterns, as part of the Content Area “Patterns, Functions and Algebra”, should serve as building blocks in developing the basic concepts of algebra in the Senior and FET phases. The study of numeric patterns should develop the concepts of variable, relationships and functions. The function concept is captured in the notion of the triad

\[
\text{Input numbers } \rightarrow \text{ Rule } \rightarrow \text{ Output numbers}
\]

Much of our pattern work focuses on methods to find the calculation plan (rule), because it is so useful to find input and output numbers.

The following two important empowering approaches to pattern work should be emphasised throughout:

- **Recursive ("horizontal") patterns** in sequences describing the relationship between any two consecutive numbers in a sequence, and then continuing the sequence. For example:

\[
3, 6, 9, 12, 15, 18, 21, \ldots
\]

- **Functional ("vertical") patterns** describing the constant relationship between two sets, and then applying this pattern to calculate further-lying values (e.g. the 100th number). For example:

<table>
<thead>
<tr>
<th>Position no. (Input):</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \times 3 )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequence no. (Output):</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These two ideas (recursive and functional relationships) are important horizon knowledge, i.e. important for future mathematical concepts.
8.1 Patterns in times tables

**Mathematical notes**
The focus of this section is the introduction of a new kind of sequence that is different to the constant difference patterns we have studied so far.

In contrast to a *constant* difference sequence like this:

\[
\begin{array}{cccccc}
2 & 6 & 10 & 14 & 18 & 22 \\
\end{array}
\]

we have *changing* differences as below. Although the differences are changing, there nevertheless is a pattern (a *constant* aspect) in the way that they change. Here, the differences increase with a constant amount:

\[
\begin{array}{cccccc}
2 & 6 & 12 & 20 & 30 & \ldots \\
\end{array}
\]

We stay with our familiar context of the multiplication table. But whereas we previously studied the horizontal and vertical sequences in the table (all are constant difference, multiples sequences), we now focus on some *diagonal sequences* like 2, 6, 12, 20, ...

The mathematics is interesting. Our previous patterns had a constant horizontal difference and the new patterns have a changing horizontal difference, as shown above. Similarly, our previous multiples sequences in the table had a constant vertical multiplication calculation plan, for example:

\[
\begin{array}{cccccc}
\text{Position no.} & 1 & 2 & 3 & 4 & 5 \\
\text{Sequence no.} & 4 & 8 & 12 & 16 & 20 \\
\end{array}
\]

We now likewise find that our diagonal sequences have a changing vertical multiplication plan, but that there is a pattern (a *constant* aspect) in the way that it changes, for example:

\[
\begin{array}{cccccc}
\text{Position no.} & 1 & 2 & 3 & 4 & 5 \\
\text{Sequence no.} & 2 & 6 & 12 & 20 & 30 \\
\end{array}
\]

**Teaching guidelines**
Instead of lecturing and telling learners about these beautiful and interesting diagonal sequences, we suggest that you should allow learners ample time to find the sequences in the table, to analyse them and to describe the patterns in their own words.
These sequences are all the same in the sense that they all have a horizontal increasing difference pattern. For example in questions 1 and 2:

1. 1 4 9 16 25 36 49

2. 2 6 12 20 30 42 56

Learners can find the next few numbers by continuing this pattern. But it will not be an efficient method to continue in this way up to 20 or to 100. On the other hand, it may also not at all be easy to find a vertical calculation plan.

You should encourage learners not to try to find patterns in the numbers, but in the structure of the numbers. In this case, the sequence comes from the multiplication table; the numbers in the multiplication table are formed in a certain way, so we can unravel the structure in the sequences by going back to the multiplication table and understanding its structure. Here is a sample from the table (question 2), showing where the numbers are located, and how they are formed:

<table>
<thead>
<tr>
<th>Pos no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seq no.</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>20</td>
<td>30</td>
<td>?</td>
</tr>
<tr>
<td>Structure</td>
<td>1×2</td>
<td>2×3</td>
<td>3×4</td>
<td>4×5</td>
<td>5×6</td>
<td>20×21</td>
</tr>
</tbody>
</table>

Once understood, we can focus on the structure and not the numbers. Once we see the structure, we can generalise the structure and not the numbers:

Position no.  | 1 | 2 | 3 | 4 | 5 | 20 |
---|---|---|---|---|---|----|
Sequence no.  | 2 | 6 | 12| 20| 30| 100|

**Answers**

1. (a) There is an increasing difference between consecutive numbers: +3; +5; +7; ...
   (b) ... 64, 81, 100, 121, 144
   (c) Sequence no. = Position no. × Position no.
   (d) 20th: 20×20 = 400; 100th: 100×100 = 10 000; Vertical is easier than horizontal.

2. (a) There is an increasing difference between consecutive numbers: +4; +6; +8; ...
   (b) ... 72, 90, 110, 132, 156
   (c) Sequence no. = Position no. × (Position no. + 1)
Answers
2. (d) 20th: $20 \times 21 = 420$; 100th: $100 \times 101 = 10000$; Vertical is easier than horizontal.

Notes on questions
You should, as always, emphasise that learners should look at these two kinds of patterns:
• Horizontal pattern of increasing differences: +5; +7; +9; +11; ...
  This pattern is useful to continue the sequence for another few numbers, but not very useful or efficient to continue to the 100th number.
• Vertical pattern as the relationship between the position number and the sequence number, leading to a rule that will make it easy to calculate the 100th number.

You should help learners to use the structure of the multiplication table on page 262 to find the vertical rule, as explained for question 2 on the previous page. Here are patterns for questions 3 and 4:

**Question 3**

<table>
<thead>
<tr>
<th>Position no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>20</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence no.</td>
<td>3</td>
<td>8</td>
<td>15</td>
<td>24</td>
<td>35</td>
<td>45</td>
<td>80</td>
<td>99</td>
</tr>
</tbody>
</table>

**Question 4**

<table>
<thead>
<tr>
<th>Position no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence no.</td>
<td>9</td>
<td>16</td>
<td>21</td>
<td>24</td>
<td>25</td>
<td>47</td>
<td>54</td>
<td>63</td>
</tr>
</tbody>
</table>

**Answers**
3. (a) There is an increasing difference between consecutive numbers: +5; +7; +9; ...
   (b) ... 80, 99, 120, 143, 168
   (c) Sequence no. = Position no. $\times$ (Position no. + 2)
   (d) 20th: $20 \times 22 = 440$; 100th: $100 \times 102 = 10000$; Vertical is easier than horizontal.

4. (a) A diagonal sequence from top right to bottom left in the table.
   There is a decreasing difference between consecutive numbers: +7; +5; +3; ...
   (b) The pattern continues like this: +7; +5; +3; +1; −1; −3; ... So ... 24, 21, 16, 9
   Note that the vertical pattern above is easier: $\times 9$, $\times 8$, $\times 7$, $\times 6$, $\times 5$, $\times 4$, $\times 3$, $\times 2$, $\times 1$
8.2 Tables, rules and flow diagrams

Mathematical notes
We have studied sequences of multiples (the “times tables”) and learners should thoroughly know that all the sequences of multiples (tables) are of the same type:

- The multiples of $k$ all have a constant difference of $+k$ between consecutive numbers (the “horizontal” pattern).
- The multiples of $k$ all have a calculation plan of the form $\times k$ (the “vertical” pattern).

Teaching guidelines
We now start to develop the notion of “families of sequences”: these sequences are all different, but are nevertheless all the same because they share the property that they all have the same constant difference. For example, this family all have a constant difference of 4:

- $3, 7, 11, 15, 19, 23, 27, ...$
- $4, 8, 12, 16, 20, 24, 28, ...$
- $6, 10, 14, 18, 22, 26, 30, ...$

The activities in this section are designed to develop an understanding of the relationship between these families of sequences by comparing their representations in words, flow diagrams, tables and rules. We then identify a relationship between the rules for these families of sequences, which makes it easier for learners to find the rules. For example:

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description in words</th>
<th>Flow diagram/Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>3, 7, 11, 15, 19, 23, 27, ...</td>
<td>one less than multiples of 4</td>
<td>$\times 4 + (-1)$</td>
</tr>
<tr>
<td>4, 8, 12, 16, 20, 24, 28, ...</td>
<td>multiples of 4</td>
<td>$\times 4 + 0$</td>
</tr>
<tr>
<td>6, 10, 14, 18, 22, 26, 30, ...</td>
<td>two more than multiples of 4</td>
<td>$\times 4 + 2$</td>
</tr>
</tbody>
</table>

This provides learners with a very powerful problem-solving strategy: if you have a “difficult” problem, can you first solve an easier related problem? And can you then use the solution of the easier problem to solve the difficult problem?

Answers
Due to space limitations, we use the one-line flow diagram notation, for teachers only.

1. $1, 2, 3, 4, 5, 6, 100$ $\rightarrow$ $5, 9, 13, 17, 21, 25, 401$ (second table)
2. $1, 2, 3, 4, 5, 6, 100$ $\rightarrow$ $4, 8, 12, 16, 20, 24, 400$ (first table)
Teaching guidelines

It is important time wise, but especially conceptually, that learners do not develop the mindset of answering each question as a stand-alone, isolated question.

The idea is that learners will see the relationship between Sequences in A, B, C ..., and therefore the relationship between their flow diagrams and between their rules. If they do, they will have developed a very important and useful problem-solving tool. This will make the work easy, and they can finish quickly.

Answers

Due to space limitations, we use the one-line flow diagram notation, for teachers only.

In the flow diagrams and rules below, we indicate +0 to emphasise the structure and the relationship between the flow diagrams and between the rules for families of sequences. But it is of course not necessary, because of the important additive property of 0, namely that adding 0 leaves the answer unchanged.

2. A (a) 1, 2, 3, ...  \(\times 4\)  + 0  \(\rightarrow\)  4, 8, 12, ...  
(b) 32, 36, 40, 44, 48  
(c) 400

B (a) 1, 2, 3, ...  \(\times 4\) + 1 \(\rightarrow\)  5, 9, 13, ...  
(b) 33, 37, 41, 45, 49  
(c) 401

C (a) 1, 2, 3, ...  \(\times 4\) + 2 \(\rightarrow\)  6, 10, 14, ...  
(b) 34, 38, 42, 46, 50  
(c) 402

D (a) 1, 2, 3, ...  \(\times 4\) + 3 \(\rightarrow\)  7, 11, 15, ...  
(b) 35, 39, 43, 47, 51  
(c) 403

E (a) 1, 2, 3, ...  \(\times 4\) + 4 \(\rightarrow\)  8, 12, 16, ...  
(b) 36, 40, 44, 48, 52  
(c) 404

(d) All the sequences have a difference of 4, but with different starting numbers. The flow diagrams all have the same \(\times 4\) multiplication operator, but different addition operators.

3. A (a) Sequence no. = 5 \(\times\) Position no. + 0  
(b) 35, 40, 45, 50, 55  
(c) 500

B (a) Sequence no. = 5 \(\times\) Position no. + 1  
(b) 36, 41, 46, 51, 56  
(c) 501

C (a) Sequence no. = 5 \(\times\) Position no. + 2  
(b) 37, 42, 47, 52, 57  
(c) 502

D (a) Sequence no. = 5 \(\times\) Position no. + 3  
(b) 38, 43, 48, 53, 58  
(c) 503

E (a) Sequence no. = 5 \(\times\) Position no. + 7  
(b) 42, 47, 52, 57, 62  
(c) 507

F (a) Sequence no. = 5 \(\times\) Position no. − 1  
(b) 34, 39, 44, 49, 54  
(c) 499

(d) All the sequences have a difference of 5, but with different starting numbers. The rules all have the same \(\times 5\) multiplication operator, but different addition operators.
8.3 Computer sequences

**Note on matching the tables and rules**
To identify which rule goes with which table, learners must connect the properties of the rules with the properties of the tables.

Although this is not knowledge that Grade 4 learners must know and remember (it is in the Senior Phase curriculum), you may know, and some learners may have noticed that:

- in the case of **multiples**, the constant horizontal difference in the sequence and the multiplication operator in the rule are the same, for example: 
  3, 6, 9, 12, ... has a constant difference of 3, and the rule is **Output no. = 3 × Input no.**
- in the case of **families of sequences** with a constant difference, the constant difference is the same as the multiplication operator in the rule, for example: 
  7, 10, 13, ... has a constant difference of 3, and the rule is **Output no. = 3 × Input no. + 4**

Alternately, learners can substitute the input numbers 1, 2, 3, ... into each rule (make their own table for the rule) and compare it to P, Q, R and S.

**Note on finding input values (solving equations)**
To find missing input numbers in the table, learners may use a trial-and-improvement strategy by using a forward strategy. For example, to find the input value for 57 in P, learners can try, say 8, giving $8 \times 5 + 2 = 42$, which is too small. They should then try bigger numbers until they find the correct one: $11 \times 5 + 2 = 57$.

Or, if they can write the rule as a flow diagram (question 3), they can use a reverse strategy, i.e. use inverse operations in reverse, e.g. for P: $(57 - 2) ÷ 5 = 11$.

**Answers**

1. A → S   B → R   C → Q   D → P

2. **P**
   - Input no. 1, 2, 3, 4, 5, 6, 18, 100
   - Output no. 7, 12, 17, 22, 27, 32, 37, 502

3. **A:** 1, 2, 3, 4, 5, 6, 18, 100 → $3 \times 3 + 4$ → 7, 10, 13, 16, 19, 22, 26, 304
   **B:** 1, 2, 3, 4, 5, 6, 13, 100 → $3 \times 3 + 3$ → 7, 11, 15, 19, 23, 27, 31, 403
   **C:** 1, 2, 3, 4, 5, 6, 26, 100 → $2 \times 2 + 5$ → 7, 9, 11, 13, 15, 17, 20, 205
   **D:** 1, 2, 3, 4, 5, 6, 11, 100 → $5 \times 2 + 2$ → 7, 12, 17, 22, 27, 32, 37, 502
Grade 4 Term 3 Unit 9    Whole numbers: Addition and subtraction

<table>
<thead>
<tr>
<th>Sections in this unit</th>
<th>Content</th>
<th>Pages in Learner Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1 Add and subtract distances</td>
<td>Revising addition and subtraction in an extended investigation</td>
<td>268 to 270</td>
</tr>
<tr>
<td>9.2 Be smart with addition and subtraction</td>
<td>Replacing calculations with equivalent but simpler calculations</td>
<td>270 to 273</td>
</tr>
<tr>
<td>9.3 Add and subtract to find information</td>
<td>Problem solving</td>
<td>273 to 274</td>
</tr>
</tbody>
</table>

**CAPS time allocation**

4 hours

**CAPS page references**

14 to 15, 69 to 71 and 100

**Mathematical background**

Learners continue to make new number facts from number facts they know or are given. They work through examples where they apply this strategy when adding and subtracting.

Learners continue to engage with three methods of addition in Grade 4:

A. Adding by filling up multiples of 10 and 100.
B. Adding by breaking down one number (the smaller one) into place value parts and adding the parts one by one.
C. Adding by breaking down both numbers, rearranging and adding up the answers of the parts.

Learners also engage with two methods of subtraction in Grade 4:

A. Subtracting by filling up multiples of 10 and 100 (subtraction by addition).
B. Subtracting by breaking down both numbers, rearranging and adding up the answers of the parts.

Learners can only apply these methods effectively if they know the addition and subtraction bonds for units and for multiples of ten and hundred well, or are able to quickly reconstruct these facts. This is practised in this unit.

Learners should also continue to use estimation to check whether their answers are reasonable.
9.1 Add and subtract distances

**Mathematical notes**
Section 9.1 is an investigation. Learners are asked to predict who will win the race (question 1). The situation involves speed, distance and time. This provides an extended context to practise addition and subtraction. As learners analyse the data and do more and more of the addition and subtraction calculations, they continuously are in a better position to predict who will win the race, so they are asked again in question 5 to make the prediction.

**Teaching guidelines**
Aim to cover this section in 1 hour and 40 minutes. One possibility is to use
- questions 1 to 8 for classwork, and
- questions 9 to 12 for additional practice.

Learners may use different methods of adding and subtracting. If a learner’s method differs from the one you expect, do not penalise the learner if his/her calculations are appropriate.

**Answers**
1. Learners’ own responses. Note that they have to provide a reason for their answer. Some learners may say Annie will win because she has run faster than Ellen during the first and second 10-minute intervals. Other learners may feel that they cannot say as Annie may slow down later in the race and Ellen may maintain her speed.

2. (a) 3 702 m
   (b) 6 298 m
   (c) \((1 867 + 1 835) - (1 768 + 1 778) = 156 m\)
   Learners can work out how far Ellen ran in 20 minutes and then subtract it from how far Annie ran in 20 minutes: 3 702 m – 3 546 m = 156 m
   Learners can subtract Ellen’s first distance from Annie’s first distance, and Ellen’s second distance from Annie’s second distance, and add the result: 99 m + 57 m = 156 m

3. (a) 5 504 m – 3 702 m = 1 802 m
   (b) 5 345 m – 3 546 m = 1 799 m
   (c) 3 m

4. 50 minutes (Ellen covered 5 345 m in 30 minutes, so she could double that distance in 60 minutes. She could therefore probably cover 10 000 m in 50 minutes.)

5. Learners’ own responses. Note that they have to provide a reason for their answer.
Teaching guidelines

Tables A, B and C are provided in the Addendum (pages 458 and 459). If you have access to a photocopier, you can photocopy them to save time.

Learners will use results from previous questions in later questions. As learners work through the questions, check their answers, so that they don’t use incorrect answers in later questions.

Also stop learners from time to time so that they can discuss their thinking, work and answers with the rest of the class.

Answers

6. and 7. Refer to the tables below.

<table>
<thead>
<tr>
<th>Table A: The distance covered after different times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>Annie</td>
</tr>
<tr>
<td>Ellen</td>
</tr>
<tr>
<td>Gap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table B: The distances covered in different 10-minute periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
</tr>
<tr>
<td>Annie</td>
</tr>
<tr>
<td>Ellen</td>
</tr>
<tr>
<td>Difference</td>
</tr>
</tbody>
</table>

8. (a) No
(b) Refer to tables above.

9. (a) Faster
(b) 10 m
(c) 21 m

6. Copy Tables A and B to help you to keep a record of the race.

<table>
<thead>
<tr>
<th>Table A: The distance covered after different times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>Annie</td>
</tr>
<tr>
<td>Ellen</td>
</tr>
<tr>
<td>Gap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table B: The distances covered in different 10-minute periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
</tr>
<tr>
<td>Annie</td>
</tr>
<tr>
<td>Ellen</td>
</tr>
<tr>
<td>Difference</td>
</tr>
</tbody>
</table>

7. Complete as much of the tables as you can. Use the information you produced when you did questions 2 and 3. Write your answer for question 3(c) in the row for “difference” in Table B.

During the fourth 10-minute period of the race, Annie runs 1 774 m and Ellen runs 1 809 m.

8. (a) Is Ellen now ahead of Annie in the race?
(b) Write all the new information into Tables A and B.

9. Think about the distances that Ellen ran over the first, second, third and fourth 10-minute periods.
(a) Is she running faster or slower as the race progresses?
(b) How much further does she run in the second 10 minutes, than in the first 10 minutes?
(c) How much further does she run in the third 10 minutes, than in the second 10 minutes?
**Answers**

10. (a) to (c)

**Table C:** Differences between the distances covered in different 10-minutes periods

<table>
<thead>
<tr>
<th>Period</th>
<th>1st and 2nd periods</th>
<th>2nd and 3rd periods</th>
<th>3rd and 4th periods</th>
<th>4th and 5th periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annie</td>
<td>32 m slower</td>
<td>33 m slower</td>
<td>28 m slower</td>
<td>38 m slower</td>
</tr>
<tr>
<td>Ellen</td>
<td>10 m faster</td>
<td>21 m faster</td>
<td>10 m faster</td>
<td>11 m slower</td>
</tr>
</tbody>
</table>

11. Annie

12. Refer to Tables A, B and C above.

**9.2 Be smart with addition and subtraction**

**Teaching guidelines**

Aim to cover this section in 1 hour and 40 minutes. One possibility is to use:

- questions 1, 2 and 7 for mental mathematics,
- questions 3(d) and the tinted passage on page 271 for concept development,
- questions 3(b), (c) and (e), 4(a) and (c), 5(a), (c), (e), (g), (i) and (k), 8, 9(a), (c) and (e), and 10 for classwork, and
- questions 3(a), (f) and (g), 4(b) and (d), 5(b), (d), (f), (h), (j) and (l), 6, and 9(b), (d) and (f) for additional practice.

Note that it is important for learners to see questions 1 and 2 in their textbooks while they calculate the answers.

Learners should always strive to work smarter, better and faster. Sometimes they can use a previous answer to reduce the amount of calculation needed (see question 7). At other times they can manipulate the calculation to make it easier (see the tinted passage on page 271).

**Notes on questions**

In question 1, pairs of numbers are equal to 2 000, e.g. 1 001 + 999 = 1 000 + 1 000 = 2 000. Each question has 4 pairs. $4 \times 2 000 = 8 000$.

In question 2 learners can see that 997 is added 10 times. Some learners may say this is $997 \times 10$ while other learners may say: $(10 \times 1000) - (10 \times 3)$.

**Answers**

1. (a) 8 000 (b) 8 000 (c) 8 000 (d) 8 000

2. 9 970
Teaching guidelines

Check that learners understand the language of addition and subtraction:

- The *sum* is the answer to an addition calculation.
- To find the *difference* between two numbers you have to subtract.

Learners have been working with filling up to the next multiple of 10, 100 or 1 000 since Term 1. Learners have also been breaking numbers down, recombining them and building them up. They have also used *transfer*.

Help learners to see that when they use *transfer* to make an addition calculation easier they transfer part of one number to the other number (so the total remains the same). This is really breaking down one number (but not into place value parts) and recombining the numbers before adding the total, for example 3 784 + 2 737 = 3 784 + (16 + 2 721) = (3 784 + 16) + 2 721 = 3 800 + 2 721, etc.

When learners use transfer for subtraction they are still filling up to the next multiple of 10, 100 or 1 000 (usually it is the number subtracted that is changed). With subtraction the amount used to “fill up” is not transferred from one number to the other. It is added to (or taken away from) both numbers: the *difference between the numbers remains the same*, for example 10 – 5 = 12 – 7 = 16 – 11 or 7 243 – 3 569 = 7 243 – 3 600 = 7 674 – 4 000.

Answers

3. (a) 7 982 + 2 648 = 10 630
   (b) 8 002 – 796 = 7 206
   (c) 895 + 6 853 + 9 342 = 17 090
   (d) 7 178 – 3 099 + 1 021 = 5 100 or
       (7 178 – 3 099) + 1 021 = 4 079 + 1 021 = 5 100
   (e) 4 050 – 3 505 = 545; 2 999 + 1 878 = 4 877; 4 877 + 545 = 5 422 or
       (4 050 – 3 505) + (2 999 + 1 878) = 545 + 4 877 = 5 422
   (f) 3 784 + 2 737 = 6 521
   (g) 7 243 – 3 569 = 3 674

4. (a) 3 403 + 2 265 = 3 400 + 2 268 = 3 000 + 2 668 = 5 668
   (b) 7 259 + 2 135 = 7 294 + 2 100 = 7 394 + 2 000 = 9 394
   (c) 3 459 + 2 265 = 3 424 + 2 300 = 3 724 + 2 000 = 5 724
   (d) 7 259 + 1 875 = 7 234 + 1 900 = 7 134 + 2 000 = 9 134
Notes on questions

In question 5 remind learners that when they add, they can transfer one amount from one number to the other to keep the totals the same. But when they subtract, they should add or subtract the same amount to or from both numbers to keep the difference the same.

Both questions 6 and 10 have calculations with brackets. Learners know to calculate what is inside the brackets first. Where the brackets are placed relative to the numbers and operations impacts on the answers.

In question 7 learners should use some answers to get other answers. For example, the answer to 7(b) will help with the answer to 7(c), 7(c) will help you to get 7(d), the answer to 7(f) will help with the answer to 7(g), 7(g) helps you to get 7(h).

Answers

5. (a) 6 145 + 2 975 = 6 120 + 3 000
   (b) 4 509 + 2 793 = 4 302 + 3 000
   (c) 6 978 – 3 123 = 6 855 – 3 000
   (d) 5 346 – 1 218 = 5 128 – 1 000
   (e) 7 966 – 4 663 = 7 303 – 4 000
   (f) 6 243 – 4 185 = 6 058 – 4 000
   (g) 8 396 – 5 579 = 7 817 – 5 000
   (h) 5 322 – 1 873 = 5 145 – 2 000
   (i) 4 008 – 2 399 = 3 609 – 2 000
   (j) 5 399 + 3 006 = 5 405 + 3 000
   (k) 2 305 + 5 032 + 1 019 = 2 356 + 5 000 + 1 000
   (l) 9 098 – 4 105 – 1 199 = 8 993 – 4 000 – 1 199 = 8 794 – 4 000 – 1 000 = 3 794

6. (a) 5 557
   (b) 5 557
   (c) 2 779
   (d) 2 779

7. (a) 3 145
   (b) 4 945
   (c) 5 145
   (d) 5 165
   (e) 2 745
   (f) 945
   (g) 745
   (h) 725

8. 9 500 – (2 341 + 578 + 4 690) = 9 500 – 7 609 = 1 891
### Teaching guidelines
Aim to cover this section in 1 hour and 40 minutes. One possibility is to use

- question 1 for concept development,
- questions 3, 4, 6, 7 and 10 for classwork, and
- questions 2, 5, 8, 9 and 11 for additional practice.

You can read question 1 to learners and ask them to explain the question in their own words. Ask questions like: “What does this question ask you to do?”, “What useful information were you given?”, “What will you do now?” Let learners do the actual calculations.

### Possible misconceptions
Some learners may just add the two amounts in question 4 to get an answer of R2 398. If they do this, you can ask them questions like: “Does the fridge cost more or less than the stove?”, “How do you know this?”, “What is the cost of the stove?”, “What is the cost of the fridge?” Then ask them to recalculate the total cost.

### Notes on questions
In question 4 learners first need to find the cost of the fridge: R2 099 + R299 = R2 398. Then add the cost of the stove, i.e. R2 099 + R2 398 = R4 497.

Draw learners' attention to the fact that question 3 does not ask how many girls there are in the school but “how many more boys than girls” there are.

### Answers

1. 493 tickets
2. 3 931 tins
3. 157 more boys than girls
4. R2 398 + R2 099 = R4 497
5. R2 018
**Mathematical notes**

Learners can use a variety of calculation methods to get the answers. This is why no number sentences are provided in the answers. For example, learners could break down numbers into place value parts, recombine and then add up the answer. They could fill up to the nearest multiple of 10, 100 or 1 000. Learners may use adding on where you might have thought of subtraction. Do not penalise learners if they use a different method to the one you expected. Check that their calculations and answers are correct.

**Teaching guidelines**

Remind learners of the value of estimating before calculating.

Also remind learners that they can check every addition calculation by doing a subtraction calculation, and vice versa.

**Possible misconceptions**

In question 7 some learners might not notice that the volume of water (1 457 ml) is given in millilitres and the capacity of the tank (5 000 ℓ) in litres. If learners get an answer of 3 543 ℓ, it means that they have not noticed this difference in units. Ask learners: “How much water is in the tank? Is it more or less than 2 litres? 10 litres? 100 litres? 1 000 litres?”

**Answers**

6. (a) R 6 053  
   (b) R 3 456  
   (c) R 2 934  
7. 4 998 ℓ and 543 ml  
8. 1 459 pear trees  
9. 918 loaves of bread  
10. (a) 4 576 m  
    (b) 2 678 m − 1 898 m = 780 m  
11. (a) R 9 137  
    (b) R 2 119

6. Juanita earns R4 756 per month. Latifa earns R1 297 more than Juanita per month.  
   (a) How much does Latifa earn?  
   (b) How much will Juanita have left over if she pays R1 300 for her rent?  
   (c) How much will Latifa have left over after she pays R230 for her TV licence, R 2 040 for rent and R489 for life insurance?  
7. A tank can hold 5 000 ℓ of water. At the beginning of the rainy season, it contains 1 457 ml of water. How much more water does the tank need to be full?  
8. Bongi has 1 286 pear trees on his farm. Josh has 2 745 pear trees on his farm. How many more pear trees than Bongi does Josh have?  
9. Red Ribbon Bakery delivers 1 856 loaves of bread daily and Tangwa Bakery delivers 2 774 loaves daily. What is the difference between the numbers of loaves delivered daily by the two bakeries?  
10. A road grader scraped 1 254 m of a gravel road on Tuesday. On Wednesday the grader worked 1 898 m of the road and on Thursday 1 424 m.  
    (a) How much of the road was scraped altogether?  
    (b) How much more of the road was scraped on Tuesday and Thursday together than on Wednesday?  
    (a) How much did she spend altogether?  
    (b) How much more did she spend on the sewing machine than on the tumble dryer?
Grade 4 Term 3 Unit 10  Whole numbers: Multiplication

### Learner Book Overview

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<td>Revision of multiplication of 2-digit numbers by 2-digit numbers</td>
<td>275 to 277</td>
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<td>Doubling, rounding off and compensating as methods</td>
<td>278 to 279</td>
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<tr>
<td>10.3 Think and make plans</td>
<td>Multiples, estimation and word problems</td>
<td>279 to 280</td>
</tr>
</tbody>
</table>

**CAPS time allocation** 5 hours

**CAPS page references** 13 to 15 and 101

**Mathematical background**

This unit provides for the knowledge and skills listed below.

- **How to multiply by units and multiples of 10.**
  Where learners do not know the multiplication facts, they should know calculation strategies that allow them to reconstruct the facts quickly. A multiplication fact is something that we know off by heart, such as $9 \times 7 = 63$. If learners do not know this multiplication fact, they should have a way to work it out quickly. For example, $10 \times 7 = 70$, so $9 \times 7 = 70 - 9 = 63$.

- **If you change the order of two numbers when multiplying, it does not change the answer.** For example, $7 \times 9 = 9 \times 7$; $50 \times 6 = 6 \times 50$. This is the commutative property of multiplication. Learners are *not* expected to know the name of this property. They only need to know how to use it to make calculations more manageable.

- **If you change the way numbers are grouped when you multiply, it does not change the answer.** For example, $7 \times (8 \times 100) = (7 \times 8) \times 100$. A learner might know that $6 \times 12 = 72$ but might not know what $3 \times 24$ is. $3 \times (2 \times 12) = (3 \times 2) \times 12 = 6 \times 12 = 72$. This is the associative property of multiplication. Learners are *not* expected to know the name of this property. They only need to know how to use it to make calculations more manageable.

- **If a calculation involves multiplication as well as addition and/or subtraction, you do the multiplication first.** However, if anything is in brackets, then that is done first. These are mathematical conventions.

- **You can break a number down into parts and multiply each part.** Mostly we break numbers down into place value parts to multiply. Each part must be multiplied by each other part, for example $53 \times 75 = 50 \times 70 + 50 \times 5 + 3 \times 70 + 3 \times 5$. The aim is to replace a difficult calculation with easier calculations.

- **You can break a number down into factors to multiply,** for example $23 \times 32 = 23 \times 2 \times 16 = 46 \times 2 \times 8 = 92 \times 2 \times 4 = 184 \times 2 \times 2 = 368 \times 2 = 736$. The aim is to replace a difficult calculation with easier calculations.

- **Learners’ approach should be one of linking different aspects of mathematics and trying to make “new” number facts from number facts that they already know.**

- **Estimation skills.**

The aim is to be able to use the knowledge and approaches outlined above to make multiplication more manageable.
10.1 Revision

Teaching guidelines
Aim to cover this section in 2 hours. One possibility is to use
- question 7 for mental mathematics,
- questions 2, 5 and 11(a) and (b) for concept development,
- questions 1, 3, 4, 8(a) and (b), 9 and 10 for classwork, and
- questions 6, 8(c) and (d), and 11(c) for additional practice.

For numbers bigger than 10, it is inefficient to use repeated addition to multiply. Begin by asking learners to complete question 1 using any method they know. Let them share their answers. You can show learners how to imagine this calculation in an array of 23 times 7 (23 rows of 7): see Term 1 Section 5.1 in this Teacher Guide (page 65) for how to model this on grid paper. Then you can show how to break this down into 20 rows of 7 and 3 rows of 7.

You can use question 5 to show learners how to use an array to model 2-digit by 2-digit multiplication.

Possible misconceptions
Ben’s calculation in question 5 is an example of a common learner error. When learners break down numbers, they sometimes incorrectly only multiply the tens with the tens and the units with the units. This is an overgeneralisation from addition. Drawing a grid to show the number (e.g. 28 × 56) as an array and how this can be broken down into four different, smaller arrays, can help learners to see that breaking numbers down into tens and units to multiply will give them four smaller multiplication calculations to do (see alongside).

Answers
1. 161
2. 20 × 7 + 3 × 7
3. 378
4. ... = 40 × 70 + 40 × 8 + 6 × 70 + 6 × 8 = 2 800 + 320 + 420 + 48 = 3 588
5. No. He should also calculate 20 × 6 + 8 × 50 and add that to 1 000 + 48.
**Critical knowledge**

Multiply by units, multiply by 10, multiply by multiples of 10.

You can break numbers down, for example into place value parts, and multiply each part separately, for example $67 \times 46 = 60 \times 40 + 60 \times 6 + 7 \times 40 + 7 \times 6$.

When you break numbers down as above in order to multiply, you must multiply each part by each other part.

If you multiply two or more numbers, you may change the order in which you multiply them. The answer will remain the same.

You can also break numbers down into factors in order to multiply, for example $80 \times 70 = 8 \times 10 \times 7 \times 10 = 8 \times 7 \times 100 = 56 \times 100 = 5600$.

When multiplication occurs in an expression together with addition and/or subtraction, you do the multiplication first.

**Teaching guidelines**

You can use the tinted passage to show learners one way to set out their work to avoid confusion as to which numbers should be multiplied by which other numbers. You can also encourage learners to show the numbers broken down into place value parts as an array.

**Answers**

6. The last part is wrong. It should be $40 \times 60 + 40 \times 6 + 6 \times 60 + 6 \times 7$.

7. 

<table>
<thead>
<tr>
<th>x</th>
<th>70</th>
<th>8</th>
<th>30</th>
<th>40</th>
<th>5</th>
<th>60</th>
<th>7</th>
<th>80</th>
<th>9</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>280</td>
<td>32</td>
<td>120</td>
<td>160</td>
<td>20</td>
<td>240</td>
<td>28</td>
<td>320</td>
<td>36</td>
<td>360</td>
</tr>
<tr>
<td>80</td>
<td>5600</td>
<td>640</td>
<td>2400</td>
<td>3200</td>
<td>400</td>
<td>4800</td>
<td>560</td>
<td>6400</td>
<td>720</td>
<td>7200</td>
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<td>7</td>
<td>490</td>
<td>56</td>
<td>210</td>
<td>280</td>
<td>35</td>
<td>420</td>
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<td>3600</td>
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<td>3000</td>
<td>350</td>
<td>4000</td>
<td>450</td>
<td>4500</td>
</tr>
</tbody>
</table>

6. This is what Jaamiah did when she tried to calculate $46 \times 67$:

$46 \times 67 = 40 \times 67 + 6 \times 67 = 40 \times 60 + 40 \times 6 + 7 \times 40 + 7 \times 6$

Where did Jaamiah go wrong?

7. Copy this multiplication table and complete it.
Mathematical notes
When we multiply each part of a number by another number, we say that multiplication is distributed over addition or subtraction. It is the distributive property of multiplication that allows us to say $43 \times 38 = 40 \times 38 + 40 \times 8 + 3 \times 30 + 3 \times 8$. Learners are not expected to know these terms, just how to use this property to make multiplication more manageable.

Teaching guidelines
Monitor learners closely when they work on question 8, and provide support where needed.

Learners have already seen that they can break numbers down to multiply, for example $43 \times 38 = 40 \times 38 + 3 \times 38$. If we change the order of the numbers multiplied, this gives us $38 \times 40 + 38 \times 3$.

In question 9 learners will see that $4 \times 3$ bananas $+ 4 \times 5$ bananas $= 32$ bananas. Draw learners' attention to the fact that in question 9, two numbers are multiplied by the same number and the answers (products) added.

In question 10 learners will see that $4 \times 8$ bananas $= 32$ bananas. The numbers were first added and then multiplied. The answers to questions 9 and 10 are the same because the same numbers were used.

Explain that this can be used in question 11. All the numbers in question 11 are multiplied by 28. This means that you can add numbers before they are multiplied. Because it is easy to multiply by multiples of 10, you can add numbers to make multiples of 10. So, $28 \times 14 + 28 \times 6 = 28 \times 20 = 560$. $28 \times 9 + 28 \times 11 = 28 \times 20 = 560$.

$28 \times 27 + 28 \times 3 = 28 \times 30 = 840$. All the answers can then be added to get $1\,960$. You could also first add all the numbers, i.e. $28 \times (14 + 6 + 9 + 11 + 27 + 3) = 28 \times 70 = 1\,960$.

Answers
8. (a) 1 634  (b) 1 036  
   (c) 1 824  (d) 3 648  
9. 32 bananas  
10. 32 bananas  
11. (a) Learners may come up with different plans, e.g. calculate $14 + 6$ and $9 + 11$ and $27 + 3$ and then $28 \times 20 + 28 \times 20 + 28 \times 30$ or calculate $14 + 9 + 27 + 6 + 11 + 3$ and then $28 \times 70$.
   (b) Learners compare their plans.
   (c) 1 960
10.2 Different methods of multiplication

Mathematical notes
Four different approaches to multiplication are shown here:
- Question 1 shows multiplication by repeated doubling.
- Question 2 shows a building-up method based on multiplying by 10. This is often used for division.
- Question 3 shows the method of multiplying by breaking down into place value parts and building up the answer. This is the method that learners used in Term 2.
- Question 4 shows a rounding off and compensating method.

Teaching guidelines
The purpose of this sequence of questions is to promote the ability to read written representations of mathematical thinking. One reason why this is important is that learners have to read and follow calculations written on the board or in the textbook. Allow learners to read each passage by themselves and then apply the method to the suggested calculation. Working through these alternative methods might also help learners to better understand the method of breaking numbers down into place value parts to multiply.

Answers
1. 2 688. This is calculated as follows with Percy’s method:

\[
\begin{align*}
16 \times 64 & + 16 \times 64 = 32 \times 64 = 2 048 \\
32 \times 64 & + 8 \times 64 = 40 \times 64 = 2 048 + 512 = 2 560 \\
40 \times 64 & + 2 \times 64 = 42 \times 64 = 2 560 + 128 = 2 688
\end{align*}
\]

2. 1 288. Ensure that learners use Busi’s method, as shown on page 278 alongside.

3. 1 036. Ensure that learners use Faiza’s method, as shown on page 278 alongside.

4. Accept all reasonable answers. One possible answer is:

\[
\begin{align*}
34 \times 50 & = 1 700 \\
34 \times 4 & = 30 \times 4 + 4 \times 4 = 120 + 16 = 136 \\
34 \times 54 & = 1 700 + 136 = 1 836
\end{align*}
\]
Notes on questions
In question 5 you might like to help learners to think about which number to round off. In questions 5(a) and (b) it may be easy to see that 98 is close to 100 and 19 is close to 20. In question 5(c) either 47 can be rounded off to 50 or 17 can be rounded off to 20. In question 5(d) either 38 can be rounded off to 40 or 23 can be rounded off to 20 (in this case you have to add to compensate).

Answers
5. (a) Rounding off: 44 \times 100 = 4 400
   Compensating by subtracting 2 lots of 44: 4 400 − 2 \times 44 = 4 400 − 88 = 4 312
(b) Rounding off: 34 \times 20 = 680
   Compensating by subtracting 34: 680 − 1 \times 34 = 646
(c) Rounding off: 50 \times 17 = 850
   Compensating by subtracting 3 lots of 17: 850 − 3 \times 17 = 850 − 51 = 799 or
   Rounding off: 47 \times 20 = 940
   Compensating by subtracting 3 lots of 47: 940 − 3 \times 47 = 940 − 141 = 799
(d) Rounding off: 38 \times 20 = 760
   Compensating by adding 3 lots of 38: 760 + 3 \times 38 = 760 + 114 = 874 or
   Rounding off: 40 \times 23 = 920
   Compensating by subtracting 2 lots of 23: 920 − 2 \times 23 = 920 − 46 = 874

10.3 Think and make plans

Teaching guidelines
Aim to spend about 2 hours on this section. One possibility is to use
- questions 1(a) and 2(a) for mental mathematics,
- questions 4 and 5(a) and (b) for concept development,
- questions 1(b) to (e), 3, 5(e) to (h), 6(a), (c) and (e), and 7(c) and (d) for classwork, and
- questions 2(b) and (c), 5(c), (d), (i) and (j), 6(b), (d) and (f), and 7(a) and (b) for additional practice.

Question 4 could be a bit of a challenge. Because the original number is not known, learners can represent this with a box: \[ \square \]. Then add 5: \[ \square + 5 \]. Then multiply by 3: \[ (\square + 5) \times 3 = 27 \]. Learners can either solve this by trying random numbers or they can ask themselves: \[ \text{what} \times 3 = 27? \]

In questions 5(a) and (b) the calculations are the same because only the order of the numbers multiplied is swapped. This is also true for 5(e) and (f).

Answers (see next page)
Answers

1. (a) 100; 125; 150; 175; 200; 225; 250; 275; 300; 325
   (b) 1 125; 1 375; 3 050
   (c) Learners’ answers will differ. Learners should recognise that it is a pattern of skip counting in 25s, or a sequence of multiples of 25. Learners may say something like: *thousands and hundreds are multiples of 25, so I looked which tens and units are multiples of 25 (a quick method) or I divided the numbers by 25 (a long method).*
   (d) 350
   (e) 20

2. (a) 60; 75; 90; 105; 120; 135; 150; 165; 180; 195
   (b) 300; 6 000; 915; 1 800
   (c) Learners’ answers will differ. Some possibilities are:
      *15 isn’t a multiple of 145; when 145 is divided by 15 there is a remainder, or 45 is a multiple of 15 but 100 isn’t (I can see from above that 90 and 105 are multiples).*

3. (a) 12 different outfits
   Learners might work out the answers in different ways. One possibility is:
   - Skirt 1: 4 blouses
   - Skirt 2: 4 blouses
   - Skirt 3: 4 blouses
   (b) 12 outfits with jacket 1 and 12 outfits with jacket 2 give 24 outfits.

4. 4

5. Accept any reasonable estimates. The final answers are:
   (a) 1 288
   (b) 1 288
   (c) 4 140
   (d) 3 375
   (e) 988
   (f) 988
   (g) 2 262
   (h) 1 218
   (i) 3 648
   (j) 6 324

6. (a) R 4 902
   (b) R 3 818
   (c) R 4 91
   (d) R 3 312
   (e) R 5 696
   (f) R 6 162

7. (a) R 1 872
   (b) 1 980c = R 19,80
   (c) 24 hours × 7 = 168 hours
   (d) 60 minutes × 24 = 1 440 minutes

3. Thandi takes 3 skirts and 4 blouses along on her holiday. All of the blouses match all of the skirts.
   (a) How many different outfits does she have to wear? Show how you got your answer.
   (b) She decides to also take two jackets that she can wear with all of the blouses and skirts. From how many different outfits can she now choose?

4. S is added to a number and the answer is multiplied by 3. The answer is 27. What is the original number?

5. Estimate the answer first and write it down before you do the multiplications.
   (a) 23 × 56
   (b) 56 × 23
   (c) 45 × 92
   (d) 75 × 45
   (e) 38 × 26
   (f) 26 × 38
   (g) 29 × 78
   (h) 42 × 29
   (i) 57 × 64
   (j) 68 × 93

6. Determine the total cost of each of the following.
   (a) 86 boxes of cereal at R 57 each
   (b) 46 sets of cutlery at R 83 for one set
   (c) 53 sets of glasses at R 47 for one set
   (d) 72 pairs of socks at R 46 for one pair
   (e) 64 T-shirts at R 89 for one T-shirt
   (f) 78 caps at R 79 for one cap

7. (a) One diary costs R 39. How much will 48 diaries cost?
   (b) If one bread roll costs 55c, how much will you pay for 36 bread rolls?
   (c) There are 24 hours in a day. How many hours are there in a week?
   (d) There are 60 minutes in an hour. How many minutes are there in 24 hours?
Grade 4 Term 3 Unit 11  Number sentences

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**CAPS time allocation**
3 hours

**CAPS page references**
20 and 102 to 103

**Mathematical background**
It is important that learners are exposed to a range of problem types: these are specified on pages 120 and 121 of the Intermediate Phase Mathematics CAPS. In Sections 11.1 and 11.2 learners work with word problems and translate them into number sentences. There are different situations or problem types associated with each of the operations. Learners work with different problem types associated with summation, namely finding the sum and finding the missing parts of a given sum. They also work with different problem types associated with increase and decrease, namely calculating the result, calculating the change and calculating the initial value. They also work with comparison by difference problems (difference models of subtraction), division as sharing and multiplication as repeated addition.

In Section 11.1 number sentences are provided that learners can link with word problems. This provides a model for the number sentences they are expected to write on their own in Section 11.2. Sometimes writing a number sentence can help learners to clarify what to calculate.

In Section 11.3 learners find numbers that will make the given number sentences true. Initially they guess numbers, but as they find which numbers are too big and which are too small, they begin to work with an increasingly narrow range of numbers until they zone in on the answer.

In Section 11.4 learners apply what they know about numbers and operations as they answer multiple-choice questions.
11.1 Learn to use number sentences

Mathematical notes
This section introduces learners to translating word problems into number sentences. Sometimes learners can see immediately how to solve a problem. At other times it helps to first write a number sentence. This section helps learners to match number sentences with problems. It models for learners how a problem written in words can be translated into a number sentence by providing number sentences that describe each word problem.

Notes on questions
Question 1(b) is probably the easiest sub-question of question 1.
Question 4(a) is similar to question 1(c). They are both examples of the difference model of subtraction. Learners can of course solve them by adding on from the smaller number, for example 60 + what = 75.

Teaching guidelines
Aim to complete this section in 45 minutes.

Give learners about 10 minutes to answer the sub-questions in question 1 that they find easy. While learners are doing this, you can write the three sub-questions on the board. Then go through each sub-question in question 2 until you can match one with question 1(a). Repeat this with 1(b) and 1(c). Learners can then use another 10 minutes to complete question 1. Now that you have modelled the process for learners, they can work through questions 4 and 5 in a similar way.

Possible misconceptions
Sometimes learners are too nervous to try to make sense of the language in word problems. They are inclined to just add the numbers they see, or subtract the smaller number from the bigger number. Insist that learners read the questions and talk about what the problem means, or restate the problem in their own words. For example, in question 1(a) you can ask learners: “How many goats did Gwede start with?”, “How many goats did he end with?”, “Did he have more goats at the end or in the beginning?”, “How did he get the extra goats?”, “How many extra goats did he get?”

Remind learners to always put their answer back in the number sentence to check that it is correct.

Answers
1. (a) 15 goats
Notes on questions

Note that learners are not expected to be able to answer all of questions 1 and 4 immediately. They will only be able to answer some sub-questions of question 1 after matching number sentences from question 2 to the problems, i.e. when they do question 3. Similarly, some sub-questions of question 4 they will only be able to answer when they do question 5, i.e. when they are asked to match number sentences from question 2 to the problems in question 4 that they found difficult and couldn’t solve.

Answers

1. (b) 135 goats

2. (a) 15  (b) 15  (c) 15  (d) 135
   (e) 15  (f) 135  (g) 135  (h) 135

3. Learners try to answer all the parts of question 1 now.
   Note that learners are only expected to match number sentences in question 2 with those problems they could not solve in question 1. The complete list is only provided for your information.

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4. (a) 15 goats  (b) 15 goats  (c) 15 goats
   (d) 15 goats  (e) 135 goats  (f) 135 goats

5. Learners try to answer all the parts of question 4 now.
   Note that learners are only expected to match number sentences in question 2 with those problems they could not solve in question 4. The complete list is only provided for your information.

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11.2 Use number sentences

Notes on questions
Questions 1 and 2 have the same structure and are straightforward subtraction calculations.
Questions 4 and 7 are similar to questions 1(c) and 4(a) in Section 11.1: they are “comparison by difference” situations (of difference models of subtraction).

Teaching guidelines
Aim to cover this section in 45 minutes. One possibility is to use
• questions 3 and 5 for concept development,
• questions 1, 2, 4 and 6 for classwork, and
• questions 7 and 8 for additional practice.

Answers
1. 36 learners (because 78 learners – 42 learners = 36 learners)
2. 952 learners (because 2 378 learners – 1 426 learners = 952 learners)
3. 8 721 chickens (because 8 721 chickens – 5 478 chickens = 3 243 chickens)
4. R423 – R384 = R39
5. R3 677 – R2 780 = R897 = cost of 3 chairs
   Cost of one (each) chair = R897 ÷ 3 = R299
6. 300 m
   Gertie walks 184 m – 124 m = 60 m further than Simon each day.
   So Gertie walks 60 m x 5 = 300 m further than Simon in 5 days.
   Learners may also first calculate how far Simon walked in 5 days (620 m) and subtract
   this from how far Gertie walked in 5 days (920 m): 920 m – 620 m = 300 m.

11.2 Use number sentences

For some of the questions below you will know immediately which calculations to do. For other questions you may need to write a number sentence first.

1. There are 78 learners on two buses together.
   There are 42 learners on the one bus.
   How many learners are on the other bus?
2. There are 2 378 learners in two schools together.
   There are 1 426 learners in the one school.
   How many learners are there in the other school?
3. After 5 478 chickens were killed in a storm, Nomvula had 3 243 chickens left. How many chickens did she have before the storm?
4. Jamie paid R384 for a pair of shoes and Vusi paid R423 for his shoes. How much more did Vusi pay than Jamie?
5. Peter bought 3 chairs for his house, all at the same price. He also bought a refrigerator for R2 780. Peter paid R3 677 in total. How much did each of the chairs cost?
6. Gertie walks 184 m to school and back home every day, and
   Simon walks 124 m to school and back home. How much further than Simon does Gertie walk to school and back, in five days?
Answers
7. 14 cm (because 157 cm − 143 cm = 14 cm)
8. R174 − (3 × R44) = R174 − R132 = R42

11.3 Try a number and improve

Teaching guidelines
Aim to cover this section in 45 minutes. One possibility is to use
- questions 1 and 2 for concept development, and
- two sub-questions of question 3 for classwork.

Learners who like a challenge can try more of question 3 for classwork and additional practice. In these number sentences learners start by trying any number. Advise learners not to start with 0 or 1. However, learners should not continue to try numbers randomly.

In question 1 learners will see that:
- with 6, the left-hand side (LHS) is less than the right-hand side (RHS).
- with 10, the left-hand side (LHS) is more than the right-hand side (RHS).

This means that to make the two sides equal, you need a number between 6 and 10. Learners should aim to find a narrower and narrower number range to work with as they zone in on the answer. For example, in question 2 they can start with 5 (and find that the LHS is more than the RHS), then try 20 and 10 (and find that the LHS is less than the RHS). Then they know that the answer is between 5 and 10.

You might like to start with a simpler “Guess my number” game. Let learners decide on a number and write it down where you cannot see it. Each time you guess a number, learners should tell you whether it is too high or too low. Show how you use this to zone in on the answer.

Answers
1. (a) No (because the LHS = 38 and the RHS = 40)
   (b) No (because the LHS = 58 and the RHS = 52)
   (c) Yes (because both sides of the equation = 43)

2. (a) Learners’ own responses
   (b) Learners try their chosen number.
   (c) 9 is the correct number, because 6 × 9 + 10 = 64 and 10 × 9 − 26 = 64
3. **Answers**

(a) 3  
(b) 10  
(c) 15  
(d) 13  
(e) 11  
(f) 25  
(g) 17  
(h) 1

**11.4 Practice in answering multiple-choice questions**

Learners sometimes need to answer multiple-choice questions, for example in the Annual National Assessments. This short section gives learners some practice in applying what they know and answering multiple-choice questions.

Question 3 tests learners' practical understanding of some of the properties of operations.

**Teaching guidelines**

This is a short section: aim to cover it in 30 minutes.

Question 1 is a simple place value question: learners can do it on their own.

For questions 2, 3 and 4, you could first introduce the simpler examples on pages 102 and 103 of the Intermediate Phase Mathematics CAPS to help orient learners to the form of the questions.

In question 2 learners need to try following the steps of the calculation with each example. It will help learners to write the rule as a number sentence: \(3 \times \text{number} + 5\). They will see that some of the examples are false as soon as they have multiplied 3 \(\times\) 3.

In question 3 learners might like to start with statement D. They will see that only the order of the "numbers" in the brackets have been swapped. Learners should know that when adding, the answer will not change if the order of the two numbers added is swapped. So they should be able to see that statement D is true.

In 3C, learners should know that they first calculate what is inside the brackets. This means that it does not matter whether \(\times 3\) is before or after the brackets; they will do it once they have calculated what is inside the brackets. So learners should also be able to see that statement C is true.

In 3A and B, learners should try to substitute any numbers (except 0 or 1) into the expressions, for example \(3 \times (4 + 2) = 3 \times 6 = 18\), but \(3 \times 4 + 2 = 12 + 2 = 14\). So, option A is not correct.

**Answers**

1. C  
2. C  
3. B, C, D  
4. C

3. In each case, try different numbers until you find the number that makes the number sentence true:

(a) \(20 \times \text{the number} + 40 = 30 \times \text{the same number} + 10\)

(b) \(23 \times \text{the number} - 60 = 15 \times \text{the same number} + 20\)

(c) \(6 \times \text{the number} + 5 = 10 \times \text{the same number} - 55\)

(d) \(6 \times \text{the number} + 5 = 10 \times \text{the same number} - 47\)

(e) \(6 \times \text{the number} + 5 = 10 \times \text{the same number} - 39\)

(f) \(400 - 10 \times \text{the number} = 4 \times \text{the same number} + 50\)

(g) \(8 \times \text{the number} + 14 = 10 \times \text{the same number} - 20\)

(h) \(37 \times \text{the number} + 15 = 15 \times \text{the same number} + 37\)
Grade 4 Term 3 Unit 12 Transformations

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**CAPS time allocation**
3 hours

**CAPS page references**
23 and 103

**Mathematical background**
Transformation means change. We can transform figures by changing the shape of the figure and/or by changing its size. This unit does not look at this kind of transformation.

We can also transform figures by changing their position, but keeping the size of the figure the same. This is called isometric transformation.

We can change the position of figures by turning them, flipping them over, or sliding them into a new position. It is possible to make many different figures by using just a few figures and applying different transformations to the figures. In this unit we combine single figures with other single figures to make new composite figures or pictures.

In Senior Phase and FET geometry many learners struggle to interpret complex geometric figures like the one shown alongside. Learners need to see figures within figures and they also need to recognise shapes, no matter what direction they face. Work done on isometric transformations in the Intermediate Phase helps learners to do this. Working with transformation helps them to develop a bank of images in their mind, which is useful to draw on in more formal geometry in later years.

Although this unit is short, it is very rewarding mathematically speaking. Transformations are at the heart of many important mathematical ideas. This section is an introduction to transformations and is informal. It is important that learners have the cut-out figures to experiment with and move around. Learners should not expect to see the answers immediately. They need to try to find them by moving the pieces in relation to each other. Learners enjoy puzzling out the solutions.

In Section 12.1 learners work with a tangram. This is a Chinese geometrical puzzle consisting of seven figures with straight sides (five triangles, a square and a parallelogram). In Section 12.2 learners work with nine figures. All the figures have some curved and some straight sides.

**Resources**
This topic involves a number of practical activities for which various resources are needed. These resources are listed in the various sections.
12.1 Combining figures

Resources
A tangram set for each learner or pair of learners. (Learners can make these as shown on page 286. If you have access to a photocopier, you can photocopy the template provided in the Addendum on page 460.)
A large demonstration tangram set that you can stick to the board when discussing solutions.
Scissors.

Teaching guidelines
Aim to spend about 2 hours on this section.
Most learners really enjoy the challenge of solving puzzle questions using tangram pieces. Questions 3, 4 and 7 can be a bit daunting at first. You can help to build learners’ confidence by first working with a smaller number of pieces, as in questions 2 and 6.
Another way to develop learners’ confidence is to build one or two of the figures on the board, and to ask learners to build a copy of these on their desks. You could use some of the examples in question 7 for this. This is more complex than it sounds. It can help learners to learn that some of the figures, especially the parallelogram, can look quite different if they face different directions.
After completing questions 2 and 6, and copying some figures from question 7, you might like learners to try Section 12.2. The questions in Section 12.2 are easier than questions 3, 4 and 7 of Section 12.1. There are two reasons for this: all the internal lines are shown (the figures that make up each picture are shown), and there are only three different kinds of shapes amongst these figures.
Do not expect learners to work fast, or to be able to complete all the questions in the allotted time. You can choose only one or two examples in questions 3, 4 and 7.
In this unit learners should draw all their solutions. This will help them to keep track of the different possibilities. Learners can work independently on this and then join up in groups to compare their results. Encourage them to check for possible repetitions.

Answers
1. Learners make their own tangram set.
Notes on questions
Often figures with a more broken outline (for example 3(a)) are easier to build than figures like triangles, squares, rectangles, etc.

Check the shape of the trees that learners build in question 3(a). There are many similar but slightly different trees that can be built with a tangram set.

There is more than one solution (different ways to arrange the pieces) for some of these questions, especially in question 7.

Answers
Note that in all the answers below the compound figures could face in any direction.

2. (a) and (b)
Any two of the following figures. Others may also be possible.

(c) Any of the following figures.

(d)

(e)

(f) Learners’ own work: too many examples to illustrate.

3. In these solutions gaps have been left between the pieces to make it easier to see which pieces are used where. Learners should not leave a gap between pieces.

(a) 

(b) 

(c)

2. Make a symmetrical figure with each combination of tangram pieces given below. Also draw each figure you make, and its line or lines of symmetry.
(a) Pieces 1 and 2   
(b) Pieces 1 and 2 differently
(c) Pieces 1 and 3   
(d) Pieces 7 and 5
(e) Pieces 4, 5 and 6   
(f) Any pieces you like

3. Use all seven tangram pieces each time to make each of the following figures. The pieces may not overlap.

(a) 

(b) 

(c)

(d)

(e)

(f)

4. Use all seven tangram pieces each time to make the following symmetrical diagrams. The pieces may not overlap. Then draw each diagram and its line of symmetry.

(a) 

(b) 

(c)

5. Explain to someone else how to make tangram figures. What makes it easy?
**Answers (continued)**

3. (d) ![Diagram](image)
   (e) ![Diagram](image)
   (f) ![Diagram](image)

4. (a) ![Diagram](image)
   (b) ![Diagram](image)
   (c) ![Diagram](image)

5. Learners’ own explanations
**Answers (for Learner Book page 288)**

The direction in which the composite figures face does not matter. Check all learners’ work, as other combinations are possible.

6.

6. (a) ![Figure A](image1.png) (b) ![Figure B](image2.png)

7. (a) ![Figure C](image3.png) (b) ![Figure D](image4.png)

(c) ![Figure E](image5.png) (d) ![Figure F](image6.png)

(e) ![Figure G](image7.png) (f) ![Figure H](image8.png)
12.2 Using figures to make pictures

Mathematical notes
Puzzles in which learners join simple figures to make composite figures and pictures are called dissection puzzles. There are many, many different kinds of dissection puzzles. Only two are used in this unit.

Thousands of different figures can be built by using the seven tangram pieces. Many different pictures can also be made by the dissection puzzle used in this section.

The objectives here are the same as in the previous section, only a very different set of figures with different shapes is being used. These figures have some curved sides and some straight sides.

Resources
Each learner should make a set of the nine pieces, as shown on page 288. If you have access to a photocopier, you can photocopy the template provided in the Addendum (page 461). Make a large version of the figures for sticking on the board for demonstration purposes.

Teaching guidelines
Aim to spend about 1 hour on this section.

Learners could work in pairs and build three of these figures. They could then demonstrate to the rest of the class how they built them. Learners can build the rest of the figures for extra practice or at home.

Notes on questions
There is a bit of a “cheat” in the fish second from the left since the tiny quarter circles forming the dorsal fin have straight edges, but are placed against the curved surface of the larger pieces making up the body of the fish. In other words, there is not a clean fit between the dorsal fins and the fish body.

Answers
1. Learners’ own work
2. Learners’ own work
3. Learners’ own work

6. Make drawings to show all the different ways in which
   (a) two tangram pieces can be used to make a square, and
   (b) three tangram pieces can be used to make a rectangle.

7. Make drawings to show how to make each of the following figures by using all seven tangram pieces each time:
   (a) a triangle
   (b) a square
   (c) a pentagon
   (d) a hexagon
   (e) a rectangle that is not a square
   (f) a quadrilateral that is not a rectangle
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**CAPS time allocation**

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<th>1 hour</th>
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**Mathematical background**

While providing opportunities to develop understanding of whole numbers, questions 1, 2 and 3 in Section 1.1 also address the content specified in the Mental Mathematics section of the CAPS.

Counting in multiples of large numbers helps learners to develop a sense of larger numbers. Once learners have a feel for larger numbers, it is easy for them to order and compare these numbers. The work on ordering and comparing numbers in this unit is based on the work done in previous terms on developing learners’ sense of numbers into the thousands, and their understanding of the structuring of these numbers.
1.1 Refresh your knowledge of numbers

**Teaching guidelines**

Try to spend only 30 minutes on this section. One possible way to organise the section is to use:

- questions 1, 2 and 3 for mental mathematics,
- questions 5(a), (e) and (f), and 6(c), (e) and (f) for classwork, and
- questions 4, 5(b) to (d), and 6(a), (b) and (d) for additional practice.

Learners are working in the thousands number range.

In questions 2 and 3 all numbers are between 1 000 and 9 000. Help learners to see and understand that in each of the two questions there is only one example of a number in each thousands band, i.e. one number between 1 000 and 2 000, one number between 2 000 and 3 000, etc. This means that learners only have to look at the thousands value of each number in order to sequence the numbers. In questions 5(a), (c) and (f) it is important that learners look beyond the thousands value before they decide which number is bigger and which is smaller.

**Possible misconceptions**

If learners think of numbers as a string of separate digits, for example if they think of the numbers in question 5(e) as one-nine-nine-nine and two-oh-oh-one, they may be tempted to say that 1 999 is greater than 2 001. This is because they are not considering the value of the parts of the number. If learners make this mistake, ask them to build the numbers with their place value cards and to show the place value parts of the number, or to write the numbers in expanded notation.

**Answers**

1. 6 500   6 750  7 000  7 250  7 500  7 750  8 000  8 250  8 500  8 750
2. 1 628   2 006  3 769  4 123  5 599  7 309
3. 8 901   7 803  6 351  5 182  3 736  2 853
4. (a) 4 000   4 500  5 000  5 500  6 000  6 500  7 000  7 500  8 000  8 500  9 000
(b) 1 000   2 500  4 000  5 500  7 000  8 500  10 000
5. (a) 1 492 < 1 942   (b) 3 678 < 6 873   (c) 2 892 < 2 929
(d) 8 506 > 7 505   (e) 1 999 < 2 001   (f) 4 089 < 4 890
6. (a) 2 000   (b) 8 000   (c) 9 250
(d) 3 750   (e) 2 900   (f) 8 985
1.2 Numbers on number lines

Teaching guidelines
Try to spend only 30 minutes on this section. One possible way to organise the section is to use
- the first two number lines in question 1, the first number line in question 2, and
  the first number line in question 3 for classwork, and
- the third number line in question 1, the second number line in question 2, and the
  second number line in question 3 for additional practice.

In all the number lines in questions 1 and 2 there are 10 unnumbered intervals between every two numbered intervals. In the first number line in question 1, the numbered intervals increase in 10s. In the other number lines in questions 1 and 2, the numbered intervals increase by different amounts, such as 100, 1 000, 20 and 50. Here learners need to know that the value of each unnumbered interval is $\frac{1}{10}$ of the value of the numbered interval. For example, in the first number line in question 2, each unnumbered interval has a value of $20 \div 10 = 2$; in the second number line in question 2, each unnumbered interval has a value of $50 \div 10 = 5$.

Possible misconceptions
Learners may assume that all unnumbered intervals have a value of 1 unit.

Notes on questions
In question 3, the subdivisions into units are not provided. Learners need to estimate these distances. They need to imagine 10 divisions, and at which tenth the arrow is positioned. Accept all answers reasonably close to the answers provided for question 3 below.

Answers
1. (a) 6 006  (b) 6 017  (c) 6 023  (d) 6 028  (e) 6 039
   (f) 6 060  (g) 6 170  (h) 6 230  (i) 6 280  (j) 6 390
   (k) 6 600  (l) 7 700  (m) 8 300  (n) 8 800  (o) 9 900
2. (a) 6 012  (b) 6 034  (c) 6 046  (d) 6 056  (e) 6 078
   (f) 6 030  (g) 6 085  (h) 6 115  (i) 6 140  (j) 6 195
3. Accept all answers reasonably close to the answers provided below.
   (a) 3 504  (b) 3 513  (c) 3 518  (d) 3 529  (e) 3 532
   (f) 3 503  (g) 3 511  (h) 3 523  (i) 3 526  (j) 3 538
Grade 4 Term 4 Unit 2            Whole numbers: Addition and subtraction

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<th>Sections in this unit</th>
<th>Content</th>
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<td>2.1 Practice</td>
<td>Revision of addition and subtraction including solving problems</td>
<td>293 to 294</td>
</tr>
<tr>
<td>2.2 Increases, decreases and differences</td>
<td>Solving problems about capacity and volume</td>
<td>295 to 296</td>
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**CAPS time allocation**
4 hours

**CAPS page references**
14 to 15, 69 to 71 and 107

**Mathematical background**
Learners practise addition and subtraction bonds for multiples of ten and multiples of hundred. They need to know these number facts, or how to reconstruct them quickly, if they are to successfully use the recommended methods of addition and subtraction.

Learners also estimate answers.

Learners solve a variety of problems. They can choose any method for adding and subtracting.
2.1 Practice

Teaching guidelines

Aim to cover this section in 2 hours. One possibility is to use

- question 1 for mental mathematics,
- questions 10 and 13 for concept development,
- questions 2, 3, 4, 5, 6, 7 and 12 for classwork, and
- questions 8, 9 and 11 for additional practice.

In question 1(a) learners can change the order of the numbers to add pairs of numbers that make 100, i.e. 80 + 20 and 30 + 70, and then add the rest of the numbers.

Remind learners always to think: “What have I done before that can help me here?” Ask them: “What is the same about questions 1(a) and (b)?”, “What is the same about questions 1(c), (d), (e), (f) and (g)?” Learners should be able to use their answers to 1(a) and (c) to vastly reduce the amount of calculating they are required to do.

Ask learners to estimate the answers to questions 4(a) and (c). Then ask them: “What is the same about questions 4(a) and (c)?”, “What is the same about questions 4(b) and (d)?” Learners can use their answers to questions 4(a) and (b) in questions 4(c) and (d).

Aim to complete questions 1 to 7 in the first hour and questions 8 to 13 in the second hour.

When you use questions 10 and 13 for concept development, it does not mean writing the calculations on the board as worked examples. Rather read the questions out loud and ask learners to explain the question in their own words. Ask questions such as: “What does this question ask you to do?”, “What useful information have you been given?”, “What will you do now?” Let learners do the actual calculations.

Answers

1. (a) 460  (b) 4600  (c) 600  (d) 4600
   (e) 8600  (f) 1600  (g) 2600

2. Learners’ estimates will differ.

3. (a) 2338  (b) 2838  (c) 3338  (d) 3838

4. (a) 10000  (b) 2889  (c) 10000  (d) 2889
**Possible misconceptions**

In questions 8 and 9 learners subtract the smaller amount from the larger amount. They might assume that they should do this in question 10 as well. However, here the context and structure of the problem is different. If about 1 500 elephants have already died and there are about 6 500 elephants left, this means that there were more elephants to begin with. Learners need to add the two amounts to find out how many elephants there were before the disease killed some of them.

**Notes on questions**

In question 13, check that learners notice that Mr Nhlapo has three children in high school but four children in primary school.

**Answers**

5. Learners check their answers and make corrections if necessary.

6. (a) 4 000 + 6 000 = 10 000
   (b) 7 899 – 2 146 = 5 753
   (c) 7 899 – 5 010 = 2 889

7. Learners will respond using their own language, but they should notice that the answer to question 6(a) is the same as the answers to questions 4(a) and (c). (This is because if you are only doing addition you can change the order in which you add the numbers. It does not affect the answer.) The answer to question 6(c) is the same as the answers to questions 4(b) and (d).

8. 1 289 km

9. R3 023

10. 8 345 elephants

11. 1 696 voters

12. By 381 votes

13. R3 858 + R3 496 = R7 354
2.2 Increases, decreases and differences

Mathematical notes
This section provides practice in addition and subtraction in the context of volume and capacity. Questions 1, 2 and 3 involve calculating in millilitres. Questions 4, 5 and 6 involve calculating in litres.

Teaching guidelines
Aim to cover this section in 2 hours. One possibility is to allocate 1 hour to questions 1 to 3. Let learners work through the questions, share their answers and then explain and discuss how they got the answers. Then spend the second hour on questions 4 to 6.

Learners can work through questions 1, 2 and 3 on their own.

It is best for learners to complete question 5 before completing question 4(e). Question 5 involves doing a lot of very similar subtraction calculations. To save time and ensure that learners complete this question, you can divide the class into six groups. Each group can calculate the total water outflow (water lost) for one tank:

- Groups 1 and 3 can calculate the outflow for Tank A.
- Groups 2 and 5 can calculate the outflow for Tank B.
- Groups 3 and 6 can calculate the outflow for Tank C.

Each group can write their answers on the board. All learners can then individually calculate the total outflow from each tank and from all three tanks together (question 4(e)). Templates of the three tables for question 5 are provided in the Addendum (page 462). If you have access to a photocopier, you can photocopy them for learners to save time.

Note, however, that there is another way to calculate the answer to question 4(e). You can calculate the total amount of water in Tanks A to C at 10:00 and subtract the total amount of water in Tanks A to C at 15:00 from it:

\[(6392 + 8654 + 7358) - (2530 + 5052 + 3333) = 22404 - 10915 = 11489\, \ell\]

Answers
1. 581 ml
2. 132 ml
3. (a) 396 ml
   (b) 1340 ml
   (c) 716 ml
Notes on questions

Question 6 is a challenging question. Learners need to estimate or calculate the average outflow from each tank for each hour. For example, for Tank A learners could estimate that the average outflow per hour is a bit less than 800 ℓ. They then need to work out how long the water will last at the average rate of outflow. There are 2 530 ℓ left in Tank A at 15:00. 3 × 800 litres = 2 400 litres, so Tank A will be empty in about 3 to 4 hours after 3 p.m., i.e. between 18:00 and 19:00.

Answers

4. (a) 6 611 ℓ
   (b) 5 743 ℓ − 4 163 ℓ = 1 580 ℓ
   (c) Tank A lost 782 ℓ   Tank B lost 676 ℓ   Tank C lost 828 ℓ
       Tank C lost the most water.
   (d) Tank A lost 778 ℓ   Tank B lost 811 ℓ   Tank C lost 830 ℓ
       Tank C lost the most water.
   (e) 11 489 ℓ

5. Tank A

<table>
<thead>
<tr>
<th>Period of time</th>
<th>10:00 to 11:00</th>
<th>11:00 to 12:00</th>
<th>12:00 to 13:00</th>
<th>13:00 to 14:00</th>
<th>14:00 to 15:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lost (in ℓ)</td>
<td>765</td>
<td>782</td>
<td>773</td>
<td>764</td>
<td>778</td>
</tr>
</tbody>
</table>

Tank B

<table>
<thead>
<tr>
<th>Period of time</th>
<th>10:00 to 11:00</th>
<th>11:00 to 12:00</th>
<th>12:00 to 13:00</th>
<th>13:00 to 14:00</th>
<th>14:00 to 15:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lost (in ℓ)</td>
<td>663</td>
<td>676</td>
<td>704</td>
<td>748</td>
<td>811</td>
</tr>
</tbody>
</table>

Tank C

<table>
<thead>
<tr>
<th>Period of time</th>
<th>10:00 to 11:00</th>
<th>11:00 to 12:00</th>
<th>12:00 to 13:00</th>
<th>13:00 to 14:00</th>
<th>14:00 to 15:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lost (in ℓ)</td>
<td>787</td>
<td>828</td>
<td>801</td>
<td>779</td>
<td>830</td>
</tr>
</tbody>
</table>

6. Tank A: Between 18:00 and 19:00
   Tank B: At approximately 22:00
   Tank C: At approximately 19:00
Grade 4 Term 4 Unit 3  
Mass

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<td>When comparing different substances, mass is not necessarily directly proportional to volume</td>
<td>297 to 298</td>
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<tr>
<td>3.2 Using a balance to compare mass</td>
<td>Using a balance to compare the mass of objects</td>
<td>298 to 299</td>
</tr>
<tr>
<td>3.3 Estimating and measuring mass in kilograms</td>
<td>Developing a feel for how heavy 1 kg is</td>
<td>299 to 300</td>
</tr>
<tr>
<td>3.4 Reading bathroom scales</td>
<td>Reading bathroom scales and understanding that we need to choose scales with appropriate units when measuring mass</td>
<td>300 to 301</td>
</tr>
<tr>
<td>3.5 Estimating and calculating in grams and kilograms</td>
<td>Estimating and calculating in grams and kilograms, including converting between units</td>
<td>302 to 303</td>
</tr>
<tr>
<td>3.6 Measuring in grams and kilograms</td>
<td>Reading kitchen scales in grams and kilograms</td>
<td>303 to 304</td>
</tr>
<tr>
<td>3.7 Solving mass problems</td>
<td>Solving problems using mass as a context</td>
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**CAPS time allocation**  
6 hours

**CAPS page references**  
26 and 108 to 110

**Mathematical background**

Learners go through four stages when learning to measure:

1. Identifying and understanding the property they are measuring.
2. Comparing and ordering examples of a particular measure.
   Learners hold one of two objects in each hand to compare their relative mass (see question 2 in Section 3.1).
3. Using informal or non-standard units to measure.
   When measuring with non-standard units we normally count the number of non-standard units used. Learners can use a balance (see Section 3.2) and a range of non-standard units such as blocks, bottle tops, peach pips (seeds), stones, nails, etc. They can count how many of a unit balances the mass of their objects. Eventually learners will realise that comparing measures done with non-standard units can be problematic.
4. Using formal or standard units to measure.
   A difficulty with standard units is that the instruments are often complex to read (see Sections 3.4 to 3.6).

**Resources**

This topic involves a number of practical activities for which various resources are needed. These resources are listed in the various sections.
3.1 Heavy and Light

**Mathematical Notes**
Length, area, capacity and volume are called spatial or geometric measures. We are often able to see these properties of an object: we can often see how long something is, how much area it covers, how much space it takes up.

Mass is not a spatial measure. It is called a physical measure. Mass – the heaviness or lightness of something – is a measure of the amount of matter in an object. We cannot always see how heavy something is. Weight and mass are different measures. Weight is the force on an object due to gravity. In everyday language we often use the word weight when we mean mass.

Young learners should first develop a sound sense of mass, as a property of an object, before they begin to read scales or to do calculations with mass. In this unit learners compare objects and describe them as heavier or lighter.

**Possible misconceptions**
Young learners often assume that the bigger something is, the heavier it must be. This is sometimes true, for example a big apple will be heavier than a small apple. If we compare the mass of the same kinds of things, then more of that kind of matter has more mass. This is not always true if we compare different objects or substances, for example a large ball of cotton wool might be lighter than a small apple. This is the focus of Section 3.1.

**Resources**
A roll of toilet paper, a pillow, a 5 kg packet of mealie meal, a brick, a loaf of bread, a rolled up pair of socks, a stone (that is smaller than the ball of socks), a 450 g tin of jam, waste paper, plastic shopping bags.

**Teaching Guidelines**
Ask learners to talk about what they see in the top picture. Use question 1 to guide the discussion. You could let learners act out the scene by giving them one packet full of light things and another with a few heavy things in it.

For question 2, let learners work physically with their school bags when they order them. Discourage learners from just looking at the bags to decide on how to order them according to mass. Allow learners to compare masses by holding one of a pair of objects in each hand as they decide which object in each pair has the greater mass.

**Answers**
1. The packet in his right hand is heavier. You can see that he is leaning to the right.
2. There is a range of possible explanations. These include comparing how heavy the school bags are by holding one in each hand, until all the bags have been compared.
3. 6 empty bottles
Answers (continued)

4. (a) The pillow (A) is bigger. The packet of mealie meal (B) has the greater mass.
     The loaf of bread (D) is bigger. The brick (C) has the greater mass.
     The pair of socks (E) is bigger. The stone (F) has the greater mass.
     The toilet paper (H) is bigger. The tin of jam (G) has the greater mass.

5. The Mathematics textbook is heavier. Once learners have made the balance in Section 3.2 they can check their answer.

6. (a) The Mathematics textbook has a mass of about 630 g. Their exercise book will be lighter than this.
     (b) Learners’ answers will differ. Almost all furniture will be heavier. Their school bags may be heavier. A litre or even 750 ml of water or juice will have a greater mass.
     (c) Learners’ answers will differ. Almost all stationery will have less mass than their Mathematics textbooks. Most fruit will have less mass.

3.2 Using a balance to compare mass

Teaching guidelines
You can find out how to make better balances with coat hangers on page 192 of COUNT. (Rev. ed.) (2013). Guidelines for Teaching Numeracy in the Foundation Phase. Johannesburg. This is freely available on the following websites:


Make a balance for each pair of learners. Let them do this activity practically in pairs.

Notes on questions
In questions 1 and 2 learners’ answers will differ depending on the kind and size of the objects that they use. In question 2 the kind of bottle top used will also impact on the answers. The differences in learners’ answers may help to motivate the need for both standard units of measurement and standardised scales.

Answers
1. (a) Learners’ answers will differ depending on the size of their erasers and pencils.
   (b) Learners’ answers will differ depending on the type of rulers and sock they use.
   (c) Three rulers will probably be heavier than 20 bottle tops. You can also ask learners how many extra bottle tops they will need to balance the rulers.
**Answers**

2. Learners’ answers will differ as they have different types of rulers, sharpeners and erasers.

3. (a) Probably not  
   (b) Probably not  
   (c) Probably not  
   (d) Maybe or maybe not

### 3.3 Estimating and measuring mass in kilograms

#### Mathematical notes

For the rest of this unit learners work with standard units. In this section learners develop a feel for how heavy 1 kg is. They use a litre bottle of water as their unit.

#### Possible misconceptions

A litre of water does not always have a mass of 1 kg. The mass of 1 ℓ of pure water at a temperature of 4 °C at sea level is 1 kg. The bottle also has mass, so this unit (a litre bottle of water) will be a little more than 1 kg. Although all measurements are approximate, they are close enough for learners to get a sense of how heavy 1 kg is. Because their unit is not exactly 1 kg, it is important to always say “about 1 kg”.

#### Resources

Ask each learner to bring a 1 ℓ plastic bottle filled with water (if possible) to class. You will also need some sand and a few cups (see question 3).

#### Teaching guidelines

In question 1 learners can first judge the mass by holding the litre of water in one hand and the other object in the other hand. Then they can work in pairs and use the balances they made in Section 3.2.

#### Answers

1. Learners’ answers will differ, as they are estimating.

2. (a) Heavier than 1 kg:  
   (a) the heaviest book in the class  
   (d) a chair  
   (b) Lighter than 1 kg:  
   (b) a shoe  
   (f) a pencil

2. Use your balance to find out how many bottle tops have the same mass as:  
   (a) your ruler  
   (b) your sharpener  
   (c) your eraser  
   Order your ruler, sharpener and eraser from lightest to heaviest.

3. Compare your answers in questions 1 and 2 with the answers of some of your classmates.  
   (a) Did you get the same answers?  
   (b) Is everyone’s pencil the same size?  
   (c) Did everyone use the same kind of rulers?  
   (d) Did everyone use the same kind of bottle tops?

If we want to measure how heavy something is, we need a **unit**. The unit you used in question 2 was bottle tops. If you used different kinds of bottle tops than your classmates, you cannot compare your measurements because your units were different.

#### 3.3 Estimating and measuring mass in kilograms

When mass measurements need to be accurate, we have to agree to compare the mass of all objects to the standard unit. The standard for mass measurement is **one kilogram (kg)**.

The mass of 1 ℓ of water is about 1 kg.

1. Fill a 1 ℓ plastic bottle with water and use it to estimate the mass of the following objects:  
   (a) the heaviest book in the class  
   (b) a shoe  
   (c) a desk  
   (d) a chair  
   (e) your school bag  
   (f) a pencil

2. Use your balance to find out how many bottle tops have the same mass as:  
   (a) your ruler  
   (b) your sharpener  
   (c) your eraser  
   Order your ruler, sharpener and eraser from lightest to heaviest.

3. Compare your answers in questions 1 and 2 with the answers of some of your classmates.  
   (a) Did you get the same answers?  
   (b) Is everyone’s pencil the same size?  
   (c) Did everyone use the same kind of rulers?  
   (d) Did everyone use the same kind of bottle tops?

If we want to measure how heavy something is, we need a **unit**. The unit you used in question 2 was bottle tops. If you used different kinds of bottle tops than your classmates, you cannot compare your measurements because your units were different.
Answers

2. See previous page.

3. (a) The shoe is probably lighter than 1 kg.
   (b) Number of cups of sand will differ depending on the type of sand and the size of the cup, but answers may be between 2 and 3 cups.
   (c) 30 rulers are lighter than 1 kg (unless very heavy wooden rulers are used).

3.4 Reading bathroom scales

Mathematical notes
Measurement provides a very useful context for understanding estimation and rounding off. Questions that ask “is it closer to …” help learners to understand rounding off.

Analogue bathroom scales are usually numbered every 10 kilograms and usually have 10 unnumbered spaces between the numbered lines. Learners find these relatively easy to read, as they are similar to the way rulers are marked.

Resources
Many learners do not have bathroom scales at home. Try to bring at least one analogue bathroom scale to class. Also try to bring the objects shown in question 3 (roll of tape, hammer and bottle of soap).

Teaching guidelines
Learners should first measure the mass of several objects heavier than 1 kg on a bathroom scale. If they measure their own mass, try to ensure that this does not become known to the whole class. When learners find out each other’s mass, it can lead to bullying. Once learners have worked with a bathroom scale, they can answer the questions in the book.

Answers

1. (a) kilogram (b) 1 kg
   (c) They mostly go up to 120 kg; some stop at 100 kg and some go up to 150 kg.

2. See next page.

Possible misconceptions
All objects have mass. There is nothing that has no mass. When a scale shows a mass of zero it simply means that scale is not sensitive enough to show the mass – the units on the scale are too large to register the mass. The unit of measurement shown on the bathroom scale, namely kilogram, is not small enough to show the mass of the objects in the pictures in question 3.
Teaching guidelines
In question 3 learners should estimate the mass of each object by holding the object in one hand and a litre of water in the other hand. They should then measure the mass of each of these objects on a bathroom scale.

Question 3 motivates the need for a different kind of scale, and a smaller unit (learners will use kitchen scales in Section 3.6). Learners will know that a hammer is heavier than a roll of tape, so it will be obvious to them that the objects do have mass. You may use the tinted passage on page 301 to explain to learners why the objects all look like they have no mass, and that this simply means we need another kind of scale and a smaller unit of measurement.

Answers
2. (a) The girl (on the scale on the left)
   (b) 38 kg
   (c) 34 kg
   (d) The boy’s mass (on the right)
   (e) The girl’s mass (on the left)

3. The masses are all less than 1 kg.
   Learners cannot meaningfully estimate the mass of the objects from the pictures. If learners are able to hold the real objects, they will be able to estimate their mass.

On the bathroom scale, the hammer, the roll of tape and the bottle of soap look as if they have the same mass. It looks as if their mass is nothing. Their mass is less than 1 kg. Their mass is too small to show on the bathroom scale. We need to use another instrument and another unit of measurement to find their mass.
3.5 Estimating and calculating in grams and kilograms

Mathematical notes

In the Intermediate Phase learners only work with grams and kilograms.

1 kg = 1 000 g, so 1 g = \( \frac{1}{1000} \) kg. Learners can learn these conversion factors off by heart. However, as with everything learnt off by heart, learners will sometimes forget them and use an incorrect conversion factor. It may be better for learners to understand how the relationship between metric units works in general. See Term 2 Unit 4 Sections 4.2 and 4.4 for more about the relationship between units in the metric place value system.

Teaching guidelines

You can help learners to practically consolidate the relationship between grams and kilograms by doing the practical activity described below.

Let learners place two 500 g items, for example packets of beans, sugar, rice or salt, on one side of a balance and a 1 kg item, for example a packet of sugar, on the other side of the balance. If you have access to a kitchen or bathroom scale, learners could place two 500 g packets on the scale and see that together they make up 1 kg. This will show them that 500 g + 500 g = 1 000 g = 1 kg.

Answers

1. (a) 1 000 g (b) 2 000 g (c) 500 g (d) 250 g
2. (a) 1 kg (b) \( \frac{1}{2} \) kg (c) \( \frac{1}{4} \) kg (d) 3 kg
   (e) \( \frac{3}{4} \) kg (f) \( 5 \frac{1}{2} \) kg or 5,5 kg
3. (a) 4 kg and 125 g = 4 125 g
   (b) 2 350 g = 2 kg and 350 g
   (c) 250 g + 250 g → 500 g + 250 g → 750 g + 250 g → 1 000 g
   (d) 200 g + 200 g → 400 g + 200 g → 600 g + 200 g → 800 g
4. (a) 1 kg and 500 g + 250 g → 1 kg and 750 g + 250 g →
   \( 2 \) kg + 0 g + 250 g → \( 2 \) kg + 250 g + 250 g →
   \( 2 \) kg + 500 g + 250 g → \( 2 \) kg + 750 g + 250 g →
   3 kg
   (b) 2 kg and 800 g + 200 g → 3 kg and 0 g + 200 g →
   3 kg + 200 g + 200 g → 3 kg + 400 g + 200 g →
   3 kg + 600 g + 200 g → 3 kg and 800 g + 200 g →
   4 kg

3.5 Estimating and calculating in grams and kilograms

Many objects are lighter than 1 kg. We can measure lighter objects in grams.

1 kg = 1 000 g

2,5 kg = 2 \( \frac{1}{2} \) kg = 2 kg and 500 g = 2 500 g

1. Write the mass in grams.
   (a) 1 kg
   (b) 2 kg
   (c) \( \frac{1}{2} \) kg
   (d) \( \frac{1}{4} \) kg

2. Write the mass in kilograms or fractions of kilograms.
   (a) 1 000 g
   (b) 500 g
   (c) 250 g
   (d) 3 000 g
   (e) 750 g
   (f) 5 500 g

3. Fill in the missing numbers to make the sentences true.
   (a) 4 kg and 125 g = ___ g
   (b) 2 350 g = ___ kg and 350 g
   (c) 250 g + 250 g → ___ g + 250 g → ___ g + 250 g → ___ g
   (d) 200 g + 200 g → ___ g + 200 g → ___ g + 200 g → ___ g

   (a) 1 kg and 500 g + 250 g → 1 kg and ___ g + 250 g → ___ kg + ___ g + 250 g → ___ kg
   (b) 2 kg and 800 g + 200 g → ___ kg and ___ g + 200 g → ___ kg
   (c) ___ kg + ___ g + 200 g → ___ kg + ___ g + 200 g → ___ kg
   (d) ___ kg + ___ g + 200 g → ___ kg and ___ g + 200 g → ___ kg
6. Estimates will depend on objects collected.

3.6 Measuring in grams and kilograms

Mathematical notes
Learners are familiar with reading measurements off rulers. On a ruler and most measuring tapes, there are 10 unnumbered intervals between numbered intervals. There are usually also 10 unnumbered intervals between the numbered intervals on a bathroom scale. This is not always the case on a kitchen scale.

Possible misconceptions
Learners often assume that there are 10 unnumbered intervals between each numbered interval on a kitchen scale. Some kitchen scales have 4 or 5 unnumbered intervals between numbered intervals: this is the case with the examples given on page 304. Teach learners to check how many unnumbered intervals there are between each numbered interval.

Resources
Many learners do not have kitchen scales at home. Try to bring at least one analogue kitchen scale to class, preferably one that does not have 10 unnumbered intervals between each numbered interval. Let learners measure a range of items using the scale. You can use the objects shown in Section 3.4, question 3.
Teaching guidelines
In Section 3.5, question 4 (skip counting in 250 g and 200 g intervals) and question 5 (filling in the unnumbered intervals on a number line) are designed to help learners with reading scales.

Learners can think about the scale (i.e. the kg and g markings) on kitchen scales as number lines. They can use the following steps to find out the mass at the dial/needle/pointer.

- **To find the value of the unnumbered intervals**
  Count the number of unnumbered intervals (not lines) between numbered intervals.
  In example 2 (the scale with the potatoes) there are 5 unnumbered intervals.
  Divide this number into the value of the numbered intervals.
  In example 2, this is 1 kg ÷ 5 = \(\frac{1}{5}\) kg, or 1 000 g ÷ 5 = 200 g.

- **To find the value of the unnumbered interval at the pointer**
  Count on (or back) in the intervals calculated above.
  In example 2, this is 4 kg, \(4\frac{1}{5}\) kg, \(4\frac{2}{5}\) kg, \(4\frac{3}{5}\) kg or
  4 kg, 4 kg and 200 g, 4 kg and 400 g, 4 kg and 600 g.

**Answers**
1. \(2\frac{1}{4}\) kg or 2 kg and 250 g  
2. \(4\frac{3}{5}\) kg or 4 kg and 600 g

### 3.7 Solving mass problems

**Teaching guidelines**
Questions 1(a) and (b) are difference models of subtraction. If learners struggle to understand what to do, you can let them hold a light object in one hand and a heavy object in the other hand. Ask them how they could find the difference in their masses. You can suggest that they use a number line to estimate the difference.

**Answers**
1. (a) \(824\ g - 126\ g = 698\ g\)  
   (b) \(126\ g - 69\ g = 57\ g\)  
   (c) 20 boxes of matches: 160 g  
       \(1\ 000 \div 160 = 6\frac{1}{4}\) packs  
   (d) \(227\ g \times 6 = 1\ 362\ g = 1\ kg\ and\ 362\ g\)
Answers

1. (e) \( 4 \times 318 \, g = 1272 \, g = 1 \, kg \) and \( 272 \, g \)
   (f) \( 1000 \div 200 = 5 \) blocks
2. Yes, because \( 500 \, g = \frac{1}{2} \, kg \)
3. (a) 2 packets \((2 \times 2\frac{1}{2} \, kg = 5 \, kg)\)
   (b) 5 packets \((5 \times 500 \, g = 2 \, kg \) and \( 500 \, g = 2\frac{1}{2} \, kg)\)
   (c) 10 packets \((10 \times 2\frac{1}{2} \, kg = 25 \, kg)\)
   (d) 20 packets \((20 \times 250 \, g = 5000 \, g = 5 \, kg)\)
   (e) 10 packets \((10 \times 100 \, g = 1000 \, g = 1 \, kg)\)
4. (a) 5 g \((1000 \, ml \) has a mass of \( 1000 \, g \), so \( 5 \, ml \) has a mass of \( 5 \, g)\)
   (b) 50 litres has a mass of 50 kg. \( 50 \, kg + 4,5 \, kg = 54,5 \, kg \), or \( 54\frac{1}{2} \, kg \)

(e) The mass of a box with 6 eggs is 318 g. What is the mass of 24 eggs packed in the same way?
(f) How many 200 g blocks can you cut from a 1 kg brick of margarine?

2. Zolani has 2 kg and 500 g of sugar. Can Zolani say that she has 2\(\frac{1}{2} \) kg of sugar? Explain your answer.
3. (a) How many \( 2\frac{1}{2} \) kg packets are there in a 5 kg box of milk powder?
   (b) How many 500 g packets can you fill with \( 2\frac{1}{2} \) kg of sugar?
   (c) How many \( 2\frac{1}{2} \) kg bags can you fill with 25 kg of flour?
   (d) How many 250 g packets can you make from 5 kg of dog food?
   (e) How many 100 g packets can you make from 1 kg of washing powder?

4. The mass of 1 \( l \) of water is about 1 kg.
   (a) Estimate the mass of a teaspoonful (5 ml) of water.
   (b) Estimate the mass of a drumful of water. The drum takes about 50 \( l \) of water. The drum itself weighs about 4,5 kg.
Learner Book Overview

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Mathematical background

This unit builds on the ideas in Term 2 Unit 6: Properties of three-dimensional objects, in which three-dimensional objects and the properties of their faces were discussed. It also builds on Term 3 Unit 5: Viewing objects, where the idea of viewing a three-dimensional object from different positions was explored. There is a strong focus on the shapes of the faces of three-dimensional objects. This helps learners to identify and classify three-dimensional objects.

All three-dimensional objects with flat faces can be built from sheets of paper or cardboard (an idea also introduced in Term 2 Unit 6). Many three-dimensional objects with curved surfaces (for example cones and cylinders) can also be built from paper or cardboard. In this unit learners will build three-dimensional objects from paper or cardboard. This focuses their attention on the features or properties of the objects; in particular the faces of the objects. Once they have built the objects, they can use them as learning aids. It is easier for learners to learn about the properties of objects if they can refer to real physical examples. It is more difficult to learn from written texts and/or pictures.

Resources

Four sheets of stiff paper or cardboard (can be scrap cardboard) for each learner.
Scissors; glue; sticky tape.
Models of geometric objects or examples of everyday objects in the shape of spheres, cones, rectangular prisms, triangular prisms, cylinders and triangular pyramids, for example balls, oranges, marbles, boxes, bricks, cardboard tubes, cylindrical piping, cans, caps of some spray bottles, glue sticks, shoe polish tins, snuff or mentholated ointment tins, etc.
4.1 Making objects from cut-out 2-D shapes

Notes on questions
In question 1 learners need to imagine how they could use the 2-D shapes to make the faces of a 3-D object. This requires a good knowledge of rectangular prisms and square-based pyramids. It also requires sound visualising skills. This question is the most abstract and most difficult question in the unit. You could leave it until after learners have built the objects.

In questions 2, 3, 4 and 5 learners have to redraw the faces, cut them out and stick them together. If you have access to a photocopier you can copy the templates in the Addendum (pages 463 to 466). If possible, copy them onto cardboard.

These questions are more practical and help learners to focus on and develop a better knowledge of the flat faces and curved surfaces of three-dimensional geometric objects.

Teaching guidelines
Aim to spend up to 3 hours on this section.

You might like to start by helping learners to revise the three-dimensional geometric objects they learnt about in Term 2: spheres, cones, rectangular prisms, triangular pyramids, cylinders. Let learners have examples of some of these objects on their desks. Ask them to find the objects in turn, and to explain how they know it is the required object.

Answers
1. (a) Rectangular prism
   (b) Square-based pyramid
2. Learners make their own models of rectangular prisms.
Teaching guidelines

Assist learners at the start of each activity by asking them questions like: “What three-dimensional objects did we learn about in Term 2?”, “Could you put these shapes together to form a perfect sphere?”, “How do you know?”, “What is a face of a geometric object?”, “Could you use only these faces to make a cylinder?”, “Why or why not?”, “Could you use only these faces to make a pyramid?”

You can also refer learners to the picture of the yellow, blue and green faces of the rectangular prisms on page 174.

Let learners work in pairs (it is easier for one learner to hold the shapes in place and the other learner to stick them together). If you do not have access to a photocopier, learners can trace the stipulated number of each shape on pages 306 to 308. They can then stick their shapes onto card. Ask learners to draw a different face (e.g. J, K, L, etc.) on each of the shapes that will be flat surfaces on the 3-D objects. This will help them to remember that we call the flat surfaces faces.

Learners may find it challenging to put the faces together to form the objects. As you walk around while they are making their constructions, you may need to ask them questions to prompt them.

Once each pair of learners has built all the objects, ask them to name each object, and talk about the kinds of surfaces and the shapes of the faces on each object.

Possible misconceptions

Some learners may miss the point of the “thinking” tasks in question 1. Be sure to help them understand that they need to imagine cutting out the flat figures and joining them along their sides to form three-dimensional objects. What objects will result?

Learners who struggle with this and are not completely successful must be engaged in a discussion about this after they have drawn, cut out and joined the actual faces. Without going back, they will not learn as much as they could have. You may choose to give some (or all) learners a second set of similar thinking tasks to reinforce what they have learnt. You could model this on question 1 on page 306, or question 4 on page 180.

Answers

3. Learners make their own square-based pyramids.
4. Learners make their own cylinders.
Answers
5. Learners make their own cones.

4.2 Identifying the shapes of objects

Mathematical notes
As was the case in Term 2 Unit 6, the purpose here is to reinforce the fact that the simple shapes of three-dimensional objects that we study in Mathematics can be seen in everyday objects. The ability to see the mathematics that is embedded in the world around us is a very important skill and lies at the heart of any successful application of mathematics.

Teaching guidelines
Aim to spend 1 hour on this section.

In the previous section learners built and worked with real objects. Here they apply what they have learnt and interpret drawings of three-dimensional objects. This is more abstract. Let learners work directly from the textbook and write their answers in their exercise books. This will prepare them for answering questions in tests and exams.

Notes on questions
Question 1 is about the three-dimensional objects and the names of the shapes of their faces (flat surfaces). Although it is difficult to see what kind of pyramid is shown in question 1(d), learners have only learnt about square-based pyramids in Grades 3 and 4. Therefore assume it is a square-based pyramid.

In question 2(b) learners should ignore the handle of the cup.

Answers
1. | Name of 3-D objects | Shape(s) of their faces (flat surfaces) |
<table>
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<tr>
<td>(a) cylinder</td>
<td>circles</td>
</tr>
<tr>
<td>(b) cone</td>
<td>circle</td>
</tr>
<tr>
<td>(c) rectangular prism</td>
<td>rectangles</td>
</tr>
<tr>
<td>(d) pyramid</td>
<td>triangles and square</td>
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5. Trace these figures on a loose sheet. Cut the figures out. Roll the figure on the right into an open cone. Join the cone and the circle with tape or clay to make a closed cone.

4.2 Identifying the shapes of objects
1. Name the 3-D objects that you see below, and write the names of the 2-D shapes of the faces of each object.

(a) cylinder
(b) cone
(c) rectangular prism
(d) pyramid
**Mathematical notes**
A square is a special kind of rectangle because it satisfies all the conditions of a rectangle, and in addition all of its sides are the same length. Similarly, a cube is a special kind of rectangular prism in which all the faces are squares.

**Notes on questions**
Question 3 requires learners to be able to read with understanding a lot of terminology about three-dimensional geometric objects. You may choose to read the questions to learners and use the opportunity to consolidate the language.

Question 3 requires learners to match particular holes in the box with particular faces on some of the objects. You may need to explain this to learners. It is important that learners name the objects each time rather than saying “this object” or “that one”.

Learners were exposed to triangular prisms on page 174. Note that while they can work with these objects it is not expected that they know them for assessment purposes.

As mentioned above, a cube is a kind of prism (a special kind of rectangular prism).

**Answers**
2. (a) Rectangular prism  
   (b) Cylinder (if the handle is ignored)  
   (c) Cylinder and cone  
   (d) Cone

3. (a) Cube  
   (b) Cube  
   (c) Cylinder  
   (d) Triangular prism
**Grade 4 Term 4 Unit 5**

**Common fractions**

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**CAPS time allocation**

5 hours

**CAPS page references**

16 and 112

**Mathematical background**

A fraction is a **number** of equal parts of the same object or measurement unit, for example “7 hundredths of a metre”.

Fractions can be used in different ways:

- To describe a part of a whole, for example 3 eighths of a cake.
- To describe **parts of collections**, for example 3 eighths of the learners in a school or 63 hundredths of the available marks. In a case like the latter, the percentage notation (% for hundredths) is normally used.
- To describe units of measurement smaller than the standard (reference) unit, for example a centimetre (“centi” means “hundredth of”).

Mathematically, the fraction concept is critical to the understanding of decimals because the place value parts after the decimal comma are fractions. The expanded notation for the number 23,47 is $20 + 3 + \frac{4}{10} + \frac{7}{100}$ or 2 tens + 3 units + 4 tenths + 7 hundredths. A good understanding of common fractions will lay a sound basis for decimal fractions when learners work with them in Grade 6. Decimal fractions are not a topic in Grade 4. Grade 4 learners only work with decimals in the context of measurement.

Learners’ concept of fractions is often undermined by the idea that a fraction consists of or is made up of two numbers, for example that “3 fifths” is made up of the numbers 3 and 5, without understanding the entirely different roles of the two numbers. This misconception is often supported by misleading language, such as referring to $\frac{3}{5}$ as “three over five” instead of “3 fifths”. The use of the proper fraction name, for example “3 fifths”, supports understanding of what the denominator of a fraction is.

**Resources**

Rulers; string.
5.1 Grouping and sharing into fraction parts

Mathematical notes
This section is a revisit, on a higher level, of the relationship between fractions and division.

Notes on questions
The questions in this section focus on different kinds of fractions.

In questions 1 and 3 a single whole is divided into equal parts.
In questions 2, 4, 5 and 6 learners find fractions of collections of objects. In questions 7 to 11 fractions are represented as images of lines (string) and on number lines. In these questions fractions are either measures or numbers.

Note that although learners have worked with equivalent fractions, there is no expectation that their answers must be in the “simplest” form. Learners are not expected to know procedures for “simplifying” fractions.

To develop a sound fraction concept it is useful to work with a range of fractions. However, learners are only required to know up to eighths for assessment purposes.

Answers
1. Learners need to understand that each piece of cake is $\frac{1}{8}$. They can then simply count up the pieces of the cake to get 6 eighths ($\frac{6}{8}$).

2. (a) 8 bags  
   (b) $\frac{1}{8}$ of the apples

3. (a) one third  
   (b) $R210 \div 3 = R70$

4. Accept any of the following answers:  
   Learners could count columns of beads to get $\frac{10}{12}$ of the beads are purple and $\frac{2}{12}$ are yellow. They could count all the beads to get $\frac{50}{60}$ of the beads are purple and $\frac{10}{60}$ are yellow. Some learners may say $\frac{5}{6}$ of the beads are purple and $\frac{1}{6}$ of the beads are yellow.

5. Purple beads: $\frac{12}{60}$  
   Yellow beads: $\frac{48}{60}$

6. Purple beads: $\frac{36}{60}$  
   Yellow beads: $\frac{24}{60}$
Notes on questions
In questions 7 and 8 learners are told how long the piece of string is and into how many equal parts to divide it. They have to find the length of the fraction parts.

In questions 9 and 10 learners are also asked to subdivide the string, but here they are told how long to make each piece. They have to find the number of equal parts and hence the size of the fraction that each part constitutes.

In question 11 learners work with fractions as numbers on a number line. This develops their understanding of fractions as numbers.

In question 11, ask learners first to focus on the section of the number lines between 0 and 1. Then ask how many parts each line is divided into, and what fraction each part of the line is. Learners can then count up in fraction parts, for example 1 fifth, 2 fifths, 3 fifths, 4 fifths, 1.

Answers
7. 12 cm ÷ 4 = 3 cm
8. 10 cm ÷ 5 = 2 cm
9. 12 cm ÷ 2 cm = 6. There are 6 pieces of 2 cm: each piece is 1 sixth of the 12 cm string.
10. 20 cm ÷ 4 cm = 5. There are 5 pieces of 4 cm: each piece is 1 fifth of the 20 cm string.

11. (a) A = \(\frac{3}{5}\)  B = \(\frac{4}{5}\)  C = 1\(\frac{2}{5}\)  D = \(\frac{4}{5}\)
   (b) A = \(\frac{1}{5}\)  B = \(\frac{2}{3}\)  C = 1\(\frac{1}{3}\)  D = \(\frac{2}{3}\)
   (c) A = \(\frac{4}{10}\)  B = \(\frac{9}{10}\)  C = 1\(\frac{2}{10}\)  D = \(1\frac{5}{10}\)  E = \(1\frac{7}{10}\)
   (d) A = \(\frac{1}{8}\)  B = \(\frac{3}{8}\)  C = \(\frac{5}{8}\)  D = \(1\frac{2}{8}\)  E = \(1\frac{5}{8}\)
5.2 Problem solving with fractions

**Teaching guidelines**

Learners can use any method they like to solve the problems. Drawing pictures might help.

Grade 4 learners are not expected to learn off by heart any rules or procedures for finding fractions of wholes (see question 4). They can use what they know about fractions and division to find unit fractions, for example \( \frac{1}{2} \); \( \frac{1}{3} \); \( \frac{1}{5} \); \( \frac{1}{6} \); \( \frac{1}{7} \); \( \frac{1}{8} \); \( \frac{1}{9} \); \( \frac{1}{10} \) of wholes. To find other fractions of wholes they simply multiply the unit fraction by the number required, for example 4 fifths = \( 4 \times \frac{1}{5} \).

**Possible misconceptions**

When learners do not have a good fraction concept, they sometimes add both numerator and denominator. For example, in question 6(a) a learner may mistakenly write \( \frac{1}{5} + \frac{3}{5} = \frac{4}{10} \).

To prevent this, learners could change the symbols to words and add 1 fifth plus 3 fifths to see that it gives 4 fifths. They can also draw bars of fifths, or number lines showing fifths, and show the fifths being added on these.

**Notes on questions**

Learners can use repeated addition for question 3. It may be easier for learners to rewrite fractions before they add them: to change from the symbol form to using a number and a word. For example, instead of \( \frac{2}{4} + \frac{3}{4} + \frac{2}{4} + \frac{3}{4} + \frac{2}{4} \) they can write \( 3 \) quarters + \( 3 \) quarters + \( 3 \) quarters + \( 3 \) quarters + \( 3 \) quarters. They can then count up in groups: 3, 6, 9, 12, 15 quarters.

Sometimes it is easier to split fractions to make a whole, for example \( \frac{3}{4} + \frac{3}{4} = \left( \frac{3}{4} + \frac{1}{4} \right) + \frac{2}{4} \).

Learners can group the fractions to make wholes and count up the remaining fraction parts.

Grade 4 learners are not expected to know any rules for multiplying fractions in question 4.

**Answers**

See next page.
Answers

1. \(8 \times 4 = 32\). So each family will get 4 whole loaves. \(34 - 32 = 2\). The 2 remaining loaves are shared by 8 families (divided by 8). So each family will get another \(\frac{1}{4}\) loaf. Each family therefore gets \(\frac{41}{4}\) loaves.

2. \(2\frac{2}{5}\). Learners can use a similar method as in question 1, or they could use drawings.

3. **Margarine:** \[\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \frac{5}{5} = 1\]. He needs 1 cup of margarine.

   Learners could also count 1 fifth of a cup, 2 fifths of a cup, 3 fifths of a cup, 4 fifths of a cup, 5 fifths of a cup to get 1 cup of margarine.

   **Sugar:** 3 quarters + 3 quarters + 3 quarters + 3 quarters + 3 quarters = 15 quarters
   
   \[= \frac{3}{4}\] cups of sugar

   Learners might also think of splitting and grouping the 3 quarters into groups of 4 quarters, i.e. 3 quarters + 3 quarters + 3 quarters + 3 quarters + 3 quarters + 3 quarters + 3 quarters + 3 quarters
   
   = (3 quarters + 1 quarter) + (3 quarters + 1 quarter) + (3 quarters + 1 quarter) + 3 quarters
   
   \[= \frac{3}{4}\] cups of sugar

   **Eggs:** 5 eggs

   **Flour:** \(5 \times 2\) cups of flour = 10 cups of flour and

   \[5 \times 1\] third cup of flour = 1 third + 1 third + 1 third + 1 third + 1 third
   
   \[= 5\] thirds = \(\frac{5}{3}\) cups. So, 10 cups of flour + \(\frac{1}{3}\) cups of flour = \(\frac{11}{3}\) cups of flour

   Or: \[2\frac{1}{3} + 2\frac{1}{3} + 4\frac{2}{3} + 2\frac{1}{3} + 7 + 2\frac{1}{3} + 9\frac{1}{3} + 2\frac{1}{3} = 11\frac{2}{3}\] cups of flour

   **Salt:** \([\frac{1}{4} + \frac{1}{4} + \frac{1}{4}] + \frac{1}{4} = \frac{1}{2}\] teaspoon salt

   **Milk:** 3 fifths cup + 3 fifths cup + 3 fifths cup + 3 fifths cup + 3 fifths cup
   
   \[= 15\] fifths cups = \(3\) cups of milk

   **Baking powder:** \(5 \times 2\) teaspoons = 10 teaspoons + \(5 \times \frac{1}{2}\) teaspoon = \(\frac{1}{2}\) teaspoons

   \[= 10\] teaspoons + \(\frac{1}{2}\) teaspoons = \(\frac{21}{2}\) teaspoons baking powder

---

5.2 Problem solving with fractions

1. 34 loaves of bread are shared equally among 8 families. How much bread does each family get?

2. 12 loaves of bread are equally shared by 5 families. How much bread does each family get?

3. Jacob bakes cakes. For one cake he needs:

   \[
   \begin{align*}
   \frac{1}{5} & \text{ cup margarine} \\
   \frac{3}{4} & \text{ cup sugar} \\
   1 & \text{ egg} \\
   \frac{2}{3} & \text{ cups flour} \\
   \frac{1}{4} & \text{ teaspoon salt} \\
   \frac{3}{5} & \text{ cup milk} \\
   \frac{1}{2} & \text{ teaspoons baking powder}
   \end{align*}
   \]

   How much of each ingredient does he need for 5 cakes?

4. A quarter of an hour is 15 minutes.

   How many minutes are each of the following?

   \[
   \begin{align*}
   (a) & \quad \frac{1}{5} \text{ of an hour} \\
   (b) & \quad \frac{3}{5} \text{ of an hour} \\
   (c) & \quad \frac{2}{3} \text{ of an hour} \\
   (d) & \quad 2\frac{1}{2} \text{ hours} \\
   (e) & \quad \frac{1}{6} \text{ of an hour} \\
   (f) & \quad \frac{5}{6} \text{ of an hour}
   \end{align*}
   \]

5. Write as single fractions.

   \[
   \begin{align*}
   (a) & \quad 1 \text{ fifth } + 3 \text{ fifths} \\
   (b) & \quad \frac{2}{8} + \frac{6}{8} \\
   (c) & \quad 5 \text{ eightths } + 7 \text{ eightths} \\
   (d) & \quad \frac{2}{7} + \frac{2}{7}
   \end{align*}
   \]

6. How many millilitres are each of the following?

   \[
   \begin{align*}
   (a) & \quad \frac{1}{5} \text{ litre } + \frac{2}{5} \text{ litre} \\
   (b) & \quad \frac{7}{8} \text{ litre } + \frac{5}{8} \text{ litre} \\
   (c) & \quad \frac{3}{8} \text{ litre } + \frac{5}{8} \text{ litre} \\
   (d) & \quad \frac{7}{10} \text{ litre } + \frac{3}{10} \text{ litre}
   \end{align*}
   \]
Answers (continued)

4. (a) 60 minutes ÷ 5 = 12 minutes
(b) 3 × 12 minutes = 36 minutes
(c) \( \frac{1}{3} \) of an hour = 60 minutes ÷ 3 = 20 minutes, so \( \frac{2}{3} \) of an hour = 2 × 20 minutes = 40 minutes
(d) 2 hours = 120 minutes
\( \frac{1}{2} \) hour = 30 minutes
2\( \frac{1}{2} \) hours = 120 + 30 = 150 minutes
(e) 60 minutes ÷ 6 = 10 minutes
(f) 5 × 10 minutes = 50 minutes

5. (a) \( \frac{4}{5} \) or 4 fifths
(b) \( \frac{8}{8} \) = 1
(c) \( \frac{12}{8} \) or 12 eighths
(d) \( \frac{4}{7} \) or 4 sevenths

6. (a) 1 ℓ = 1 000 ml
\( \frac{1}{5} \) of 1 000 ml = 1 000 ÷ 5 = 200 ml. So, \( \frac{3}{5} \) of 1 000 ml = 3 × 200 ml = 600 ml
So, \( \frac{2}{5} \) of 1 000 ml + \( \frac{3}{5} \) of 1 000 ml = 200 ml + 600 ml = 800 ml
(b) \( \frac{2}{8} + \frac{6}{8} = \frac{8}{8} = 1 \). So, \( \frac{2}{8} \) of 1 000 ml = 1 000 ml
(c) \( \frac{5}{8} + \frac{7}{8} = \frac{5}{8} + \frac{3}{8} + \frac{4}{8} = 1 + \frac{4}{8} = 1 + \frac{1}{2} \). So, \( \frac{11}{2} \) × 1 000 ml = 1 500 ml
(d) \( \frac{1}{10} \) of 1 000 ml = 1 000 ml ÷ 10 = 100 ml
\( \frac{2}{10} + \frac{3}{10} = \frac{5}{10} \)
\( \frac{5}{10} \) of 1 000 ml = 5 × \( \frac{1}{10} \) of 1 000 = 5 × 100 ml = 500 ml
Some learners might recognise that 5 tenths is equal to 1 half and say half of 1 000 ml = 500 ml.

5.2 Problem solving with fractions

1. 34 loaves of bread are shared equally among 8 families. How much bread does each family get?
2. 12 loaves of bread are equally shared by 5 families. How much bread does each family get?
3. Jacob bakes cakes. For one cake he needs:
- \( \frac{1}{5} \) cup margarine
- \( \frac{3}{4} \) cup sugar
- 1 egg
- \( 2\frac{1}{2} \) cups flour
- \( \frac{1}{4} \) teaspoon salt
- \( \frac{3}{5} \) cup milk
- \( 2\frac{1}{2} \) teaspoons baking powder
How much of each ingredient does he need for 5 cakes?
4. A quarter of an hour is 15 minutes. How many minutes are each of the following?
   (a) \( \frac{5}{3} \) of an hour
   (b) \( \frac{2}{5} \) of an hour
   (c) \( \frac{2}{3} \) of an hour
   (d) \( 2\frac{1}{2} \) hours
   (e) \( \frac{1}{6} \) of an hour
   (f) \( \frac{5}{6} \) of an hour
5. Write as single fractions.
   (a) 1 fifth + 3 fifths
   (b) \( \frac{2}{5} + \frac{6}{8} \)
   (c) 5 eighths + 7 eighths
   (d) \( \frac{2}{7} + \frac{2}{7} \)
6. How many millilitres are each of the following?
   (a) \( \frac{1}{5} \ell + \frac{2}{5} \ell \\
   (b) \( \frac{7}{8} \ell + \frac{5}{8} \ell \\
   (c) \( \frac{5}{8} \ell + \frac{7}{8} \ell \\
   (d) \( \frac{2}{10} \ell + \frac{3}{10} \ell \\

312  UNIT 5: COMMON FRACTIONS
Grade 4 Term 4 Unit 6        Whole numbers: Division

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**Mathematical background**

Division is applicable to three different kinds of situations:

- Situations in which a quantity is shared (divided) into a **given number of parts** of unknown equal size, like situation B on page 315. Thus, a situation in which the number of equal parts is known but the size of each part is unknown. Situations like these are called **sharing** situations.

- Situations in which a quantity is shared (divided) into an unknown number of **parts of given equal size**, like situation A on page 315. Thus, a situation in which the number of equal parts is unknown but the size of each part is known. Situations like these are called **grouping** situations.

- Scaling situations where two quantities of the same kind are compared in terms of their **ratio**, not the difference between the two quantities. Situation C on page 316 is an example of a **ratio situation** that requires division.

To perform division, for example to calculate 906 ÷ 3, it is useful to ask what the divisor must be multiplied with to produce the given total: 3 × ? = 906. Stated differently, the fact that multiplication is the inverse of division can be utilised to perform division. In an example like 906 ÷ 3 = 302, 906 is called the dividend, 3 is called the divisor, and 302 is called the quotient.
6.1 Multiply so that you can divide

**Teaching guidelines**

Remind learners to think about what they already know that can help them to do any calculation or solve any problem. This includes using known multiplication facts, or multiplication facts that can easily be derived, to solve division calculations.

It also includes seeing whether what they do in one question can help them with another question. Learners should use the answers in question 1 to get the answers in question 2. In question 2 learners only need to multiply $3 \times 80$ (that is just $3 \times 8 \times 10$; they already worked out $3 \times 8$ in 1(g)), and $3 \times 6$ (they worked out $3 \times 60$ in 1(d)). For the rest, they only need to use the answers from question 1 and add.

Try to move quickly through this section: aim to cover it in 1 hour. One possibility is to use

- questions 3(a) and (b), and 6(a) and (b) for concept development,
- questions 1, 2, 3(c), (d) and (h), 5 and 6(c) and (d) for classwork, and
- questions 3(e) to (g), 4 and 6(e) and (f) for additional practice.

Remind learners how to make clue boards of easy multiples. Numbers that are easy to multiply by are 1, 2 and 10 (zero is also an easy number to multiply by, but it does not help with division). Learners can first write out $1 \times 3$, and $10 \times 3$. By repeated doubling they can find $2 \times 3$, $20 \times 3$, $4 \times 3$, $40 \times 3$, $8 \times 3$, and $80 \times 3$. They can find $5 \times 3$ by halving $10 \times 3$. They can use these values and an empty number line to calculate the answer.

Learners can use this method for questions 3 and 6. Below we have done this for 3(a).

1. $1 \times 3 = 3$
2. $2 \times 3 = 6$
3. $4 \times 3 = 12$
4. $8 \times 3 = 24$
5. $5 \times 3 = 15$
6. $200 \times 3$
7. $40 \times 3$
8. $20 \times 3$
9. $8 \times 3$

Using this for question 3(a):

1. $300 \times 3 = 900$
2. $200 \times 3 = 600$
3. $400 \times 3 = 1200$
4. $800 \times 3 = 2400$

$804 \div 3 = 200 + 40 + 20 + 8 = 268$

Multiplying to check: $200 \times 3 + 60 \times 3 + 8 \times 3 = 600 + 180 + 24 = 804$

**Answers**

1. (a) 600  
   (b) 900  
   (c) 150  
   (d) 180  
   (e) 270  
   (f) 210  
   (g) 24  
   (h) 12

2. (a) $600 + 180 + 24 = 804$
   (b) $300 + 240 + 12 = 552$
   (c) $300 + 210 + 18 = 528$
Teaching guidelines

1 \times 3 = 3  
10 \times 3 = 30  
100 \times 3 = 300

2 \times 3 = 6  
20 \times 3 = 60  
200 \times 3 = 600

4 \times 3 = 12  
40 \times 3 = 120  
400 \times 3 = 1200

8 \times 3 = 24  
80 \times 3 = 240

5 \times 3 = 15  
50 \times 3 = 150

Learners should always estimate answers before calculating. They can use the clue board to do this. For example, in question 3(a) you can ask learners whether the answer will be:

- more or less than 200. They can see from the clue board that it will be more than 200.
- more or less than 400. They can see from the clue board that it will be less than 400.
- more or less than 300. They can add 100 \times 3 and 200 \times 3 from the clue board to find out that the answer will be between 200 and 300.
- more or less than 250. They can add 200 \times 3 and 50 \times 3 from the clue board to see that the answer will be close to 250 (250 \times 3 = 650) but a bit more than 250.

Encourage them to multiply to check all their answers. If they do not get what they started with as the answer, they should check their calculations to see where they made a mistake.

Show learners how they can use some previous answers, or parts of previous answers, in a current calculation. For example in 3(a): 804 \div 3 = 268 means that you do not have to calculate 3(b) 806 \div 3. You can see that 806 is 2 more than 804 and they are both divided by 3. So, 806 \div 3 = 268 remainder 2. Similarly, the answer for 3(g) can be read off the answer to 3(f). Question 3(e) can help you to see the answer for 4(b). In question 6 the answer to 6(b) is obtained from 6(a), 6(d) from 6(c), and 6(f) from 6(e).

Answers

3. (a) 268  
   (b) 268 remainder 2  
   (c) 260  
   (d) 208  
   (e) 184  
   (f) 176  
   (g) 176 remainder 2  
   (h) 190

4. (a) 303 remainder 2  
   (b) 185  
   (c) 209 remainder 2  
   (d) 93 remainder 1

5. (a) 700 + 210 + 56 = 966  
   (b) 350 + 42 = 392  
   (c) 350 + 210 + 28 = 588  
   (d) 350 + 70 + 49 = 469

6. (a) 138  
   (b) 138 remainder 4  
   (c) 56  
   (d) 57 remainder 1  
   (e) 67  
   (f) 67 remainder 6

3. How much is each of the following?
   (a) 804 \div 3  
   (b) 806 \div 3  
   (c) 780 \div 3  
   (d) 624 \div 3  
   (e) 552 \div 3  
   (f) 528 \div 3  
   (g) 530 \div 3  
   (h) 570 \div 3

4. Calculate the following.
   (a) 911 \div 3  
   (b) 555 \div 3  
   (c) 629 \div 3  
   (d) 280 \div 3

5. How much is each of the following?
   (a) (7 \times 100) + (7 \times 30) + (7 \times 8)  
   (b) (7 \times 50) + (7 \times 6)  
   (c) (7 \times 50) + (7 \times 30) + (7 \times 4)  
   (d) (7 \times 50) + (7 \times 10) + (7 \times 7)

6. Calculate the following.
   (a) 966 \div 7  
   (b) 970 \div 7  
   (c) 392 \div 7  
   (d) 400 \div 7  
   (e) 469 \div 7  
   (f) 475 \div 7

The mathematical statement 970 = 138 \times 7 + 4 tells us that 970 \div 7 = 138 remainder 4.

Division is called the inverse of multiplication.

The mathematical statement 970 \div 7 = 138 remainder 4 tells us that 970 = 138 \times 7 + 4.

Multiplication is called the inverse of division.
6.2 Equal parts in different situations

**Mathematical notes**
There are different types of situations that can be represented by division.
In Section 6.2:
- Situation A is a **grouping problem** (the number of groups must be calculated).
- Situation B is a **sharing problem** (the size of each group must be calculated).
- Situation C is a **ratio problem** (the size of one of the parts must be calculated).
- Situations D and E are **rates problems** (the number of booklets is related to the time to print them. In D, the number of booklets printed per hour must be calculated. In E, the time to print all the booklets must be calculated).

**Teaching guidelines**
This is a short section. Allow about 45 minutes for it.
Read Situation A to the class. Ask them what needs to be calculated. Ask them to write a number sentence to describe the problem. Learners may write \(720 \div 8 = \Box\). They may also write \(\Box \times 8 = 720\). Both of these are valid.
Repeat this for Situation B. Let learners read and answer question 1.
You can also read situations C, D and E on the next page and ask learners what needs to be calculated each time, and to write a number sentence to describe the problem.

**Answers**
1. (a) True. 90 groups of 8 litres make 720. Therefore 90 households can each get a “group” of 8 litres.
(b) True. 720 litres are shared equally among 8 households. So each household will get 90 litres.
Answers
2. (a) True
   (b) True
   (c) True
3. All of them

Here are three more situations in which the numbers 720 and 8 appear. Read them carefully and think about the questions that are asked.

**Situation C**
Simon prepares drinks for a big soccer game, by adding concentrated fruit juice to water.
For every 8 litres of water, he uses 1 litre of concentrated fruit juice.
How many litres of concentrated fruit juice should he add to 720 litres of water?

**Situation D**
A printing machine works at the same pace all the time. It takes 8 hours to print 720 booklets on the machine.
How many booklets are printed each hour?

**Situation E**
720 booklets have to be printed on another machine, which prints 8 booklets each minute.
How long will it take to print all 720 of these booklets?

2. Now check whether the statements below are true. Write good reasons for your answers.
   (a) In Situation C, Simon should add 90 litres of concentrated fruit juice to 720 litres of water.
   (b) In Situation D, 90 booklets are printed each hour.
   (c) In Situation E, it will take 90 minutes to print the 720 booklets.

3. Which of Situations A to E can be described with the number sentence $720 \div 8 = \square$?
6.3 Practice

Teaching guidelines
This section revises what has been done with division up until now. Aim to complete this section in 1\(\frac{3}{4}\) hour. One possibility is to use

- questions 2, 3 and 7 for concept development,
- questions 1(a) to (c), 5, 6 and 8 for classwork, and
- question 1(d) to (f), 4 and 9 for additional practice.

Help learners to make sense of division firstly by estimating. For example: “Will the answer to question 2(b) be about 100 mm? About 50 mm? About 200 mm? About 20 mm? About 1 000 mm?” Learners can use their clue board of easy multiples to answer.

Then ask learners to use their estimate (and calculation if they have completed it) to estimate the answer to question 2(a). “Are there more or fewer pieces in 2(a) than in 2(b)? Will the pieces be longer or shorter than in 2(b)? How much shorter? About 7 times shorter? About 4 times shorter? About 2 times shorter, in other words about half as long? How can you tell? About how long will each piece be: 200 mm? 100 mm? 1 000 mm? 50 mm? 80 mm?”

Similarly with question 3(b): “Will the answer be about 100 bags? About 50 bags? About 20 bags? About 25 bags?” Ask learners whether Taro will fill more or fewer bags in question 3(a). Ask them to use the estimate from 3(b) (or the answer to 3(b) if they have worked it out) to say whether the answer to 3(a) will be about 50, about 100, about 25 or about 20.

Remind learners to check all solutions by multiplying out their answers. They should find and correct any errors.

Answers
1. (a) 82 (b) 57 (c) 93
   (d) 72 remainder 8 (e) 142 remainder 4 (f) 63
2. (a) 161 mm (b) 92 mm
3. (a) 18 bags (b) 27 bags
4. R57
5. (a) 10 kilometres (b) 15 kilometres
6. 100 full cups with a capacity of 100 ml
7. R38
8. 22 sheets of paper for each learner and 2 will remain unshared. If these two sheets are shared out each learner will get an extra \(\frac{2}{3}\) of a sheet of paper.
9. 79 bags can be filled with 8 onions each.
Grade 4 Term 4 Unit 7  Perimeter, area and volume

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**CAPS time allocation**  7 hours  
**CAPS page references**  28 and 114 to 115

**Mathematical background**

Learners go through four stages when learning to measure:

1. Identifying and understanding the property they are measuring.  
   In Grade 3 learners have measured perimeters and lots of lengths. However, they have not measured volume, and only touched on measuring area. For this reason it is important that Grade 4 learners get the chance to explore measuring three-dimensional objects and to develop an understanding of how measuring perimeter is different to measuring area, which are both different to measuring volume. It is important not to skip this first stage of measuring when learners are exposed to properties that are new to them. (See pages 318 and 319 in Section 7.1.)

2. Comparing and ordering examples of a particular measure. (See Section 7.1, questions 4(a) and (b), and 6(a).)

3. Using informal or non-standard units to measure.  
   Most of this unit deals with informal measurement of area and volume using non-standard units. Learners can learn all the principles of measuring using non-standard units. They can also develop a sound conceptual understanding of the property they are measuring because they do not get involved in the complexity of reading instruments calibrated in standard units, or in converting between units. When learners use non-standard measurement it always involves counting, for example counting the number of grid squares covered, or the number of blocks or small boxes used. “Area and volume are only measured informally in the Intermediate Phase. Learners are not required to know or apply formulae for the perimeter, area or volume of any shapes or objects.” (CAPS, page 114)

4. Using formal or standard units to measure.  
   Only perimeter is measured formally using metric units (see Section 7.2). This is because learners already have an understanding of measuring lengths and perimeters.

**Resources**

This topic involves a number of practical activities for which various resources are needed. These resources are listed in the various sections.
7.1 Perimeter, area and capacity

**Mathematical notes**
There are different ways to measure three-dimensional objects. We can find the distance around the shape. We can find the surface area. We can find the capacity. In Grade 4 learners work with the perimeter and area of two-dimensional shapes and the capacity/volume of three-dimensional objects.

**Resources**
Boxes with different shapes, preferably examples that hold similar amounts. If you give learners a matchbox, a shoebox, a box that held photocopying paper and an apple box, it will be easy to order these from biggest to smallest simply by looking at them. If, however, you give learners a large shoebox and the lid of a box that held photocopying paper, it is not so obvious which one is bigger.
Square grid paper. If you have access to a photocopier you can photocopy the square grid paper provided in the Addendum (page 433). If not, ask learners to draw square grid paper as shown on page 102.

**Teaching guidelines**
Aim to spend about 2½ hours on this section.

If possible, let each group of learners have two or three boxes of a similar size but with different shapes. It should not be immediately obvious which box is the biggest and which the smallest. In the illustration on page 318 it is not immediately obvious which box is the biggest: the red box is the tallest, but it has the smallest base; the yellow box appears to have the biggest base, but it is the shallowest. Learners can work from the illustrations, but it may make more sense to them if they work with actual boxes.

Ask learners which box is the biggest. They should motivate their answers and also talk about how they would measure the size of the boxes. The important issues here are the reasons that learners give for estimating the size of the boxes, and also their suggestions for how to measure the size of the boxes. Focus discussion on these issues (see the “Teaching guidelines” on the next page).

**Answers**
1. Learners estimate to get possible answers.
Teaching guidelines

From learners’ discussions, focus their attention on the following measurements:

- **perimeter** – the distance around a shape
- **area** – the size of the surface
- **volume** – the amount of space that something takes up.

You can use the tinted passage on page 319 to guide you. You can also talk with learners about dimensions.

The rest of this section and Sections 7.2 and 7.3 focus on perimeter and area. Capacity and volume is the focus of Section 7.4.

If your classroom has a tiled floor, you can ask learners to use the tiles to describe the area of the floor, for example the floor is 400 tiles big. Some schools have tiled or paved passages, or paved areas outside the classrooms. All of these could be used to describe the size of the areas. Also measure the perimeters of these spaces using builder’s tape measures, measuring tapes or strides. The aim is to help learners distinguish between the distance around a shape or space, which is the perimeter, and the size of the surface, which is the area.
Mathematical notes
Shapes can have the same perimeter but different areas. Shapes can also have the same area but different perimeters.

Teaching guidelines
In question 2 learners work out the area of the shapes by counting grid squares. They work out the perimeter by counting the number of sides of grid squares, or measure it with rulers.

You can start by asking learners to check whether the area of the green shape is 21 grid squares big (i.e. does it cover 21 grid squares) and whether the perimeter is 20 cm. Learners can then continue with shapes (a) and (c) to (f).

Let learners report back on their answers. Discuss how all the shapes have the same perimeter, but the areas vary from 9 grid squares big to 25 grid squares big. Be explicit about the fact that in general there is no fixed relationship between perimeters and areas of shapes.

If you have access to a photocopier, you can photocopy the square grid paper provided for this unit in the Addendum (page 433). If not, ask learners to draw square grid paper as shown on page 102. Ask learners to draw three different looking shapes, all with an area of 12 grid squares. Ask learners to count the perimeter of each shape. Learners should compare shapes, check that they all have an area of 12 grid squares, and compare perimeters. This will show that shapes can have the same area but different perimeters.

Answers
2.  
(a) A: 25 grid squares  P: 20 cm  (A = Area; P = Perimeter)
(b) A: 21 grid squares  P: 20 cm
(c) A: 9 grid squares  P: 20 cm
(d) A: 9 grid squares  P: 20 cm
(e) A: 16 grid squares  P: 20 cm
(f) A: 13 grid squares  P: 20 cm
Teaching guidelines
When learners work through the questions on this page and on page 322, it is useful for them to have both pages open. One learner can have page 321 of the Learner Book open while the learner next to him/her can have page 322 open.

Learners will find that the rectangles in 3(a) and (b) have the same size: both the perimeters and areas are the same. These two rectangles are identical: only their colours and the directions they face are different, but these aspects do not impact on size.

Questions 4 and 5(a) are intended to prevent the possible misconception that shapes have to be covered neatly with full squares.
Question 5 is another reminder that equal areas does not imply equal perimeters.

Possible misconceptions
You may need to remind learners that a square is a special kind of rectangle. So the square with the green edge can be called a rectangle.

On a square grid each square is the same size. The side lengths of each square are the same size/length. The lines that connect opposite corners of a square are called diagonals. Many learners assume that the diagonals have the same length as the sides. This is not true. The diagonal of a square is always longer than the side of a square. To check, learners can measure the diagonal and the side lengths of the yellow square. If you draw a square on two sides of a square and on one of the diagonals, it shows this length difference quite clearly: see the diagram alongside.

Answers
3. (a) A: 8 grid squares  P: 12 units/cm
   (b) A: 8 grid squares  P: 12 units/cm
   (c) A: 16 grid squares  P: 16 units/cm
4. (a) Yes
   (b) Yes
5. (a) 8 grid squares
   (b) Between 12,9 and 13 cm
Mathematical notes
When learners are in Grade 7 they will use the fact that the diagonal divides the area of a rectangle in half to work out that the area of a triangle is half the area of a rectangle around it ($\frac{1}{2}$ base $\times$ height).

Teaching guidelines
Learners might find it easier to answer question 6 by looking at the green and yellow rectangle in question 3 on page 321. Since the green and yellow triangles are visibly identical, each have an area half of the area of the rectangle.

Answers
6.  (a) Same area
    (b) 4 grid squares

7.  90 mm + 16 mm + 21 mm + 20 mm + 61 mm + 25 mm = 233 mm
    Some rulers may not have the millimetres accurately calibrated. Accept answers that range from about 230 mm to 236 mm.
7.2 Calculate perimeter

Mathematical notes
Learners should by now understand and know that the perimeter is the distance around a shape. If a shape has many sides, you calculate the perimeter by adding the lengths of the sides.

Teaching guidelines
This is a short section. You could aim to complete it in about 1 hour. One possibility is to use
- question 1(a) for concept development,
- question 1(b) and (c) for classwork, and
- question 2 for additional practice.

You can start by asking learners how they could calculate the perimeter of the plot in question 1(a). Ask learners whether they think the perimeter will be more or less than 1 000 m.

Once learners have calculated the perimeter of the plot in 1(a), ask them whether they think the perimeter of the plot in 1(b) will be more or less than the perimeter of the plot in 1(a). Some learners may not notice that the measurements of plot (b) are given in kilometres.

Ask learners whether they think the perimeter of the plot in 1(c) will be more or less than the perimeter of the plot in 1(a). Ask them which estimated length below they think will be closest to the answer:

A. 9 000 m  B. 10 000 m  C. 8 000 m

Answers
1. (a) 1 555 m  (b) 46 km  (c) 10 304 m
2. R9 330
7.3 Perimeter and area of curved figures

**Mathematical notes**

Not all shapes follow the lines on square grid paper. Square grid paper does not allow us to state exactly how big curved shapes are. We can, however, use the squares to describe the area by saying that it is more than a certain number of grid squares but less than a certain other number of grid squares. For example, in the shape on page 324 the area is more than 60 grid squares but less than 94 grid squares. The smaller the range we give, the more closely it will approximate the area of the shape.

Sometimes in mathematics we give the answer as lying in a range: between an upper limit and a lower limit.

**Teaching guidelines**

You could aim to complete this section in about 1 hour. You can use questions 1 and 2, and the yellow circle in question 3 for classwork. Learners who finish this quickly could estimate the perimeter of the green circle too.

In question 1 learners will find that the purple area (60 grid squares) is bigger than the blue area (34 grid squares).

Learners might find it easier to first answer question 2(b) before answering question 2(a). If the area of the curved figure is more than the number of purple squares it must also be more than the number of blue squares.

Questions 2(a) and (b) only allow learners to say that the area of the curved figure is bigger than 60 grid squares, but this could be any size: 100 grid squares, 1 000 grid squares, etc. Ask learners questions that will allow them to see that they can state that the curved figure is also smaller than a certain size. For example, you could ask them: “How many squares are there altogether in the grid?”, “Is the curved figure bigger or smaller than the whole grid?”, “Imagine the total area of the coloured squares was one colour. How big would this figure be?” (The size of the purple squares + blue squares = 94 grid squares.) “Is the area of the curved figure more or less than the area of all the coloured squares put together?”

**Answers**

1. Area of purple figure: 60 grid squares
   Area of blue figure: 34 grid squares
2. (a) Bigger
   (b) Bigger
   (c) Between 60 and 94 grid squares big
**Mathematical notes**

Learners only work formally with perimeters (and areas) of circles in Grade 8.

In question 3 learners estimate the perimeters of the circles by calculating the perimeters of polygons that fit closely around the edges of the circles. The circles will have slightly smaller perimeters (and areas) than the polygons.

A polygon is a two-dimensional closed figure with straight sides. Examples of polygons are triangles, quadrilaterals, pentagons, hexagons, etc.

A circle is not a polygon because it has a curved side, not straight sides.

The more sides a polygon has, the more closely it looks like a circle, and the closer the length of its perimeter to the perimeter of a circle, the closer its area will be to the area of a circle.

The perimeters of circles are usually called the circumference. Learners do not need to know this word in Grade 4.

**Teaching guidelines**

Remind learners that the 2 cm long straight lines make up polygons that fit around the outside of the circles. Once they have worked out the perimeters of the polygons, remind them that they are asked to estimate the perimeters of the circles. Ask learners questions like: “Does the circle have exactly the same perimeter as the polygon?” “Is the perimeter of the circle more than or less than the perimeter of the polygon?”

Learners could estimate the perimeter of the green circle for additional practice.

**Possible misconceptions**

Learners might forget that they are trying to find the perimeters of the circles. They might just add or multiply the lengths of the straight lines and forget what the question was.

**Answers**

3. The perimeter of the polygon around the yellow circle is 24 cm.
   This means that the perimeter of the yellow circle is a bit less than 24 cm.

   The perimeter of the polygon around the green circle is 36 cm.
   This means that the perimeter of the yellow circle is a bit less than 36 cm.
7.4 Capacity and volume

Mathematical notes
In this section learners work informally with the volume of a stack of blocks or small boxes, and fill larger boxes with small boxes or blocks to calculate informally (count) the capacity of the larger boxes. This lays the basis for an understanding of cubic units.

Learners are asked to estimate the sizes of various objects and spaces. Estimation is not random guessing. Estimation of size works best if you can compare the size (of what you are estimating) to the size of something that is known. For example, you need to have a good sense of the size of a metre before you can estimate lengths in metres.

Resources
Metre lengths of string; old newspapers or other large sheets of paper; sticky tape.
Cardboard boxes approximately the size of shoeboxes.
Small blocks, all the same size, or many empty matchboxes.

Teaching guidelines
Aim to spend about 2\(\frac{1}{2}\) hours on this section.

You can ask learners to estimate the number of grey cubes that will fill the green box. Rather than guessing wildly, encourage learners to use the three lengths of 5 cubes given in the drawing: they are drawn in the directions of the length, breadth and height of the green box to make it easier to estimate. Learners can return to question 1 after they have completed this section.

Learners have worked with metres since Grade 3. Ask them to measure out 1 m and cut a length of string this long. Then ask them to roll newspaper into 1 m long tubes. Groups of learners can then join 4 tubes to make a square shape that shows one square metre (1 m \(\times\) 1 m). They can join six of these squares into a box shape that shows one cubic metre (1 m \(\times\) 1 m \(\times\) 1 m). They can use this to estimate their answers to questions 2(a), (b) and (c).

Notes on questions
In questions 1, 2 and 3 learners are asked for their opinions; their opinions will differ. Keep asking learners to motivate why they have given these answers. Focus on the reasons that learners give for their answers.

Answers
1. Some learners will say “yes”, other learners will say “no”.
2. See the next page.
**Answers**

2. (a) Some learners will say “yes”, other learners will say “no”. Most Grade 4 learners should be able to roll themselves up into a space smaller than 1 cubic metre.
   (b) Some learners will say “yes”, other learners will say “no”. Most desks cannot fit into this space.
   (c) The sizes of classrooms differ. Learners’ estimates will also differ.

**Teaching guidelines**

If you do not have enough cubes or matchboxes to let learners do question 3 individually or even in groups, do it as a classroom demonstration, but let learners do questions 3(a) and (d) individually.

Introduce learners to the term “volume”. Volume is the amount of space something takes up, and it can be used to describe the size of a three-dimensional object such as a stack of cubes.

**Answers**

3. Task done by learners. Answers will differ. Consider all answers.
Teaching guidelines
Learners can count the number of cubes in each stack and give the volume of each stack in number of cubes. Learners could work out the size of the stacks in questions 4(a), (b) and (e), and also the number of cubes in the stack in question 5(b) as classwork. They could do questions 4(c) and (d), and 5(a) as additional practice.

Notes on questions
Question 5(b) is the more difficult question in this section. Learners are not given the illustration, so they cannot count the cubes. They have to imagine that there are 4 cubes in a row and 6 of these rows, which gives 24 cubes (learners could multiply or count in 4s or 6s). They have to imagine that there are 7 layers of 24 cubes. Here they need to multiply $7 \times 24 = 168$ cubes.

Answers
4. (a) 15 cubes (b) 15 cubes (c) 10 cubes
(d) 30 cubes (e) 45 cubes
5. (a) 75 cubes (b) 168 cubes
Grade 4 Term 4 Unit 8     Position and movement

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<td>8.2  Make your own maps</td>
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**CAPS time allocation**
2 hours

**CAPS page references**
24 and 115

**Mathematical background**
It is not easy to describe where each of a large number of objects is. A way to make this much easier is to put a grid over the surface on which the objects are resting. One can then look at the cell in which a particular object lies and give the cell position (row this, column that). This is a very, very important basic idea in mathematics, one without which many uses of mathematics would not exist.
8.1 Positions on a grid

Mathematical notes
This section shows that putting a grid over a surface allows us to say where a particular object is. When the grid is placed over the surface each object will be mostly in particular cells of the grid. For any particular object we only have to say which row and which column of the grid it lies in. Once we have these two pieces of information we can say with confidence where the object is. The grid is therefore a position-locating tool. Note that we usually use a square grid.

Teaching guidelines
First let learners use everyday terms and referents to describe the position of people and things in the classroom. Then introduce learners to the idea that we can impose a grid over the surface (or situation), and explain the terms row, column and cells as used in grid referencing: see the tinted passage on page 330 and the summary bar on page 331.

This is a very important first experience of finding positions using a grid. Be sure to let your learners appreciate the idea that we place the grid on the surface to make it easier to say where each thing is.

You can use the position of learners in your classroom to draw a diagram on the board similar to the one shown on page 329. You can then impose a grid onto your diagram so that it will look similar to the diagram on page 330.

Possible misconceptions
Learners may confuse the term column (up–down) with row (across). This is simply a matter of carefully remembering which name goes with which direction.

In many classrooms learners’ desks are arranged in rows running from the front to the back of the classroom. If this is the case in your classroom, then learners may use the term row to describe where learners sit. For example, learners may say: “Sophia sits in front in the row on the left of the classroom; Nkosi and Busi sit at the back of this row.” They may then get confused when they turn over the page to page 330 and see that on the grid this is labelled Column A, and the Sophie, Miriam and Jack sit in Row 7.

Answers
1. to 4. Learners’ own work – ensure that learners use a reference point to describe positions.
Mathematical notes

These are columns

These are rows

Answers
5. Column D
6. Row 7

There is a grid on the map below.
The grid has 8 rows, marked 1 to 8 from bottom to top.
The grid has 5 columns, marked A to E from left to right.

Nathi sits in Column C, in Row 4.
5. In which column does Jack sit?
6. In which row does Jack sit?
Critical knowledge

Note that in Sections 8.1 and 8.2 two different kinds of questions are asked. In questions 7, 8, 10, 11 and 12 learners are given the name of the person (or the object) and asked in which cell they are sitting (or appear). In question 9 learners are given the cell number and asked who sits in that cell. Section 8.2 asks more questions in the latter form (learners are given the cell reference number to go to).

Learners need to be able to answer both kinds of questions: they have to find a stated object and give the cell name, and they have to find the named cell and say what is in it.

Answers

7. Column E Row 4

8. (a) Column A Row 7  (b) Column A Row 2
    (c) Column C Row 7  (d) Column D Row 5
    (e) Column B Row 4  (f) Column B Row 4

9. Nkhosi and Busi

10. C8

11. E8

12. (a) A2  (b) B2  (c) C1  (d) E1

13. 8 rows

14. 5 columns

15. 8 \times 5 = 40 cells

16. Learners can list any five of the following cells:
    A1; A3; A4; A5; A6; A8
    B1; B3; B6; B7; B8
    C2; C3; C5; C6
    D1; D2; D4; D6
    E2; E3; E5; E7

The squares in a grid are called cells.

Zwelisits in Cell D3. This means Zweli sits in Column D, in Row 3.

9. Who sits in Cell A2?

10. In which cell is the board?

11. In which cell is the cupboard?

12. In which cells do the following learners sit?
    (a) Nkhosi  (b) Sibu  (c) Julius  (d) Mpho

13. How many rows are there on this map?

14. How many columns are there on this map?

15. How many cells are there on this map?

Cell C3 is empty.

16. Name five other cells that are also empty.
8.2 Make your own maps

**Teaching guidelines**
Ask learners to complete questions 1(a) and (b) on their own. In question 1(a) learners draw and label a grid or photocopy the grid in the Addendum on page 467. In question 1(b) learners fill in the stated numbers in particular cells. In question 1(c) learners need to use logic and counting in multiples to work out the answers. Let learners first work out what numbers go into B6 and C4. Then discuss with them how they got the answers. This will help them to find the other answers.

**Answers**
Learners are not asked to write in the numbers shown in black in the grid below, but they will need to say these (aloud or in their heads) to get the answers to question 1(c).

1. (a) Learners draw the grid and label it.
   (b) See the red numbers.
   (c) See the blue numbers.

2. Learners’ own work. Answers will differ from class to class.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<td>11</td>
<td>13</td>
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Grade 4 Term 4 Unit 9  
Transformations

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<td>Making tessellations from basic shapes</td>
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**CAPS time allocation**
3 hours

**CAPS page references**
23 and 116

**Mathematical background**
A flat surface (like a floor, wall or table top) and evenly rounded surfaces (like the skin of a fish or snake) can be divided into or covered by one or more identical flat shapes that do not overlap or leave any gaps. A pattern formed in this way is called a tessellation (the Latin word for *tile* is *tessell*).

Any quadrilateral can be used to make a tessellation pattern:

![Tessellation pattern](image)

**Resources**
Each learner or pair of learners needs 12 of each of the shapes on page 338 (if you have access to a photocopier, you can photocopy the templates in the Addendum on pages 469 to 471).
A demonstration set of large copies of the shapes that you can stick to the board when discussing solutions.
Scissors.
9.1 Tessellations

**Mathematical notes**
Tessellations are patterns formed by arranging shapes to fit neatly next to each other. There are no gaps in a tessellation and none of the shapes overlap (see the summary bar on page 337).

Each of the tessellations in this section is made up of a single shape. Any triangle or quadrilateral will tessellate. This is an important fact that can be very useful to you as a teacher.

**Teaching guidelines**
Aim to spend about 1 hour on this section.

You can start by explaining to learners what a tiling or tessellation pattern is. Ask learners to look around to see whether they can see any tessellations. Brickwork, floor tiles, fences and sometimes window panes make tessellating patterns. Ask learners to name or describe the shape (tile) that is repeated to make the pattern. You can use the tinted passage on page 333 to consolidate the concept of a tessellation and the tiles that are used to make up the patterns.

Drawing the patterns helps learners to focus more clearly on how the tessellation is made. This is a focus in questions 1, 2 and 3. Describing the patterns not only helps learners to develop the language to talk about the patterns, but also helps them to think more clearly about the patterns.

Learners can trace and cut out the shape in question 4, or you can photocopy the one in the Addendum (page 468).

If time permits, you can include additional tile shapes to tessellate. Printing and cutting out many copies of the same triangle or quadrilateral will provide you with additional tessellation activities.

**Possible misconceptions**
It is possible to arrange tiles so that they do not tessellate, i.e. that there are gaps between the tiles. If learners do this, remind them that there are no gaps in a tessellation. Otherwise they may believe that the activities are about arranging tiles in any pattern, including non-tessellating patterns.
Mathematical notes
The scales on real fish overlap. You can draw a pattern of fish scales that do not overlap: see page 391. This is a simplified model of the scales.

Answers
1. (a) Learners' own drawings of the tessellating pattern in a honeycomb.
   (b) Learners' descriptions will differ. Learners cannot be expected to produce good descriptions. The purpose of the question is to challenge them to think about the pattern and to try to find words and phrases that can be used to describe it.
Notes on questions

Drawing the patterns and talking about it help learners to focus more clearly on how the tessellation is made. Talking about two or more different patterns helps learners to see and talk more clearly about how each pattern is made.

You can ask learners what is the same about the brick patterns (they are both made up of bricks; each pattern uses one kind of brick). Then you can ask learners what is different about the patterns (in the top photograph the bricks have straight edges and are all laid in the same direction; in the bottom photograph the bricks have wavy/curvy edges and some bricks lie “north–south” and others “east–west”).

Answers

2. (a) Learners’ own drawings of the tessellation of bricks.
   (b) Learners’ descriptions will differ, but they could say something like:
       “The bricks make a pattern of rows. All bricks have straight edges and are identical. Each brick touches the two bricks next to it along a short side, and the bricks above and below it along a long side.”

3. (a) Learners’ own drawings of the tessellation of bricks.
   (b) Learners’ descriptions will differ, but they could say something like:
       “The bricks make a tessellating pattern because there are no gaps or overlaps. These bricks do not make a pattern of rows, because some bricks have the long side going up and down, and other bricks have the long side going across. All bricks have curvy sides and are identical to each other.”
Answers

4. (a) to (c) Learners' own work

4. (a) Put a clean sheet on top of this page and trace the figure below.

(b) Cut out all 12 tiles.

(c) Arrange the 12 tiles on your desk, so that they fit together neatly to form a copy of the above tessellation.
9.2 Tessellate

Mathematical notes

Some of the tessellations on page 337 involve two or more different tiles. Some tiles (shapes) cannot tessellate (see the example in question 1 on page 338).

Resources

Each learner or pair of learners needs 12 of each of the shapes on page 338. If you have access to a photocopier, you can photocopy the templates in the Addendum (pages 468 to 470).

A large demonstration set of the shapes that you can stick to the board when discussing solutions.

Scissors.

Teaching guidelines

Aim to spend about 2 hours on this section.

You might like to start by reminding learners what a tessellation is: see the description at the top of page 337. You can ask learners what they see in the photographs. Then focus their attention on the shapes that make up the patterns. One way to do this is to ask them to copy the pattern. The fence is a tessellating pattern of quadrilaterals. The other two tessellations are both made up of two shapes. Ask learners to talk about these shapes and their arrangements. They can use drawings to explain the patterns. The diagram at the bottom of page 337 is a mosaic and not a tessellation, because none of the shapes are repeated.

In question 1 learners use the shapes to try to make tessellating patterns. If you have access to a photocopier, photocopying the templates in the Addendum (pages 468 to 471) will save time. If possible, allow learners to engage in structured discussions about the activities. Since most of the activities in this section are open-ended, it is valuable for learners to compare and evaluate their approaches.

Notes on questions

Question 4 of Section 9.1 about the tessellation of quadrilaterals (page 336) should help to prepare learners to tessellate with the shapes in question 1 on page 338.

Question 2 is challenging because learners have to decide whether each tile will tessellate, and explain their decision, without cutting out the shapes. Take advantage of any learner responses that use drawing to help explain their thinking. It is important that learners realise that drawings can be tools to help them understand things, and that they may choose to make one or more drawings to help their thinking whenever they wish.
Once learners have tried to imagine whether the shapes can tessellate, ask them to trace 12 of the shapes, cut them out and try to tessellate with them, or photocopy the templates provided in the Addendum (pages 472 to 474) to save time.

**Answers**

1. (a) Learners make 12 copies of each tile/shape.
   (b) Learners’ tessellations should look something like the diagram below.

   ![Tessellation Example](image)

   (c) The pentagon does not tessellate. When you place pentagons next to each other there are either gaps between them or they overlap.
   The rounded tile will tessellate – see (d) below.

   (d) Sample sketches are shown. Note that learners might place tiles vertically rather than horizontally as shown below.

   ![Tessellation Examples](image)

2. (a) All the shapes tessellate.
   (b) All the shapes tessellate.

1. (a) Trace and cut out 12 copies of each of the figures below.
   (b) Try to tessellate with the quadrilateral tile. This means you have to arrange the 12 tiles in such a way that they fit together to form a tessellation.
   (c) Try to tessellate with the other two tiles.
   (d) You can tessellate in two different ways with the rounded tile. Find out what the two ways are, and make rough drawings to show how they differ.

2. (a) Which of these figures do you think will work to make a tessellation pattern?
   (b) Explain why you think the other figures will not work. Also make drawings to show why you think they will not work.
**Grade 4 Term 4 Unit 10**  

**Geometric patterns**

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<td>Visual recognition and generalisation of structure in geometric figures</td>
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<td>10.2 Investigate and extend more patterns</td>
<td>Visual recognition and generalisation of structure in geometric figures</td>
</tr>
<tr>
<td>10.3 From tables to flow diagrams</td>
<td>Tables and flow diagrams as different equivalent representations of patterns</td>
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**CAPS time allocation**  
2 hours

**CAPS page references**  
19 and 117

**Mathematical background**

While providing opportunities to develop understanding of patterns, continuing the sequences or completing the tables according to a pattern also contributes to the development of the Mental Mathematics section of the CAPS.

All the sequences in Section 10.1 are sequences of multiples (e.g. 3, 6, 9, 12, ...) and therefore reinforces the times tables. All the sequences in Section 10.2 are based on increasing differences (e.g. +3, +4, +5, ...) and therefore reinforces mental addition strategies.

The approach in this unit is not to reduce the work on geometric patterns to numerical patterns in tables – that too – but to capitalise on the visual aspects of geometric representations as a method to find rules based on the structure of the geometric figures.

This implies that you should help learners not only to count the number of dots in a figure (counting in ones), but to use “clever counting” by identifying appropriate larger units. Then they should not actually count the larger units, but rather write down a numerical expression (calculation plan or rule) expressing the structure of the figure. It is very important that learners should learn to study the structure of such an expression, and not to jump into calculation.

To find a general rule for the pattern requires a second level of pattern recognition, namely recognising the structure in a series of numerical expressions – what is unchanged (is constant) and what changes (is variable). This process is illustrated below, and on the next page.
10.1 Investigate and extend patterns

**Mathematical notes**

All the geometric patterns in this section can be transformed to numeric patterns by completing a table. The resulting numeric patterns are all sequences of multiples. We studied patterns in sequences of multiples in Term 1, so it is important that you help learners to see that these are different representations of the same pattern, and that they bring the knowledge that they developed in Term 1 to this “new” work.

However, the focus in this unit should be on solving the problems directly in the geometric context by “seeing” the structure in the geometric representations. Learners should continue the mindset of “clever counting” developed in Term 2: the way to “see” structure is to understand that in Triangle 4 we try to identify a unit of 4, in Triangle 3 we try to identify a unit of 3, in Triangle 2 a unit of 2, etc. For example:

\[
\begin{align*}
T1 &= 3 \times 1 \\
T2 &= 3 \times 2 \\
T3 &= 3 \times 3 \\
T4 &= 3 \times 4 \\
\end{align*}
\]

Pattern recognition now proceeds at a different level: we need to see the structure – not in a number sequence or in a figure, but in a series of related specific calculation plans. This requires us to be very clear about what is changing (the variable) and what remains unchanged (constant). If you present it vertically it may help learners to see the pattern. It is this structure that must be generalised to a general calculation plan (rule):

\[
\begin{align*}
T1 &= 3 \times 1 \\
T2 &= 3 \times 2 \\
T3 &= 3 \times 3 \\
T4 &= 3 \times 4 \\
\end{align*}
\]

So \( T30 = 3 \times 30 \)

Note that some learners may use clever counting by using the triangle sides as a unit. But they may then say that Triangle 4 has 5 dots on each of the 3 sides, and reason that the total number of dots in Triangle 4 is \( 3 \times 5 = 15 \). However, this would be wrong, because we have in fact now counted each of the corner dots twice!

*Continued on the next page*
Instead of abandoning the method, we can simply build in the correction and construct an alternative equivalent rule:

\[
\begin{align*}
T_1 &= 3\times2 - 3 \\
T_2 &= 3\times3 - 3 \\
T_3 &= 3\times4 - 3 \\
T_4 &= 3\times5 - 3 \\
T_{30} &= 3\times31 - 3
\end{align*}
\]

The squares, pentagons and hexagons on page 340 can be approached in the same way.

**Answers**

1. (a) Each triangle has three more dots than the previous triangle.  
   (b) Triangle 6: \(3\times6\) dots = 18 dots; Triangle 7: \(3\times7\) dots = 21 dots  
   (c) Triangle 60: \(3\times60\) dots = 180 dots; Triangle 70: \(3\times70\) dots = 210 dots  
   (d) \(3, 6, 9, 12, 15, 18;\) Triangle 30: \(3\times30 = 90\) dots

2. (a) To make the next figure, add one dot to each side of the previous figure.  
   Squares: (b) Square 6: \(4\times6\) dots = 24 dots  
   (c) Square 60: \(4\times60\) dots = 240 dots  
   Pentagons: (b) Pentagon 6: \(5\times6\) dots = 30 dots  
   (c) Pentagon 60: \(5\times60\) dots = 300 dots  
   Hexagons: (b) Hexagon 6: \(6\times6\) dots = 36 dots  
   (c) Hexagon 60: \(6\times60\) dots = 360 dots

<table>
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<th>5</th>
<th>6</th>
<th>30</th>
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<tbody>
<tr>
<td>No. of dots in square</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
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<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>150</td>
</tr>
<tr>
<td>No. of dots in hexagon</td>
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</tr>
</tbody>
</table>

The sequences are multiples of the number of sides of the figure (\(4\times, 5\times\) and \(6\times\) tables).

3. The patterns are all the same in the sense that they are all multiples.  
   The patterns are all different in the sense that they are different multiples.
10.2 Investigate and extend more patterns

Notes on questions
In question 1 the next few numbers are easily found mentally by using the beautiful and useful horizontal increasing differences pattern, like this:

<table>
<thead>
<tr>
<th>Triangle no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of dots</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>15</td>
<td>21</td>
<td>28</td>
<td>36</td>
<td>45</td>
<td>55</td>
<td>66</td>
</tr>
</tbody>
</table>

However, it may be useful not to calculate a running total, but to rather manipulate the numerical structure in the picture, e.g. Triangle 10 = 1+2+3+4+5+6+7+8+9+10+11.

Once the numerical expression is written down, we can manipulate it to an equivalent expression to make calculation easier, for example:

Triangle 10: \[1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 = 66\]

In question 2 we can also use the horizontal increasing differences pattern +5, +7, +9, … for the next few numbers, but it will be unproductive to continue like this all the way to 30. A more efficient strategy is to look at the structure of the pictures and to imagine in your head what Square 30 will look like. The pattern can be developed like this:

<table>
<thead>
<tr>
<th>Square 1</th>
<th>Square 2</th>
<th>Square 3</th>
<th>Square 4</th>
<th>Square 5</th>
<th>...</th>
<th>Square 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>2×2</td>
<td>3×3</td>
<td>4×4</td>
<td>5×5</td>
<td>6×6</td>
<td>...</td>
<td>31×31</td>
</tr>
</tbody>
</table>

Answers
1. (a) In each triangle every row has one more dot than the previous row: from the top the number of dots is 1, 2, 3, 4, ...
(b) Triangle 6 has 7 dots in the bottom row, and Triangle 7 has 8.
(c) Triangles 6: \[1 + 2 + 3 + 4 + 5 + 6 + 7 = 28\]; Triangle 7: \[1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 = 36\]

2. (a) Each square has one more dot in a side that the Square number.
(b) Square no. 1 2 3 4 5 6 7 8 30
   No. of dots 4 9 16 25 36 49 64 81 961

3. In Section 10.1 all the sequences had a constant difference. Here the difference is not constant.
10.3 From tables to flow diagrams

Teaching guidelines

You should continue to emphasise different approaches to “see” the patterns that are useful to generalise towards a rule, so that the rule can then be used to calculate missing output values. Using a rule is usually easier than other methods.

Here are some alternatives approaches for making rules:

- **Visually, using the structure in the pictures.** For example:

<table>
<thead>
<tr>
<th>Pink 1</th>
<th>Pink 2</th>
<th>Pink 3</th>
<th>Pink 4</th>
<th>Pink 5</th>
<th>Pink 6</th>
<th>Pink 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2+1</td>
<td>3+2</td>
<td>4+3</td>
<td>5+4</td>
<td>6+5</td>
<td>30+29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Green 1</th>
<th>Green 2</th>
<th>Green 3</th>
<th>Green 4</th>
<th>Green 5</th>
<th>Green 6</th>
<th>Green 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>2+1</td>
<td>3+2</td>
<td>4+3</td>
<td>5+4</td>
<td>6+5</td>
<td>7+6</td>
<td>31+30</td>
</tr>
</tbody>
</table>

Although the above structures can be used directly to calculate output values, they do not fit the flow diagram representation. Therefore, instead of quick calculation, it is useful to first transform the numerical structure into a more useful equivalent structure, for example Green 3 = 4+3 = 1+3+3 = 2×3 + 1; ... that can be generalised to Green n = 2×n + 1; ...

- **Numerically, using horizontal patterns.** For example, for Pink and Green: +2; +2; +2; ...

- **Numerically, using vertical patterns.** For example, for Total: Total no. = Figure no. × 4

- **Using relationships between the sequences**, often first using an easy known sequence like the even numbers, and then using it to find the others. See the example below.

Answers

1. Learners to describe and discuss methods and patterns in the table.

<table>
<thead>
<tr>
<th>Figure number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pink triangles</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>59</td>
</tr>
<tr>
<td>First use an easy sequence: Even numbers</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Number of green triangles</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>13</td>
<td>61</td>
</tr>
<tr>
<td>Total number of triangles</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>120</td>
</tr>
</tbody>
</table>

Due to space limitations we use the one-line flow diagram notation, for teachers only:

2. 1, 2, 3, 4, 5, 6, 30 \( \times 2 - 1 \rightarrow \) 1, 3, 5, 7, 9, 11, 59
3. 1, 2, 3, 4, 5, 6, 30 \( \times 2 + 1 \rightarrow \) 3, 5, 7, 9, 11, 13, 61
4. 1, 2, 3, 4, 5, 6, 30 \( \times 4 - 0 \rightarrow \) 4, 8, 12, 16, 20, 24, 120
Grade 4 Term 4 Unit 11  Whole numbers: Addition and subtraction

<table>
<thead>
<tr>
<th>Sections in this unit</th>
<th>Content</th>
<th>Pages in Learner Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.1 Practise addition and subtraction</td>
<td>Addition and subtraction calculations</td>
<td>343 to 344</td>
</tr>
<tr>
<td>11.2 Find information</td>
<td>Problem solving, calculating, rounding off and estimating</td>
<td>345</td>
</tr>
<tr>
<td>11.3 One number for many</td>
<td>Estimation and addition, developing a feel for averages</td>
<td>346</td>
</tr>
</tbody>
</table>

**CAPS time allocation**
3 hours

**CAPS page references**
14 to 15, 69 to 71 and 118

**Mathematical background**
Learners revise addition and subtraction. For most of the calculations and problems that they solve, they may use any method for adding and subtracting. They also practise rounding off and estimating.
11.1 Practise addition and subtraction

Mathematical notes
Questions 6 and 7 demonstrate the associative (grouping) property of addition. It does not matter how we group numbers within a calculation when we add, the answer remains the same. Question 4 is another demonstration of the associative property of addition, but here the parts of the numbers are grouped differently within the numbers in a calculation.

Learners do not have to know the names of this property, just how to use it.

Teaching guidelines
Aim to cover this section in 1 1/2 hours. One possibility is to use

- questions 1(a), (c), (e) and (g), 2, 4, 5, 10, 11 and 12 for concept development and classwork, and
- questions 1(b), (d), (f) and (h), 3, 6, 7, 8 and 9 for additional practice.

Notes on questions
In question 4 learners are asked which questions they think will have the same answer. They are not asked to give answers. It is useful to discuss why these answers are the same.

In questions 4(a) and (d) the thousands, tens and units parts of both numbers are the same. The hundreds parts of the first and second number are swapped around. If learners separate out the hundreds parts of the numbers they will get 5 074 + 3 098 + 600 + 200 and 5 074 + 3 098 + 200 + 600. These will clearly give the same answer. If learners struggle to see this, you can demonstrate that the totals will be the same by using place value cards.

In questions 4(a) and (c) learners can separate out the thousands parts of the numbers and get 5 000 + 674 + 3 000 + 298 = 3 000 + 674 + 5 000 + 298 (the thousands parts are swapped).

In question 4(f) the same thousands, hundreds, tens and units are added, only the order is different (5 000 + 3 000) + (200 + 600) + (70 + 90) + (8 + 4).

Answers
1. (a) 7 453 (b) 3 678 (c) 7 453 (d) 3 678
   (e) 7 453 (f) 3 678 (g) 7 453 (h) 3 678
2. Learners check their answers and correct any mistakes.
3. Learners check their answers and correct any mistakes.
4. (a), (c), (d) and (f)
5. (a) 8 972 (b) 9 674 (c) 8 972 (d) 8 972 (e) 9 170 (f) 8 972
6. All four will have the same answer. (Because you can add numbers in any order without changing the answer.)
7. (a) to (d) all add up to 7 887.
Notes on questions

In questions 8 and 9 it is only 8(b) that has a different answer. The answer to 9(b) is a negative number. Grade 4 learners have not yet learnt about negative numbers. They will probably say that “you cannot subtract a bigger number from a smaller number”. Some learners might say that the answer is zero. You can either let learners know that they will learn about numbers smaller than zero in later years, or you could use this opportunity to explain and explore negative numbers. You can start with counting backwards from zero and then do some calculations with smaller numbers, for example 2 – 3; 4 – 6; 1 – 9, etc.

Answers

8. Learners make a judgement.

9. (a) 3 721  
   (b) −935  
   (c) 3 721  
   (d) 3 721  
   (e) 3 721  
   (f) 3 721

10. (a) Rounded to the nearest 1 000:
    1 000  2 000  1 000  2 000  1 000
    1 000  0  1 000  1 000  1 000
    Estimated total: 11 000

   (b) Rounded to the nearest 100:
    1 000  1 700  900  1 600  500
    1 300  400  800  1 000  600
    Estimated total: 9 800

11. Learners may make different transfers. Check all their answers.

12. If learners worked accurately, their total should be 9 894.
11.2 Find information

**Teaching guidelines**

Aim to cover this section in 45 minutes. One possibility is to use
- questions 1, 2 and 5 for classwork, and
- questions 3 and 4 for additional practice.

Let learners work on the problems on their own. As they work, go around and check that they understand the questions by asking them to retell the questions in their own words.

**Possible misconceptions**

Check that learners understand that in question 1 there were 7 352 books after the book sale. This means that there were more books before the book sale. They need to add 7 352 + 2 659.

**Notes on questions**

Note that question 2 involves multiplication. The inclusion was deliberate. It is important that learners develop the habit and skill to think critically when they read and analyse problems so that they choose an appropriate operation to solve the problem.

**Answers**

1. 10 011 books
2. 384 beds
3. R6 940
4. 889 bricks
5. 94 mm; 87 mm; 68 mm; 79 mm; 105 mm; 112 mm; 94 mm
   Total: 639 mm
11.3 One number for many

**Mathematical notes**
While this section involves practice in addition and subtraction, it also serves to develop an intuitive sense of the concept “average” (mean), which is part of the content of Data Handling.

Learners will also be rounding and estimating.

**Teaching guidelines**
Aim to cover this section in 45 minutes. One possibility is to use
- questions 1 to 7 for classwork, and
- question 8 for additional practice.

**Answers**
1. No, because most numbers are bigger than 500.
2. Learners choose a number and estimate the total.
3. 7 400
4. Bennie’s estimate of the sum was 5 000.
   Learners’ answers will differ, but they need to see whether the difference between their estimate and the exact answer is more than 2 400 or less than 2 400.
5. 10 × 800 = 8 000
   Learners make a judgement, but they need to see whether the difference between their estimate and the exact answer is more than 600 or less than 600.
6. 700 or 750 would be a good choice.
7. 740 would have been a “perfect” choice.
8. (a) A number between 1 700 and 1 800 would be a good choice.
   (b) 8 654

---

Bennie has to find the sum of the ten numbers below.
He decides to make an estimate by choosing an easy number that is close to these numbers and multiplying it by 10.

<table>
<thead>
<tr>
<th>887</th>
<th>734</th>
<th>639</th>
<th>729</th>
<th>901</th>
</tr>
</thead>
<tbody>
<tr>
<td>663</td>
<td>781</td>
<td>809</td>
<td>585</td>
<td>672</td>
</tr>
</tbody>
</table>

Bennie chooses 500 and multiplies it by 10, so his estimate of the sum is 5 000.

1. Do you think Bennie made a good choice for a single number? If not, explain why you think 500 is not a good choice.
2. Choose a number that you think is better than 500, and use it to make your estimate of the sum of the above numbers.
3. Now add up the ten numbers accurately.
4. Was your estimate of the sum better than Bennie’s estimate?
5. Investigate whether the single number 800 would have produced a better estimate than the number you chose.
6. Which of the following numbers would have been the best choice for a single number?
   - 600
   - 650
   - 700
   - 750
   - 800
7. Which number would have been a “perfect” choice for a single number?
   (a) Choose a single number and use it to estimate the sum of 1 354, 2 007, 1 785, 1 576 and 1 932.
   (b) Add the numbers up accurately to check how close your estimate was.
Grade 4 Term 4 Unit 12  Probability

<table>
<thead>
<tr>
<th>Sections in this unit</th>
<th>Content</th>
<th>Pages in Learner Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.1 How does it work to flip a coin?</td>
<td>Chance, likelihood of a certain result</td>
<td>347</td>
</tr>
<tr>
<td>12.2 An experiment with flipping a coin</td>
<td>Two possible outcomes with equal chances of occurring, but experimental results vary</td>
<td>348 to 350</td>
</tr>
<tr>
<td>12.3 An experiment with rolling a die</td>
<td>Six possible outcomes with equal chances of occurring, but experimental results vary</td>
<td>350 to 352</td>
</tr>
</tbody>
</table>

**CAPS time allocation**  2 hours
**CAPS page references**  31 and 119

**Mathematical background**
When a coin is tossed, one of two things can happen: the coin can come to rest on one side or on the other side. Stated differently, there are two possible outcomes. The terms HEADS and TAILS are often used to distinguish the two sides of a coin. When a normal coin is tossed many times, there is no reason to expect that the one outcome (HEADS) will occur more often than the other outcome (TAILS). We say the two possible outcomes are “equally likely” – this is a way of saying that one would expect more or less the same number of HEADS and TAILS if a coin is tossed many times. The same applies to the rolling of a die, though in this case there are six different equally likely outcomes.

When a fair coin is tossed (or an unbiased die is rolled) once, it is impossible to predict with any confidence what the outcome of the event will be. Although the range of possible outcomes is known, no grounds exist to predict that one outcome rather than another will occur. Any of the outcomes is exactly as likely to occur as any other. Hence the outcome of the event is unpredictable. Such events are called random events.

Although the outcome of a random event is completely unpredictable, predictions can be made about approximately how often a particular outcome will occur if the event is repeated many times. For example, if a coin is tossed many, many times, it will end up on one side for about half of the time and on the other side for about half of the time. If an ordinary die is rolled many, many times, the number 4 (or any other number in the range 1, 2, 3, 4, 5, 6) can be expected to occur roughly one sixth of the time. Suppose another die is not marked 1, 2, 3, 4, 5, 6 on its six faces, but coloured red on one face, blue on two faces and yellow on three faces. If such a coloured die is rolled many, many times, red can be safely predicted to come on top about 1 sixth of the time, blue to come on top roughly one third of the time and yellow to come on top roughly half of the time.

The activities in this unit provide learners with experiences of repeated random events, with a view to provide them with experiences where the different possible outcomes occur approximately the same number of times.

**Resources**
A coin for each pair of learners.
A die for each pair or group of learners.
Square grid paper to record results.
12.1 How does it work to flip a coin?

Mathematical notes
When we flip a coin there are two possible outcomes: HEADS and TAILS. Each outcome has the same chance of occurring every time you flip the coin. The focus of this section is on fairness. If there is an equal chance of getting any of the results, it does not matter which possibility you choose because there is no way of predicting what the outcome will be.

Teaching guidelines
When learners do the experiments their results will differ. That is the nature of probability experiments. Lots of discussion is needed about what learners expect. The discussion in this section focuses on whether there is an equal chance of getting the result of your choice. It also focuses on the understanding that only if there is an equal chance of getting any of the results, is the mechanism/method a fair way to make a decision.

Aim to spend about 30 minutes on this section.

Possible misconceptions
Learners may think that they can accurately predict the result when flipping a coin. They may predict correctly now and then, but that is “luck”.

Notes on questions
Let learners draw up tally tables to record the results of their experiments.

Answers
1. (a) Discussion about fairness. A coin flip is a fair way to decide because both teams have the same chance to win the toss.
(b) Answers will differ. There are different ways to make such decisions in different cultures. Learners may talk about methods such as choosing the fist with the stone, or counting rhymes they use on the playground. Counting rhymes have a pattern and one can work out what the result will be. Therefore counting rhymes are not fair in the way a coin flip is.
12.2 An experiment with flipping a coin

Mathematical notes
There is no way to tell whether you will get exactly the same results as before when you repeat an experiment with coins. We all know that the chances are small to get exactly the same number of HEADS and TAILS when you compare 20 flips of a coin. However, it is not impossible to get the same result again.

Teaching guidelines
Let learners work in pairs. One learner collects the data of the flips and the other shades squares in a tally table.

For question 3 you may prepare a table on the board in which to write each learner’s results so that you can compare the results as a class.

Aim to spend about 45 minutes on this section.

Possible misconceptions
Learners may think that exactly half of the flips must be HEADS and half must be TAILS.

Critical knowledge
When we flip a coin there are two possible outcomes. Each outcome has the same chance to occur every time we flip the coin.

Answers
1. Answers will differ. If there is time, allow more flips.
2. (a) The total number of flips each learner recorded may differ.
   (b) The total number of HEADS will differ from one learner to the next. Some may have the same total.
   (c) The fraction of HEADS and the fraction of TAILS must add up to 20 out of 20 \(\frac{20}{20}\) if they made a total of 20 flips.
3. (a) Results will differ. It is not possible to get a bigger fraction than \(\frac{20}{20}\) HEADS.
   It is possible to get \(\frac{20}{20}\) and \(\frac{0}{20}\) HEADS. Both results are unlikely – we will be surprised to see such a result.
   (b) The results differ because we cannot predict how the coin will land.

In the example above, the HEADS are 11 out of 20, and the TAILS are 9 out of 20.
Answers

4. (a) Each learner calls out the number of HEADS in his or her experiment so that the
tally table can be completed.
Example tally table (the data from your class will differ):

<table>
<thead>
<tr>
<th>Number of HEADS in 20 flips per learner</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
</tr>
<tr>
<td>/ / // /// /// /// /// /// /// /// //</td>
</tr>
</tbody>
</table>

(b) Example of pictograph (the data from your class will differ):

```
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
```

(c) The graph shows that most of the fractions are close to the middle of the range.

5. (a) Example of data table (the data from your class will differ):

<table>
<thead>
<tr>
<th>Number of flips</th>
<th>Fraction HEADS</th>
<th>Fraction TAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>After the first 20 flips 6/20</td>
<td>14/20</td>
<td></td>
</tr>
<tr>
<td>After 40 flips 24/40</td>
<td>16/40</td>
<td></td>
</tr>
<tr>
<td>After 60 flips 26/60</td>
<td>34/60</td>
<td></td>
</tr>
<tr>
<td>After 80 flips 35/80</td>
<td>45/80</td>
<td></td>
</tr>
<tr>
<td>After 100 flips 46/100</td>
<td>54/100</td>
<td></td>
</tr>
</tbody>
</table>

(b) Answers will differ. In general, the more flips that are combined the closer to half
of the total the fractions can be expected to be.

(c) See question 4(b). It is unlikely to get very small numbers of HEADS out of 100
flips. The number line must start at the smallest number obtained in the class and
go up to the biggest number obtained in the class.
**Answers**

5. (d) Answers may differ. For example: The number of HEADS out of 100 flips is mostly between ______ and ______. A few groups got more than ______ HEADS out of 100, and some got fewer than ______ HEADS out of 100.

   (e) Answers will vary. The more flips you do, the closer the fraction of HEADS is expected to get to half of the total number of flips. Still, we cannot predict with certainty what the exact result will be.

6. (a) Possible, but unlikely.
   (b) Possible, but unlikely.
   (c) Answers will differ. It is quite likely to get 15 HEADS in 20 flips.
   (d) Answers will differ. Although it is not unlikely to get 20 HEADS in 100 flips, it will be unusual. We expect a fraction that is closer to half of 100.
   (e) Answers will differ. We cannot predict exactly, but we can expect a fraction close to half of 100.

7. (a) $20 - 12 = 8$. 8 TAILS
   (b) $100 - 56 = 44$. 44 TAILS
   (c) The number of HEADS and TAILS must add up to the total number of flips.

---

**12.3 An experiment with rolling a die**

**Critical knowledge**

When we roll a die there are six possible outcomes. Each outcome has the same chance to occur every time we roll the die.

**Notes on questions**

For question 7 learners may combine their data to get the results of 100 rolls instead of rolling 100 times.

**Answers**

1. Possible numbers: 1, 2, 3, 4, 5, 6.
2. Learners’ lists of numbers will vary. We cannot predict accurately, but it is possible to get all the numbers.
Teaching guidelines

Let learners work in pairs. One learner records the data of the rolls in a grid and the other records them in a tally table. The information in the tally table does not give the results of the rolls one after the other. Use the grid blocks to discuss that there is no fixed pattern or order in which you get numbers.

For question 3 you may prepare a table on the board in which to write each learner’s results so that you can compare the results as a class. Similarly, with question 4 you may prepare the “frame” of the pictograph on the board while learners roll their dice.

Aim to spend about 45 minutes on this section.

You can remind learners that because a die has six identical faces shaped like squares, it looks like a cube.

Answers

3. Make a tally table that runs from 1 to 6.
4. Answers will differ.
   (c) Answers will differ. For example: I got the same number of ___ and ___. I was surprised to get so many ___, and so few ____.
Answers

5. (a) Answers will differ.
(b) The graphs are different because you rolled only 20 times each. The more times you roll the more you can expect your graphs to start looking the same.

6. There still will be only 6 possible outcomes. You can expect the graph to start evening out, and the differences between the different outcomes to be smaller than with 20 rolls.

7. Results will differ.

8. Graphs will differ. In general you expect the results to even out.

9. (a) Did that happen to anyone in the class? If you roll 20 times, you should not be too surprised if you get no 2s. You should be surprised if you get no 2s in 100 rolls.
(b) Did that happen to anyone in the class? Yes, you should be surprised, especially if you roll many times.
(c) Did that happen to anyone in the class? No, you should not be surprised if you roll about equally many of each number. Each number has the same chance with every roll.
(d) Did that happen to anyone in the class? Yes, you should be surprised, especially if you roll many times.
(e) Did that happen to anyone in the class? You should not be surprised.
Addendum

General resources
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Place value cards for teachers .......................................................................................... 419
Grid paper ......................................................................................................................... 433
Dotted paper ....................................................................................................................... 434

Resources per term
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Term 2 Resources .............................................................................................................. 447
Term 3 Resources .............................................................................................................. 454
Term 4 Resources .............................................................................................................. 462

If you do not have access to a photocopy machine, ask learners to prepare grids or tables beforehand, for example as homework, so that they do not waste class time.
Place value cards for learners
(3 pages = 1 set)
<table>
<thead>
<tr>
<th>3000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td>7000</td>
<td>8000</td>
</tr>
<tr>
<td>9000</td>
<td>1000</td>
</tr>
</tbody>
</table>
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Term 1

Term 1 Unit 1: Section 1.1, question 7      (TG p. 7; LB p. 6)
Term 1 Unit 1: Section 1.1, questions 10 to 13 (TG p. 7; LB p. 6)
## Term 1 Unit 4: Section 4.5, question 1

(TG p. 62; LB p. 58)

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(TG p. 67; LB p. 62)

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### Term 1 Unit 5: Section 5.3, question 4

(TG p. 69; LB p. 64)

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(TG p. 71; LB p. 66)

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(TG p. 71; LB p. 66)

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Term 1 Unit 5: Section 5.4, question 1  (TG p. 72; LB p. 67)

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Term 1 Unit 6: Section 6.3, question 5 (TG p. 87; LB p. 81)
Term 1 Unit 9: Section 9.1, question 7  
(TG p. 115; LB p. 105)

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Term 1 Unit 9: Section 9.2, question 2  
(TG p. 116; LB p. 106)

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Term 1 Unit 9: Section 9.4, question 1  (TG p. 118; LB p. 108)

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Term 2 Unit 1: Section 1.4, question 5   (TG p. 138; LB p. 127)

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Term 2 Unit 5: Section 5.1, question 1       (TG p. 178; LB p. 161)

(a)  

(b)  

Term 2 Unit 5: Section 5.1, question 2       (TG p. 178; LB p. 161)

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(TG p. 179; LB p. 162)

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## Term 2 Unit 5: Section 5.2, questions 1, 2, 4, 5, 6 and 7

(TG p. 182; LB p. 164)

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</tbody>
</table>
Term 2 Unit 6: Section 6.1, Resources  (TG p. 192)
Term 2 Unit 7: Section 7.2, question 2 (TG p. 202; LB p. 182)

(a) 

(b) 

(c) 

(d)
Term 3

Term 3 Unit 1: Section 1.2, question 1 (TG p. 241; LB p. 214)

What fractions are shown on each of the measuring sticks?

A

B

C

D

E

F

G

halves

...........................
Term 3 Unit 1: Section 1.3, question 2  
(TG p. 243; LB p. 216)

thirds

sixths

A

B

C

D

E

F

G
Term 3 Unit 1: Section 1.6, question 2  (TG p. 251, LB p. 223)
Term 3 Unit 3: Section 3.2, question 1 (TG p. 272; LB p. 240)

(a)  1 000     2 000                        9 000

(b)  3 800     3 900                      4 700

(c)  6 980     6 990                    7 060

(d)  9 655     9 660                               9 700
Table A: The distance covered after different times

<table>
<thead>
<tr>
<th>Time</th>
<th>0</th>
<th>10 min</th>
<th>20 min</th>
<th>30 min</th>
<th>40 min</th>
<th>50 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annie</td>
<td>0</td>
<td>1 867</td>
<td></td>
<td>5 504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ellen</td>
<td>0</td>
<td>1 768</td>
<td></td>
<td>5 345</td>
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<tr>
<td>Gap</td>
<td>0</td>
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</table>

Table B: The distances covered in different 10-minute periods

<table>
<thead>
<tr>
<th>Period</th>
<th>First 10 min</th>
<th>Second 10 min</th>
<th>Third 10 min</th>
<th>Fourth 10 min</th>
<th>Fifth 10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annie</td>
<td>1 867</td>
<td>1 835</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ellen</td>
<td>1 768</td>
<td>1 778</td>
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<tr>
<td>Difference</td>
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</tbody>
</table>
Table C: The differences between the distances covered in different 10-minutes periods

<table>
<thead>
<tr>
<th>Periods</th>
<th>1st and 2nd periods</th>
<th>2nd and 3rd periods</th>
<th>3rd and 4th periods</th>
<th>4th and 5th periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annie</td>
<td></td>
<td></td>
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<tr>
<td>Ellen</td>
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</table>
Term 3 Unit 12: Section 12.1, question 1       (TG p. 329; LB p. 286)
Term 3 Unit 12: Section 12.2, question 3  (TG p. 333; LB p. 288)
## Term 4

Term 4 Unit 2: Section 2.2, question 5  
(TG p. 344; LB p. 296)

### Tank A

<table>
<thead>
<tr>
<th>Period of time</th>
<th>10:00 to 11:00</th>
<th>11:00 to 12:00</th>
<th>12:00 to 13:00</th>
<th>13:00 to 14:00</th>
<th>14:00 to 15:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lost (in ℓ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

### Tank B

<table>
<thead>
<tr>
<th>Period of time</th>
<th>10:00 to 11:00</th>
<th>11:00 to 12:00</th>
<th>12:00 to 13:00</th>
<th>13:00 to 14:00</th>
<th>14:00 to 15:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lost (in ℓ)</td>
<td></td>
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</tbody>
</table>

### Tank C

<table>
<thead>
<tr>
<th>Period of time</th>
<th>10:00 to 11:00</th>
<th>11:00 to 12:00</th>
<th>12:00 to 13:00</th>
<th>13:00 to 14:00</th>
<th>14:00 to 15:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lost (in ℓ)</td>
<td></td>
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Term 4 Unit 4: Section 4.1, question 2  (TG p. 356; LB p. 306)
Term 4 Unit 4: Section 4.1, question 3   (TG p. 357; LB p. 307)
Term 4 Unit 4: Section 4.1, question 4  
(TG p. 357; LB p. 307)
Term 4 Unit 4: Section 4.1, question 5  (TG p. 358; LB p. 308)
Term 4 Unit 8: Section 8.2, question 1  (TG p. 388; LB p. 332)
Term 4 Unit 9: Section 9.1, question 4  (TG p. 393; LB p. 336)
Term 4 Unit 9: Section 9.2, question 1  (TG p. 395; LB p. 338)
Term 4 Unit 9: Section 9.2, question 2  (TG p. 395; LB p. 338)