Solomon Islands

MATHEMATICS
Year 7 Learner's Book

Book 1

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Book 1

CONTENTS

HOW TO USE THIS BOOK

The **Solomon Islands Mathematics** series has been written to cover the General Learning Outcomes of the Solomon Islands Secondary Mathematics Syllabus Years 7 to 9.
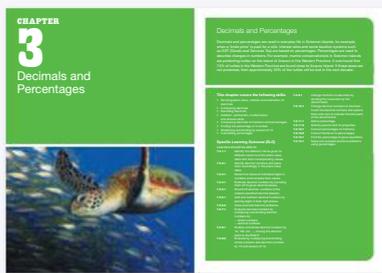
Chapter opening pages

Chapter opening pages include a contemporary or historical context for the content and provide learners with a list of the skills that are covered in the chapter.
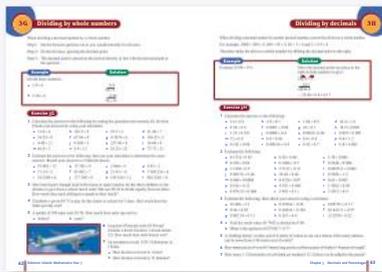
Theory and exercise sections

Theory and exercise sections contain explanations, examples and exercises designed to develop understanding of concepts and provide opportunities for students to practise new skills.
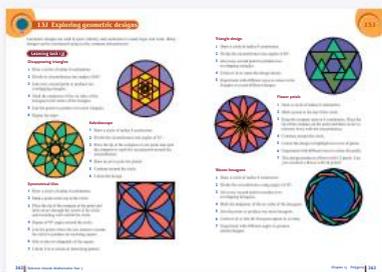
Explorations

Explorations are scattered throughout the chapters, allowing students to work independently on non-standard problems and construct their own understandings.

These features are found at the end of each chapter
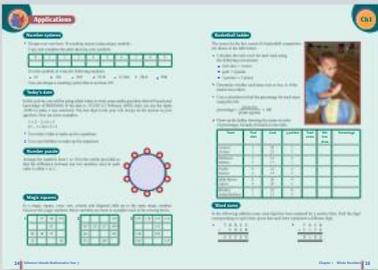
Puzzles

Puzzles are included for extra skills practice.
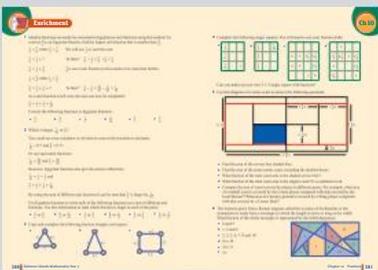
Application

Application sections investigate and apply mathematical ideas in a creative way and provide activities for a range of learner abilities.
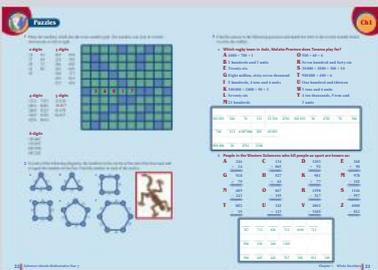
Enrichment

Enrichment sections contain challenging tasks for learners to apply and extend their understanding of concepts.
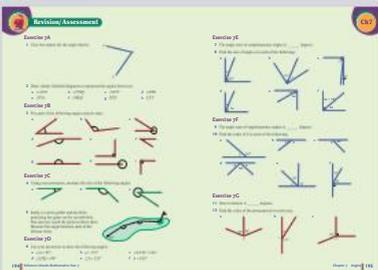
Revision questions

Revision questions provide opportunities for learners to consolidate understanding of concepts.

Solomon Islands Mathematics Year 7 Learner's Book

Introduction

This book is written to help you learn Mathematics by actively participating in a variety of activities. There are a total of 14 chapters, each of which focuses on a particular topic from one of the strands in the Solomon Islands Secondary Mathematics Syllabus. The strands are *Number*, *Measurement*, *Algebra*, *Geometry*, *Statistics* and *Probability*. We hope that the activities in this book will encourage you to learn Mathematics effectively, and to gain enjoyment and enrichment from the topics and contexts involved.

Chapter organisation

The chapter order provides opportunities to revise topics studied in earlier years, to acquire new knowledge and skills, and to review and develop your understandings throughout the school year.

The Number strand

The chapters that will develop your number skills include *Whole Numbers*, *Number Patterns*, *Decimals and Percentages*, *Directed Numbers* and *Fractions*. You will learn about the symbols that different cultures have used to represent numbers in history, and come to appreciate why base 10 and place value make counting and calculations easy in our own system. Number properties can be illustrated by using patterns. Patterns will help you appreciate number properties, allowing you to make sensible estimates, round answers and apply number skills in all the other Mathematics strands. Most importantly, your number skills will help you solve real-life problems.

The Measurement strand

The chapters that will develop your measuring skills include *Length and Perimeter*, *Time and Mass* and *Area and Volume*. You will need to become familiar with standard metric units and be able to use a range of tools to measure accurately and with precision. You will need to understand and use appropriate formulae to calculate areas and volumes and apply them to practical problems. You will also learn to estimate measurements so that you will know whether you are being given approximately the right quantity when buying goods in a shop.

The Algebra strand

The chapter that will develop your algebra skills in Year 7 is *Algebra Symbols*. This topic is one that will become increasingly important in future years, so a sound understanding at this early stage is necessary. Algebra develops the patterns first studied in Numbers and generalises them to explain their relationships. Algebra uses symbols, equations and graphs to describe patterns, and will be very useful later when solving practical problems.

The Geometry strand

The chapters that will develop your geometric skills include *Angles*, *Polygons*, and *Coordinate Graphs and Location*. Geometry is concerned with size, shape, position and the properties of space. It uses properties from other Mathematics strands to utilise points, lines and planes so that you can explore shapes in two and three dimensions. Geometrical patterns are found in nature, architecture, clothing designs and carving. The study of geometry will help you appreciate how Mathematics is everywhere around us.

The Statistics and Probability strand

There is one chapter for your study of *Statistics* and another for *Probability*. Statistics deals with the collecting, organising, presenting and interpreting of numerical information (data). Our newspapers are full of statistical information and it is important that you can understand statements and graphs to check the accuracy of the conclusions. Your study of Probability will help you describe the chance of various events occurring. Games of chance are a fun way of learning about probability, but the concepts can be applied to many real-life situations when outcomes are uncertain, and so the study of Probability is necessary for the development of decision-making skills.

How to learn Mathematics

As you work through the chapters you will be asked to work on your own, work with a partner or in a group, and sometimes with the whole class. Therefore, you must be willing to participate actively in all the tasks and not rely on the teacher or friends for answers. You will learn a great deal when you take an active part in the learning process.

Making mistakes

Learning Mathematics is a skill, like riding a bicycle. You cannot learn to ride a bicycle by just listening to the teacher telling you how to ride—you can only learn by doing it. Nobody has learnt to ride a bicycle without falling off many times. Making mistakes is part of the learning process and this is also true for Mathematics. The more familiar you are with the topic, the fewer mistakes you are likely to make. Like bicycle riding, Mathematics learning needs lots of practice and the exercises in this book are designed to help you practise until you become confident in each new skill. Homework is a chance to further practise the skills learnt in class, and what you can't do on your own, you can ask your teacher or a friend to help you with the next day.

Developing skills

Mathematics is more than a series of facts and rules. It involves understandings and skills that can be applied to new situations. After each lesson, it is useful to reflect on your learning and in particular the problem-solving strategies that you used that day. Those same strategies may be useful for other problems in the future. And if you discover a new skill, show it to a friend. Not only will your friend benefit, but it will help you remember it too!

Suggested teaching plan for the Year 7 Learner's Book

Semester 1

Weeks	Sub-strands	Allocated Times
	Number	
1	Chapter 1: Whole Numbers	2 Weeks
2		
3	Chapter 2: Number Patterns	2 Weeks
4		
5	Chapter 3: Decimals and Percentages	3 Weeks
6		
7		
	Measurement	
8	Chapter 4: Length and Perimeter	3 Weeks
9		
10		
	Probability and Statistics	
11	Chapter 5: Statistics	3 Weeks
12		
13		
	Algebra	
14	Chapter 6: Algebra Symbols	3 Weeks
15		
16		
	Geometry	
17	Chapter 7: Angles	3 Weeks
18		
19		
20	*Mid-Year Examinations*	1 Week
	Mid-year Holidays	

Semester 2

Weeks	Sub-strands	Allocated Times
	Number	
21		
22	Chapter 8: Directed Numbers	3 Weeks
23		
	Geometry	
24		
25	Chapter 9: Coordinate Graphs and Location	2 Weeks
	Number	
26		
27	Chapter 10: Fractions	3 Weeks
28		
	Measurement	
29		
30	Chapter 11: Time and Mass	2 Weeks
	Probability and Statistics	
31		
32	Chapter 12: Probability	3 Weeks
33		
	Geometry	
34		
35	Chapter 13: Polygons	3 Weeks
36		
	Measurement	
37		
38	Chapter 14: Location	3 Weeks
39		
40	*Final Examinations*	1 Week
	End-of-year Holidays	

Whole Numbers

From the beginning of human existence, people have needed numbers to count and record information. Early civilisations such as the Egyptians, Romans, Indians, Greeks and Arabians developed their own number systems and methods of calculation. The Hindus developed today's decimal system in 600–900 AD. Every whole number can be written by using only ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. We use numbers every day in many different ways.

This chapter covers the following skills:

- Understanding place value
- Adding, subtracting, multiplying and dividing whole numbers
- Doubling and halving mentally
- Estimating values
- Converting numbers from different counting systems
- Simplifying by using order of operations
  - B Work out the calculations inside the brackets first. If there is more than one operation inside the brackets, then they must also follow the rules of BODMAS
  - O If the question contains fractions of, or powers of, then these are calculated next
  - D Work out the division and
  - M multiplication calculations, working across the page from left to right
  - A Work out the addition and
  - S subtraction calculations, working across the page from left to right.

Specific Learning Outcome (SLO)

Learners should be able to:

7.1.1.1 Identify the different counting systems that were used in the olden days in Solomon Islands.

7.1.1.2 Identify and distinguish between the different number systems that were used in the past, including: Hindu-Arabic that we use now, Egyptian, Roman, Greek and Chinese–Japanese.

7.1.2.1 Write numbers using different number systems of the past: Roman, Greek etc.

7.1.3.1 Convert numbers from one counting system to another using the past and present number systems.

7.1.4.1 Write and express numbers in figures, using digits: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9, and also in words.

7.1.5.1 Identify the names and values of numbers in respect to the positions of the digits in the Place Value Table.

7.1.5.2 Arrange numbers in ascending and descending order according to their values.

7.1.6.1 Use the four (4) basic operations: *Addition, Subtraction, Multiplication* and *Division* to compute and solve whole number problems.

7.1.7.1 Use the doubling and halving techniques to calculate and evaluate number problems.

7.1.8.1 Apply the Order of Operation Rule [BODMAS] when performing Number Calculations.

7.1.9.1 Round off numbers to the nearest Ones, Tens, Hundredths, Thousands etc.

Number systems of the past

We are most familiar with the Hindu–Arabic number system because we use it every day. However, many early civilisations developed their own number systems, including the Egyptians, Romans, Indians, Greeks and Arabians.

The following tables show the Hindu–Arabic system and several others.

The Hindu–Arabic number system

1	2	3	4	5	6	7	8	9	10

It is uncertain if it was Arab or Indian Mathematicians who first introduced the zero.

The Roman number system

0	1	2	3	4	5	6	7	8	9	10	15	20	50	100
	I	II	III	IV	V	VI	VII	VIII	IX	X	XV	XX	L	C

The Romans wrote their numbers from left to right, as we do; however, the Roman system does not rely on the use of place value so there was no need for a symbol to represent zero.

In the Roman number system 463 is written as CCCCLXIII.

The Egyptian number system

Examples of this were found on stones, wood and pottery from about 3500 BC. Numbers were written from right to left.

1	2	3	4	5	6	7	8	9	10

100	1000	10 000	100 000	1 000 000	10 000 000	e.g. 256

The Egyptian number system does not rely on place value so there is no need for a zero.

The Greek number system

The Greek number system was similar to the Egyptian one, except that the symbol for 5 was often combined with the symbol for 10, 100, 1000 and 10 000.

1	2	3	4	5	10	$5 \times 10 = 50$	100	1000	10 000
I	II	III	IIII	Γ	Δ	ΓΔ	H	X	M

The Chinese–Japanese number system

The traditional Chinese–Japanese numerals are demonstrated below. Unlike the other systems this one was based on multiplication and was written down the page rather than across it.

1	2	3	4	5	6	e.g. 3276
一	二	三	四	五	六	三千二百七十六
7	8	9	10	100	1000	
七	八	九	十	百	千	

Exercise 1A

1 Represent each of the following numbers using the ancient Hindu–Arabic number system:
   a 46 b 97 c 257
   d 308 e 1248 f 1004

2 Represent each of the following numbers using Roman numerals:
   a 59 b 137 c 73
   d 14 e 482 f 124

3 Rewrite each of these Roman numerals into modern Hindu–Arabic:
   a XXIV b CCLV c CCCXI
   d CCCIX e XLV f XCIX

4 Rewrite each of the following numbers using the Egyptian number system (remember to write them right to left):
   a 11 b 1245 c 8
   d 10 000 e 1006 f 10 205

5 Decode the following Greek numbers:
   a ΔΔΓΙ b ΓΙΙΙ c ΓΔΔΔΓΙΙΙΙ
   d ΗΗΗΔΔΓΙΙ e ΧΔΙΙ f ΓΗΓΔΓΙ

6 Rewrite each of the following numbers using the traditional Chinese–Japanese number system (remember to write them down the page):
   a 93 b 84 c 51
   d 238 e 782 f 1258

7 Explain in a sentence or two some of the advantages of the traditional Chinese–Japanese system.

8 Explain in a sentence or two some of the disadvantages of the Roman number system.

1B Place value

The Hindu–Arabic or whole number system uses ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Each digit represents a different value depending on its position in the number.

The numbers 3482 and 2 497 501 are shown in place value columns below.

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Units/ Ones
			3	4	8	2
2	4	9	7	5	0	1

In numbers 10 000 and greater, a space is left after every three digits to the left of the last digit, to make the number easier to read.

Example

1 Write the number twelve thousand, seven hundred and four using digits.

2 Write 3 002 195 in words.

Solution

12 704

3 002 195 is three million, two thousand, one hundred and ninety-five

Exercise 1B

1 Write the following numbers in figures:
  a twenty-four
  b six hundred and twelve
  c two hundred and four
  d six thousand, four hundred and fifty-eight
  e thirty-seven thousand
  f five million, six thousand and one
  g six hundred thousand
  h forty million and sixty-seven
  i two hundred and fifteen thousand, and ninety-nine
  j one hundred and forty thousand, five hundred and thirty
  k eight hundred and nine million, eighty-seven thousand, nine hundred and twenty

2 Write each of these numbers in words:
  a 48
  b 291
  c 125 909
  d 3490
  e 2063
  f 9 745 100
  g 67 405
  h 9003
  i 224 000 000
  j 872 004
  k 4 000 016
  l 213 500

3 What is the place value of the 3 in each of the following numbers?
  a 13
  b 23 002
  c 3 090 765
  d 356
  e 65 834
  f 2 435 769
  g 24 530 000
  h 557 213
  i 308 457 888
  j 4538
  k 1 306 501
  l 10 301

4 What is the value of the 3 in each of the following numbers?

a 123   **b** 34   **c** 3054   **d** 329

e 309 642   **f** 452 135 222   **g** 23 986 457   **h** 3 566 421

5 Write each of these sums as a single number:

a 30 000 + 2000 + 300 + 40 + 3   **b** 400 000 + 20 000 + 500 + 20

c 900 000 + 40 000 + 300 + 10 + 1   **d** 45 000 + 400 + 80 + 1

e 3 000 000 + 40 000 + 300   **f** 12 000 + 500 + 70 + 8

6 Write the numbers formed from the following:

a 8 hundreds and 6 tens

b 3 ten thousands, 5 tens and 6 units

c 4 thousands, 8 hundreds and 3 tens

d 80 million, 5 ten thousands and 3 tens

e 1 ten thousand, 6 hundreds, 8 tens and 7 units

f 5 millions, 4 hundred thousands, 6 thousands and 7 units

7 Write the largest number possible in each case by using each digit once:

a 1, 4 and 8   **b** 3, 5, 9 and 8   **c** 6 and 1

d 2, 4, 9, 6 and 1   **e** 4, 6, 7, 1, 9 and 0   **f** 9, 8, 7, 4, 3, 2, 1 and 0

8 Write the smallest number possible in each case by using each digit once:

a 5 and 8   **b** 5, 7, 6, 3, 1 and 0   **c** 5, 9, 3 and 6

d 2, 4, 3, 9, 7, 0 and 5   **e** 4, 8 and 7   **f** 6, 7, 4, 3 and 2

9 Write the following lists of numbers in order from smallest to largest:

a 123, 321, 145, 16, 35, 245, 12   **b** 306, 316, 360, 366, 603, 660, 303

c 4007, 4070, 4707, 4770, 4777   **d** 55 976, 55 980, 55 809, 55 796, 55 789

e 345, 467, 34, 56, 721, 3, 5005   **f** 12 405, 52 401, 42 510, 20 451

10 Write down the total amount of money in each of these photographs:

a

b

c

1C Addition

Addition is used to combine two or more whole numbers to find their sum or total value. When adding numbers, be sure to keep the digits in their correct place value position.

Example

Find the sum of each of the following:

a 235 + 42

b 358 + 469

Solution

$$
\begin{array}{r}
235 \\
+\ \ 42 \\
\hline
277 \\
\hline
\end{array}
$$

$$
\begin{array}{r}
{}^{1\ 1} \\
358 \\
+\ 469 \\
\hline
827 \\
\hline
\end{array}
$$

Exercise 1C

1 Find the sum of each of the following:

a
$$
\begin{array}{r}
123 \\
+\ \ 34 \\
\hline
\end{array}
$$

b
$$
\begin{array}{r}
457 \\
+\ 681 \\
\hline
\end{array}
$$

c
$$
\begin{array}{r}
2987 \\
+\ \ 853 \\
\hline
\end{array}
$$

d
$$
\begin{array}{r}
45 \\
+\ 347 \\
\hline
\end{array}
$$

e
$$
\begin{array}{r}
235 \\
89 \\
+\ 1246 \\
\hline
\end{array}
$$

f
$$
\begin{array}{r}
89 \\
234 \\
+\ 9359 \\
\hline
\end{array}
$$

g
$$
\begin{array}{r}
3\,456 \\
12\,438 \\
+\ \ 931 \\
\hline
\end{array}
$$

h
$$
\begin{array}{r}
5 \\
34 \\
+\ 6781 \\
\hline
\end{array}
$$

i
$$
\begin{array}{r}
254 \\
976 \\
+\ 3591 \\
\hline
\end{array}
$$

j
$$
\begin{array}{r}
5781 \\
43 \\
+\ \ \ 9 \\
\hline
\end{array}
$$

k
$$
\begin{array}{r}
532 \\
5681 \\
+\ 2855 \\
\hline
\end{array}
$$

l
$$
\begin{array}{r}
90 \\
7852 \\
+\ 1666 \\
\hline
\end{array}
$$

2 Place the following addition questions in columns and then work out the answers:

a What is the sum of 2265, 8642 and 2451?

b Add 45 671 and 89 065.

c What do you get when you add 45 651 and 3459?

d What is 492 plus 571 plus 3490?

e Find the result of 3561 + 56 + 8900.

f What is the answer to 346 plus 45 698 plus 445 621?

3 Sarah went to the shopping centre to buy some new clothes. She bought a pair of shoes for $45, jeans for $82, two T-shirts for $16 each and a windcheater for $28. How much did she spend altogether?

4 Matthew needed new skateboard gear. He bought a new skateboard for $436, a helmet for $134, and some elbow and knee guards for $75. How much did Matthew spend?

5 Mr Young goes to a cattle sale to buy some cows. He buys five cows, which cost him $785, $862, $804, $930 and $912. How much does Mr Young spend on his purchases?

6 A Toyota salesperson makes five new car sales in one week. He sells a Land Cruiser for $45 955, a Camry for $27 350, an Echo for $16 975, a Corolla for $20 890 and an Avalon for $35 420. What was the total of his sales for the week?

7 Find the shortest distance between Mbaranaba and Central Hospital by using the map opposite.

8 Three cousins live in different wards in Honiara. They decided to meet at Town Ground to watch the Trade Show. Refer to the map below and answer the following questions.

a How far does Alice have to travel if she lives in Mbuburu?

b What distance does Bonnie cover to get to Town Ground if she lives in Naha?

c How far from Town Ground is Regina's house in White River?

d Which cousin travels the least distance?

e How far in total do the girls travel to get to Town Ground?

f Bonnie is having a party. How far do Alice and Regina have to travel to get to Bonnie's house (assuming that they travel through Town Ground)?
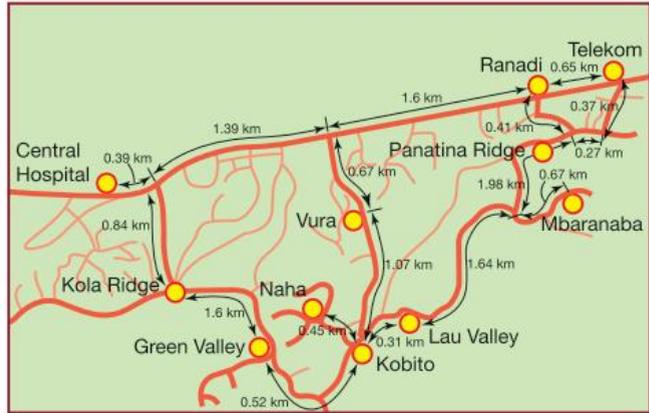
9 The Soltai Company decided to launch its latest 'Curry Flavour' tinned fish product in Western, Malaita and Isabel Provinces. The company wishes to analyse its sales for October, November and December in each of these three provinces. The sales for each province over the three months are listed in the table below (in number of tins of fish).

Provinces	October	November	December
Western	4235	6231	2451
Malaita	6854	2585	3567
Isabel	2400	3476	3296

Use the table to answer the following questions.

a What are the total sales for each province and for the company over the three-month period?

b Which province has the highest sales?

c What are the total sales for each month?

d Which month produced the highest sales?

1D Subtraction

Subtraction is used to find the difference between two numbers where one quantity is taken away from another quantity. The order in which numbers are subtracted is important here: the larger number must be placed first to find a positive difference.

When subtracting numbers be sure to keep the digits in their correct place value position.

Example	Solution

Find the answer to each of the following subtraction questions:

a
$$\begin{array}{r} 489 \\ - 213 \\ \hline \end{array}$$

$$\begin{array}{r} 489 \\ - 213 \\ \hline 276 \\ \hline \end{array}$$

b
$$\begin{array}{r} 5248 \\ - 1362 \\ \hline \end{array}$$

$$\begin{array}{r} {\scriptstyle 4\ 11\ 14} \\ 5\cancel{2}4\cancel{8} \\ - 1362 \\ \hline 3886 \\ \hline \end{array}$$

Exercise 1D

1 Find the answer to each of the following subtractions:

a
$$\begin{array}{r} 875 \\ - \ 51 \\ \hline \end{array}$$
b
$$\begin{array}{r} 829 \\ - 517 \\ \hline \end{array}$$
c
$$\begin{array}{r} 921 \\ - 810 \\ \hline \end{array}$$
d
$$\begin{array}{r} 86 \\ - 42 \\ \hline \end{array}$$

e
$$\begin{array}{r} 235 \\ - \ 89 \\ \hline \end{array}$$
f
$$\begin{array}{r} 5632 \\ - \ 689 \\ \hline \end{array}$$
g
$$\begin{array}{r} 7632 \\ - 1999 \\ \hline \end{array}$$
h
$$\begin{array}{r} 3412 \\ - \ 621 \\ \hline \end{array}$$

i
$$\begin{array}{r} 967 \\ - 383 \\ \hline \end{array}$$
j
$$\begin{array}{r} 5288 \\ - 3598 \\ \hline \end{array}$$
k
$$\begin{array}{r} 8561 \\ - \ 985 \\ \hline \end{array}$$
l
$$\begin{array}{r} 8572 \\ - 5895 \\ \hline \end{array}$$

2 Place the following subtractions in columns and then work out the answers.

   a What is 8642 minus 3851?

   b Subtract 54 739 from 98 642.

   c What is the difference between 5651 and 999?

   d Take away 876 from 30 500.

   e Find the result of 56 000 − 32 879.

   f What number is 659 less than 34 232?

3 Emily spends a day shopping and buys clothes to the value of $438. If she started the day with $750 in her purse and hasn't bought anything else, how much money does she have left?

4 The Jones family buys a house and land package valued at $225 000. If they have $23 750 to put towards the package, how much more money must they borrow from the bank?

5 Adam would like to know how many more days are left in the year. If it is not a leap year and it is 10 July today, find the answer for Adam. Use the saying '30 days have September, April, June and November. All the rest have 31, except February, which has 28 days and 29 days in a leap year'.

6 A silo, which is a container for storing grain, can hold 20 000 kilograms of wheat. If it currently has 8745 kilograms in it, how much more wheat can be added to the silo?

7 Mt Makarakomburu and Mt Popomanaseu are the highest mountains on the island of Guadalcanal. If Mt Makarakomburu is 2447 metres high and Mt Popomanaseu is 2330 metres high, how much higher is Makarakomburu than Popomanaseu?

8 The distance between Ngalibiu and Tamboko via Honiara main road is about 42 700 metres. The map indicates the distance between some major places along the main road. Use this map to answer the following questions:

  a How far is it from Mamara to Ngalibiu?

  b How far is it from Tamboko to Rove?

  c Calculate the distance from Rove to Ngalibiu.

  d Find the distance between Point Cruz and Panatina.

 **e** How many kilometres is it between Tamboko and Henderson Airport?
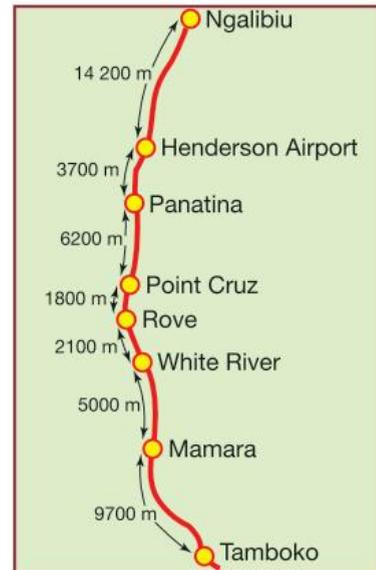
9 In the mid-1980s there was a big drought in the country. Many of the tanks around Honiara Town were affected by the drought and the water levels became very low.

  a White River tank can hold 312 000 ML of water but currently only has 23 880 ML. Calculate how many megalitres are required to bring White River tank up to its normal capacity.

  b Legakiki tank currently has 36 981 ML. How many megalitres are required if it is to reach its capacity of 40 000 ML?

  c How many ML are needed to fill Tuvaruhu tank from its current level of 182 738 ML to capacity of 411 000 ML?

  d The Kola Ridge tank currently has 129 048 ML. How many megalitres are needed to fill it to its capacity of 190 230 ML?

  e The Panatina tank can hold 1 068 000 ML of water but currently only has 496 382 ML. Calculate how many megalitres are required to fill the tank.

Conversion Table:
Volume
1 litre (L) = 1000 millilitres (ML)
1 kilolitre (kL) = 1000 litres (L)
1 megalitre (ML) = 1 000 000 litres (L)
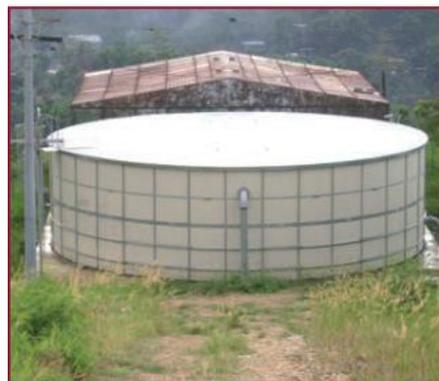
1E Multiplication

Multiplication is the short way of adding up numbers in a pattern.

Three groups of four coins = 4 + 4 + 4 = 3 × 4 = 12 coins

When multiplying numbers, or finding the product, write the smaller number under the larger number.

Example	Solution
Find the answer to each of the following multiplications:	

a 428 × 7

$$\begin{array}{r} {\scriptstyle 1\;5} \\ 428 \\ \times \quad 7 \\ \hline 2996 \\ \hline \end{array}$$

b 248 × 36

$$\begin{array}{r} {\scriptstyle 1\;2} \\ {\scriptstyle 2\;4} \\ 248 \\ \times \; 36 \\ \hline 1488 \\ 7440 \\ \hline 8928 \\ \hline \end{array}$$

Exercise 1E

1 How many coins are shown in each of the following?

a

b

c

2 Find the answer to each of the following:

a	142 × 4	**b**	95 × 9	**c**	208 × 8	**d**	1267 × 5
e	218 × 47	**f**	310 × 53	**g**	1219 × 67	**h**	2397 × 123
i	424 × 99	**j**	309 × 102	**k**	4578 × 89	**l**	3905 × 394

3 Place the following multiplication questions in columns and then work out the answers:

   a What is 625 times 92?

   b What are 6 lots of 238?

   c What is the answer when 24 is multiplied by 287?

   d What is the product of 410 and 162?

   e What are 47 groups of 742?

4 Michael filled his car with 55 litres of unleaded fuel, which cost 120 cents per litre. How much did it cost Michael to fill his car?

5 Sasha earns $68 each week working part-time at a fast food outlet. How much does she earn for the year if she works for 45 weeks?

6 For the start of the term, Mia's parents purchase three shirts for $44 each, a pair of pants for $86 and three windcheaters for $35 each. How much did Mia's clothes cost?

7 A farmer sells 565 chickens for $45 each. How much did the farmer receive in total for the sale of his chickens?

8 The MV *Renbel* travels between Honiara and Auki. It leaves Point Cruz in Honiara and takes about 5 hours to travel across to Auki.

   a If the boat makes 320 crossings per year, for how many hours is the boat at sea?

   b If MV *Renbel* can carry 250 people at an average cost of $130 per adult, how much money can be collected in fares in one crossing?

   c The boat can transport 7 cars at $450 each. What is the income from carrying 7 cars at this rate for one crossing?

   d The boat can transport two three-tonne trucks at $750 each. What is the income from carrying 2 three-tonne trucks at this rate for one crossing?

   e What is the total income per trip from carrying 150 adult passengers, 3 cars and a three-tonne truck for one crossing?

9 The winner of the mountain bike endurance competition takes 8 minutes to complete a lap. How long does it take him to complete the competition, which involves 24 laps of the course?

10 Shen does a newspaper round each morning at 6 am on his bike. He travels 3 kilometres each morning, delivering 94 newspapers. At the end of the week Shen is paid $42 for his 7 delivery days.

   a How far does Shen travel in 1 week?

   b How far does he travel in 10 weeks?

   c How many newspapers does he deliver in 1 week?

   d How many newspapers are delivered by Shen in a year (52 weeks)?

   e How much money would Shen earn in 8 weeks?

   f How much money would Shen earn in a year?

1F   Division

Division is used to find out how one number can be shared equally between groups. If 12 coins are shared or divided equally between four students, how many coins will each student receive?

There are 4 groups of 3 in 12 and $12 \div 4 = 3$, so each student receives three coins.

Division is the opposite operation of multiplication.

$56 \div 8 = 7$ Thus 7 groups of 8 = 56.

Or $8 + 8 + 8 + 8 + 8 + 8 + 8 = 56$

Or $7 \times 8 = 56$

Example

Find the answer to each of the following division questions:

a $427 \div 7$

b $22\,368 \div 6$

Solution

$$7\overline{)427} \;\; \begin{smallmatrix}061\end{smallmatrix} = 61$$

$$6\overline{)22\,368} \;\; \begin{smallmatrix}03\,728\end{smallmatrix} = 3728$$

Exercise 1F

1 Find the answer to each of the following:

   a $2\overline{)4286}$ **b** $6\overline{)1266}$ **c** $8\overline{)2480}$

   d $4\overline{)1732}$ **e** $9\overline{)1872}$ **f** $5\overline{)265}$

   g $7\overline{)46\,123}$ **h** $12\overline{)6120}$ **i** $11\overline{)2937}$

   j $3\overline{)1686}$ **k** $5\overline{)4570}$ **l** $7\overline{)6874}$

2 Set the following questions out correctly and then work out the answers:

   a $645 \div 3$ **b** $1468 \div 4$ **c** $3005 \div 5$ **d** $594 \div 6$

   e $2037 \div 7$ **f** $10\,160 \div 8$ **g** $8991 \div 9$ **h** $4800 \div 10$

   i $29\,161 \div 11$ **j** $74\,964 \div 12$ **k** $4064 \div 8$ **l** $144\,291 \div 7$

3 The answer to a division sum is also called a quotient. Set the following division questions out correctly before working out the quotients:

   a What is the quotient of $4575 \div 3$?

   b What is 19 704 divided by 6?

   c How many times does 11 go into 6644?

   d How many groups of 8 are in 544?

4 Maria works in a department store and earns \$480 per week. How much does she earn per day if she works from Monday to Friday?

5 John counts 47 520 legs in his herd of cows. How many cows does John have?

6 A hiker walked 192 kilometres over 12 days. How far did she walk per day?

7 The National Fisheries Development (NFD) cannery factory has 11 880 tuna which need to be cleaned by six of its employees.

    a If all the employees work at the same rate, how many tuna does each employee clean?

    b If cleaning lasts 9 days, how many tuna does each employee clean in a day?

    c If the tuna are divided into groups of 20, how many groups can be made out of the total tuna?

8 A piggery produced 14 166 piglets in a year. If each sow (mother pig) produces one litter of nine piglets on average, how many sows does the piggery have?

9 A car dealership sells 288 new cars per year.

    a How many cars are sold on average per month?

    b If a month consists of 4 weeks, how many cars are sold per week?

10 The Kamilo family went sailing from Honiara for a holiday around the islands of Western Province, during which they travelled 1920 kilometres.

    a How many kilometres per day did they travel, if they sailed for 16 days altogether?

    b If they travel at an average speed of 15 kilometres per hour, how many hours did they travel each day?

11 A factory produces 1 440 000 bottles of soft drink per 5-day week.

    a If the factory has 10 identical machines, how many bottles of soft drink does each machine produce per week?

    b How many bottles of soft drink are produced by each machine in a day?

    c If the machines run for 8 hours each day, how many bottles of soft drink are produced by a machine each minute?

    d If each machine bottles 120 litres of soft drink in 1 minute, how many litres are in each bottle?

12 The Ozbon family of four spent $8124·48 for the year on groceries (food from the shop or store). Calculate the following:

    a How much did they spend per person, in dollars and cents?

    b On average, how much did they spend on groceries each month?

    c On average, how much did they spend on groceries each week?

13 The Betikama farm spent $2029·50 on 30 tonnes of fertiliser for their farm. How much did the fertiliser cost per tonne?

Estimation gives us an approximate answer to a question, but there are other techniques that can give us the exact answer without doing detailed working out.

When two different numbers are multiplied by the same number, the calculation can be simplified.

Example   **Solution**

1   Simplify the following to find the answers:

   a $36 \times 8 + 44 \times 8$

$36 \times 8 + 44 \times 8$
$= 36 \text{ lots of } 8 \text{ plus } 44 \text{ lots of } 8$
$= (36 + 44) \times 8$
$= 80 \times 8$
$= 640$

   b $23 \times 5 - 18 \times 5$

$23 \times 5 - 18 \times 5$
$= (23 - 18) \times 5$
$= 5 \times 5$
$= 25$

In multiplication the order can be rearranged: $2 \times 3 \times 4 = 4 \times 2 \times 3$. This can be used to simplify multiplication questions.

Example   **Solution**

2   Simplify the following to find the answers:

   a $20 \times 18 \times 5$

$20 \times 18 \times 5$
$= 20 \times 5 \times 18$
$= 100 \times 18$
$= 1800$

   b 61×30

61×30
$= 61 \times 3 \times 10$
$= 183 \times 10$
$= 1830$

The doubling and halving technique can also be used to make questions simpler without altering the value of the question.

Example   **Solution**

3   Use the doubling and halving technique to find the answers:

   a 36×50

36×50
$= 36 \times 100 \div 2$
$= 3600 \div 2$
$= 1800$

   b 88×500

88×500
$= 88 \times 1000 \div 2$
$= 88\,000 \div 2$
$= 44\,000$

Exercise 1G

1 Rearrange the numbers to make it easier to find the answers:

   a $20 \times 4 \times 5$ **b** $25 \times 9 \times 4$ **c** $10 \times 56 \times 10$

   d $37 \times 50 \times 2$ **e** $10 \times 10 \times 321$ **f** $34 \times 4 \times 25$

   g $50 \times 66 \times 2$ **h** $5 \times 19 \times 20$ **i** $99 \times 10 \times 10$

   j $2 \times 33 \times 50$ **k** $20 \times 5 \times 71$ **l** $4 \times 15 \times 25$

2 Find an easy way to evaluate the following:

   a $8 \times 3 + 2 \times 3$ **b** $8 \times 55 + 2 \times 55$ **c** $15 \times 14 + 5 \times 14$

   d $5 \times 6 + 7 \times 6$ **e** $19 \times 12 + 31 \times 12$ **f** $18 \times 14 + 2 \times 14$

   g $14 \times 8 - 6 \times 8$ **h** $34 \times 21 - 24 \times 21$ **i** $65 \times 3 - 3 \times 15$

   j $98 \times 7 - 18 \times 7$ **k** $63 \times 12 - 13 \times 12$ **l** $85 \times 11 - 11 \times 15$

3 Evaluate mentally:

   a 56×30 **b** 21×20 **c** 80×14 **d** 60×15

   e 200×34 **f** 500×12 **g** 20×45 **h** 85×40

   i 19×30 **j** 50×23 **k** 90×18 **l** 66×20

4 Use the doubling and halving method to find the answers:

   a 28×50 **b** 50×91 **c** 36×500

   d 52×500 **e** 5×387 **f** 46×5

5 Maria buys 28 betel nut fruits for $1 each, while Eliza buys 35 for $2 each during the 30th Independence Anniversary at SICHE Panatina campus. How much do they spend in total?

6 During the Tenaru National Secondary School Annual Bazaar, Malcolm buys 5 coconuts for his friends at $3 each while Scott buys 5 pizza slices for $5 each. How much do the boys spend in total at the annual bazaar?

7 At the Nguvia school carnival, Kelvin and Glen competed in the 800-metre event, which is 2 laps around the running track. Glen took 1 minute 22 seconds per lap, while Kelvin took 1 minute 38 seconds per lap. What is the total time taken by the two boys to complete the 800-metre race?

1H Order of operations

When a question contains more than one operation we need a system or set of rules to follow. **BODMAS** represents the order of operations that allows us to calculate questions correctly.

- **B** Work out the calculations inside the **brackets** first. If there is more than one operation inside the brackets, then they must also follow the rules of BODMAS.
- **O** If the question contains fractions **of** or powers **of**, then these are calculated next.
- **D** Work out the **division** and **multiplication** calculations, working across the page
- **M** from left to right.
- **A** Work out the **addition** and **subtraction** calculations, working across the page
- **S** from left to right.

Example

Use BODMAS to evaluate each of the following:

a $2 + (3 \times 6) - 5$

b $5 \times 4 + (18 \div 3) \times 2$

c $33 \div 3 + 4 \times 9 - 6$

d $\frac{1}{2}$ of $12 \times (3 + 1)$

Solution

$2 + (3 \times 6) - 5$
$= 2 + 18 - 5$
$= 20 - 5$
$= 15$

$5 \times 4 + (18 \div 3) \times 2$
$= 5 \times 4 + 6 \times 2$
$= 20 + 12$
$= 32$

$33 \div 3 + 4 \times 9 - 6$
$= 11 + 36 - 6$
$= 47 - 6$
$= 41$

$\frac{1}{2}$ of $12 \times (3 + 1)$
$= 6 \times 4$
$= 24$

Exercise 1H

1 Evaluate each of the following:

a $14 \div 2 + 3 \times 4$

b $60 \div 3 \div 4 + 2$

c $(16 + 4) \div 5 \times 3$

d $5 \times (4 - 3) + 9$

e $6 \times (2 + 7) - 2 \times 7$

f $5 + 7 - 3 \times 2$

g $3 \times 15 - 6 \times 5$

h $18 \div 2 \times 10 - (7 \times 8)$

i $6 \times 9 + 4$

j $55 - 3 \times 9$

k $(34 + 6) \times 6$

l $8 + 4 \times (26 - 15)$

m $5 + 24 - 13$

n $(144 \div 6) - 3 \times 7$

o $(15 + 6) \div 7 \times 2$

p $6 \times 2 \div 3$

q $(9 - 4) \times (6 + 3) \div 15$

r $(8 + 7) \div 5 \times 3 - 1$

s $3 \times 3 \times 3 - (4 \times 5)$

t $(1 + 2 + 3) \times 10 + 40$

u $(6 + 2 \times 8) \div 2 + 32$

v $2 \times 9 + 7$

w $16 \div 4 + 5$

x $16 - 3 \times 2$

2 Evaluate the following:

a $\frac{1}{2}$ of $16 \times 5 - 2 \times (10 - 7)$ **b** $6 + 34 \div 17 - 66 \div 11$ **c** $9 - 8 \times 7 \div 14 + 10$

d $13 + \frac{1}{4}$ of $18 + \frac{1}{2} - 2 \times 6$ **e** $11 - 64 \div 8 + 5 \times 11$ **f** $(4 - 24 \div 8) \times 55 - 9 \times 5$

3 Insert brackets where necessary to make the following equations true:

a $6 + 8 - 1 = 13$ **b** $54 \div 6 + 3 + 2 = 8$ **c** $6 + 34 \div 2 + 3 \div 2 = 13$

d $42 \div 5 + 2 \times 5 = 30$ **e** $15 + 4 \times 5 - 5 = 15$ **f** $81 \div 9 \div 2 + 1 = 3$

g $12 - 2 \times 5 = 50$ **h** $120 \div 10 + 2 + 5 = 15$ **i** $8 + 4 - 3 \times 2 = 10$

j $45 \div 3 \times 2 + 16 = 46$ **k** $18 \div 9 \times 5 + 7 = 24$ **l** $4 + 3 \times 3 + 4 = 25$

m $4 - 2 \times 100 \div 25 = 8$ **n** $100 \div 25 \times 5 + 6 = 26$ **o** $48 \div 16 + 5 \times 2 = 16$

4 Insert the symbols $\times, \div, +, -$ to make the following equations true:

a $(2\,\square\,8)\,\square\,5 = 2$ **b** $(14\,\square\,5)\,\square\,9 = 81$ **c** $6\,\square\,(8\,\square\,3) = 30$

d $(21\,\square\,5)\,\square\,2 = 13$ **e** $12\,\square\,8\,\square\,5 = 9$ **f** $40\,\square\,(14\,\square\,7) = 38$

g $(10\,\square\,8)\,\square\,(5\,\square\,4) = 18$ **h** $(34\,\square\,12)\,\square\,(12\,\square\,4) = 66$ **i** $(36\,\square\,9)\,\square\,(10\,\square\,4) = 10$

j $(64\,\square\,16)\,\square\,(16\,\square\,8) = 8$ **k** $20\,\square\,100\,\square\,25 = 24$ **l** $(9\,\square\,3)\,\square\,(8\,\square\,3) = 60$

5 True or false?

a $16 \div (3 + 1) \times 3 + 6 = 36$ **b** $(2 + 3 \times 5) - (3 + 16 \div 4) = 18$

c $5 \times 10 + 3 \times 8 \div 4 = 56$ **d** $44 \div 4 + 7 \times 2 - 3 = 5$

e $(16 + 3 \times 2) \div 11 - 1 = 1$ **f** $(48 + 2) \div 5 - 18 \div 3 = 4$

g $15 \times 3 \div (6 + 3) + 1 = 6$ **h** $(14 + 5 - 1) \div (2 \times 5 - 1) = 3$

**i** $100 \div 25 \times (6 + 2) = 26$ **j** $64 \div 16 + 16 - 8 = 12$

6 For each pair of equations below, write down which is the correct equation, i or ii:

a　**i** $(2 + 4) \times 3 = 14$　　　**ii** $2 + 4 \times 3 = 14$

b　**i** $3 + 36 \times 2 = 75$　　　**ii** $3 + 36 \times 2 = 78$

c　**i** $4 \times 8 + 2 = 16$　　　**ii** $4 \times 8 + 2 = 34$

d　**i** $16 \div 4 + 4 = 8$　　　**ii** $16 \div (4 + 4) = 8$

e　**i** $(13 + 8) \div (3 + 4) = 3$　　**ii** $13 + 8 \div 3 + 4 = 3$

f　**i** $81 \div 9 + 1 = 9$　　　**ii** $81 \div 9 + 1 = 10$

BODMAS

The operations are completed in the order in which you go down these stairs.

■ Brackets first.

■ Fractions or powers of are on the next step, so calculate these next.

■ Multiplication and division are on the second step.

■ Addition and subtraction are on the bottom step. Calculate these last.

Remember that for division and multiplication, and for addition and subtraction, which are on the same steps, work across the page from left to right.

B

O

DM

AS
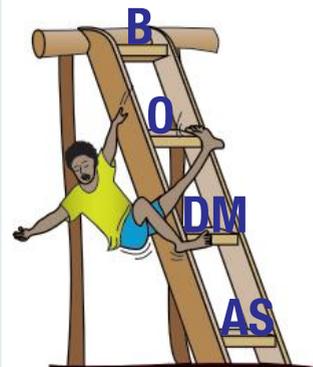
In many situations we do not need to calculate the exact answer to a question and we can do an approximate calculation in our head. This is a very useful technique to check calculations and ensure that we have not made any careless mistakes. To make estimates of an approximate answer we can round the numbers to the nearest multiple of 10 or 100, so each number in the approximation will have a non-zero digit at the start followed by zeroes. The symbol ≈ is used to represent 'approximately equal'.

Example	**Solution**
Estimate the following:	
a If there are 39 houses in a street and every household donates $5 in a doorknock appeal, about how much will be collected, $20, $200, $2000?	39 is approximately equal to 40 $39 \approx 40$ $39 \times 5 \approx 40 \times 5$ $= 200$ So approximately $200 will be collected.
b **i** 23×506 **ii** $645 + 398$	**i** 23×506 **ii** $645 + 398$ $\approx 20 \times 500$ $\approx 600 + 400$ $= 10\,000$ $= 1000$

Exercise 1I

1 Round each number to the nearest multiple of 10, 100 or 1000 and then estimate the answers to the following:

a $54 + 234$	**b** $1249 + 90$	**c** $651 + 16 + 270$
d $1239 + 854 + 45$	**e** $789 - 88$	**f** $1467 - 674$
g $358 - 104 - 55$	**h** $2478 - 865$	**i** 45×89
j 478×12	**k** $49 \times 82 \times 105$	**l** $372 \times 34 \times 2$
m $83 \div 12$	**n** $57 \div 6$	**o** $804 \div 37$

2 Forau wishes to purchase the following items when shopping: jeans $190, shoes $1150, jumper $372 and lunch $64. Estimate how much money he needs to have in his wallet to cover the costs of his purchases.

3 By air, Henderson Airport is 211 kilometres from Anua Airport (Bellona), 381 kilometres from Nusatupe (Gizo), 650 kilometres from Lata (Temotu Province), 502 kilometres from Taro (Choiseul Province), and 332 kilometres from Munda. Approximate each of these distances and then estimate the sum of these distances.

4 a Estimate the number of people that are shown in the photograph below.

b Estimate the number of betel nut fruits shown below.

Puzzles

1 Place the numbers listed into the cross-number grid. The numbers can only be written downwards or left to right.

2 digits

14	52
27	64
29	73
32	99
43	

3 digits

222	534
224	592
266	685
291	692
384	713
418	833
523	836

4 digits

1331	7533
2851	8453
2885	9225
3285	9238
4256	9634

5 digits

35 636
36 817
41 678
94 367
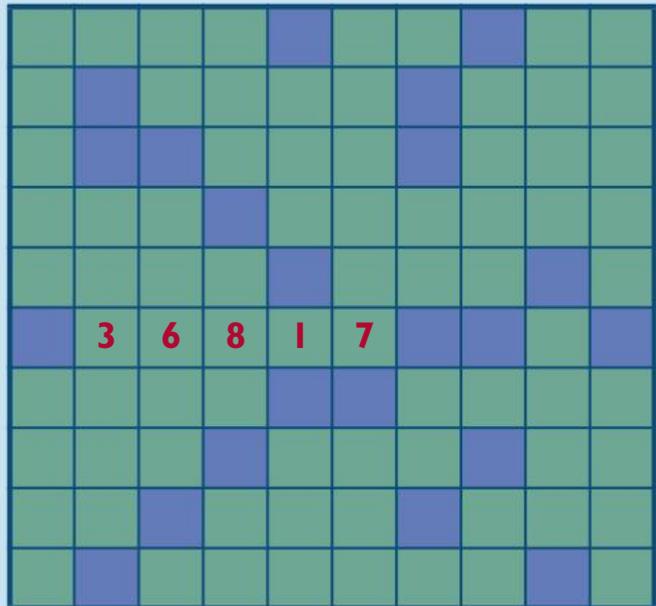
6 digits

143 667
154 927
692 586
842 283

Grid contains: 3 6 8 1 7

2 In each of the following diagrams, the numbers in the circles at the end of the line must add to equal the number on the line. Find the number in each of the circles.

a. 17, 14, 15

b. 29, 22, 27

c. 16, 13, 20, 17

d. 40, 31, 22, 13

e. 15, 19, 10, 13, 11

f. 19, 26, 31, 33, 29, 24
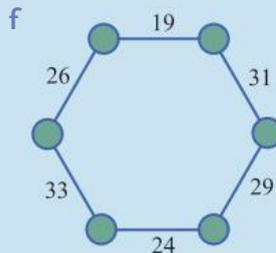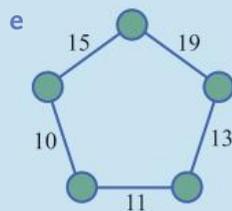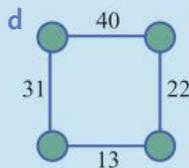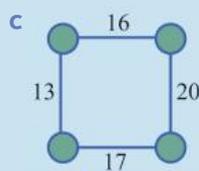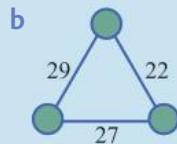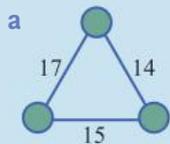
3 Find the answer to the following questions and match the letter to the correct number below to solve the riddles:

a **Which rugby team in Auki, Malaita Province does Torama play for?**

A 4000 + 700 + 1

B 2 hundreds and 3 units

E Twenty-six

G Eight million, sixty-seven thousand

I 5 hundreds, 4 tens and 6 units

K 300 000 + 2000 + 50 + 3

L Seventy-six

M 21 hundreds

O 500 + 60 + 6

R Seven hundred and forty-six

S 30 000 + 2000 + 300 + 10

T 900 000 + 400 + 6

U One hundred and thirteen

W 3 tens and 6 units

Y 4 ten thousands, 5 tens and 3 units

| 302 053 | 546 | 76 | 113 | 32 310 | 4701 | 302 053 | 36 | 4701 | 76 | 566 |

| 746 | 113 | 8 067 000 | 203 | 40 053 |

| 900 406 | 26 | 4701 | 2100 |

b **People in the Western Solomons who kill people as sport are known as:**

A   246
     + 14

C   134
     + 865

D 1203
     + 92

E   268
     + 90

G   518
     + 79

H   527
     + 63

K   981
     + 77

M   978
     − 152

N   685
     − 243

O   867
     − 155

R 1298
     − 367

S 1146
     − 957

T   802
     − 35

U   342
     + 123

V 4002
     − 3185

Z 6000
     − 812

| 767 | 712 | 826 | 712 | 1058 | 712 |

| 590 | 358 | 260 | 1295 |

| 590 | 465 | 442 | 767 | 358 | 931 | 189 |

Applications

Number systems

I Design your own base 10 counting system using unique symbols.
Copy and complete the table showing your symbols:

0	1	2	3	4	5	6	7	8	9

Use the symbols to write the following numbers:

a 43   b 102   c 269   d 2310   e 12 436   f 5841   g 998

Can you design a counting system that is not base 10?

Today's date

In this activity you will be using today's date to write some maths questions that will need your knowledge of BODMAS. If the date is 13/2/03 (13 February 2003), then you use the digits 13203 to make a true statement. The last digit in the year will always be the answer to your question. Here are some examples:
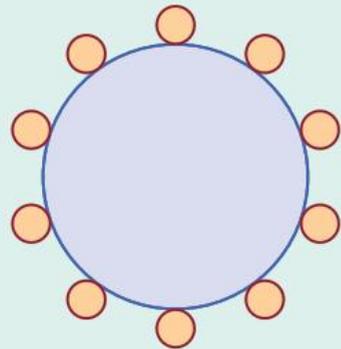
$$1 \times 3 - 2 \times 0 = 3$$
$$(2 - 1 + 0) \times 3 = 3$$

I Use today's date to make up five equations.

2 Use your birthday to make up five equations.

Number puzzle

Arrange the numbers from 1 to 10 in the circles provided so that the difference between any two numbers next to each other is either 1 or 2.

Magic squares

In a magic square, every row, column and diagonal adds up to the same magic number. Discover the magic numbers below and then use them to complete each of the missing boxes.

I

	27	20	118
		83	
90	48	55	
13			34

2

			119
167	131	137	149
143			125
173		107	

3

| 107	118	217	116
		125	
128		106	
183			152

Basketball ladder

The scores for the first round of a basketball competition are shown in the table below.

a Calculate the total score for each team using the following conversions:

- foul shot = 1 point
- goal = 2 points
- 3 pointer = 3 points

b Determine whether each team won or lost, or if the match was a draw.

c Use a calculator to find the percentage for each team using the rule:

$$\text{percentage} = \frac{\text{points for}}{\text{points against}} \times 100$$

d Draw up the ladder showing the teams in order of percentage. Include all details in the table.
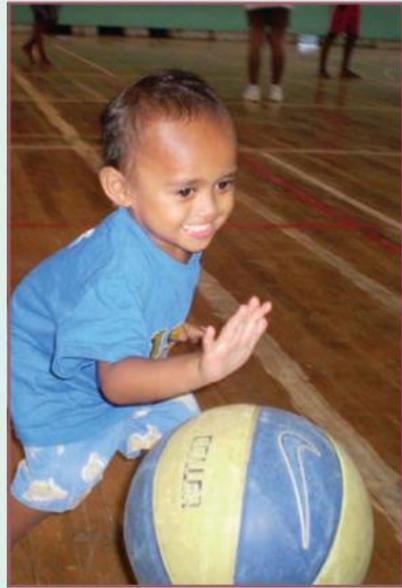
Team	Foul shot	Goal	3 pointer	Total score	Win loss draw	Percentage
Arasina	5	30	5			
JJ Auto	1	23	1			
Mt Dazza	3	15	2			
SOSSA	5	17	1			
Avaiki	6	22	2			
Sunrise	2	15	3			
QQQ Marist	0	26	4			
Lakers	4	28	1			
KOSSA	2	22	0			
Andel (Bullets)	1	15	5			

Word sums

In the following addition sums each digit has been replaced by a certain letter. Find the digit corresponding to each letter, given that each letter represents a different digit.

a
```
    T H R E E
  +   F O U R
  ---------
    S E V E N
```

b
```
    F O U R
  + F I V E
  ---------
    N I N E
```

Enrichment

I Replace the ☐ with the missing number in the following addition sums:

a
```
    2 ☐ 6
 +  1 8 ☐
 ─────────
    4 2 9
```

b
```
    6 ☐ ☐
 +  ☐ 9 9
 ─────────
  ☐ 0 2 7
```

c
```
  ☐ ☐ ☐
 + 4 9 5
 ─────────
   9 1 1
```

d
```
  ☐ 2 1 2
 + ☐ 4 ☐
 ─────────
  1 8 ☐ 5
```

2 Replace the ☐ with the missing number in the following subtraction sums:

a
```
    2 ☐ 4
 -  1 8 ☐
 ─────────
    1 1 0
```

b
```
  1 6 ☐ 8
 - ☐ 4 8
 ─────────
  ☐ 1 8 ☐
```

c
```
   ☐ 9 ☐
 - 1 9 9
 ─────────
   4 ☐ 3
```

d
```
  4 2 4 3
 - 1 ☐ 5 ☐
 ─────────
  ☐ 2 ☐ 2
```

3 Replace the ☐ with the missing number in the following multiplication sums:

a
```
  1 2 8
 ×   4
 ─────────
  ☐ 1 ☐
```

b
```
  ☐ 2 4
 ×   ☐
 ─────────
 1 ☐ 9 2
```

c
```
       4 2 6
 ×       3 ☐
 ───────────
     1 7 0 4
   1 2 7 ☐ ☐
 ───────────
 ☐ ☐ 4 8 4
```

d
```
     ☐ ☐ 3
 ×     6 ☐
 ───────────
   1 ☐ 8 1
 1 6 ☐ ☐ 0
 ───────────
 ☐ 8 ☐ 6 1
```

4 Replace the ☐ with the missing number in the following division sums:

a
```
       4 ☐
 7 ) 3 1 5
```

b
```
       5 ☐ ☐
 11 ) ☐ 7 9 7
```

c
```
         6 2 ☐ 7
 ☐ ) 4 ☐ ☐ 3 6
```

Example

Use long division to solve:

$12\,098 \div 23$

Solution

```
        526
 23 ) 12098
      - 115
      ─────
        59
      - 46
      ─────
       138
      -138
      ─────
       000
```

23 into 120 goes 5 times: $5 \times 23 = 115$.

This leaves 5. Bring the 9 down to the 5 to make 59.

23 into 59 goes twice: $2 \times 23 = 46$.

This leaves 13. Bring the 8 down to make 138. $138 \div 23 = 6$

---

5 Study the long division technique shown in the example and follow the process to find the answers to the questions below.

a $6939 \div 27$

b $8917 \div 37$

c $62\,453 \div 19$

d $138\,327 \div 21$

e $7137 \div 13$

f $46\,980 \div 29$

g $8128 \div 32$

h $164\,568 \div 24$

i $72\,437 \div 17$

Binary numbers

When you began to count you probably used your fingers, as our decimal system has ten digits. A computer does not have ten fingers, it has switches that are either on or off. Computers therefore use a system with only two numbers, 0 and 1, the binary number system.

The place value for the binary number system is:
$2^0 = 1, 2^1 = 2, 2^2 = 2 \times 2 = 4, 2^3 = 2 \times 2 \times 2 = 8, 2^4 = 2 \times 2 \times 2 \times 2 = 16 \dots$
For example, $10\,101_2 = 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$
$$= 16 + 0 + 4 + 0 + 1 = 21$$
So $10\,101_2 = 21_{10}$, where the subscript (the $_2$ or the $_{10}$) refers to the base.

6 Convert the following binary numbers to decimal numbers:

a 101
b 1000
c 1101

d 11100
e 1010101
f 111010101

g 111000
h 1000000000
i 101101101101

To convert a decimal number to a binary number, simply divide by 2 and record the remainder of each division. For example:
$49 \div 2 = 24$ remainder 1, $24 \div 2 = 12$ remainder 0, $12 \div 2 = 6$ remainder 0
$6 \div 2 = 3$ remainder 0, $3 \div 2 = 1$ remainder 1, $1 \div 2 = $ no whole remainder 1
$49 = 110\,001_2$

7 Write the binary representation for the following decimal numbers:

a 22
b 79
c 35
d 56
e 64

f 100
g 164
h 256
i 599
j 1024

The four rules for adding binary numbers are simple:
$0 + 0 = 0$
$0 + 1 = 1$ and $1 + 0 = 1$
$1 + 1 = 10$ (put down a 0 and carry a 1)
$1 + 1 + 1 = 11$ (put down a 1 and carry a 1)

> **Example**
>
> $$\begin{array}{r} 1\,101 = 13_{10} \\ +\quad 1\,001 = \;\;9_{10} \\ \hline 10\,110 = 22_{10} \end{array}$$

8 Convert each number to a binary number and add using binary addition:

a $2 + 8$
b $7 + 9$
c $3 + 15$

d $8 + 26$
e $16 + 64$
f $128 + 256$

g $31 + 46$
h $8 + 99$
i $15 + 32 + 101$

9 Does binary multiplication work in the same way as conventional multiplication?

a Calculate 9×4, then convert each number to a binary number and multiply to check your answer.

b Calculate 14×6 in binary multiplication.

c Multiply $1\,000\,101 \times 10\,111$, convert to a decimal number and multiply to check your answer.

10 Explore number systems other than base 2 and base 10, such as base 3:
$3^0 = 1, 3^1 = 3, 3^2 = 9 \dots$

Exercise 1A

1 Represent each of the following numbers using Roman numerals:

  a 19   b 127   c 63

  d 34   e 401   f 1234

2 Rewrite each of these Roman numerals as modern Hindu–Arabic numbers:

  a XIV   b CCLVI   c CCXXII

  d CVI   e XLV   f CL

Exercise 1B

3 Write the following numbers in descending order, that is going from largest to smallest:

  a 2348, 65, 90 876, 567, 3258, 543

  b 267, 627, 726, 266, 276, 626

  c 404, 40, 440, 444, 400, 4, 44

4 Write the following numbers in words:

  a 230   b 123 562   c 1872   d 21   e 8

5 Write the following numbers:

  a four thousand, six hundred and twenty

  b one million, two hundred and forty-nine thousand and sixteen

  c nineteen thousand, four hundred and sixty-five

  d fifty thousand, nine hundred, two tens and five units

Exercise 1C

6 a Find the answers to the following:

  i$$\begin{array}{r} 2349 \\ 409 \\ + 4812 \\ \hline \\ \hline \end{array}$$
  ii$$\begin{array}{r} 458 \\ 4892 \\ + 9827 \\ \hline \\ \hline \end{array}$$
  iii$$\begin{array}{r} 23 \\ 10\,764 \\ + 522 \\ \hline \\ \hline \end{array}$$

  b Add 308, 6670 and 201.

  c What is the answer to 568 plus 631?

Exercise 1D

7 a Find the answers to the following:

  i$$\begin{array}{r} 498 \\ - 34 \\ \hline \\ \hline \end{array}$$
  ii$$\begin{array}{r} 12\,902 \\ - 9\,734 \\ \hline \\ \hline \end{array}$$
  iii$$\begin{array}{r} 23\,000 \\ - 8\,796 \\ \hline \\ \hline \end{array}$$

  b What is 876 minus 235?

  c Find the difference between 7387 and 4649.

Exercise 1E

8 a Calculate the following:

i	459	**ii**	1275	**iii**	6035
	$\times 8$		$\times 26$		$\times 307$

b What is 740 multiplied by 12?

c What is 39 groups of 489 equal to?

Exercise 1F

9 a Calculate the following:

i $6)\overline{948}$ **ii** $12)\overline{16\,824}$ **iii** $5)\overline{22\,015}$

b What is the answer when 1416 is divided by 3?

c How many groups of 11 are in 10 835?

Exercise 1G

10 Evaluate mentally:

a 44×500	**b** $34 \times 7 + 16 \times 7$	**c** $25 \times 7 \times 4$
d $5 \times 78 \times 20$	**e** 345×20	**f** $50 \times 95 \times 2$
g $6 \times 67 + 67 \times 4$	**h** 4806×50	**i** $18 \times 471 - 8 \times 471$
j 471×50	**k** 34×200	**l** 432×20

Exercise 1H

11 Find the answers to the following questions:

a $56 \div 8 \times 2$	**b** $15 + 5 \times 6 - 4$	**c** $(8 + 9) \times 2 + 6$
d $5 \times (11 - 3) \div 4$	**e** $(6 - 6) \times 7 + 3$	**f** $8 + 2 \times 8 \div 16$
g $(25 - 8 \times 2) \div 3 + 10$	**h** $44 \div 2 \div 11 + 5$	**i** $3 \times 6 - 18 \div 9$

Exercise 1I

12 The distance from Point Cruz Post Office to the main market is about 1894 metres, the distance from the main market to the Panatina Plaza is about 5289 metres and the distance from Panatina Plaza to King George National Secondary School is about 3217 metres. Find the approximate total distance from Point Cruz Post Office to King George National Secondary School.

13 The Head of RAMSI in Honiara, Tim George, has decided to visit all the provinces in Solomon Islands and to talk to RAMSI officers who are posted out in those provinces. The cost of return airfares from Honiara to all provinces are as follows: Renbel $1964·40, Choiseul $3220·40, Malaita (Auki) $1458·40, Gizo $2592·40, Kirakira $1938·40, Lata $3766·40, Yandina $1362·40 and Isabel $1650·40. Estimate the total costs that Tim George will have to pay to travel to all these provinces.

2

Number Patterns

Number Patterns

Patterns are a part of our culture and heritage. The booming drums and harmonious panpipe music, the rhythm of custom dancing, the tattooing of bodies, and the shell money that graces a bride's body are just a few examples of the unique array of patterns found only in Solomon Islands. That is why we need to preserve our culture and our heritage.

This chapter covers the following skills:

- Exploring and comparing number patterns
- Finding factors, common factors and highest common factors of given numbers
- Finding multiples, common multiples and lowest common multiples of given numbers
- Expressing a number as a product of its prime factors
- Revising divisibility tests
- Exploring prime and composite numbers
- Expressing products of factors in index form
- Finding squares and square roots
- Investigating odd and even numbers

Specific Learning Outcome (SLO)

Learners should be able to:

7.2.1.1	Identify patterns that can be found in natural settings around our environment.
7.2.2.1	Create patterns, using sticks, stones and numbers: *rectangles, square* and *rectangle* numbers.
7.2.2.2	Identify and complete patterns with numbers and dots, etc.
7.2.3.1	Find multiples of numbers and factors by identifying the patterns they created.
7.2.4.1	Find the common multiples, lowest and highest common multiples of given numbers. Find factors of numbers, identifying the patterns they created.
7.2.4.2	Find common factors, lowest and highest common factors of given numbers.
7.2.5.1	Identify and find other factors with no remainders, using the 'Divisibility Test'.
7.2.6.1	Define prime and composite numbers.
7.2.6.2	Identify prime and composite numbers.
7.2.6.3	Solve prime and composite number problems.
7.2.7.1	Identify parts of an index number:

$$\text{Base} \longrightarrow a^3 \longleftarrow \text{Index number}$$

7.2.8.1	Identify the 'index number or power' and its purpose or function. *'Index number or power' indicates how many times a number is multiplied by itself.*
7.2.9.1	Express numbers in 'index notation'.
7.2.9.2	Evaluate index number problems using the BODMAS rule.
7.2.10.1	Define square and square roots.
7.2.10.2	Evaluate numbers by squaring them.
7.2.10.3	Evaluate numbers by taking their square roots.
7.2.11.1	Define prime factors.
7.2.11.2	Write composite numbers as products of their prime factors.
7.2.11.3	Construct a factor tree to express a composite number as a product of its prime factors.
7.2.12.1	Define odd and even numbers.
7.2.12.2	Identify and list odd and even numbers and solve odd and even number problems.

2A Exploring number patterns

Whole numbers produce some interesting patterns when basic operations are applied. Patterns exist all around us in the real world if we know where to look.

Number patterns can be simple like these:

1   3   5   7   9 …   Each number is formed by adding 2 to the previous number.
  2   2   2   2

1   2   4   7   11 …   Each number is formed by adding 1 to the difference between the
  1   2   3   4   previous two numbers.

Adding and multiplying numbers can produce some interesting patterns such as these:

$$1 \times 7 + 1 = 8 \qquad\qquad 3 \times 67 = 201$$
$$12 \times 7 + 2 = 86 \qquad\qquad 6 \times 67 = 402$$
$$123 \times 7 + 3 = 864 \qquad\qquad 9 \times 67 = 603$$
$$1234 \times 7 + 4 = 8642 \qquad\qquad 12 \times 67 = 804$$

In about 1202, Leonardo Fibonacci of Pisa discovered a sequence of numbers based on the problem 'How many pairs of rabbits can be produced from a single pair in one year if it is assumed that every month each pair produces another pair and each new pair breeds from the second month?'

1, 1, 2, 3, 5, 8, 13 …

Each number is obtained by adding the two previous numbers.

Learning task 2A

1 Write the next five numbers in each of the number patterns below:

   a 4, 5, 6, 7, 8, 9 …   **b** 2, 4, 6, 8, 10 …

   c 1, 3, 6, 10, 15 …   **d** 1, 2, 3, 5, 7, 10, 13 …

   e 3, 5, 9, 15, 23 …   **f** 1, 2, 4, 8, 16 …

   g 70, 59, 49, 40, 32 …   **h** 2, 3, 5, 9, 17 …

2 Copy and complete the following number patterns:

a	b	c
$1 \times 1 =$	$1 \times 5 + 1 =$	$1 \times 9 + 2 =$
$11 \times 11 =$	$2 \times 5 + 2 =$	$11 \times 9 + 2 =$
$111 \times 111 =$	$3 \times 5 + 3 =$	$111 \times 9 + 2 =$
$1111 \times 1111 =$	$4 \times 5 + 4 =$	$1111 \times 9 + 2 =$

3 Use Fibonacci's number pattern 1, 1, 2, 3, 5, 8, 13 …

  a Write down the first 20 numbers in the sequence.

  b Find the sum of the first 3 terms and compare it to the fifth term.

  c Find the sum of the first 4 terms and compare it to the sixth term.

  d Find the sum of the first 5 terms and compare it to the seventh term.

  e Find the sum of the first 6 terms and compare it to the eighth term.

  f Find the sum of the first 18 terms.

4 Use your library or the Internet to explore the Fibonacci number patterns that exist in nature and art.

5 When dots are arranged in the shape of a rectangle, the dots are counted to form rectangular numbers. The first three terms have been drawn for you:

$$3 \qquad 8 \qquad 15$$
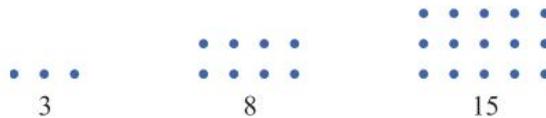
  a Draw the next two terms in the pattern.

  b Write down the first 10 rectangular numbers.

  c Find the difference between consecutive rectangular numbers for the first 10 terms. Is there a pattern? Explain your answer.

6 **a** For each of the patterns below, count the number of dots in each shape to give you the first two numbers in the pattern.

    i   **ii**
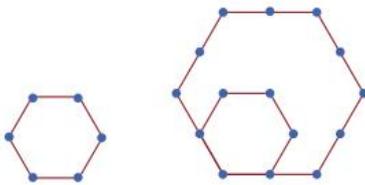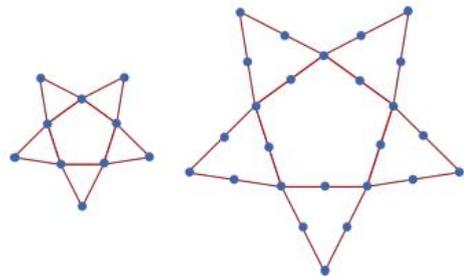
  b Find the difference between the number of dots in the first two terms. Is there a pattern? Explain your answer.

  c Draw the next shape in each pattern.

  d Write down the first 10 terms for each pattern.

7 The following number patterns are all formed by using the same process. Describe the pattern and write down the next three numbers in each pattern:

  a 2, 5, 11, 23 …   **b** 3, 5, 9, 17 …   **c** 1, 9, 25, 57 …

  d 5, 9, 17, 33 …   **e** 2, 7, 17, 37 …   **f** 1, 7, 19, 43 …

  g 3, 10, 24, 52 …   **h** 1, 10, 28, 64 …

2B Multiples

Multiples can be found by multiplying any whole number by all the whole numbers.

Example	Solution
1 List the *multiples* of 6 less than 65.	6, 12, 18, 24, 30, 36, 42, 48, 54, 60
2 List the *multiples* of 9 less than 65.	9, 18, 27, 36, 45, 54, 63
3 Find the *common multiples* of 6 and 9 which are less than 65.	The common multiples of 6 and 9 that are less than 65 are 18, 36, 54.
4 Find the *lowest common multiple* of 6 and 9.	The lowest common multiple of 6 and 9 is 18.

Exercise 2B

1 For each number below, list all multiples that are less than 100:

   a 6   **b** 7   **c** 8   **d** 9   **e** 10

2 For each number below, list all multiples that are less than 50:

   a 2   **b** 3   **c** 4   **d** 5

3 List the multiples of 11 between 40 and 80.

4 List the multiples of 12 between 140 and 200.

5 List the common multiples and then state the lowest common multiple of the following:

   a 2 and 5   **b** 3 and 4   **c** 7 and 9

   d 6 and 7   **e** 6 and 8   **f** 6 and 10

6 Find the lowest common multiple of the following:

   a 2, 5 and 10   **b** 3, 4 and 5   **c** 6, 8 and 9

7 Sarah and Emily ride their bicycles around a track. Sarah completes one circuit in 42 seconds, while Emily takes 60 seconds. If they start together how long will it be before they are together at the start again? How many circuits will each girl do?

8 The Solbrew factory has four machines that together produce soft drinks of many kinds at different rates. A Coca Cola bottle is produced every 12 seconds, a Fanta bottle every 8 seconds, a lemonade bottle every 6 seconds and a Vimto bottle every 3 seconds. If the machines start at the same time, how long will it take before all four machines produce a soft drink at the same time?

9 The Y-Sato Company regularly changes the tyres of its 3 vehicles. The three-tonne truck has its tyres changed every 4 weeks, those on the Rav4 every 9 weeks while those on the Pajero are changed every 12 weeks. If they all have their tyres changed today, how many weeks will it be until they next all have their tyres changed on the same day? If the tyres on all the vehicles are changed on 1 January, how many times during the year will they have their tyres changed on the same day?

10 Francis Maneori and Jack Iroga are training for an athletic carnival. Maneori takes 47 seconds to run a lap, while Iroga takes 49 seconds. If they start together, how long will it be until they reach the starting line at the same time? How many laps will each boy cover?

The **factors** of a certain number are all the numbers that divide exactly into that number. They can be paired together except for factors of perfect squares.

Example	**Solution**
1 List all the *factors* of 24.	1, 2, 3, 4, 6, 8, 12, 24
2 List all the *factors* of 36.	1, 2, 3, 4, 6, 9, 12, 18, 36
3 Find the *common factors* of 24 and 36.	The common factors of 24 and 36 are 1, 2, 3, 4, 6 and 12.
4 Find the *highest common factor* of 24 and 36.	The highest common factor of 24 and 36 is 12.

Exercise 2C

1 List the factors of the following numbers:

a	48	**b**	30	**c**	14	**d**	40
e	52	**f**	15	**g**	32	**h**	13
i	50	**j**	27	**k**	60	**l**	144

2 Find the highest common factor of the following pairs of numbers:

a	48 and 30	**b**	15 and 30	**c**	14 and 27
d	13 and 52	**e**	40 and 32	**f**	40 and 50
g	30 and 60	**h**	48 and 144	**i**	32, 48 and 144

3 Two pieces of rope, 40 metres and 64 metres long, are to be cut into smaller lengths. What is the largest length into which the ropes can be cut so that every piece is the same length?

4 Two pieces of wood, 150 centimetres and 180 centimetres long, are to be cut into smaller lengths to make shelves that must all be the same length. What is the largest shelf length into which each piece of wood can be cut so that there is no wastage?

5 Kekeni has three sections of rope to use in her garden. The ropes are 4 metres, 6 metres and 10 metres in length. She wishes to cut the rope into the longest possible equal lengths without having any left over.
    a How long would each piece of rope be?
    b How many pieces of rope will Kekeni have for her garden?

6 Mr Lulumani has 24 students in his class, and he wishes to work with them in groups. How many students would be in each group if all the groups have the same number of students and no students are left out? In each case how many groups would Mr Lulumani have?

7 The scouts gather for their annual camp with representatives from Western Province, Honiara, Isabel Province and Malaita Province. There are 84 scouts from Isabel Province, 126 from Honiara, 294 from Malaita Province and 462 from Western Province. The scouts are distributed equally into groups. Calculate the highest common factor of 84, 126, 294 and 462, and state the maximum possible number of groups.

2D Divisibility tests

Knowing which numbers are more likely to divide into a certain number can make it much quicker to find all the factors, particularly prime factors, which we will look at next. Here are some easy divisibility tests or rules for numbers, which can help you find factors.

Divisor	Divisibility test	Example
2	The number must be even. This means it can end in either 0, 2, 4, 6 or 8.	3568 is divisible by 2. This can be divided by 2 as it ends in an even number.
3	Add up all the digits. The result must be divisible by 3.	4086 is divisible by 3. $4 + 0 + 8 + 6 = 18$ 18 can be divided by 3 exactly.
4	The last two digits of the number must be divisible by 4.	6312 is divisible by 4. The last two digits are 12, which can be divided by 4 exactly.
5	The last digit must be either a 0 or a 5.	67 945 is divisible by 5. The last digit is a 5.
6	The number must pass the test for divisibility by 2 and 3.	4566 is divisible by 6. The number is even and the sum of the digits is 21. The answer is divisible by 2 and 3.
8	The last three digits of the number must be divisible by 8.	23 464 is divisible by 8. $464 \div 8 = 58$
9	Add up all the digits. The result must be divisible by 9.	134 820 is divisible by 9. $1 + 3 + 4 + 8 + 2 + 0 = 18$ $18 \div 9 = 2$
10	The number must end in a zero.	4 576 260 is divisible by 10 as the last digit is a zero.

Exercise 2D

1 Which of these numbers are divisible by: **a** 5? **b** 10?

45   55   724   8761   6210   546

2 Which of these numbers are divisible by: **a** 3? **b** 6? **c** 9?

64   346   6780   545   87 452   234

3 Which of these numbers are divisible by: **a** 2? **b** 4? **c** 8?

32   540   346 884   5672   65 321   54 984

4 Use the divisibility test to state whether the following numbers are divisible by 2, 3, 4, 5, 8 or 9:

  a 720   **b** 375   **c** 486

  d 273   **e** 728   **f** 909

  g 9843   **h** 10 520   **i** 22 959

5 Write down three 4-digit numbers that are divisible by:

  a 2   **b** 3   **c** 6   **d** 5   **e** 8

Exploring primes and composites 2E

A **prime number** is a positive whole number that has exactly two factors: itself and one. Example: $37 = 1 \times 37$. The number 1 is not prime as it has only one factor.

A **composite number** is a positive whole number that has more than two factors, i.e. it is not a prime. Example: $36 = 1 \times 36, 2 \times 18, 3 \times 12, 4 \times 9, 6 \times 6$.

Learning task 2E

Copy the table below and follow the instructions to sieve out all the numbers that are not prime.

- Cross out the number 1 because it is not a prime.
- Circle the number 2 and cross out all of the multiples of 2.
- Circle the number 3 and cross out all of the multiples of 3.
- Circle the number 5 and cross out all the multiples of 5.
- Circle the number 7 and cross out all the multiples of 7.

The numbers remaining are the prime numbers less than 100.

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

1 From the table above, write down all the prime numbers that are less than 100.

2 List all the composite numbers less than 20.

3 Christian Goldbach suggested that every even number greater than 2 can be written as the sum of two prime numbers.
Examples: $4 = 2 + 2$ $6 = 3 + 3$ $8 = 3 + 5$
Write each even number from 10 to 30 as a sum of two prime numbers.

2F · Index notation

Index notation is used when a number is multiplied by itself several times. The index or power tells us how many times the number must be multiplied by itself.

5 is the base → 5^3 ← 3 is the index or power

Example	Solution
1 Write 5^3 in expanded form.	$5^3 = 5 \times 5 \times 5$
2 Evaluate 3^5.	$3^5 = 3 \times 3 \times 3 \times 3 \times 3$ $= 243$
3 Evaluate $4^3 - 5^2$.	$4^3 - 5^2 = 4 \times 4 \times 4 - 5 \times 5$ $= 64 - 25$ $= 39$

Exercise 2F

1 Write each of the following in index form:

a $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ b $6 \times 6 \times 6$

c $17 \times 17 \times 17$ d $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$

e $23 \times 23 \times 23 \times 23$ f $3 \times 3 \times 3 \times 3 \times 3$

g $1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1$ h 19×19

2 Write each of the following in expanded form:

a 9^2 b 23^1 c 3^7 d 4^5

e 8^9 f 19^3 g 6^{10} h 2^8

3 Evaluate:

a 5^2 b 10^3 c 0^{13} d 2^8

e 20^1 f 3^4 g 4^4 h 13^2

4 Evaluate (remember BODMAS):

a $9^2 - 4^2$ b $8^2 - 2^5$ c $4^2 + 2^3$ d $5^2 + 16$

e $2^4 + 3^2 + 4^3$ f $10^2 \times 5$ g 5×6^2 h $50 - 2^5 + 3^2$

i 2×5^2 j $(5 \times 2)^2$ k 5×2^2 l $2^2 \times 5^2$

5 Arrange these index expressions in order from smallest to largest:

2^5 1^{10} 3^4 5^3 10^5 4^4 25^2

6 Four cat owners each have four Persian cats, which each have four kittens. If the owners take all their cats and kittens to the cat show, how many cages are needed if they must all be caged separately?

7 A bakery has three cupboards to display the cakes they sell. Each cupboard has six shelves and each shelf can hold six trays of cakes. How many cakes are on display when the cupboard is full, if each tray has six cakes across the width and six cakes along the length?

Square numbers

When a number is multiplied by itself or raised to the power of 2, the number is said to be squared.

Example	Solution

1 Evaluate:

   a 4^2

$$4^2 = 4 \times 4$$
$$= 16$$

   b 7^2

$$7^2 = 7 \times 7$$
$$= 49$$

2 Use a calculator to find 24^2.

$$24^2 = 576$$

Square roots

The square root of a number is the opposite of squaring, you are finding the number that is multiplied by itself to give the number under the square root sign.

Example	Solution

3 Evaluate:

   a $\sqrt{64}$

$\sqrt{64} = 8$ since $8 \times 8 = 64$

   b $\sqrt{49}$

$\sqrt{49} = 7$ since $7 \times 7 = 49$

4 Use a calculator to find $\sqrt{3136}$.

$\sqrt{3136} = 56$

Exercise 2G

1 Evaluate the following without using a calculator:

   a 5^2 **b** 2^2 **c** 10^2 **d** 9^2 **e** 8^2

   f 12^2 **g** 13^2 **h** 11^2 **i** 20^2 **j** 40^2

2 Evaluate the following without using a calculator:

   a $\sqrt{36}$ **b** $\sqrt{9}$ **c** $\sqrt{25}$ **d** $\sqrt{121}$ **e** $\sqrt{49}$

   f $\sqrt{100}$ **g** $\sqrt{81}$ **h** $\sqrt{225}$ **i** $\sqrt{144}$ **j** $\sqrt{900}$

3 Use your calculator to evaluate the following:

   a 17^2 **b** 26^2 **c** 30^2 **d** 125^2 **e** 100^2

   f 52^2 **g** 47^2 **h** 33^2 **i** 81^2 **j** 63^2

4 Use your calculator to evaluate the following:

   a $\sqrt{324}$ **b** $\sqrt{2916}$ **c** $\sqrt{676}$ **d** $\sqrt{10\,201}$ **e** $\sqrt{12\,321}$

   f $\sqrt{7921}$ **g** $\sqrt{4761}$ **h** $\sqrt{19\cdot36}$ **i** $\sqrt{1\cdot44}$ **j** $\sqrt{2\cdot25}$

A **prime factor** is a factor of a positive whole number that is a prime number. Every composite number can be written as a product of its prime factors. This can be done using a ladder system or factor tree. Writing a number as a product of its prime factors is also called **prime decomposition**.

Example   **Solution**

1 Write 36 as a product of its prime factors by using a ladder system.

2	36
2	18
3	9
3	3
	1
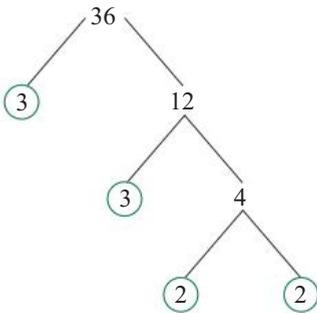
Place the 36 on the right-hand side of the ladder. Place the prime factors on the left-hand side of the ladder. Use the prime factors to divide the number down until you end up with 1.

$36 = 2 \times 2 \times 3 \times 3$
$\quad = 2^2 \times 3^2$

2 Write 36 as a product of its prime factors by using a factor tree.

Find two numbers that multiply together to give 36. Let's choose 3×12.

Circle the number 3 as it is prime. 12 is composite so find two numbers that multiply to give 12.

Let's choose 3×4. Circle 3 as it is prime. 4 is composite so break it up into 2×2.

Circle both of the 2s as they are prime.

$36 = 2 \times 2 \times 3 \times 3$
$\quad = 2^2 \times 3^2$

Exercise 2H

1 Copy and complete these factor trees and ladders:
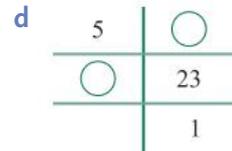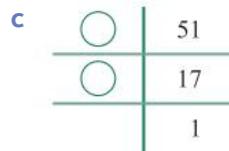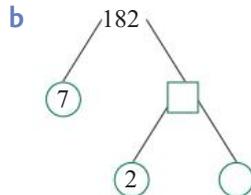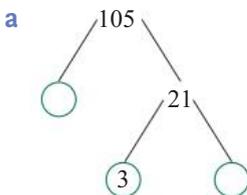
2 Use a ladder system to write each of the following numbers as products of its prime factors:

a	20	b	49	c	100	d	36	e	16
f	48	g	30	h	24	i	70	j	54
k	84	l	63	m	81	n	66	o	120

3 Use a factor tree to write each of the following numbers as products of its prime factors:

a	42	b	65	c	90	d	28	e	72
f	196	g	400	h	224	i	420	j	560
k	1000	l	603	m	110	n	525	o	13 860

Even numbers

An even number can be divided exactly by 2 with no remainder. Every even number ends in an even digit. Examples: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22 …

Odd numbers

An odd number cannot be divided exactly by 2 and, therefore, is not even.
Examples: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 … Zero is neither odd nor even.

Exercise 2I

1 State whether each number is odd, even or neither:

a 34	**b** 1001	**c** 976	**d** 432	**e** 0
f 33	**g** 871	**h** 3902	**i** 64	**j** 28
k 45	**l** 100 003	**m** 542	**n** 63	**o** 22 680

2 List all the even numbers between 50 and 60 inclusive. (Inclusive means including the numbers mentioned.)

3 List all the even numbers between, but not including, 86 and 108.

4 List all the odd numbers between, but not including, 27 and 41.

5 List every second odd number between 1 and 21 inclusive.

6 List three consecutive (that is, in order) even numbers that add to 24.

7 List four consecutive even numbers that add to 52.

8 List three consecutive odd numbers that add to 33.

9 List four consecutive odd numbers that add to 24.

10 Add the following examples and use the results to answer part e:

   a $2 + 4 =$ **b** $6 + 10 =$ **c** $12 + 4 =$ **d** $4 + 16 =$

   e When an even number is added to an even number the result is always _____.

11 Add the following examples and use the results to answer part e:

   a $3 + 5 =$ **b** $11 + 7 =$ **c** $17 + 5$ **d** $5 + 19 =$

   e When an odd number is added to an odd number the result is always _____.

12 Add the following examples and use the results to answer part e:

   a $3 + 8 =$ **b** $4 + 11 =$ **c** $10 + 7 =$ **d** $12 + 11 =$

   e When an odd number is added to an even number the answer is always _____.

13 State whether the following are odd or even and give an example to support your answer:

   a the product of two even numbers

   b the product of two odd numbers

   c the product of an odd and an even number

   d the difference between two odd numbers

   e the difference between two even numbers

   f the difference between an odd number and an even number

1 Match the numbers with their lowest common multiple to answer the following question:

Which mountain in Solomon Islands has a botanical garden?

A 6, 9   **E** 7, 9   **H** 12, 15   **G** 12, 14

I 6, 7   **M** 4, 6   **N** 3, 9   **O** 10, 16

S 5, 15   **T** 3, 8   **U** 15, 25   **W** 10, 15

___	___	___	___	___	
12	80	75	9	24	

___	___	___	___	___	___
18	75	15	24	42	9

2 Match the numbers with their highest common factor to answer the following riddle:

What do people become who smoke marijuana?

A 30, 40   **D** 15, 100   **E** 21, 56   **I** 32, 64

K 35, 70   **L** 108, 144   **O** 72, 120   **P** 121, 132

R 40, 72   **S** 30, 36   **U** 48, 64   **Y** 15, 18

___	___	___	___	___	___		___	___	___	___
5	7	10	5	12	3		5	16	12	12

___	___	___	___	___	___
11	7	9	11	12	7

3 Complete the cross-number puzzle using indices.
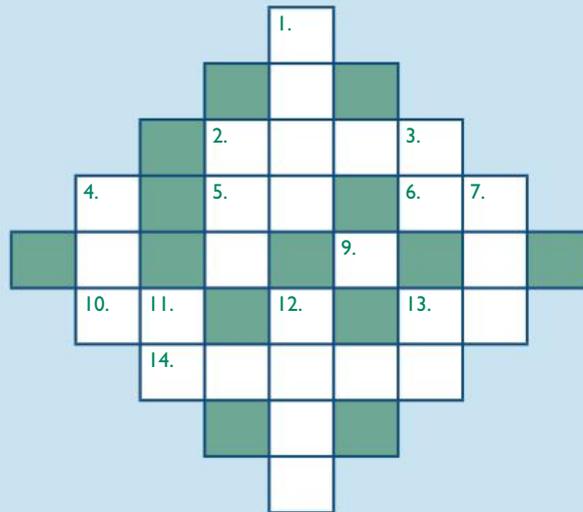
Across

2. 12^3
5. 5^2
6. $2^2 + 3^2$
9. 2^3
10. $4^2 - 2^2$
13. $3^3 - 2^2$
14. 11^4

Down

1. 15^3
2. 5^3
3. 9^2
4. 29^2
7. 7^3
11. $5^2 - 2^2$
12. 41^2
13. $5^3 - 10^2 - 2^2$

4 Complete the following number patterns to find the answer to the riddle:

How can you describe those people who tell lies?

A 4, 7, 10, 13, _____

E −9, −1, 8, 18, _____

L −1, −5, −12, −22, _____

O 2, 4, 8, 16, _____

S 13, 26, 39, 52, _____

U 5, 25, 125, 625, _____

D 1, 3, 6, 10, _____

H 17, 34, 51, _____

N 2, 6, 13, 23, _____

R 1, 8, 27, 64, _____

T 21, 28, 35, 42, _____

W 4, 16, 64, 256, _____

_____	_____	_____	_____	_____		_____	_____	_____	_____
−35	32	1024	29	125		49	68	16	36

_____	_____	_____		_____	_____	_____	_____
49	68	29		15	3125	65	49

Pascal's Triangle

Blaise Pascal was a French mathematician who investigated an arrangement of numbers that is now known as Pascal's Triangle. It is a triangular array of numbers that dates back to Ancient China. This arrangement of numbers contains many different number patterns that relate to numerous areas of mathematics.

```
                    1
                1       1
            1       2       1
        1       3       3       1
     1       4       6       4       1
   1     5      10      10      5      1
  1    6     15     20     15     6     1
```
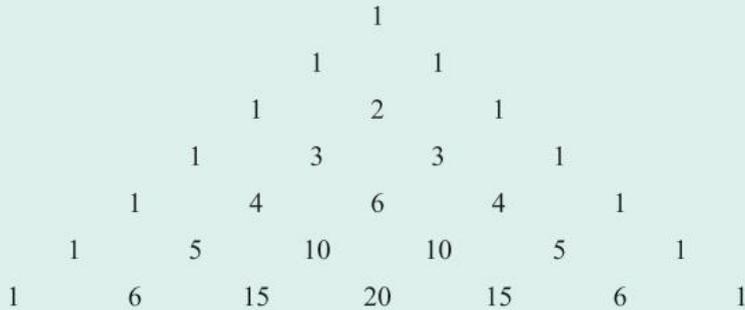
a Pascal's Triangle contains many patterns. Work with a partner and try to find as many patterns as you can.

To add more rows to the triangle, work out how each row is made from the numbers just above it. Look at the third and fourth rows.

Row 1   1

Row 2   1   1

Row 3   1   2   1

Row 4   1   3   3   1

b How is 3 formed using the numbers above it? Check your pattern with other rows. Write this pattern in your book.

c Copy rows 1–4 of the triangle into your book, then add six more rows to it.

d What is the sum of the numbers in each row? Is there a pattern? If so, describe the pattern in your own words.

Pascal's Triangle also contains many patterns that form interesting shapes within the triangle.

e With a red pencil, shade in all the multiples of 5. Describe the shape and pattern of the shaded region.

f With a blue pencil, shade in all the multiples of 7. Describe the shape and pattern of the shaded region.

g With a green pencil, shade in all the even numbers. Describe the shape and pattern of the shaded region.

Try to find some other patterns that form interesting shapes. Write down your instructions to form these shapes and swap them with your partner. Form the patterns.

Factor puzzle

Find the smallest number with:

a 1 factor
b 2 factors
c 3 factors
d 4 factors
e 5 factors
f 6 factors

Is there a pattern?

Brick walls

You have been given bricks with which to build a brick wall. The bricks are twice as long as they are high.

You are to investigate possible wall patterns if the wall is to be only two units high.

If the wall is one unit wide, the wall will be made with only one brick on its end.

If the wall is two units wide, the wall can be made in two ways: two bricks side by side on their ends or one brick lying long-ways and the other brick on top.

If the wall is three units wide, the wall can be made in three ways as shown:
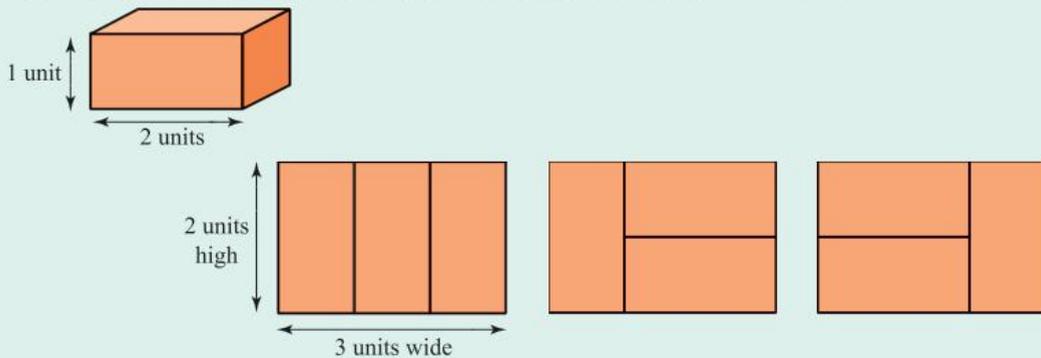
a How many wall patterns are possible for a wall four units wide?

b How many different patterns are there for a wall of length 5 units?

c Draw all the patterns. You may need dot paper to help you.

d How many different patterns are there for a wall of length 6 units?

e Draw all the patterns.

f Look at the number of wall patterns found for a wall of length 1, 2, 3, 4, 5 and 6 units.

    i Does this pattern look familiar?

    ii What name do we give to this pattern of numbers?

g Using your number pattern, how many different brick walls could be made for walls of the following lengths?

    i 8 units
    ii 11 units
    iii 30 units

1 The Aloha night club has three different-coloured lights that they use during dance time. The red-coloured one flashes every 9 seconds, the blue-coloured one flashes every 15 seconds and the yellow-coloured one at the bottom flashes every 21 seconds. At regular intervals all three coloured lights flash at the same time.

   a At what interval do the red- and the blue-coloured lights flash together?

   b At what interval do the red- and the yellow-coloured lights flash together?

   c At what interval do the blue- and the yellow-coloured lights flash together?

2 At the Point Cruz Post Office there are 200 post office boxes. The boxes are numbered and line a wall of the post office. At the start of the day all the boxes are empty. A post office employee places a brochure in each of them. He then places a letter in every second post office box. Next he places a letter in every third box. He continues in this way, placing a letter in every fourth post office box until he has only one letter left. This letter goes in the 200th box.

   Which boxes will have an even number of articles in them and which boxes will have an odd number of articles in them when he has finished?

   Begin by looking at 20 post office boxes first and try to discover a pattern for odds and evens. Extend your theory to 50 or 100 post office boxes.

3 In a tennis tournament there are 128 players at the start. In the first round there are 64 matches as each person plays another person. Only the winners advance to the next round. This process continues until there are only two players left to play in the grand final.

   a If there are 64 players to advance to the second round, how many matches need to be played in the second round?

   b Express this number as a product of its prime factors in both expanded and index form.

   c How many matches will be played in the third round?

   d How many matches will be played in the fourth round?

   e How many matches will be played in total for the tournament?

4 Sometimes when you reverse the digits in a prime number the result is also a prime number. These are called reverse primes. Find all the reverse primes between 1 and 100.

5 A perfect number is a natural number that is equal to the sum of its integer factors not including the original number. For example, 6 is a perfect number, as $6 = 1 + 2 + 3$. The prime factors of 6 are $\{1, 2, 3\}$.

   a What are the next three perfect numbers?

   b What are happy numbers?

   c Find the first six happy numbers.

The prime factor tree or the prime decomposition of numbers can be used to find the highest common factor (HCF) and lowest common multiple (LCM) without finding all the factors or multiples. They can also be used to find all the factors of a number.

Example	Solution
1 Find the HCF of 320 and 360.	$320 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5$ $360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$ The highest common factor will have prime factors in both expressions. $HCF = 2 \times 2 \times 2 \times 5 = 40$ The factors of 320 will be 1, 2, 2^2, 2^3, 2^4, 2^5, 2^6, 5, 5×2, 5×2^2, 5×2^3, 5×2^4, 5×2^5, 5×2^6
2 Find the LCM of 40 and 36.	$40 = 2 \times 2 \times 2 \times 5 = 2^3 \times 5$ $36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$ The lowest common multiple must have the highest power of a prime occurring in either number. $LCM = 2^3 \times 5 \times 3^2 = 360$

6 a Find the lowest common multiple of 24, 30 and 40.
   b Find the lowest common multiple of 693 and 9317.
   c Find the highest common factor of 1178 and 1444.
   d Find the highest common factor of 204 and 1380.
   e List all the factors of 204 and 1380.
   f Find the smallest whole number that has the factors 2, 3, 5, 10, 16, 22, 24 and 32.
   g Find the largest three-digit number that has exactly three factors including 1 and itself.
   h Find the largest three-digit number that has exactly six factors.
   i A balloon manufacturer makes red, green, yellow and orange balloons. He has made 245 700 red balloons, 132 300 green balloons, 114 660 yellow balloons and 207 900 orange balloons. The manufacturer wishes to distribute the balloons equally among the packers so that they have equal numbers of each different-coloured balloons. What is the greatest number of balloons that can be packaged?

7 The original Fibonacci sequence (1, 1, 2, 3, 5, 8, 13 …) is formed by adding the last two numbers together to form the next number in the pattern.
   a By using 2 and 2 as the first two terms and Fibonacci's pattern, write down the first 10 terms. Find the sum of the first 10 terms.
   b Write down the first 10 terms if the starting numbers are 1 and 4. Find the sum of the first 10 terms.
   c Using the original Fibonacci sequence, find the sum of the first 10 terms. Try to find a connection between the sum and the seventh term in the sequence. Test your finding on the two sequences formed in part a and part b.

Learning task 2A

1 For each of the number shapes or patterns below, count the number of dots in each shape to find the first four numbers of the pattern. Write down the first 10 numbers in each pattern.

a

b

2 For each of the number shapes below, count the number of dots to find the first three numbers of the pattern. Write down the first 10 numbers in each pattern.

a

b
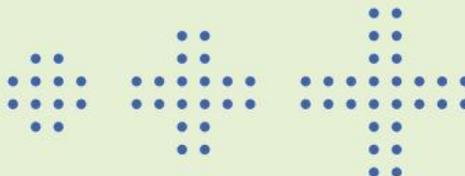
Exercise 2B

3 a List the multiples of 7 that are less than 40.

b List the multiples of 3 and the multiples of 5 that are less than 40.

c What are the common multiples of 4 and 6 that are less than 50?

d Find the lowest common multiple of 9 and 12.

e Find the lowest common multiple of 2, 6 and 7.

f Find the lowest common multiple of 3, 5 and 7.

4 Susan and Ngai are having races running up a flight of stairs. Susan can take the steps three at a time while Ngai can only take them two at a time. If both students reach the top with no stairs left over, give four possible answers for the number of steps. What is the least number of steps possible?

5 Dean can swim a lap of the pool in 36 seconds, Aiden takes 44 seconds and Hudson takes 66 seconds. If they all start together, how long does it take for them to all touch the wall at the same time?

Exercise 2C

6 a List all the factors of 15 and 20.

b State which is the highest common factor of 15 and 20.

c Find the highest common factor of 14 and 21.

d Find the highest common factor of 36, 42 and 54.

e Find the highest common factor of 18, 51 and 63.

7 The Elliott family wishes to put new carpet squares in the lounge room of their holiday house. The rectangular room is 650 centimetres long and 475 centimetres wide. What is the largest square tile that could be used so that no tiles have to be cut? How many tiles will be placed along each wall?

8 A canoeing club has 126 members. If no members are left out, could they canoe in groups of:

a 2? b 5? c 6? d 8?

Exercise 2D

9 Use your divisibility tests to fill in the table below.
Use a tick for yes (✓), and a cross for no (✗).

	2	3	4	5	6	8	9	10
3696								
580								
4752								
4599								

Learning task 2E

10 State whether the number is prime or composite:

    a 23   **b** 9   **c** 14   **d** 56   **e** 1001   **f** 61

Exercise 2F

11 Write each of the following in index form:

    a $4 \times 4 \times 4 \times 4 \times 4 \times 4$ **b** $9 \times 9 \times 9$

    c $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$ **d** 2×2

12 Write each in expanded form:

    a 6^2 **b** 4^5 **c** 8^3 **d** 10^4 **e** 3^6

13 Evaluate:

    a 3×2^3 **b** $3^2 \times 2^3$ **c** $(3 \times 2)^2$ **d** $(3 \times 2)^3$ **e** $3^2 + 2^3$

Exercise 2G

14 Evaluate without using a calculator:

    a 6^2 **b** 15^2 **c** $\sqrt{64}$ **d** $\sqrt{169}$

15 Evaluate using a calculator:

    a 28^2 **b** 107^2 **c** $\sqrt{2116}$ **d** $\sqrt{10\,609}$

Exercise 2H

16 Express the following numbers as a product of their prime factors by using a factor tree or a ladder system:

    a 18   **b** 64   **c** 26   **d** 32   **e** 242   **f** 128

Exercise 2I

17 **a** List all the even numbers between 44 and 60 not inclusive.

    b List all the odd numbers between 17 and 33 not inclusive.

    c List every second odd number between 3 and 17 inclusive.

    d List three consecutive even numbers that add to 18.

Decimals and Percentages

Decimals and percentages are used in everyday life in Solomon Islands, for example, when a 'bride price' is paid for a wife. Interest rates and some taxation systems such as GST (Goods and Services Tax) are based on percentages. Percentages are used to describe changes in numbers. For example, marine conservationists in Solomon Islands are protecting turtles on the island of Anavon in the Western Province. It was found that 74% of turtles in the Western Province are found close to Anavon Island. If these areas are not protected, then approximately 25% of the turtles will be lost in the next decade.

This chapter covers the following skills:

- Revising place value, notation and estimation of decimals
- Comparing decimals
- Rounding decimals
- Addition, subtraction, multiplication and division skills
- Comparing decimals to fractions and percentages
- Finding the percentage of a number
- Multiplying and dividing by powers of 10
- Calculating percentages

Specific Learning Outcome (SLO)

Learners should be able to:

7.3.1.1	Identify the different names given to different columns of the place value table with their corresponding values.
7.3.2.1	Identify decimal numbers and place them accordingly in the place value table.
7.3.3.1	Determine values of individual digits in numbers and compare their values.
7.3.4.1	Estimate decimal numbers by rounding them off to given decimal places.
7.3.5.1	Round off decimal numbers to the nearest specified decimal place(s).
7.3.6.1	Add and subtract decimal numbers by placing digits in their right places.
7.3.6.2	Solve practical decimal problems.
7.3.7.1	Evaluate decimal numbers by multiplying and dividing decimal numbers by: – whole numbers – decimal numbers.
7.3.8.1	Multiply and divide decimal numbers by 10, 100, etc …, moving the decimal point to the RIGHT.
7.3.8.2	Evaluate by multiplying and dividing whole numbers and decimal numbers by 10 and powers of 10.
7.3.9.1	Change fractions to decimals by dividing the numerator by the denominator.
7.3.10.1	Change decimal numbers to fractions. Count the decimal numbers and replace them with zero to indicate the total parts of the denominator.
7.3.11.1	Define percentage.
7.3.11.2	Identify percent and its properties.
7.3.12.1	Convert percentages to fractions.
7.3.12.2	Convert fractions to percentages.
7.3.13.1	Find the percentage of given quantities.
7.3.14.1	Solve and evaluate practical problems using percentages.

Place value and notation

The place value columns used when working with whole numbers can be extended to numbers that are smaller than 1. This is done by using a decimal point to separate the whole number from the fraction part.

The place value columns are listed in the grid below. Two numbers, 472·35 and 1·20, are included.

472·35 means 4 hundreds + 7 tens + 2 units + 3 tenths + 5 hundredths

1·20 means 1 unit + 2 tenths + 0 hundredths

Hundred	Tens	Units/ones	·	Tenths	Hundredths
4	7	2	·	3	5
		1	·	2	0

Exercise 3A

1 Copy the table into your workbook then place the following numbers into their correct place value column.

Question	Hundreds	Tens	Units	·	Tenths	Hundredths	Thousandths	Ten-thousandths
a 3·12								
b 12·890								
c 123·5								
d 8·5678								
e 2·008								
f 56·7071								
g 0·1004								
h 440·6								
i 49·003								
j 943·761								
k 78·0002								
l 0·0643								

2 Write down the place value of the 3 in each of the following numbers:

a 23·678	**b** 12·4378	**c** 178·9003	**d** 0·346
e 349·44478	**f** 390·89751	**g** 14·003457	**h** 2·436887
i 1278·46376	**j** 567·89032	**k** 2·467830	**l** 0·000035

3 How many decimal places are in each of these numbers?

a 16·89076	**b** 346·23	**c** 1·670	**d** 90·006031
e 0·456	**f** 56·789789789	**g** 1·23478930	**h** 2·9
i 4·987	**j** 9643·2300	**k** 7·90909	**l** 2·3

4 Write the following words as decimals:

a 2 units + 6 tenths

b 5 units + zero tenths + 7 hundredths

c 8 thousandths

d 9 tens + 2 hundredths + 4 thousandths

e 9 ten-thousandths

f 7 tenths + 7 thousandths

5 Which is bigger? For each pair of decimals write down the number that is bigger:

a 0·543 or 5·43

b 4·96 or 4·69

c 7·6 or 7·06

d 0·014 or 0·14

e 126·896 or 126·986

f 1·074 or 10·47

g 6 hundredths or 0·006

h 7 tenths or 0·17

6 Write the following sets of numbers in ascending order (that is, from smallest to largest):

a 2·345, 3·245, 2·435, 2·543, 2·453

b 27·81, 27·18, 2·718, 27·08

c 19·115, 19·511, 19·151, 19·500

d 0·4, 0·00004, 0·004, 0·0004

e 1·003, 0·997, 1·909, 0·909, 0·907

f 0·989, 0·9999, 0·9909, 0·9199, 0·99989

7 One day, Mabulou recorded the temperature every 3 hours between 9 am and 9 pm. The results are listed in the table below:

Time	9 am	12 noon	3 pm	6 pm	9 pm
Temperature	30·4°C	32·8°C	33·5°C	31·3°C	28·8°C

a At what time was the temperature highest?

b Which temperature has a place value of 5 tenths?

c Write in words the temperature at 6 pm.

d Arrange the temperatures in ascending order.

8 Monica purchased a hat for $27·92. Martin also purchased a hat, which cost $29·72. Mandy's hat cost 8 hundredths of a dollar more than Monica's hat.

a How many cents is 8 hundredths of a dollar?

b What was the price of Mandy's hat?

c Whose hat was the most expensive?

9 An athletics carnival was held for the secondary schools in and around Honiara. The following heights were recorded for the students who competed in the Junior category for the high jump event: Sally 1·45 m, Mary 1·85 m, Deborah 1·55 m, Amanda 2·05 m.

a Who had the highest jump?

b Whose jump was the shortest?

c Whose jump can be written as 1 unit, 8 tenths and 5 hundredths?

d List the first, second and third place-getters.

e Calculate the total jumps for the four students.

f Find the difference between the highest jump and the lowest jump.
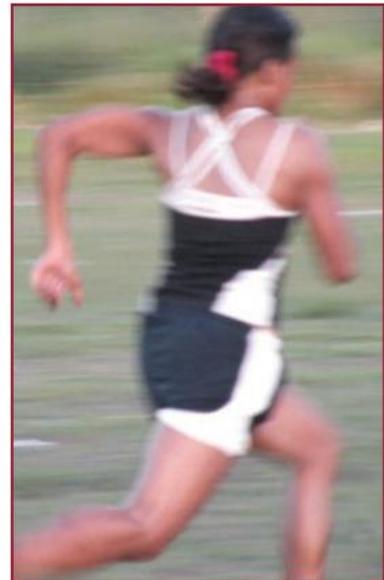
3B Estimation of decimals

In Chapter 1 Whole Numbers, estimation was used as a quick check of calculations to ensure that a careless mistake had not been made. In some circumstances an estimation is more than adequate. Estimation can also be used to check decimal calculations. To make estimates of an approximate answer we need to round off the numbers. The symbol $\approx$ means 'is approximately equal to'.

Example

Evaluate:

a $123 \cdot 08 \times 2 \cdot 87$

b $4 \cdot 789 + 6 \cdot 5$

c $25 \cdot 897 - 1 \cdot 234$

d $0 \cdot 36 \div 2$

e $41 \cdot 63 \div 6$

Solution

$123 \cdot 08 \times 2 \cdot 87 \approx 120 \times 3$
$= 360$

$4 \cdot 789 + 6 \cdot 5 \approx 5 + 7$
$= 12$

$25 \cdot 897 - 1 \cdot 234 \approx 26 - 1$
$= 25$

$0 \cdot 36 \div 2 \approx 0 \cdot 4 \div 2$
$= 0 \cdot 2$

$41 \cdot 63 \div 6 \approx 42 \div 6$
$= 7$

Exercise 3B

1 Copy and complete the following table:

	Question	Approximate question	Estimate answer	Exact answer
e.g.	$124 \cdot 78 + 23 \cdot 23$	$\approx 120 + 20$	$= 140$	$= 148 \cdot 01$
a	$0 \cdot 89 + 14 \cdot 78$			
b	$235 \cdot 8907 + 7 \cdot 008$			
c	$1 \cdot 78 + 9 \cdot 45$			
d	$14 \cdot 95 - 4 \cdot 12$			
e	$13 \cdot 67 - 0 \cdot 87$			
f	$56 \cdot 9 - 0 \cdot 767$			
g	$24 \cdot 89 \times 12 \cdot 89$			
h	$4 \cdot 55 \times 12 \cdot 09$			
i	$13 \cdot 95 \times 3 \cdot 004$			
j	$235 \cdot 97 \div 4$			
k	$637 \cdot 89 \div 8$			
l	$80 \cdot 586 \div 9$			

2 Estimate the total cost if Hamish purchased four items at $5·99, $4·49, $3·25 and $1·09.

3 At a factory outlet, Milan buys five items costing $79·95, $16·95, $128·50, $43·70 and $69·95. Estimate the total cost of these items.

Decimals are rounded to a set number of decimal places when the decimal continues forever or when a lesser degree of accuracy is needed.

Steps in rounding a decimal

Step 1: Count the number of decimal places required and place a vertical line between these digits and the ones that follow.

Step 2: Look at the digit to the right of the line.

Step 3: If the digit is 0, 1, 2, 3 or 4, then the digit to the left of the line remains the same and the digits after the line can be dropped off. If the digit is 5, 6, 7, 8 or 9, then the digit immediately before the vertical line is increased by 1.

Example	Solution

Round the following decimals to the number of places indicated in the brackets.

a 23·6342 [2 dp]

23·63|42 The digit after the line is 4, so the digit before the line stays the same: 23·63

b 1·234597 5 [4 dp]

1·2345|975 The digit after the line is 9, so the digit before the line has one added to it: 1·2346

Exercise 3C

1 Round each of the following to the nearest whole number (i.e. with no decimal places):

  a 7·8   **b** 19·7   **c** 124·5   **d** 23·85

  e 47·13   **f** 983·054   **g** 0·9   **h** 0·47

2 Write each of the following decimals correct to 1 decimal place:

  a 2·345   **b** 0·243   **c** 4·5721   **d** 99·8732

  e 0·09   **f** 689·0812   **g** 45·89   **h** 0·02

3 Write each of the following decimals correct to 2 decimal places:

  a 23·693   **b** 12·809   **c** 25·00673   **d** 14·5573

  e 56·222351   **f** 12·1   **g** 14·999   **h** 88·0984

4 Write each of the following decimals correct to 3 decimal places:

  a 45·2535   **b** 97·02478   **c** 19·6578   **d** 14·234875 345

  e 2·6097   **f** 107·9999   **g** 2·679679   **h** 0·3333

5 Write the following decimals correct to the number of decimal places (dp) indicated in the brackets:

  a 45·876124 [5 dp]   **b** 0·087346 23 [7 dp]   **c** 21·469023 [4 dp]

  d 0·004562 [3 dp]   **e** 34·99 [0 dp]   **f** 17·090457 [4 dp]

  g 0·7 [3 dp]   **h** 0·142857 [4 dp]   **i** 43·467̇ [4 dp]

  j 1·5426 [2 dp]   **k** 9·154679 [3 dp]   **l** 0·004672 [4 dp]

3D Adding decimals

When adding decimals ensure that the digits are placed in their correct place value column and that the decimal points are in line. You may like to fill any empty decimal places with zeros. The decimal point should appear in the answer directly beneath the decimal points in the question.

Example

Add these decimals:

a $54·13 + 3·25$

b $14·37 + 1·66 + 23·8$

Solution

$$
\begin{array}{r}
54·13 \\
+\ \ 3·25 \\
\hline
57·38 \\
\hline
\end{array}
$$

$$
\begin{array}{r}
{}^{1\ \,1} \\
14·37 \\
1·66 \\
+\ 23·80 \\
\hline
39·83 \\
\hline
\end{array}
$$

Exercise 3D

I Add these decimals:

a $\begin{array}{r} 23·21 \\ +\ 13·54 \\ \hline \end{array}$

b $\begin{array}{r} 127·3 \\ +\ \ \ 45·6 \\ \hline \end{array}$

c $\begin{array}{r} 1·25 \\ +\ \ 6·51 \\ \hline \end{array}$

d $\begin{array}{r} 45·91 \\ +\ 12·73 \\ \hline \end{array}$

e $\begin{array}{r} 237·72 \\ +\ \ \ 56·91 \\ \hline \end{array}$

f $\begin{array}{r} 12·909 \\ +\ 93·007 \\ \hline \end{array}$

g $\begin{array}{r} 34·95 \\ +\ \ \ 6·86 \\ \hline \end{array}$

h $\begin{array}{r} 1·78 \\ +\ \ 8·56 \\ \hline \end{array}$

i $\begin{array}{r} 1·42 \\ +\ 92·08 \\ \hline \end{array}$

2 Write each of the following sums in columns, making sure the decimal points are in line, then find the answer. Check your answer by using estimation:

a $0·65 + 3·98 + 5·12$

b $12·763 + 45·601$

c $104·69 + 23·28$

d $129·87 + 42·90$

e $14·89 + 342·09 + 5·01 + 12·77$

f $160·876 + 2·801 + 0·083$

g $1·05 + 4·99 + 120·12$

h $19·3 + 10·6 + 250·9$

i $136·8 + 568·01 + 3018·34$

j $44·82 + 1·7 + 1000·74 + 0·07$

3 What is the sum of 245·98, 34·07 and 1·88?

4 Find the total weight for 45·75 kilograms, 16·25 kilograms and 100·2 kilograms.

5 Angela is training to swim in the school 800-metre freestyle event. During one week she swam 0·67 kilometres on Monday, 2·5 kilometres on Tuesday, 1·45 kilometres on Wednesday, 0·85 kilometres on Thursday and 1·8 kilometres on Friday. How far did Angela swim for the week?

6 Sian went to the supermarket and purchased a packet of jelly babies $1·86, a block of chocolate $3·28, a bottle of soft drink $1·87 and a packet of chips $2·79. How much did Sian spend?

7 Max took five parcels to the Post Office. The parcels weighed 2·75 kg, 0·58 kg, 0·27 kg, 1·8 kg and 0·95 kg.

   a What was the total weight of his parcels?

   b What was the combined weight of the heaviest and lightest parcels?

8 Anita purchases some material to make herself some new clothes. She purchases 2·3 metres of island materials to make a skirt, 3·1 metres of cord to make a jacket and 1·8 metres of cotton to make a shirt. What was the total length of material purchased?

9 Rosalie purchases fresh fruits and vegetables from the market. She buys the following items:

potatoes	$6·00
beans	$3·50
lettuce	$2·95
peanuts	$5·00
oranges	$4·20
bananas	$2·30
green coconut	$2·50

The next week her brother Tamana purchases:

potatoes	$6·50
beans	$2·50
capsicum	$1·30
pumpkin	$5·80
fern	$3·00
peanuts	$3·95
bananas	$3·20
oranges	$2·95
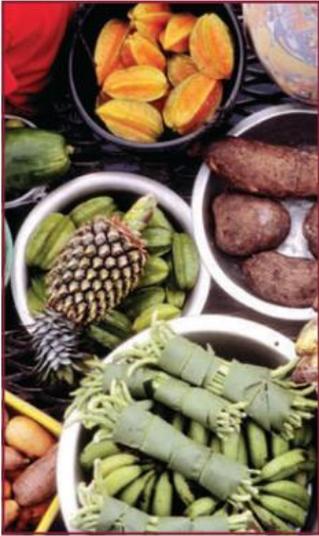
   a How much did Rosalie spend at the market?

   b How much did Tamana spend at the market?

   c Who spent the most at the market?

   d What was the total cost of the fruit and vegetables for the two weeks?

10 Morgan decides to make grated mangrove pod pudding (Koa) for dinner. He buys some mangrove pods $4·25, capsicum $1·90, shallots $3·30, ginger $1·70, tomatoes $3·65 and an onion $1·30. He knows there are coconuts for coconut milk and also some reef fish at home. Morgan has taken $11·20 from his money box and has $6·80 in his wallet.

   a How much will it cost Morgan to make grated mangrove pod pudding?

   b How much money does Morgan have?

   c Does he have enough money to buy the ingredients for the grated mangrove pod pudding? Explain your answer.

11 Ozbon bought an exercise book $3·90, a pencil case $1·65, some pencils $3·95, and a packet of highlighters $3·25. What was the total cost?

12 A family paid $252·15 for their July electricity bill. They had been given a discount of $52·75. What was the original cost of their electricity bill?

13 Emilia is 5 years old and weighs 20·65 kg. At birth she weighed 3·19 kg. How much weight has she gained since birth?

3E Subtracting decimals

When subtracting decimals check that the digits are placed in their correct place value column and that the decimal points are in line, just as you do for addition. You will need to fill any empty decimal places with zeros. The decimal point should appear in the answer directly beneath the decimal points in the question.

Example	Solution

Subtract these decimals:

a $57 \cdot 86 - 3 \cdot 41$

$$
\begin{array}{r}
57 \cdot 86 \\
- 3 \cdot 41 \\
\hline
54 \cdot 45 \\
\hline
\end{array}
$$

b $14 \cdot 371 - 8 \cdot 820$

$$
\begin{array}{r}
{\scriptstyle 0\ 13\ \ 13\ 6\ 11} \\
1\!\!\!/4 \cdot 3\!\!\!/71 \\
- 8 \cdot 820 \\
\hline
5 \cdot 551 \\
\hline
\end{array}
$$

Exercise 3E

1 Subtract these decimals:

a
$$
\begin{array}{r}
28 \cdot 76 \\
- 13 \cdot 54 \\
\hline
\end{array}
$$

b
$$
\begin{array}{r}
187 \cdot 9 \\
- 15 \cdot 6 \\
\hline
\end{array}
$$

c
$$
\begin{array}{r}
10 \cdot 87 \\
- 7 \cdot 54 \\
\hline
\end{array}
$$

d
$$
\begin{array}{r}
85 \cdot 81 \\
- 14 \cdot 23 \\
\hline
\end{array}
$$

e
$$
\begin{array}{r}
167 \cdot 32 \\
- 94 \cdot 96 \\
\hline
\end{array}
$$

f
$$
\begin{array}{r}
22 \cdot 72 \\
- 13 \cdot 07 \\
\hline
\end{array}
$$

g
$$
\begin{array}{r}
64 \cdot 1 \\
- 6 \cdot 9 \\
\hline
\end{array}
$$

h
$$
\begin{array}{r}
9 \cdot 56 \\
- 8 \cdot 78 \\
\hline
\end{array}
$$

i
$$
\begin{array}{r}
92 \cdot 8 \\
- 9 \cdot 7 \\
\hline
\end{array}
$$

2 Write the following subtractions in columns, making sure the decimal points are in line, and find the answers. Check your answers by using estimation:

a $80 \cdot 98 - 5 \cdot 12$

b $212 \cdot 96 - 85 \cdot 61$

c $140 \cdot 39 - 23 \cdot 20$

d $219 \cdot 87 - 32 \cdot 44$

e $14 \cdot 3 - 5 \cdot 7$

f $16 \cdot 81 - 0 \cdot 08$

g $1 \cdot 99 - 0 \cdot 14$

h $19 \cdot 97 - 9 \cdot 29$

i $1018 \cdot 34 - 568 \cdot 20$

j $1164 \cdot 9 - 246 \cdot 86$

k $176 \cdot 8 - 12$

l $44 - 3 \cdot 8$

3 What is the difference between $34 \cdot 7$ and $21 \cdot 8$?

4 How much bigger is $65 \cdot 07$ than $30 \cdot 77$?

5 What is the difference between $3 \cdot 76$ metres and $121 \cdot 05$ metres?

6 The Chan family spent $\$143 \cdot 35$ on groceries at the supermarket. How much change did they get from $\$200$?

7 Henderson Airport recorded a minimum temperature of $28 \cdot 8°C$ at 6:10 am. The temperature rose to a maximum of $31 \cdot 4°C$ at 2 pm. How much did the temperature rise?

8 Ten years ago shares in a particular bank were priced at $9·35. They are now priced at $31·12. By how much has the cost of these shares risen?

9 The Frazer family noted the odometer (an instrument in cars used to measure distances) reading before they started on their holiday. They noted it again at the end of each day of travelling. The odometer readings, in kilometres, are given in the table below:

	Odometer reading
Start	108 372·7
Monday	108 818·8
Tuesday	109 391·3
Wednesday	109 900·5

a Calculate the distance travelled on:

i Monday   **ii** Tuesday   **iii** Wednesday

b On which day did they travel furthest?

c What was the total distance travelled on their trip?

10 James Toata has a savings account with the ANZ Bank in Honiara. His bank statement comes every month and the top section for April is given below. He had $57·34 in the bank as indicated by his opening balance.

ANZ Banking Group Ltd

Statement begins 1 April 2015

Closing balance $

Savings Account Number: 124 976 334 554

Name: James Toata

Branch: Point Cruz, HON

Date	Transaction detail	Debit (−)	Credit (+)	Balance
01 Apr 2015	Opening balance			$57·34 cr
07 Apr 2015	Interest		$4·57	$61·91 cr
	Deposit		$10·00	$71·91 cr

The bank pays James Toata $4·57 interest and James deposits $10 in the bank on 7 April. Using the information given below, calculate James' bank balance after each transaction:

a James is given $20 for his birthday, which he deposits in the bank on 9 April.

b On 14 April he places his leftover pocket money of $5·82 in the bank.

c James needs $29·95 from the bank to buy a new shirt for himself and a present for his mate's birthday. He withdraws this money on 20 April.

d James deposits $25·85 in the bank on 27 April, which he earned doing odd jobs.

Multiplying decimals

Multiplication of numbers with decimals uses the same skills as you practised in Chapter 1. Use estimation to check that you have a sensible answer.

Example

Solution

Multiply these numbers:

a $6·9 \times 3$

Estimation check: $7 \times 3 = 21$

$$
\begin{array}{r}
6·9 \\
\times \quad 3 \\
\hline
207 \\
\hline
20·7
\end{array}
$$

There is 1 decimal place in the question, so the answer needs one decimal place.

b $24·59 \times 0·5$

Estimation check: $25 \times \dfrac{1}{2} = 12.5$

$$
\begin{array}{r}
24·59 \\
\times \quad 0·5 \\
\hline
12\,295 \\
\hline
12·295
\end{array}
$$

There are 3 decimal places in the question, so the answer must have three decimal places.

Exercise 3F

1 Calculate the answers to the following questions by setting the questions out correctly for multiplication. Check your answers by using your calculator:

a $23·6 \times 7$	**b** $14·9 \times 9$	**c** $0·42 \times 7$	**d** $124·75 \times 4$
e $2·354 \times 3$	**f** $56·89 \times 6$	**g** $9·98 \times 9$	**h** $4·874 \times 8$
i $45·980 \times 7$	**j** $9·807 \times 8$	**k** $23·9087 \times 5$	**l** $19·08745 \times 8$
m $7·6 \times 0·4$	**n** $41·5 \times 2·5$	**o** $5·8 \times 9·3$	**p** $25·3 \times 1·2$

2 Estimate the answers to these questions, then use your calculator to determine the exact answers:

a $12·7 \times 14$	**b** $34·9 \times 23$	**c** $0·67 \times 38$	**d** $6·84 \times 19$
e $99·5 \times 72$	**f** $5·78 \times 47$	**g** $4·74 \times 53$	**h** $134·87 \times 21$
i $1·76 \times 49$	**j** $84·098 \times 124$	**k** $78·934 \times 87$	**l** $129·57 \times 264$
m $2·9 \times 21·7$	**n** $44·83 \times 5·13$	**o** $149·56 \times 32·9$	**p** $3·87 \times 1·57$

3 Find the answers to the following:

a $2·6 \times 0·7$	**b** $5·6 \times 0·9$	**c** $9·4 \times 0·3$	**d** $5·9 \times 0·4$
e $4·1 \times 0·8$	**f** $34·2 \times 0·6$	**g** $96·2 \times 0·8$	**h** $14·8 \times 0·9$
i $36·98 \times 0·4$	**j** $1·235 \times 0·5$	**k** $3·604 \times 0·6$	**l** $67·908 \times 0·7$

4 Calculate the following:

a $0·046 \times 0·6$	**b** $0·0065 \times 0·7$	**c** $0·000\,06 \times 0·3$
d $0·0033 \times 0.08$	**e** $0·005 \times 0·008$	**f** $0·81 \times 0·06$
g $0·000\,901 \times 0·004$	**h** $0·067 \times 0·009$	**i** $0·43 \times 0·007$

5 Find the answers to the following:

   a $13 \cdot 7 \times 1 \cdot 7$ **b** $44 \cdot 9 \times 3 \cdot 9$ **c** $15 \cdot 8 \times 5 \cdot 9$ **d** $12 \cdot 57 \times 9 \cdot 7$

   e $54 \cdot 09 \times 6 \cdot 9$ **f** $23 \cdot 63 \times 3 \cdot 5$ **g** $46 \cdot 92 \times 7 \cdot 8$ **h** $10 \cdot 56 \times 4 \cdot 3$

   i $66 \cdot 81 \times 1 \cdot 25$ **j** $84 \cdot 23 \times 1 \cdot 57$ **k** $123 \cdot 08 \times 2 \cdot 87$ **l** $44 \cdot 89 \times 3 \cdot 49$

6 **a** Find the product of $45 \cdot 9076$ and $234 \cdot 5613$.

   b What is $50 \cdot 8076$ times $23 \cdot 569$?

   c What is the product of $1208 \cdot 34$ and $0 \cdot 3266$?

   d Multiply $19 \cdot 0005$ and $45 \cdot 9090909$.

7 Gordan sold a bull at the market. The bull weighed $856 \cdot 5$ kilograms and the butcher paid him $\$1 \cdot 38$ per kilogram. How much did Gordan receive for his bull?

8 A plumber charges $\$38 \cdot 50$ per hour.

   a The Fafale family decides to have the bathroom renovated. The plumber spends $4 \cdot 5$ hours connecting pipes. How much will the Fafale family pay the plumber?

   b The plumber then unblocks a drain for the Telamo family, which takes $0 \cdot 75$ hour. How much will the Telamo family pay?

   c How much did the plumber earn for the day?

9 Marcia filled her car with $42 \cdot 72$ litres of unleaded petrol which costs $116 \cdot 7$ cents per litre. How much did Marcia pay for the petrol?

10 Frank is concreting his garage and orders $13 \cdot 75$ cubic metres of ready-mixed concrete which costs $\$127 \cdot 50$ per cubic metre. How much will it cost Frank to concrete his garage?

11 Membership to the local golf club costs $\$250$ for the year from January to December. Joe Sika wants to join at the end of May, so the club charges him for 7 months, which is approximately $0 \cdot 58$ of the year. How much will Joe Sika pay for membership?

12 Candice purchases $3 \cdot 65$ metres of material to make a dress. If the material costs $\$12 \cdot 80$ per metre, how much did Candice pay?

13 A farmer sells bananas for $\$0 \cdot 95$ per kilogram, cucumbers for $\$3 \cdot 30$ per kilogram, oranges for $\$2 \cdot 80$ per kilogram, ginger for $\$0 \cdot 95$ per kilogram, taro for $\$4 \cdot 30$ per kilogram, potatoes for $\$1 \cdot 30$ per kilogram and tomatoes for $\$1 \cdot 95$ per kilogram.

   a Find the cost of the following items:

      i $2 \cdot 3$ kilograms of oranges   **ii** $4 \cdot 76$ kilograms of cucumbers

     iii $0 \cdot 33$ kilogram of taro   **iv** $1 \cdot 78$ kilograms of tomatoes

      v $5 \cdot 2$ kilograms of potatoes   **vi** $1 \cdot 87$ kilograms of ginger

     vii $3 \cdot 23$ kilograms of bananas

   b Find the total cost of the fruits, vegetables and root crops.

14 Les wants to purchase 25 rolls of netting to use when baling hay. If it costs $\$273 \cdot 90$ per roll, find the total cost of the netting.

3G   Dividing by whole numbers

When dividing a decimal number by a whole number:

Step 1: Set the division question out as you would normally for division.

Step 2: Do the division, ignoring the decimal point.

Step 3: The decimal point is placed in the answer directly in line with the decimal point in the question.

Example

Divide these numbers:

a $2·4 \div 6$

b $2·36 \div 4$

Solution

$$\begin{array}{r} 0·4 \\ 6\overline{)2·4} \end{array}$$

$$\begin{array}{r} 0·59 \\ 4\overline{)2·36} \end{array}$$

Exercise 3G

1 Calculate the answers to the following by setting the questions out correctly for division. Check your answers by using your calculator:

a $15·6 \div 4$	b $145·5 \div 5$	c $97·2 \div 3$	d $21·84 \div 7$
e $34·24 \div 8$	f $67·86 \div 9$	g $0·3474 \div 6$	h $146·35 \div 5$
i $0·44 \div 11$	j $0·045 \div 5$	k $237·96 \div 6$	l $14·64 \div 8$
m $46·8 \div 2$	n $8·4 \div 12$	o $10·25 \div 25$	p $73·71 \div 21$

2 Estimate the answers to the following, then use your calculator to determine the exact answers. Round your answers to 2 decimal places:

a $47·982 \div 12$	b $17·765 \div 9$	c $2·064 \div 4$	d $4·87 \div 2$
e $71·14 \div 5$	f $95·092 \div 7$	g $21·93 \div 11$	h $7·034\,216 \div 8$
i $24·2424 \div 6$	j $177·390 \div 9$	k $143·618 \div 12$	l $962·3261 \div 8$

3 Mrs Natei hasn't enough food in the house to make lunches for her three children so she decides to give them a school lunch order. She has $9·45 to divide equally between them. How much does each child get to spend on their lunch?

4 Elizabeth is given $9·75 to pay for bus tickets to school for 5 days. How much does her ticket per day cost?

5 A packet of 100 cups costs $3·56. How much does each cup cost in:

a   dollars?   b   cents?

6 A packet of biscuits costs $3·48 and contains a dozen biscuits (1 dozen means 12). How much does each biscuit cost?

7 An aeroplane travels 1555·5 kilometres in 3 hours.

a   How far does it travel in 1 hour?

b   How far does it travel in 15 minutes?

When dividing a decimal number by another decimal number, convert the divisor to a whole number.

For example, $2000 \div 500 = 4$, $200 \div 50 = 4$, $20 \div 5 = 4$ and $2 \div 0.5 = 4$.

Therefore make the divisor a whole number by shifting the decimal point to the right.

Example	**Solution**
Evaluate $24.68 \div 0.4$.	Move the decimal point one place to the right in both numbers to give: $246.8 \div 4$ $$\begin{array}{r} 61.7 \\ 4\overline{)246.8} \end{array}$$ $\therefore\ 24.68 \div 0.4 = 61.7$

Exercise 3H

1 Calculate the answers to the following:

a	$2.6 \div 0.2$	**b**	$4.9 \div 0.7$	**c**	$1.08 \div 0.9$	**d**	$14.4 \div 1.2$
e	$0.36 \div 0.6$	**f**	$0.0081 \div 0.09$	**g**	$10 \div 0.1$	**h**	$18.9 \div 0.009$
i	$1.21 \div 0.011$	**j**	$0.0008 \div 0.4$	**k**	$0.0024 \div 0.06$	**l**	$0.025 \div 0.005$
m	$72 \div 0.8$	**n**	$0.9 \div 0.06$	**o**	$0.8 \div 0.8$	**p**	$0.6 \div 1.2$
q	$0.182 \div 0.08$	**r**	$0.000\,64 \div 0.4$	**s**	$0.42 \div 0.7$	**t**	$6.8 \div 0.005$

2 Evaluate the following:

a	$0.1374 \div 0.03$	**b**	$0.28 \div 0.08$	**c**	$1.58 \div 0.005$
d	$0.256 \div 0.04$	**e**	$0.1806 \div 0.7$	**f**	$0.3648 \div 0.008$
g	$1.1304 \div 0.9$	**h**	$2.7137 \div 0.11$	**i**	$0.002512 \div 0.002$
j	$0.008\,76 \div 0.06$	**k**	$54.69 \div 0.06$	**l**	$0.5499 \div 1.2$
m	$0.048 \div 0.0008$	**n**	$8.4326 \div 0.07$	**o**	$0.65 \div 0.005$
p	$0.186 \div 0.12$	**q**	$4.593 \div 0.006$	**r**	$1.4562 \div 0.09$
s	$0.076\,53 \div 0.004$	**t**	$5.492 \div 0.11$	**u**	$3.3912 \div 0.9$

3 Estimate the following, then check your answers using a calculator:

a	$10.488 \div 2.3$	**b**	$0.87864 \div 0.56$	**c**	$0.00765 \div 0.17$
d	$0.46 \div 0.02$	**e**	$0.36816 \div 0.104$	**f**	$42.64113 \div 0.57$
g	$0.002\,34 \div 0.13$	**h**	$0.367 \div 0.4$	**i**	$25.2978 \div 0.22$

4 a Find the result when 56.7902 is divided by 0.08.

   b What is the quotient of $679.847 \div 0.7$?

5 A clothing factory worker uses 0.4 metre of cotton to sew on a button. How many buttons can be sewn from a 98-metre reel of cotton?

6 How many pieces of wood 0.3 metre long can be cut from a piece of timber 5.4 metres in length?

7 How many 1.2-litre bottles of soft drink are needed if 22.2 litres is to be added to the punch?

3I Exploring powers of 10

Learning task 3I

1 Copy the table and use your calculator to evaluate the following, providing reasoning for your answers:

Question	Answer	Reasoning
$1·8 \times 10$	18	The answer is larger than the decimal number in the question and the decimal point has moved one place to the right. Also $18 \div 10 = 1·8$
$0·6 \times 10$		
$7·3 \times 10$		
$3·68 \times 100$		
$5·008 \times 100$		
$0·005 \times 1000$		
$1·612 \times 1000$		
$1·75 \times 1000$		

2 Use the information from the table to answer the following questions:

   a Describe the effect when a decimal number is multiplied by 10.

   b Describe the effect when a decimal number is multiplied by a power of 10, say 100 or 1000.

3 Copy the table below and then solve the following divisions, providing reasoning for your answers:

Question	Answer	Reasoning
$40·3 \div 10$	$4·03$	The answer is smaller than the decimal number in the question and the decimal point has moved one place to the left. Also $4·03 \times 10 = 40·3$
$50·4 \div 10$		
$0·24 \div 10$		
$650·48 \div 100$		
$346·24 \div 100$		
$19·36 \div 100$		
$1087·4 \div 1000$		
$471·28 \div 1000$		
$0·24 \div 100$		

4 Use the information from the table to answer the following questions:

   a Describe the effect when a decimal number is divided by 10.

   b Describe the effect when a decimal number is divided by a power of 10, say 100 or 1000.

5 Find the answers to the following without doing a formal calculation. (Hint: Move the decimal point.)

a $12·74 \times 10$ b $76·54 \times 10$ c $1·456 \times 10$

d $5·983 \times 10$ e $0·65 \times 100$ f $15·8739 \times 100$

g $0·3589 \times 100$ h $0·0067 \times 100$ i $123·678 \times 1000$

j $0·00876 \times 1000$ k $2·78904 \times 1000$ l $42·78 \times 1000$

6 Find the answers to these questions, then check your answers by using estimation:

a $34·987 \times 1000$ b $65·0098 \times 10\,000$

c $0·000\,340\,08 \times 1\,000\,000$ d $87·76402 \times 10$

e $2·857162 \times 100$ f $5·679011 \times 100\,000$

g $235·890 \times 100$ h $34·12567 \times 1000$

i $456·99987 \times 10\,000$ j 345×1000

k $2·348\,712\,45 \times 10\,000\,000$ l $34·78 \times 100\,000$

7 Evaluate:

a $3·475 \times 500$ b $0·341\,195 \times 30\,000$ c $15·347 \times 50$

8 Evaluate the following by simply moving the decimal point:

a $3·983 \div 10$ b $123·876 \div 100$ c $145\,832·45 \div 1000$

d $345·98 \div 10$ e $56·99 \div 100$ f $0·87 \div 10$

g $980·54 \div 100$ h $234·123 \div 1000$ i $56\,732·9 \div 1000$

j $6060·98 \div 100$ k $235·9087 \div 1000$ l $34·90 \div 10$

9 Find the answers to these problems, then check your answers by using estimation:

a $23·87 \div 1000$ b $0·098 \div 10$ c $234·98 \div 100\,000$

d $1·23 \div 10\,000$ e $67·908 \div 10$ f $0·876 \div 100$

g $23\,4567·9 \div 100\,000$ h $12\,765·4 \div 1\,000\,000$ i $12·45 \div 10\,000$

j $345·76 \div 10\,000$ k $3·456 \div 100$ l $1257·45 \div 10\,000$

m $4·789 \div 100$ n $3·7652 \div 1000$ o $19·567 \div 10$

p $0·098 \div 100$ q $34·567 \div 1000$ r $0·0876 \div 1000$

s $23\,456·23 \div 1000$ t $0·0987 \div 100$ u $0·105 \div 100\,000$

10 Calculate the following:

a $24·86 \times 20$ b $124·65 \times 500$ c $19·25 \times 50$

d $444·88 \div 200$ e $435·84 \div 30$ f $99·54 \div 600$

g $3434·55 \times 5000$ h $346·84 \times 40$ i $9478·35 \times 50$

j $8560 \div 400$ k $9160 \div 200$ l $21\,570 \div 300$

m $1·68 \times 2000$ n $2·95 \times 500$ o $10·04 \times 400$

Fractions and decimals

Every fraction can be changed to a decimal by dividing the numerator by the denominator. The result will be a decimal that has no remainders, or one that has a pattern of remainders.

Example ———— **Solution**

I Change these fractions to decimals:

a $\frac{3}{8}$

$\frac{3}{8} = 3 \div 8$
$= 0.375$

$$8\overline{)3.0\overset{6}{0}\overset{4}{0}}$$ $\quad 0.375$

b $\frac{1}{9}$

$\frac{1}{9} = 1 \div 9$
$= 0.\dot{1}$

$$9\overline{)1.0\overset{1}{0}\overset{1}{0}}$$ $\quad 0.11\dot{1}$

The decimal $0.111\ldots$ is a recurring or repeating decimal. Place a dot above the digit to indicate that it repeats.

If two or more digits repeat, use a line above the digits that repeat.

Example ———— **Solution**

2 Change $\frac{2}{11}$ to a decimal.

$\frac{2}{11} = 2 \div 11$
$= 0.181\,818\ldots$
$= 0.\overline{18}$

$$11\overline{)2.0\overset{9}{0}\overset{2}{0}\overset{9}{0}\overset{2}{0}}$$ $\quad 0.18181$

Exercise 3J

I Convert the following fractions to decimals:

a $\frac{1}{3}$ **b** $\frac{2}{5}$ **c** $\frac{1}{4}$ **d** $\frac{1}{8}$

e $\frac{7}{8}$ **f** $\frac{5}{12}$ **g** $\frac{5}{6}$ **h** $\frac{3}{4}$

i $\frac{4}{5}$ **j** $\frac{3}{10}$ **k** $\frac{5}{9}$ **l** $\frac{3}{11}$

m $\frac{5}{8}$ **n** $\frac{8}{9}$ **o** $\frac{5}{6}$ **p** $\frac{2}{3}$

q $\frac{2}{9}$ **r** $\frac{1}{5}$ **s** $\frac{1}{6}$ **t** $\frac{5}{11}$

2 Convert these fractions to decimals:

a $\frac{16}{9}$ **b** $\frac{10}{3}$ **c** $\frac{9}{5}$ **d** $\frac{16}{11}$

e $\frac{13}{6}$ **f** $\frac{17}{10}$ **g** $\frac{12}{11}$ **h** $\frac{13}{12}$

3 Convert these fractions to decimals and round to 2 decimal places:

a $\frac{4}{7}$ **b** $\frac{1}{7}$ **c** $\frac{14}{3}$ **d** $\frac{17}{7}$

e $\frac{4}{9}$ **f** $\frac{3}{8}$ **g** $\frac{2}{7}$ **h** $\frac{15}{9}$

To convert a decimal into a fraction you need to remember your place value table and your knowledge of fractions, and to follow the steps listed below.

Step 1: The digits to the right of the decimal point become the numerator of your fraction.

Step 2: The place value of the last digit becomes the denominator.

Step 3: Simplify the fraction if possible.

Hundreds	Tens	Units	·	Tenths	Hundredths	Thousandths
		0	·	3	5	
		1	·	2	0	6

Example

Convert these decimals to fractions:

a 0·35

b 1·206

Solution

The decimal part becomes the numerator and the last digit (in this case 5) is in the hundredths column so the denominator is 100.

$$0·35 = \frac{35}{100}$$

$$= \frac{7}{20}$$

$$1·206 = 1 + \frac{206}{1000}$$

$$= 1\frac{103}{500}$$

Exercise 3K

1 Write the following decimals as fractions in their simplest form:

    a 0·2   **b** 0·04   **c** 0·9   **d** 0·003

    e 0·13   **f** 0·45   **g** 0·066   **h** 0·088

    i 0·25   **j** 0·375   **k** 0·75   **l** 0·125

2 Write the following decimals as fractions in their simplest form:

    a 8·5   **b** 3·6   **c** 2·07   **d** 8·008

    e 1·06   **f** 2·875   **g** 3·625   **h** 4·07

3 Write these decimals as fractions in their simplest form:

    a 0·104   **b** 0·909   **c** 0·705   **d** 0·340

    e 0·135   **f** 0·996   **g** 0·548   **h** 0·625

    i 1·25   **j** 2·75   **k** 1·02   **l** 3·65

    m 5·315   **n** 7·343   **o** 9·384   **p** 12·648

    q 10·105   **r** 12·018   **s** 15·360   **t** 20·045

Percentage means per one hundred: 20% means 20 out of 100. The symbol for percentage is %.

To convert from a percentage to a fraction, write as a fraction out of 100 then simplify.

Example ──────────────────────── **Solution**

I Convert these percentages to fractions:

a 9% $\frac{9}{100}$ This means 9 out of every 100.

b 45% $\frac{45}{100} = \frac{9}{20}$

c 125% $\frac{125}{100} = 1\frac{25}{100} = 1\frac{1}{4}$

2 Write the following as percentages:

a $\frac{17}{100}$ $\frac{17}{100} = 17\%$

b $\frac{4}{20}$ $\frac{4}{20} \times \frac{5}{5} = \frac{20}{100}$
$= 20\%$

c 0·73 $0\cdot73 = \frac{73}{100} = 73\%$

Exercise 3L

I Write each percentage as a fraction:

a 21%   b 97%   c 50%   d 25%

e 65%   f 173%   g 159%   h 333%

2 Change each of the following fractions into percentages:

a $\frac{3}{100}$ b $\frac{81}{100}$ c $\frac{7}{10}$ d $\frac{3}{10}$ e $\frac{23}{50}$ f $\frac{1}{50}$

g $\frac{1}{25}$ h $\frac{12}{25}$ i $\frac{1}{2}$ j $\frac{1}{5}$ k $\frac{1}{4}$ l 1

3 Rewrite each of the following percentages as decimals:

a 16%   b 47%   c 7%   d 88%   e 50%   f 90%

g 35%   h 5%   i 114%   j 425%   k 250%   l 315%

4 Convert each of the following decimals to percentages:

a 0·33   b 0·45   c 0·13   d 0·93   e 0·19   f 0·05

g 0·01   h 0·02   i 1·63   j 1·59   k 1·0   l 1·06

5 Arrange each of the following sets of numbers from smallest to largest by converting the fractions and percentages to decimals:

a $0\cdot8, 82\%, \frac{7}{8}, \frac{8}{9}, 0\cdot8\dot{7}$ b $67\%, \frac{2}{3}, 0\cdot6, 65\%, 0\cdot6\dot{7}$

c $0\cdot96, \frac{9}{10}, 98\%, 0\cdot923, 92\cdot5\%$ d $29\%, \frac{7}{25}, 24\%, 0\cdot26, \frac{1}{4}$

3M   Finding percentages of quantities

To find a percentage of a quantity, follow these steps.

Step 1:   Write the percentage as a fraction with a denominator of 100.

Step 2:   Change the 'of' to multiplication.

Step 3:   Write the amount as a fraction.

Step 4:   Simplify.

Example

Find:

a   10% of $340

b   120% of $90

Solution

10% of $340

$= \dfrac{10}{100} \times \dfrac{340}{1}$

$= \$34$

120% of $90

$= \dfrac{120}{100} \times \dfrac{90}{1}$

$= 12 \times 9$

$= 108$

Exercise 3M

1   Find:

    a   20% of 90   **b**   25% of 88   **c**   10% of 400   **d**   30% of 660

    e   10% of 40   **f**   15% of 250   **g**   5% of 60   **h**   12% of 350

    i   70% of 490   **j**   36% of 175   **k**   19% of 30   **l**   2% of 400

2   Find:

    a   110% of 80   **b**   200% of 150   **c**   130% of 70   **d**   225% of 100

    e   106% of 750   **f**   105% of 1200   **g**   155% of 75   **h**   350% of 12

3   Find these percentages:

    a   6·5% of 200   **b**   10·2% of 500   **c**   3·3% of 11 000   **d**   40·5% of 400

    e   0·25% of 800   **f**   0·01% of 80 000   **g**   9·8% of 3500   **h**   20·4% of 1250

4   Talo has savings of $10 000 in the bank. He decides to use 60% of his savings to buy a motorbike. How much does the motorbike cost?

5   **a**   Lake Rano holds 312 000 megalitres of water when full. If it is 65% full, how much water is in it?

    b   Lake Tengano holds 3 390 000 megalitres when full. If it is only 4% full, how much water is that?

    c   The volcano crater at Simbo holds 64 200 megalitres when full. If it is only 4% full, how many megalitres of water is in the crater?

6   Salome obtained 67% on her Maths test. If her test was out of 85 marks, how many marks did Salome obtain?

Calculating percentages **3N**

Best Jeans is having a sale and all their jeans are discounted by 10%. How much would you pay for the jeans if they are $109·50?

Two methods can be used to determine the discount price: subtracting the discount, and finding the percentage paid.

Example

Tickets to the circus cost $52 each. Abdi is entitled to a 20% discount. How much is Abdi's ticket?

Solution

Method 1 Subtracting the discount:

20% of $52
$0·20 \times 52 = 10·40$
$52·00 - 10·40 = 41·60$
So, Abdi pays $41·60 for his ticket.

Method 2 Finding the percentage paid:

$100\% - 20\% = 80\%$
$0·8 \times 52 = 41·60$
So, Abdi pays $41·60 for his ticket.

Exercise 3N

1 Use either method to determine the sale price of the following items:

a 10% Off $12

b 15% Off $100

c 20% Off $199

d 5% Off $30

e 75% off $60

f $12\frac{1}{2}$% Off $999

2 Calculate the value of each of the following:

a 15% of 50 kilometres **b** 17% of 1000 metres **c** 125% of $70

d 95% of 20 litres **e** 62·5% of $400 **f** 35% of 8 centimetres

3 The Department of Tax in the Ministry of Inland Revenue is considering a Goods and Services Tax (GST). This tax is *added* to the cost of goods and services. The GST rate is 10%. Calculate the total cost of each of the following items after GST has been added:

a $45 bag of cement **b** $150 pair of sunglasses **c** $120 pair of jeans

d $750 pair of runners **e** $25 compact disc **f** $36·50 tie

Puzzles

1 Determine the place value of the 5 in each of the numbers below and then match the letter to the answer to solve the riddle:

Why didn't Suilobo smile?

L 5̲0   **O** 10̲5   **S** 3·69̲5   **I** 0·5̲2   **E** 10·1̲5

H 5̲37·2   **T** 5̲346·2   **M** 5̲1 246·2   **F** 72·138̲5

| $\dfrac{}{100}$ | $\dfrac{1}{100}$ | | $\dfrac{}{10}$ | $\dfrac{}{1}$ | $\dfrac{1}{1000}$ | $\dfrac{}{1000}$ | | $\dfrac{}{10\,000}$ | $\dfrac{}{1}$ | $\dfrac{1}{1000}$ | $\dfrac{}{1000}$ | | $\dfrac{}{1}$ | $\dfrac{1}{10\,000}$ |

| $\dfrac{}{100}$ | $\dfrac{1}{10}$ | $\dfrac{1}{1000}$ | | $\dfrac{}{1000}$ | $\dfrac{1}{100}$ | $\dfrac{1}{100}$ | $\dfrac{}{1000}$ | $\dfrac{}{100}$ |

2 Complete the decimal multiplication problems to solve the riddle:

Why did the student find decimals so difficult?

A $\begin{array}{r} 1·3 \\ \times\,3 \\ \hline \end{array}$
B $\begin{array}{r} 2·4 \\ \times\,5 \\ \hline \end{array}$
C $\begin{array}{r} 2·13 \\ \times\,6 \\ \hline \end{array}$
D $\begin{array}{r} 10·5 \\ \times\,2 \\ \hline \end{array}$

E $\begin{array}{r} 16·5 \\ \times\,4 \\ \hline \end{array}$
H $\begin{array}{r} 3·4 \\ \times\,5·5 \\ \hline \end{array}$
I $\begin{array}{r} 6·8 \\ \times\,0·5 \\ \hline \end{array}$
L $\begin{array}{r} 2·4 \\ \times\,1·6 \\ \hline \end{array}$

N $\begin{array}{r} 5·12 \\ \times\,2·5 \\ \hline \end{array}$
O $\begin{array}{r} 15·3 \\ \times\,0·5 \\ \hline \end{array}$
P $\begin{array}{r} 10·48 \\ \times\,0·5 \\ \hline \end{array}$
S $\begin{array}{r} 4·1 \\ \times\,0·9 \\ \hline \end{array}$

T $\begin{array}{r} 4·2 \\ \times\,1·4 \\ \hline \end{array}$
U $\begin{array}{r} 5·6 \\ \times\,1·2 \\ \hline \end{array}$
V $\begin{array}{r} 9·1 \\ \times\,0·3 \\ \hline \end{array}$
Y $\begin{array}{r} 7·9 \\ \times\,1·2 \\ \hline \end{array}$

12	66	12·78	3·9	6·72	3·69	66		18·7	66
12·78	7·65	6·72	3·84	21	12·8	5·88		3·69	66	66
5·88	18·7	66		5·24	7·65	3·4	12·8	5·88

3 Complete the following decimal division problems to solve the riddle:

What is the longest piece of furniture in the school?

A $30 \div 0 \cdot 2$ **B** $45 \div 1 \cdot 5$ **C** $26 \div 0 \cdot 4$ **E** $48 \div 1 \cdot 2$

H $10 \div 2 \cdot 5$ **I** $8 \cdot 4 \div 0 \cdot 12$ **L** $50 \cdot 4 \div 1 \cdot 2$ **M** $65 \cdot 4 \div 0 \cdot 6$

N $45 \cdot 6 \div 0 \cdot 12$ **O** $124 \div 0 \cdot 8$ **P** $31 \cdot 2 \div 5 \cdot 2$ **T** $69 \cdot 7 \div 1 \cdot 7$

U $10 \cdot 35 \div 0 \cdot 45$ **V** $51 \cdot 2 \div 6 \cdot 4$ **W** $1 \cdot 48 \div 3 \cdot 7$ **Y** $4 \cdot 55 \div 0 \cdot 65$

___	___	___
41	4	40

___	___	___	___	___	___	___	___	___	___	___	___	___	___
109	23	42	41	70	6	42	70	65	150	41	70	155	380

___	___	___	___	___
41	150	30	42	40

4 Convert the following decimals to percentages to solve the riddle:

What happened to the mechanic who cried?

A $3 \cdot 25$ **C** $0 \cdot 55$ **D** $0 \cdot 1$ **E** $0 \cdot 5$

H $1 \cdot 2$ **I** $0 \cdot 89$ **M** $2 \cdot 13$ **N** $0 \cdot 25$

___	___		___	___	___	___		___	___
120%	50%		213%	325%	10%	50%		325%	25%

___	___	___		___	___	___	___	___	___	___
89%	55%	50%		213%	325%	55%	120%	89%	25%	50%

The price is right?

In each case use the clues given to find the correct price for each grocery item.

1 310 mL bottle of Solomon Szeba Orange soft drink
$5·26, $5·03, $4·47, $4·81, $4·67, $4·96, $4·77, $4·36, $4·49, $4·57

Clue 1: The number is not divisible by 2.
Clue 2: The number is smaller than the result of $2·6 \times 1·77$.
Clue 3: The sum of the digits is odd.
Clue 4: The number has four tenths.
Clue 5: The last two digits form a prime number.

2 750 g packet of Solomon Soap (powder)
$3·28, $3·15, $2·97, $3·49, $2·99, $3·38, $3·60, $3·39, $3·47, $3·29

Clue 1: The digit in the hundredth column is greater than 4.
Clue 2: The sum of the tenths and hundredths columns is not 10.
Clue 3: The last two digits form a composite number.
Clue 4: The number has 9 hundredths.
Clue 5: The number in the tenths column is even.

3 A 4-pack of Solbrew drinks
$3·18, $3·12, $2·95, $2·87, $3·03, $3·14, $3·21, $3·08, $3·29, $3·19

Clue 1: The number has 3 units.
Clue 2: The number is greater than $3·05.
Clue 3: The number is smaller than $3·84 \div 1·2$.
Clue 4: The sum of the digits is odd.
Clue 5: The number has the digit 1 in either the tenths or hundredths column.

Magic squares

Magic squares have every row, column and diagonal adding up to the same magic number. For each magic square below, discover the magic number and then use it to complete each of the missing boxes. You will be practising your addition and subtraction skills using decimals.

12·78			5·68
	4·26		7·1
2·84		11·36	15·62
	17·04	1·42	19·88

	37·8		25·2
100·8	18·9		31·5
12·6	81·9		
	75·6	6·3	

Currency

1 Solomon Islands has 5, 10, 20 and 50 cent coins in circulation. In how many ways can you make 50 cents using these coins? List all the possibilities.

2 In the United States they have 1, 5, 10, 25 and 50 cent coins in circulation. In how many ways can you make 50 cents using these coins? List all the possibilities.

3 In Canada they have only 1, 5 and 25 cent coins in circulation. How many of each of these coins can make 50 cents?

4 Brazil has 1, 5, 10 and 50 centavos coins in circulation. How many of each of these coins are required to make 50 centavos?

5 Israel has only 5, 10 and 50 agorot coins in circulation. In how many ways can you make 50 agorots using these coins?

6 How many Solomon Islands $1 (nguzunguzu) coins would you need to stack to your height? What would be the value of the stack? You will need to know the thickness of a $1 coin and your height. Approximate the thickness of the $1 coin and then divide your height by the number of coins in the stack.

7 What value of 5 cent, 10 cent, 20 cent or $1 coins would be needed in each case to reach your height?

Enrichment

In Exercise 4K we looked at changing decimals to fractions; however, you did not change any decimals that continue on forever. These are called recurring decimals. Changing recurring decimals to fractions is more challenging and requires some basic algebra.

Example

Convert $0\cdot\overline{45}$ to a fraction.

Solution

$0\cdot\overline{45} = 0\cdot45454545...$

Let N represent the fraction we are trying to find.

$N = 0\cdot454545454545...$ Equation 1

$100N = 45\cdot45454545...$ Equation 2

$100N - N = 45\cdot454545...$
$\qquad\qquad\quad - 0\cdot4545454545...$

Equation 2 − Equation 1

$99N = 45$ The recurring decimal part is subtracted.

$N = \dfrac{45}{99} = \dfrac{5}{11}$

1 Convert the following recurring decimals to fractions by using the example above:

a $0\cdot2\dot{3}$ b $0\cdot\dot{8}$ c $0\cdot7\dot{2}$ d $0\cdot\dot{5}$ e $0\cdot3\overline{45}$ f $0\cdot2\overline{45}$

g $0\cdot1\dot{8}$ h $0\cdot4\overline{56}$ i $0\cdot0\dot{6}$ j $2\cdot4\dot{7}$ k $0\cdot30\dot{8}$ l $3\cdot6\overline{73}$

2 Find the cost of building a dog's house using the design below. You have the following materials available for use:

Dressed hardwood:

42 mm × 19 mm	$2·64 per metre
65 mm × 19 mm	$3·40 per metre
65 mm × 32 mm	$7·95 per metre

Dressed pine

70 mm × 35 mm	$2·60 per metre
35 mm × 35 mm	$2·23 per metre
42 mm × 42 mm	$3·48 per metre

Pine lining

89 mm × 19 mm	$4·11 per metre
108 mm × 19 mm	$5·28 per metre
140 mm × 12 mm	$1·60 per metre

Waterproof roofing

| 86 cm × 1·8 m | $26·91 per sheet |

Calculate how much of each material is used and the total cost of the dog's house.
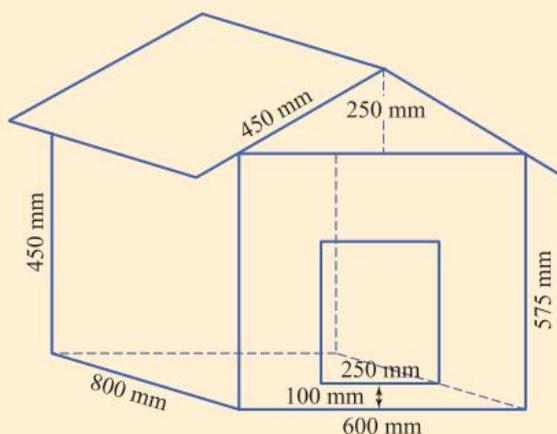
3 The 2008 'Solo Idol' was said to be the best ever show since the series started in Honiara in 2006. Very stiff competition among participants and a high turn out of people for the show made for a memorable night. It was estimated that 7000 people went to the show.

   a A quarter of those that turned up were children. How many of them were there?

   b If they charged $10 per adult, how much did they collect from adults?

   c If they charged $5 per child, how much did they collect from both adults and children?

   d If the males represented 43% of the total attendance that night, what percentage of the audience was female? It was said that 'most of the people that came that night were male'. Was the statement correct?

   e How many males and how many females attended the show?

4 A fencing contractor builds fences for people. The owners of a block of flats want to replace the fence along the front of the flats. They decide to use a series of pine structures shown below.
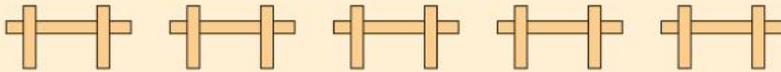
   a Calculate the cost of each structure if the posts are 1·8 metres long and cost $8·25 each. The 3·6-metre rails cost $17·60 each.

   b If the front boundary is 126·6 metres long and the ends of the rails are 0·5 metre apart, calculate how many structures are needed to cover the distance if the first and last structures are exactly in line with the side boundaries.

   c How many posts are needed?

   d How much will the posts cost?

   e A bolt is placed through each post where the rail crosses. If each bolt and nut costs $3·50, what is the total cost of the nuts and bolts?

   f What is the total cost of materials for the fence?

   g The contractor also charges for his labour. He estimates he will spend two 8-hour days using his machinery to put in the posts. He will charge the owner $50 per hour. It will take another four 8-hour days to assemble the rails and he will charge $25 per hour for those days. What is the total cost of labour?

   h What is the total cost of materials and labour for the fence?

   i The contractor also charges GST, an additional 10%. Calculate the total cost of materials and labour, including GST.

Revision/Assessment

Exercise 3A

1 Write down the place value of the 5 in each of the following questions:

    a 45·907   **b** 38·0056   **c** 12·508   **d** 50·893

    e 102·456870   **f** 12·268405   **g** 88·587   **h** 4·087354 879

Exercise 3C

2 Round each decimal to the number of decimal places indicated in the brackets:

    a 34·876234 [4 dp]   **b** 1·34589 [2 dp]   **c** 19·606060 [3 dp]

    d 0·00884 [2 dp]   **e** 0·04 [1 dp]   **f** 0·5 [4 dp]

Exercise 3D

3 Find the answers to the following questions:

    a 23·89 + 45·12   **b** 508·909 + 689·234

    c 0·98 + 1·45   **d** 0·876 + 12·687

    e 23·78 + 974·67 + 3·984   **f** 17·09 + 34·67 + 0·08

4 Sonja has a bank balance of $204·78, Michael's bank balance is $389·56 and Nello's bank balance is 5 tens and 6 hundredths more than Sonja's.

    a How many dollars and cents is 5 tens and 6 hundredths?

    b How much is Nello's bank balance?

    c Who has the most money in the bank?

    d How much more money than Sonja does Michael have?

Exercise 3E

5 Find the answers to the following questions:

    a 134·78 − 34·54   **b** 0·873 − 0·063   **c** 12·569 − 1·999

    d 809·6 − 6·9   **e** 67·000 − 2·568   **f** 687·2 − 2·85

Exercise 3F

6 Find the answers to the following questions:

    a 13·5 × 8   **b** 0·34 × 6   **c** 0·45 × 5

    d 19·6 × 0·5   **e** 34·76 × 4·2   **f** 234·6 × 3·5

7 Max needs some help to decide which is the best buy:

    ■ 20 kg of dog food for $35·80

    ■ 10 kg of dog food on special for $17·50 normally $18·90

    ■ 2·5 kg of dog food for $6·25

    a Calculate the cost per kilogram for the 20 kilogram bag of dog food.

    b Calculate the cost per kilogram for the 10 kilogram bag of dog food when on special.

    c Calculate the cost per kilogram for the 2·5 kilogram bag of dog food.

    d Which product should Max buy? Explain your answer.

Exercises 3G and 3H

8 Calculate the answers to the following questions:

    a $100·16 \div 8$ **b** $12·6 \div 6$ **c** $308·61 \div 3$

    d $62·5 \div 2·5$ **e** $23·04 \div 0·4$ **f** $56·4 \div 0·08$

Learning task 3I

9 Calculate:

    a $3·789 \times 100$ **b** $12·345 \times 100\,000$ **c** $100·56 \times 4000$

    d $7·98 \times 30$ **e** $234·875 \div 10$ **f** $124\,567·432 \div 100\,000$

Exercise 3J

10 Convert the following fractions to decimals:

    a $\frac{7}{12}$ **b** $\frac{3}{8}$ **c** $\frac{1}{11}$ **d** $\frac{7}{9}$ **e** $\frac{9}{5}$ **f** $\frac{11}{8}$

Exercise 3K

11 Convert the following decimals to fractions:

    a $0·5$ **b** $0·007$ **c** $0·67$ **d** $0·346$ **e** $5·809$ **f** $12·058$

Exercise 3L

12 Write the following percentages as fractions and decimals:

    a   23%   **b**   90%   **c**   35%   **d**   300%   **e**   225%   **f**   1%

Exercise 3M

13 Evaluate (mentally if possible):

    a   10% of $80   **b**   20% of 30 cm   **c**   25% of $100

    d   5% of 20 cents   **e**   120% of $10   **f**   250% of $50

Exercise 3N

14 Kelly purchased 126·75 metres of pipe, which cost $2·89 per metre. She also bought some pipe fittings and joiners, which cost $6·98, $7·02, $2·33, $15·87 and $10·33.

    a   How much did the pipe cost Kelly?

    b   How much did the pipe fittings and joiners cost?

    c   What was the total cost of the pipe, pipe fittings and joiners?

    d   What would the cost be if Kelly was given a 10% discount?

    e   How much change would Kelly get from $500?

Length and Perimeter

Solomon Islands is a Melanesian country, located in the South West Pacific Ocean, east of Papua New Guinea. It has a population of 523 170 (as estimated in 2009). It has an estimated land area of 27 556 km^2 and a sea area of 1 340 000 km^2. Because of the vast sea area and many scattered islands, proper planning is vital to ensure that effective transportation and communication systems are in place, even in the most remote parts of the country. The improvements in technology in this new era have made it possible for satellites to accurately measure the total sea area as well as the total length of coastline to assist planning.

This chapter covers the following skills:

- Selecting appropriate units to specify a quantity
- Using common prefixes and notation, and converting between units
  1 cm = 10 mm
  1 m = 100 cm = 1000 mm
  1 km = 1000 m = 100 000 cm
- Using measuring instruments accurately
- Devising ways to accurately measure objects too big or too small to measure individually
- Reading a variety of scales accurately
- Calculating perimeters of shapes
  Perimeter: total distance around the outside of shape

Specific Learning Outcome (SLO)

Learners should be able to:

7.4.1.1	Identify common metric units that are used to measure lengths and distances: [*millimetre (mm), centimetre (cm), metre (m), kilometre (km)*].
7.4.2.1	Identify appropriate metric units that would go along with given lengths, e.g. centimetres are best for small lengths, kilometres best for long distances.
7.4.3.1	Estimate the lengths and distances of given objects by comparing the measurements of given objects.
7.4.4.1	Estimate lengths and sizes of objects, even with distracting lines or designs around them.
7.4.5.1	Read scales on measuring instruments and use them to measure lengths of lines, objects accurately.
7.4.6.1	Use rulers to accurately measure lengths, objects, distances and lines.
7.4.7.1	Change metric units of lengths from one to another.
7.4.8.1	Use conversion factors to change one metric unit to another: *1 cm = 10 mm, 1m = 100 cm,1 km = 1000 m*.
7.4.9.1	Add and subtract lengths and distances using appropriate metric units.
7.4.10.1	Define perimeter.
7.4.10.2	Identify the perimeter of given shapes and objects.
7.4.11.1	Calculate the perimeter of shapes and objects with straight sides.
7.4.12.1	Identify some of the methods that were used in the past civilization for measurements.
7.4.13.1	Choose appropriate units that can be used to measure lengths. and objects in the past.

Units used to measure lengths

The standard unit that we use when stating the length of a small object in the metric system is the metre. Small objects are measured using parts of a metre:

■ centimetres (cm; there are 100 in a metre)　■ millimetres (mm; there are 1000 in a metre)

Large objects are measured in metres and long distances are measured in kilometres.

Exercise 4A

1 What unit would be the best to use when measuring the following? (Choose from 1 km = 1000 m; 1 m = 100 cm and 1 cm = 10 mm.)

  a The height of the school assembly hall.

  b The height of your maths teacher.

  c The height of the Anthony Saru building at Point Cruz.

  d The length of a standard soccer field.

  e The height of the longest building in your school.

  f The length of your maths classroom.

  g The distance between Honiara and Wellington, New Zealand.

  h The width of your desk.

  i The thickness of your exercise book.

  j The depth of a swimming pool.

2 List five things that would be best measured by using the following units:

  a kilometres   **b** metres   **c** centimetres   **d** millimetres

3 List five things that you would find in your classroom that are longer than 5 centimetres but shorter than 10 centimetres.

4 List five things you would find in the kitchen that are longer than 30 centimetres.

When we put our mind to it it's amazing what things we are able to estimate. Often we can use things of known measure to compare to other unknown objects.

Example

Estimate the height of DJ Matangi, the smallest boy standing in front of the photo, given that Takika the tallest boy, at the back of the photo, is 95 centimetres (cm) tall.

Solution

DJ appears to be approximately 60%, or 0·6 times, the height of Takika. Therefore, to find the height of DJ calculate 0·6 of $0.95 = 0.57$ or $0.6 \times 0.95 = 0.57$

DJ is approximately 0.57 metres tall.

Exercise 4B

l Use a suitable strategy to estimate the following, explaining your method for each question. You might like to work in groups to complete this exercise—other people's opinions are important.

a Estimate the height of the bridge if the height of the truck is 2 metres.

b Estimate the height of the building if the height of a post is 2.5 metres.

c Estimate the height of Freda if Jemila (with the pink bag) is 1.2 metres tall.
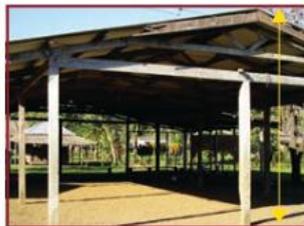
d Estimate the height of the roof if the height of the posts are 4.8 metres from the ground.

e Estimate the height of the incomplete house if the height of the man is 1.7 metres.

f Estimate the height of the vehicle if the height of the female police officer is 1.5 metres.

2 Estimate the following lengths, explaining your method for each question:

a Estimate the height of the youngest girl standing if the height of the father is 1.5 metres.

b Estimate the height of the electricity pole, given that the gate is 2 metres high.

c Estimate the height of the bus if the height of the man who refills it is 1.6 metres.

d Estimate the height of the man who is under the tap if the top of the tap is 1.8 metres off the ground.

e Estimate the width of the middle window if the width of the house is 8 metres.

f Estimate how high the top of the tank is from the ground if the top of the roof from the ground is about 4.5 metres.

Shapes and lines can be made to look larger or smaller by drawing other distracting lines or designs around them. For each of the following decide which shape you think is the larger and then measure both to check your guess.

Exercise 4C

1 Compare the two shapes. Are they circular? Are their diameters the same length?
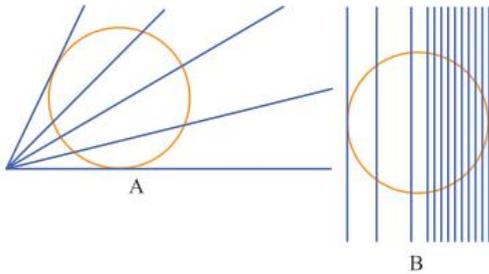
2 Compare the two lines by measuring their lengths.
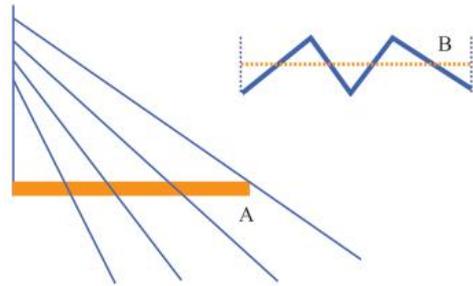
3 Compare the two shapes by measuring the length of each edge.
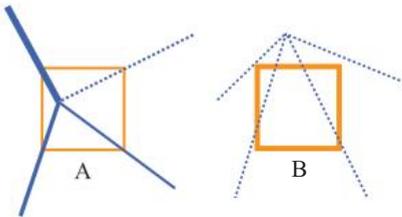
4 Compare the two rectangles by measuring the length and width of each.

5 Compare the cylinders by measuring their heights and diameters.
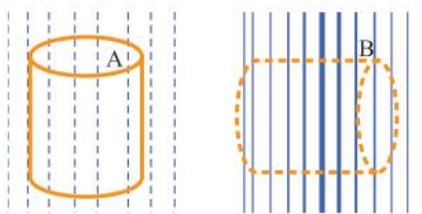
6 Compare the sizes of the triangles by measuring the height and the base length of each one.
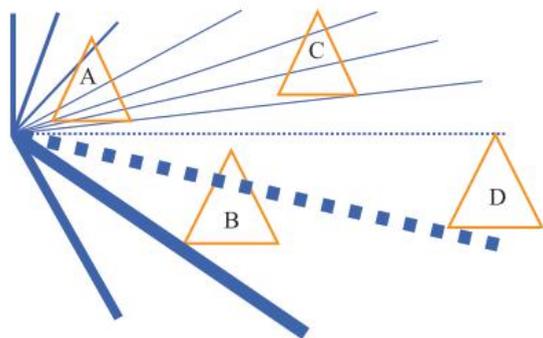
7 Which is the largest bird? Compare the sizes of the birds by measuring each one's height. Check by measuring the birds.

a

b

c
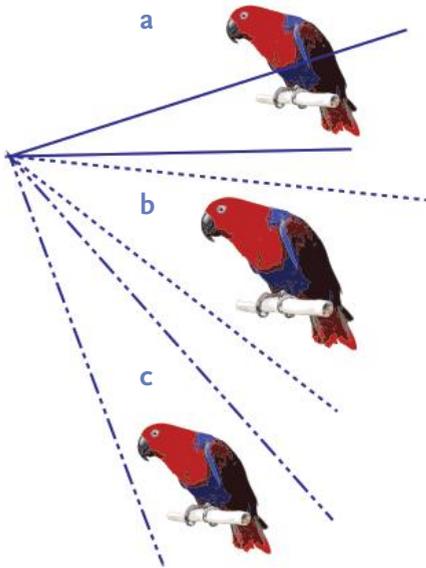
8 Which is the smallest shell? Compare the sizes of the shells by measuring the width and length of each one. Check by measuring.

a

b

c

d
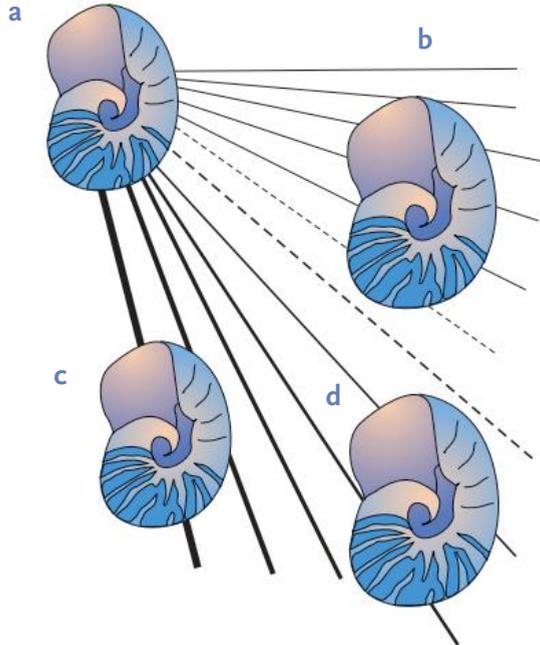
9 Estimate the lengths of the following lines by using the scale given below, then measure them to check your answer. List the lines in order of easiest to most difficult to estimate. Explain the order.

A

B

C

D

E

F

G

0 CM 1 2 3 4 5 6 7 8
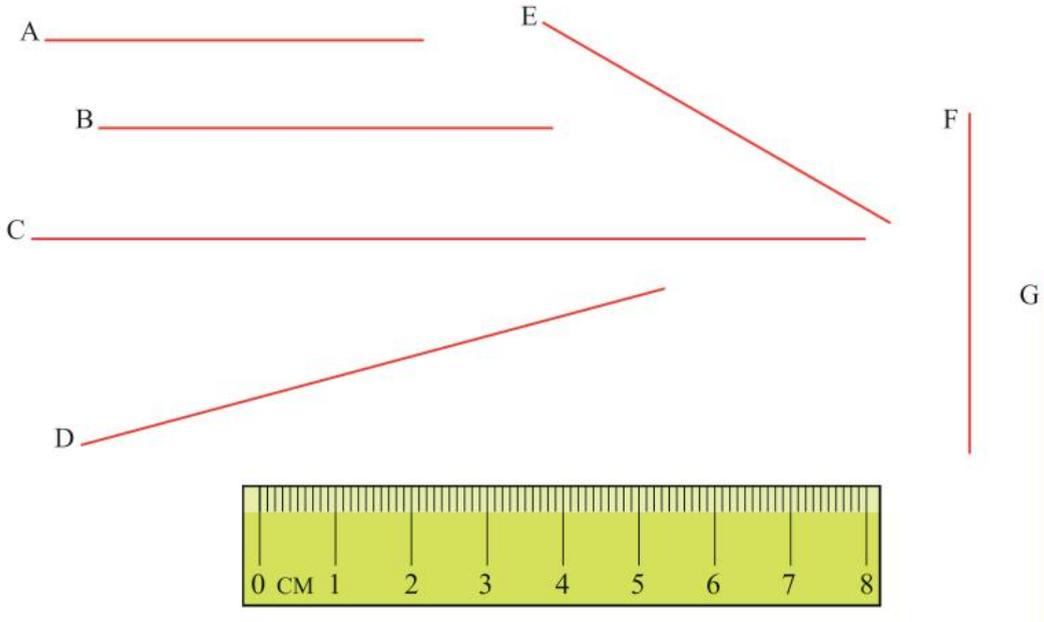
Instruments that we use to measure have scales marked on them, which are read to determine the measurement. When reading a scale, count the spaces between the whole numbers to work out how much each mark represents.

Example

Find the length of each pencil to the nearest millimetre using the ruler.
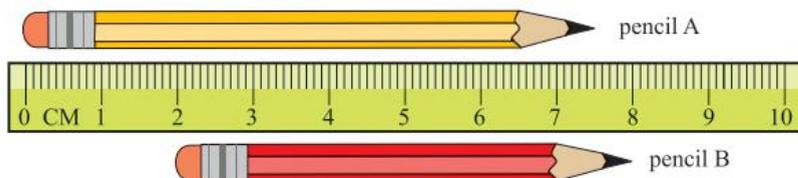
Solution

Use the information on the ruler to work out the scale:

■ The whole numbers are 1 centimetre apart.

■ There are 10 spaces between each centimetre, therefore each small space represents $\frac{1}{10}$ of a centimetre, which is 1 millimetre.

Pencil A
The zero of the ruler matches the start of the pencil, so read the scale where the pencil ends.

Pencil A is 75 mm long.
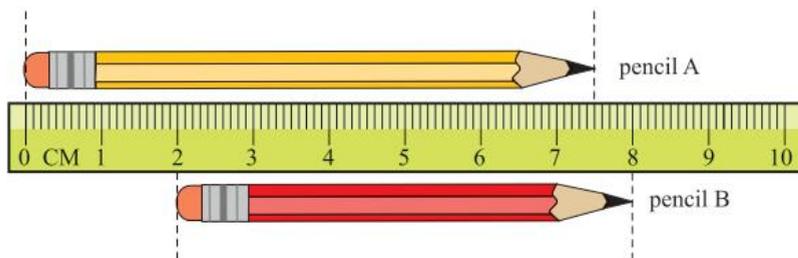
Pencil B
The start of the pencil is on the 2 cm or 20 mm mark. The end of the pencil is on the 80 mm mark, so the length is 80 mm less the 20 mm on the scale.

Pencil B = 80 − 20 = 60 mm long.

Exercise 4D

1 Measure the lengths of the lines below to the nearest millimetre using the rulers:

a

b

c

d

e

f
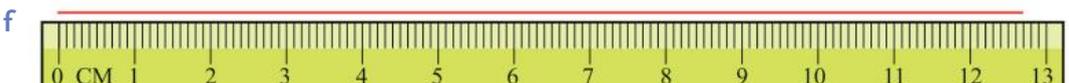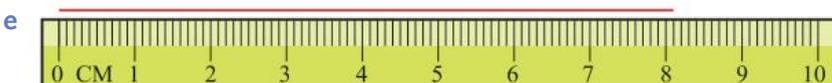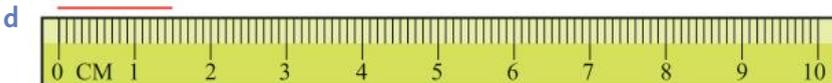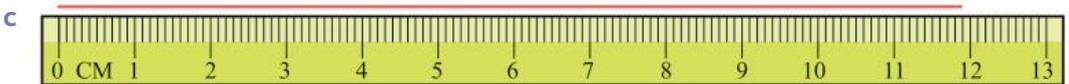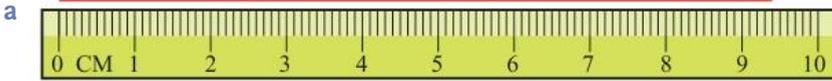
2 Use the scale below to find the length of each line:

a

b

c

d

e
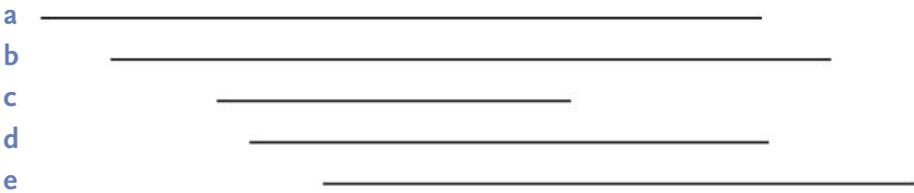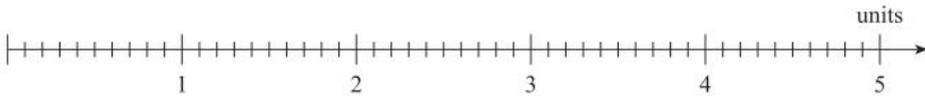
3 In a shed, Baeoro found an old ruler that looks different from the one he uses at school. He counted 16 spaces between the whole numbers, so each small space stands for a sixteenth of an inch. On this ruler the position of point F is 4 inches and 9 small spaces; that is, length $= 4\frac{9}{16}$ inches.

Using fractions, identify the positions of the letters shown below:
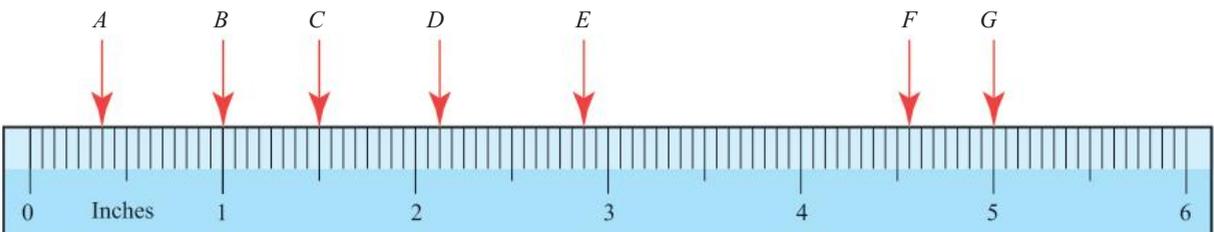
Lengths need to be measured accurately when materials are to be cut to a precise length. Dressmakers and plumbers, for example, need to measure carefully and accurately before cutting the materials with which they are working. If the pieces are cut too short, then that piece may be not be able to be used to complete the job.

When you measure an object make sure that the zero of the ruler is placed at the beginning of the object. Trace an imaginary line across from the end of the object to the scale of the ruler. Work out the scale and so determine the length of the object. Curved lines can be measured by placing a piece of string over the line and then stretching the string tightly against a ruler.

Example

Measure the height of this light globe by using the centimetre ruler provided.
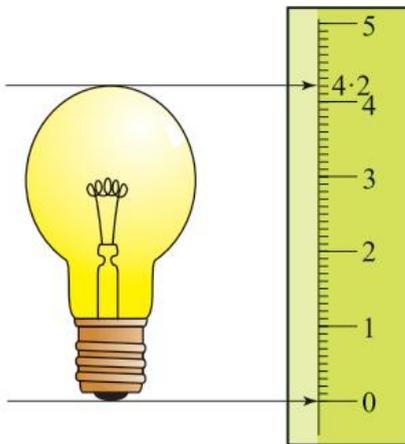
Solution

Place the ruler in the same direction as the height of the light globe. Make sure that the bottom of the globe is on the same level as the zero of the ruler.

The height of globe is 4·2 cm.

Exercise 4E

1 Use a ruler to measure the indicated lengths to the nearest millimetre.

a

b

c

d

e

f
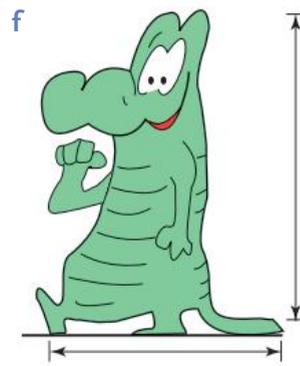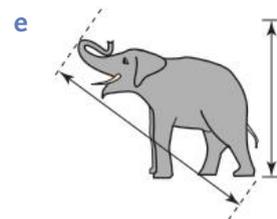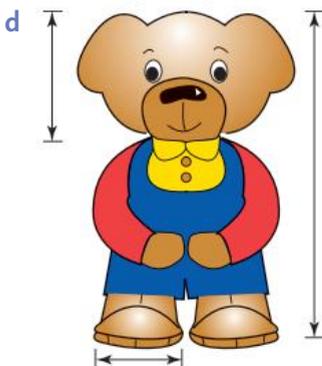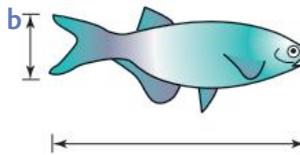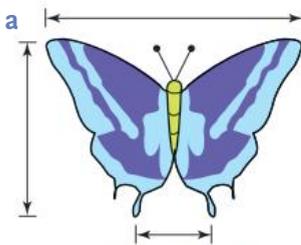
2 Measure the outside of these silhouettes as accurately as possible. A piece of string may help to measure the curved parts.

a

b

c

d
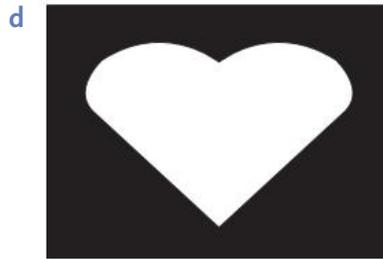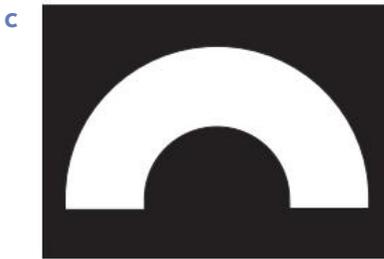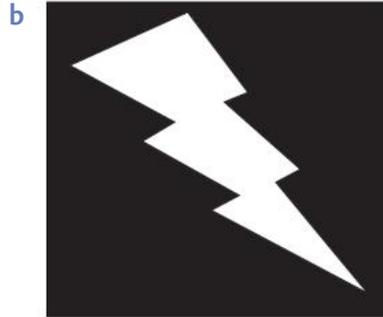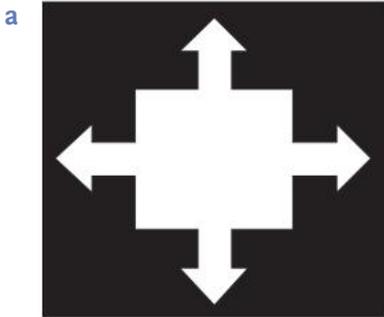
3 Measure these lengths of wire as accurately as possible.

a

b
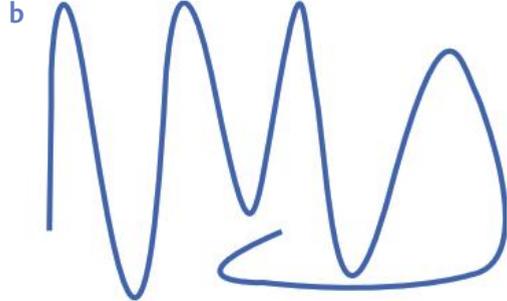
4 Measure each mobile carefully to the nearest millimetre to find the length of wire that is needed to make it. If the special wire costs $12 per centimetre, how much will the wire cost for each mobile?

a

b
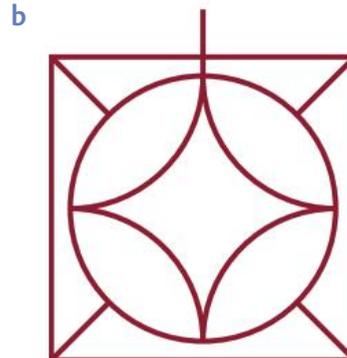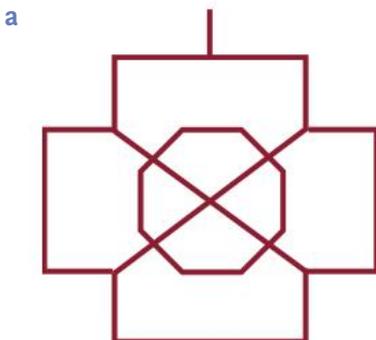
The standard length is that of the metre, and the smaller and larger length units are related to it via a series of conversion factors.

Milli means 'a thousandth', so a millimetre (mm) is a thousandth of a metre (m) and there are 1000 millimetres in 1 metre.

> 1000 mm = 1 metre

Centi means 'a hundredth' and so a centimetre (cm) is a hundredth of a metre (m) and there are 100 centimetres in 1 metre.

> 100 cm = 1 metre

Kilo means 'thousands of' and so a kilometre (km) is a thousand metres (m) and there are 1000 metres in 1 kilometre.

> 1000 m = 1 km

The units can be thought of as being connected by either multiplication or division using multiples of 10. You can use the metric ladder as a visual guide.

- When climbing down the ladder, multiply by the factor.
- When climbing up the ladder, divide by the factor.

÷ 1000   kilometre (km)   × 1000
÷ 100   metre (m)   × 100
÷ 10   centimetre (cm)   × 10
millimetre (mm)
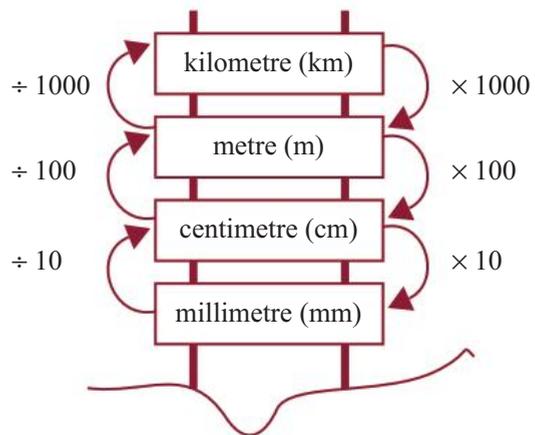
Example	Solution
1 Find the factor that can be applied to convert:	
a metres to centimetres	Multiply by 100 to convert metres to centimetres.
b millimetres to centimetres	Divide by 10 to convert millimetres to centimetres.
2 Use a conversion factor to express:	
a 200 m in kilometres	$200 \text{ m} \div 1000 = 0 \cdot 2 \text{ km}$
b 30 cm in millimetres	$30 \text{ cm} \times 10 = 300 \text{ mm}$

4F

Exercise 4F

1 Show the factor that would have to be applied to convert the following quantities:

a metres to centimetres
b millimetres to centimetres
c metres to kilometres
d millimetres to metres
e centimetres to metres
f kilometres to metres
g kilometres to centimetres
h centimetres to millimetres

2 Fill in the spaces:

a $3{\cdot}9$ km = _____ m = _____ cm
b _____ km = $0{\cdot}3$ m = _____ mm
c _____ m = 14 cm = _____ mm
d _____ m = _____ cm = 570 mm

3 Convert the following to the units indicated:

a 120 cm = _____ m
b 1500 m = _____ km
c $0{\cdot}2$ m = _____ cm
d 120 m = _____ km
e 470 cm = _____ mm
f $0{\cdot}02$ m = _____ mm
g 120 mm = _____ cm
h 800 m = _____ km
i 20 mm = _____ cm
j $3\frac{1}{2}$ m = _____ cm
k $4\frac{1}{2}$ km = _____ m
l $2\frac{2}{5}$ cm = _____ mm

4 Express the total length of the path in metres.
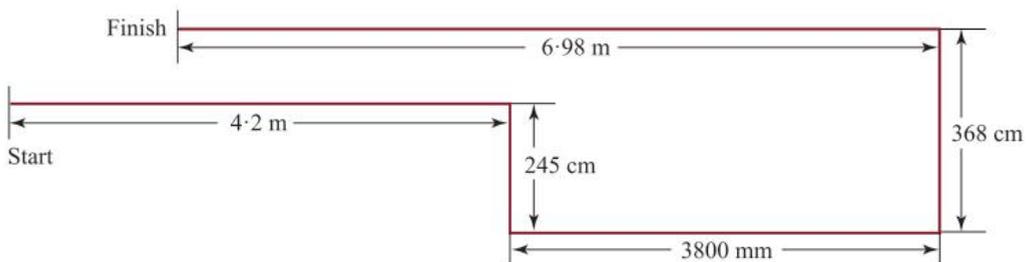
5 Kelesi lives $1{\cdot}08$ km from the local church at Takwa in Malaita. If he goes to church to pray and then back to his house twice every day during his 2-week holiday break, find the distance that he will have walked to and from the church over the holiday period. Express your answer in both metres and kilometres.

6 The diameter of a 20-cent coin is about 30 millimetres. If forty-two 20-cent coins were placed in a straight line, how long would the line be? Express your answer in both centimetres and metres.

7 The thickness of a 50-cent coin is 2 millimetres. Find the height in metres of a vertical stack of 50-cent coins worth:

a $100
b $212
c $583{\cdot}50

Adding and subtracting lengths 4G

When we measure lengths in different units, we need to convert them to the same unit before we can combine or compare them. Usually the smaller unit is chosen to avoid the use of decimals.

Example

Find the answer to each of the following:

a 5 km + 2300 m

b 5·8 cm − 26 mm

Solution

Convert units to metres.

5 km + 2300 m
= 5000 + 2300 $5 km \times 1000 = 5000 m$
= 7300 m

The answer is 7300 m or 7·3 km.

Convert units to millimetres.

5·8 cm − 26 mm
= 58 − 26 $5\cdot8 cm = 58 mm$
= 32 mm

The answer is 32 mm or 3·2 cm.

Exercise 4G

1 Find the sums or differences of the following lengths:

  a 56 mm + 25 mm   **b** 26 m + 5 m   **c** 32 mm + 48 mm

  d 598 km + 12 km   **e** 365 mm − 25 mm   **f** 29 cm − 14 cm

  g 125 m − 12 m   **h** 12 mm − 9 mm   **i** 32 m + 25 m + 236 m

  j 2 mm + 3 mm + 23 mm   **k** 14 km + 2 km + 56 km   **l** 69 cm + 23 cm + 95 cm

2 Find the sums of the lengths, expressing your answers in the smaller unit:

  a 7·9 m + 68 cm   **b** 7·9 km + 390 m   **c** 58 cm + 3·4 m

  d 59 mm + 4·2 cm   **e** 54 cm + 130 mm   **f** 73 mm + 2·9 cm

  g 436 m + 0·3 km   **h** 93 mm + 5·3 cm   **i** 56 km + 789 m

  j 23 m + 980 cm   **k** 45 cm + 251 mm   **l** 569 cm + 5·63 m + 231 cm

3 Find the sums or differences of the lengths, expressing your answers in the larger unit:

  a 7·09 km + 34 m   **b** 57 cm + 4·3 m   **c** 87 mm + 8·3 cm

  d 86 m + 5·9 km   **e** 78 m − 270 cm   **f** 7·3 cm − 59 mm

  g 736 m − 0·234 km   **h** 93 m − 783 cm   **i** 600 m + 2·6 km

  j 256 mm + 56·1 cm   **k** 78·9 km + 9800 m   **l** 5·6 m − 450 cm

4 The following shot-put scores were recorded for three schools at the Inter-Secondary School Carnival that was held at the King George Sixth National Secondary School sports ground. The throws from those athletes were recorded.

Tenaru NSS: 3.2 m, 210 cm, 380 cm, 4.5 m
King George Sixth NSS: 3850 mm, 3·9 m, 450 cm, 630 mm
Selwyn NSS: 520 cm, 4·75 m, 6980 mm, 0·005 km

  a For each group, what were the longest and shortest throws, in metres?

  b Find the difference between the length of the shortest and the longest throw in each group.

5 Sam kicked a football 23·2 m with his first kick and then 1989 cm with the next. Which kick travelled further, and by how much did it beat the other attempt?

6 Bill found a worm that was 123 mm long. Harrison's worm was 9 cm long. Who found the longer worm and how much longer was it than the other one?

7 Shan lives 2·5 km from school. Jin lives 560 m from Shan's house. If the girls meet at Shan's house before walking to school, what distance does each girl walk?

8 Wally was playing golf. His first shot from the tee travelled 45 m. His subsequent shots travelled 3220 cm, 56·2 m and finally 30 cm. The straight-line distance from the tee to the hole was 97 metres.

   a Find the total distance of his shots.

   b How much further did he play than the golfer who scored a hole-in-one?

9 Arrange the following lengths from shortest to longest:

   a 3 cm, 27·3 mm, 0·045 m

   b 43 mm, 153 mm, 8 cm, 0·0045 km

   c 6·8 km, 7932 m, 1450 mm

   d 3 m, 180 cm, 0·0045 km

   e 0·0058 km, 3·5 mm, 0·12 cm, 0·009 m

   f 15 mm, 0·2 cm, 0·006 km, 0·04 m

10 Bricks that measure 20 cm long by 15 cm deep by 10 cm high are stacked so that there are no gaps between them.

   a Find the length, depth and height, in metres, if the blocks are stacked in the following ways:

     i

     ii
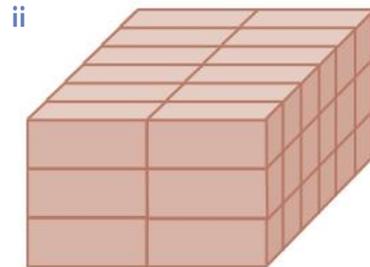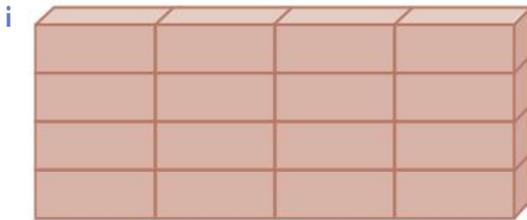
   b Ali, the landscape gardener, has a design that he recommends to people who want to have a border along their garden beds. It is a simple line of the bricks described above, two bricks tall as shown below.

     Ali has estimated the number of bricks he needs for a number of jobs. Find the length of the borders for each of the jobs detailed below:

     ■ job at Betikama girls' dormitory: 5000 bricks

     ■ job at Don Bosco School: 2100 bricks

     ■ job at Tasahehoysins estate: 41 500 bricks

     ■ job at PNG High Commission at Town Ground: 65 250 bricks

Perimeter of shapes with straight sides 4H

The **perimeter** of a shape is the distance around the outside of the shape.

If the lengths are measured in a mixture of units such as centimetres and metres, convert all units to the same unit before adding the lengths.

The perimeter of the Island of Choiseul is its coastline, which has been estimated to be about 517 kilometres.
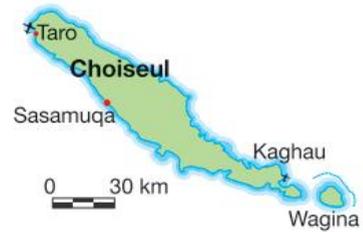
Example

Find the perimeters of the following shapes:

a

b

c
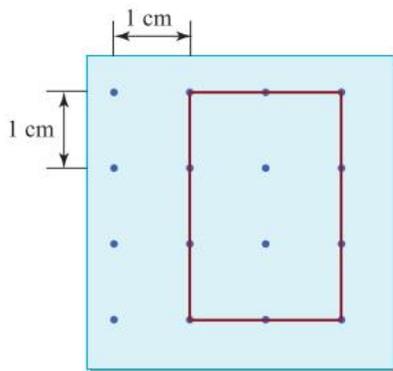
Solution

The length of the rectangle is 3 cm and the width is 2 cm.

Perimeter $= 2 + 3 + 2 + 3$
$\qquad\quad = 10$ cm

The perimeter of the rectangle is 10 cm.
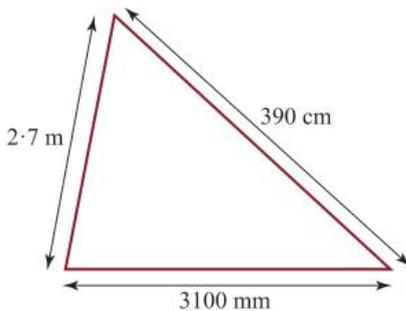
Convert the units to metres.

390 cm $\div$ 100 $= 3 \cdot 9$ m

3100 mm $\div$ 1000 $= 3 \cdot 1$ m

Perimeter $= 2 \cdot 7 + 3 \cdot 9 + 3 \cdot 1$
$\qquad\quad = 9 \cdot 7$ m
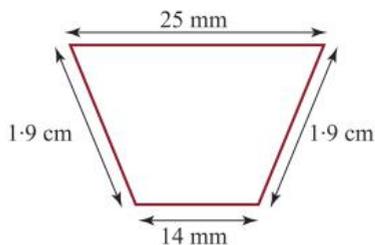
Change the units to millimetres.

$1 \cdot 9$ cm $\times$ 10 $= 19$ mm

Perimeter
$= 19$ mm $+ 14$ mm $+ 19$ mm $+ 25$ mm
$= 77$ mm or $7 \cdot 7$ cm

4H

Exercise 4H

1 Find the perimeter of the following shapes shown on the centimetre-dot paper:
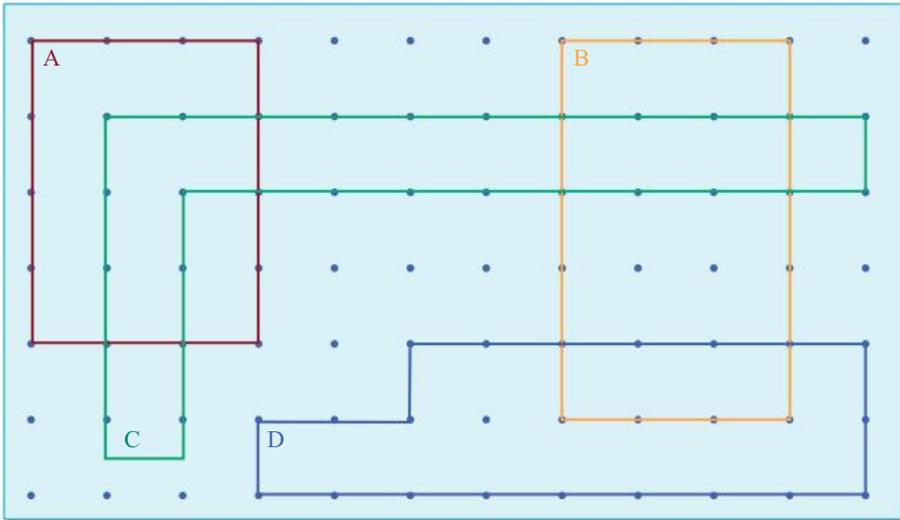
2 Find the perimeter of these shapes made up of squares of different sizes:
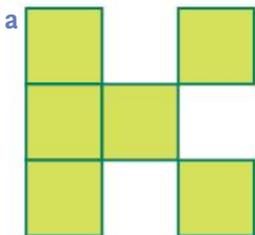
a square size = 10 cm
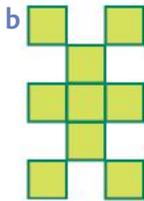
b square size = 2·5 cm
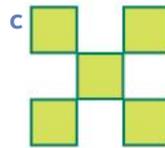
c square size = 4·2 cm
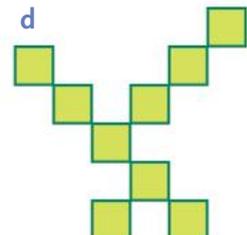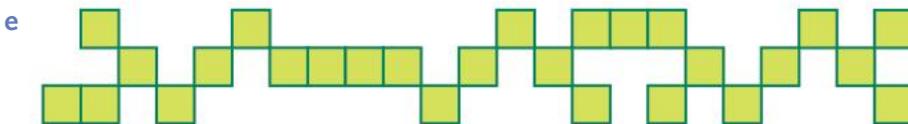
d square size = 0·5 cm

e square size = 0·25 cm

3 Find the perimeter of each of the following shapes. Describe a shortcut method that could be used to find their perimeter. Regular means that all the sides are the same length.
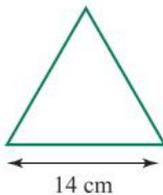
a equilateral triangle **b** regular hexagon **c** regular pentagon **d** rectangle
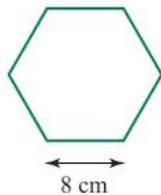
14 cm   8 cm   17 cm   11 cm   16 cm
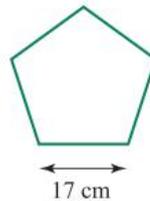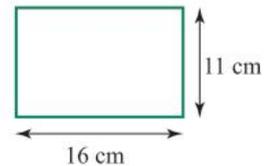
4 Find the perimeter of each of these shapes, expressing your answer in the units used:

a

9 m
14 m
11 m
21 m
21 m

b

35 cm
12 cm
26 cm
28 cm
22 cm
15 cm
31 cm
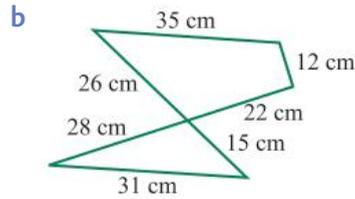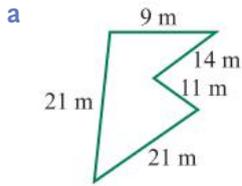
5 Find the perimeter of these shapes. All the angles are right angles. Express your answer in centimetres:

a

10 cm
14 cm

b

30 mm
35 mm
15 cm
9 cm
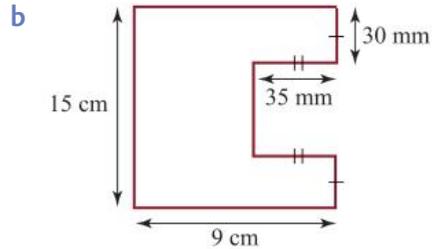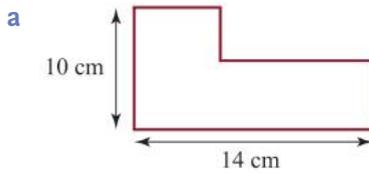
6 Mr Maebiru has to replace the bamboo sticks that he puts around each of his six rectangular garden beds. He measured the garden beds and drew them on a piece of paper. Find the total length of bamboo sticks that he needs to cut from the bush, in centimetres and metres:

Bed 1

840 cm
950 cm

Bed 2

950 cm
1·2 m

Bed 3

0·6 m
1950 cm

Bed 4

11 m
950 cm

Bed 5

750 cm
32 m

Bed 6

380 cm
4·2 m
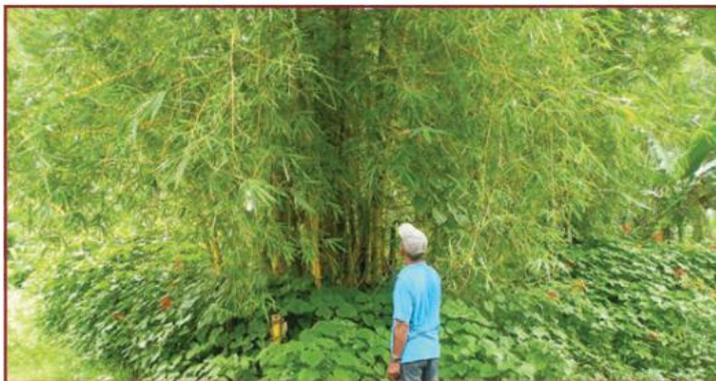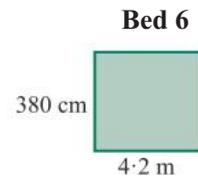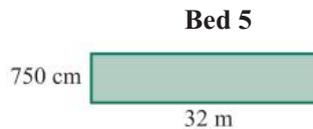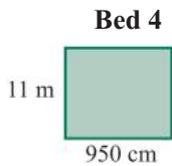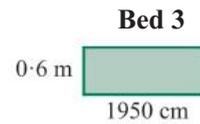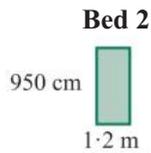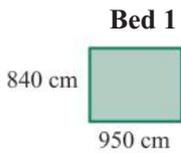
7 Sketch the following, then find the perimeter expressed in centimetres:

   a equilateral triangle with side length 10·03 cm

   b regular pentagon with side length 2·06 m

   c regular hexagon with side length 0·9 km

   d regular nonagon (9 equal sides) with side length 154 mm

   e rectangle of length 124·06 m and width 0·06 km

8 Find the perimeters of these shapes. Express your answer in each of the units used:

   a

2·2 m
1·8 m
135 cm
150 cm

   b

32 mm
2·7 cm
6·3 cm
1·9 cm

   c

1500 cm
64 m
4800 cm
32 m

   d

6900 mm
3·8 m
450 cm
6·3 m
780 cm
520 cm

   e

280 cm
4·9 m
3·9 m
2·5 m
3·7 m
490 cm
3800 mm
980 cm
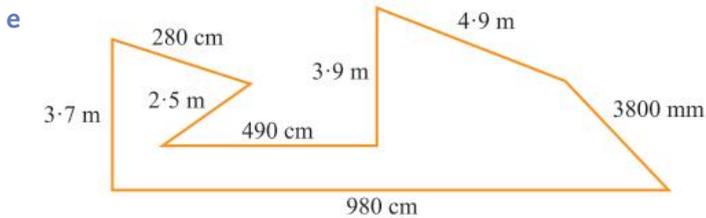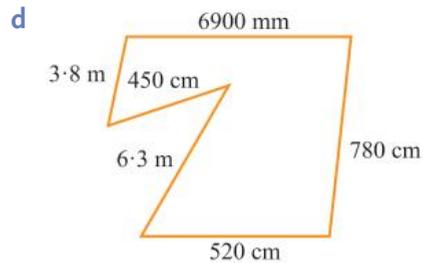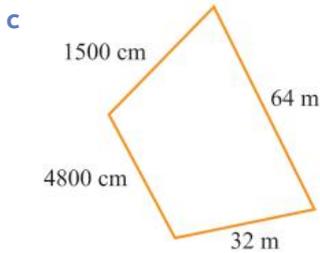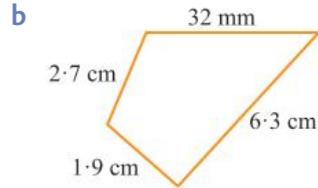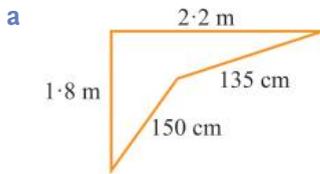
9 Using 2 lengths of bamboo stick (1 m long and 10 cm long) and 2 pieces of string (1 m long and 10 cm long), work in pairs to measure the following distances and perimeters to the nearest centimetre. Record your results in your books next to a description of the object you chose and its location. Compare your results with other students who measured the same objects.

   a Width of a classroom doorway

   b Length of a classroom window

   c Height of a teacher's desk

   d Perimeter of a learner's desk

   e Perimeter of the classroom block

   f Perimeter of a small tree in the school compound

   g Length, width and perimeter of the largest leaf you can find in the school compound

Exploring measurement in the past 4I

The first measurement systems were based on body measurements. This proved difficult at times due to the differences between individuals. The Egyptian royal cubit was the first widely used standard unit in the ancient world. It was developed in about 3000 BC and was based on the length of the forearm from the elbow to the outstretched fingertips. At regular intervals, all cubit sticks were checked against the royal master cubit made of black granite, to ensure uniformity. The cubit was divided into 28 digits; each digit is equal to the width of a middle finger. Each digit was divided into parts to allow for very accurate fractional measurements.

A royal cubit was approximately 524 mm long and subdivided into smaller units.

Royal cubit		524 mm
Digit	28 digits in a cubit	Approx. 19 mm
Palm	4 digits in a palm	Approx. 76 mm
Hand	5 digits in a hand	Approx. 95 mm
Small cubit	24 digits or 6 palms in a small cubit	Approx. 456 mm

The Great Pyramid of Giza was built by thousands of people who measured with cubit sticks. The sticks were very accurate because the sides of the pyramids vary by less than 10 cm over a height of approximately 230 metres.

Learning task 4I

1 a Measure the distance from your elbow to outstretched fingers.

  b Compare the length of your cubit with that of the royal cubit.

  c A digit is the width of your middle finger. Compare your digit with that used in ancient Egypt. Explain any possible differences.

2 Choose an appropriate ancient Egyptian unit to measure each of the following lengths:

  a the length of the classroom

  b the height of a friend

  c the length of your pen

  d the width of your desk

  e the thickness of your mathematics text book

Puzzles

1 Convert the units of length to find the answer to the riddle:

What does Genesis in the Bible teach us?

A 30 cm = _____ mm   **C** 150 cm = _____ m   **D** 24 cm = _____ mm

E 100 mm = _____ cm   **F** 1·5 km = _____ m   **H** 3600 m = _____ km

I 240 mm = _____ m   **L** 3·6 mm = _____ cm   **N** 1·5 cm = _____ m

O 0·1 mm = _____ cm   **R** 240 cm = _____ m   **S** 3·6 cm = _____ m

T 0·1 km = _____ m   **U** 0·36 km = _____ m   **Y** 1500 cm = _____ m

___	___	___		___	___	___	___		___	___	___	___	___
100	3·6	10		0·36	0·24	1500	10		0·036	100	0·01	2·4	15

___	___		___	___	___	___	___	___	___
0·01	1500		1·5	2·4	10	300	100	0·24	0·01	0·015

2 Find the perimeter of the shapes below to solve the riddle:

What happened to Raymond when he met the man-eating monster?

A 4, 5

B 8

C 3, 5, 4

E 18, 10

F 6, 5, 8

H 8, 5

M 3, 4, 9

N 3, 5

R 4, 3, 7, 10

X 5

Y 15, 5, 10, 10

Z 5, 7, 10

___	___		___	___	___	___	___	___
26	38		24	38	12	13	20	38

___	___		___	___	___	___
13	16		50	34	13	45
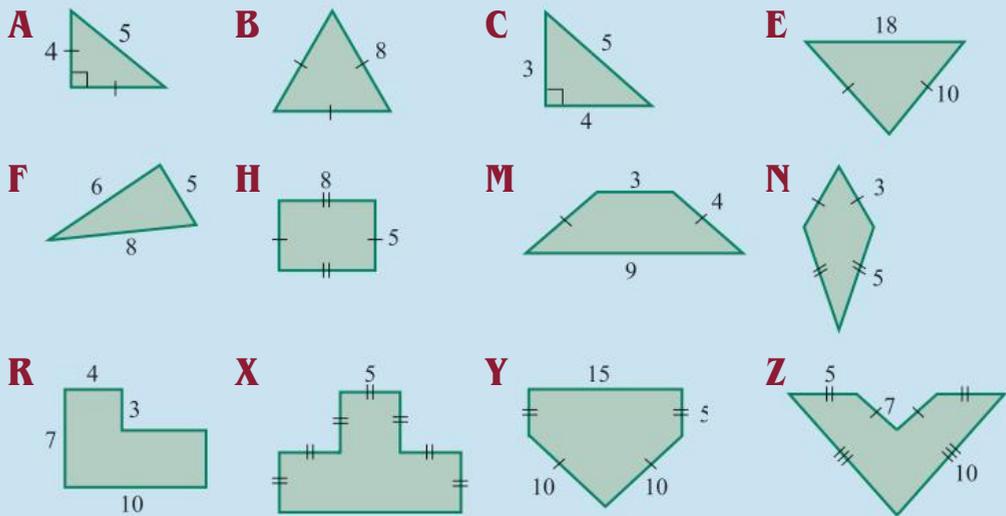
3 Calculate the perimeter of the shapes below. Match the letters to the correct value below to find the answer to the riddle:

How much do pirates pay for their earrings?
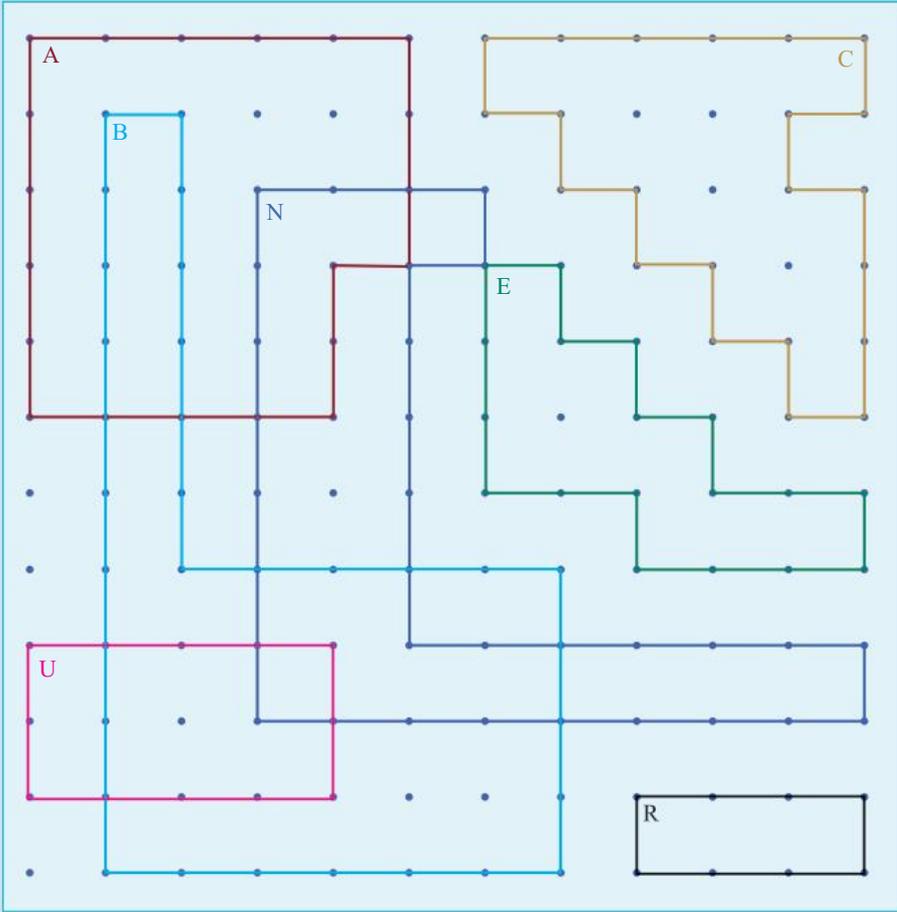
| ___ | | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| 20 cm | | 32 cm | 12 cm | 22 cm | 22 cm | 20 cm | 32 cm | 18 cm | 18 cm | 8 cm |

Applications

Coins

Measure the diameter of the following coins correct to the nearest millimetre:

a   20-cent coin   b   10-cent coin   c   5-cent coin

Use your measurements to find the distances to the nearest millimetre, centimetre, metre and kilometre that one million of each of the coins would reach if placed in straight lines.

Pace lengths

Go out onto the oval and design an experiment to find:

■ the length of your walking pace over 100 metres

■ the length of your running pace over 100 metres.

Determine the pace lengths for each member of your class and find the average (or mean) pace length for the class for walking and running.

Presents

You have been given the job of wrapping a birthday present which is a book that is 20 cm long, 15 cm wide and 2 cm thick. Unfortunately you don't have much wrapping paper. Experiment with paper rectangles of different sizes to find the rectangle with smallest perimeter that will allow you to wrap the present. Submit the most successful attempt as well as your other attempts to your teacher.

Brick walls

Find a brick wall and count the number of bricks contained in a square metre of wall, including mortar joints.

Use this information to find the number of bricks required to build a brick wall such as a wall of your house, your school or some other building. Remember to allow for any windows in that wall. Submit a photograph of the wall along with your calculations.

Clinometer

In pairs, determine the height of tall objects around your school by using a tape measure and a clinometer. Possible objects are the flagpole, basketball or netball post, buildings, trees etc.

1 Choose one object and mark out a suitable distance (e.g. 5 or 10 metres) from the base of the object on level ground.

2 From that point, measure the angle from your eye to the top of the object.

3 Record the size of the angle and the distance.

4 Measure your height.

5 Using a suitable scale, draw a scale diagram to help you determine the height of each object.

Are you a rectangle or a square?

Work in a group and, with a tape measure, measure the armspan and the height of each person as accurately as possible.

A person is a square if their armspan is the same as their height. Your group can decide what difference in these measurements is allowed (5 millimetres is reasonable).

A person is a rectangle if their armspan and height are not the same. They are a tall rectangle if their height is greater than their armspan or a short rectangle if their armspan is greater than their height.

Record the results for your group, then combine them for your class. Draw a chart of the results. Are the rectangular people tall or short rectangles?
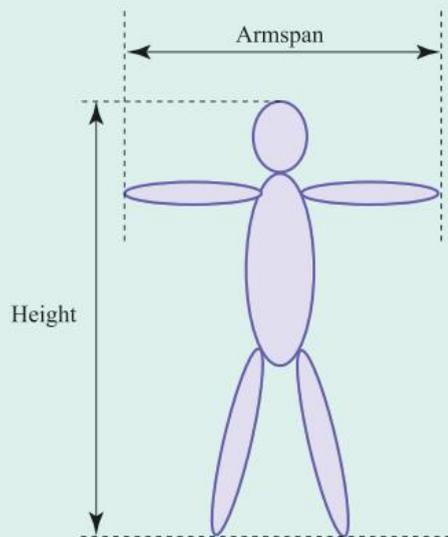
1 A piece of plastic water pipe needs to be cut and then glued between two flexible end pieces already in place. The pipe needs to overlap 15 mm inside the larger end pieces and then be glued into position.

Pipe A

Pipe B

Pipe C
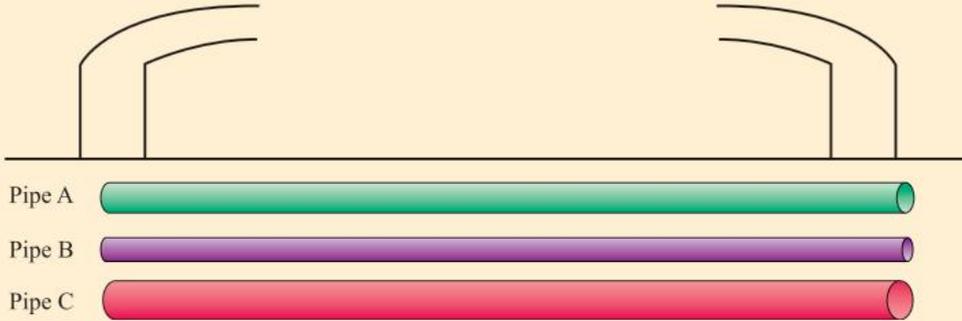
a Measure the diameter of pipes A, B and C and determine which pipe should be used for the job.

b What length of pipe needs to be cut to complete the job if the diagram above has a scale of 1:10?

2 Find the perimeter of these shapes in which all angles are right angles:

a

65 mm

100 mm

2 cm

b

70 cm

10 cm

70 cm
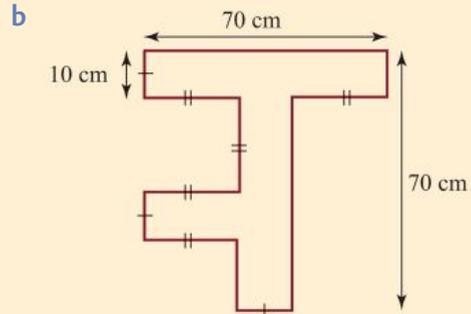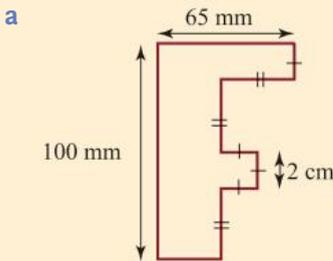
3 Regular hexagons and octagons with edge lengths of 15 centimetres are to be made out of wire and hung as mobiles. Twice as many hexagons as octagons are to be made for an order for 330 shapes. What weight of wire is required if the wire weighs 200 grams per metre?

4 These figures are made of lengths of wire soldered together. If they are made up of regular shapes with all sides equal, find:

  i the total length of wire needed

  ii the perimeter of each figure for each figure.

a

14 mm

b

12 mm
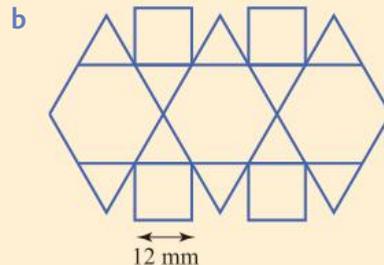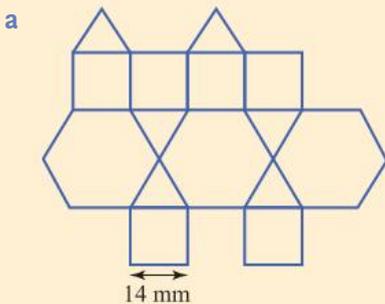
5 The local under 10s soccer club plans to decorate its soccer field by constructing a series of coloured rectangles on the pitch as shown in the diagram.
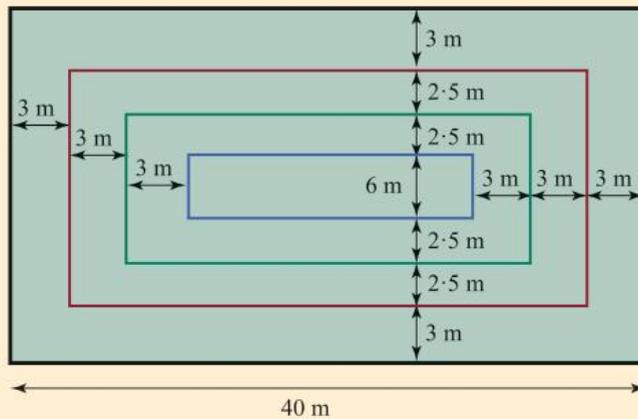
a Find the total length of each colour required for the job.

b If the tape costs 25 cents per metre how much will the tape cost to complete the job?

6 Linda wants to replace the border tiles that go around each of the five rectangular beds in her garden. She measured the garden beds and drew them on a piece of paper.
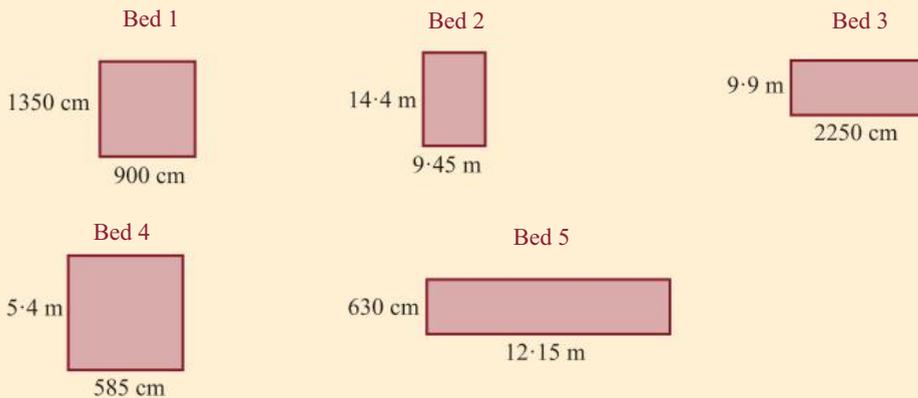
Find the number of tiles she needs to buy if each tile is 45 cm long.

7 A pen manufacturer claims that each of its pens can write for a total length of 10 kilometres. As part of a trial, straight vertical lines are drawn between darker horizontal lines that have been especially printed on pieces of paper. The dark lines are 1·5 centimetres apart and the pen lines need to be 4 millimetres apart. If the paper is 30 centimetres wide and 40 centimetres long how many sheets of paper will be needed for each pen?
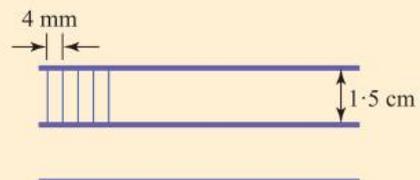
Exercise 4A

1 What length unit would be best to measure:

   a the height of an ant?   **b** the length of a football field?

   c the distance from Honiara to Tulagi?   **d** the height of your classroom?

Exercise 4B

2 Estimate the height of the ANZ Bank's male security guard if the height of the door is 2 metres.

Exercise 4C

3 Without using a ruler, draw straight lines with the following lengths:

   a 3 cm   **b** 4 cm

   c 10 cm   **d** 30 cm

Check the accuracy of the lengths and note how far out your estimates were. You may have estimated exactly!

Exercise 4D

4 Mark the following lengths on the ruler:

   a 2·5 cm   **b** $1\frac{1}{4}$ cm   **c** 4·2 cm

   d 4 cm   **e** 0·2 cm   **f** 2 cm
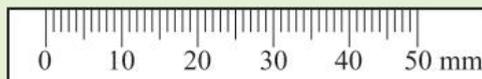
Exercise 4E

5 Use a ruler to measure the following lines to the nearest millimetre:

   a   **b**   **c**   **d**   **e**

   f   **g**
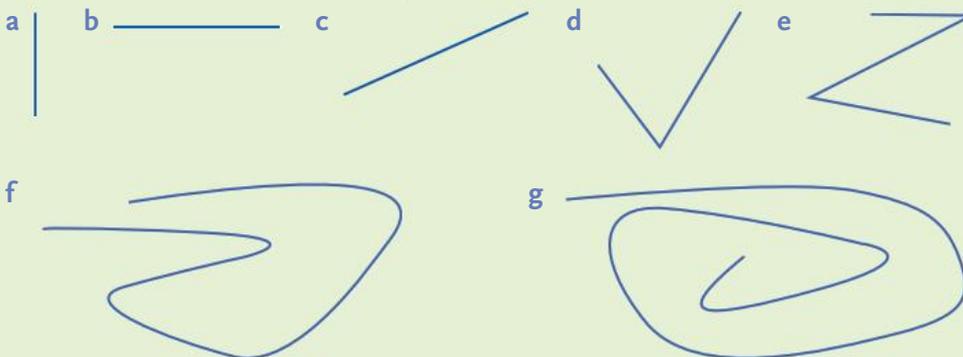
Exercise 4F

6 Complete these length conversions:

a $48·9\ cm =$ _____ mm b $32·88\ km =$ _____ m c $214\ mm =$ _____ cm

d $0·021\ km =$ _____ m e $8·56\ cm =$ _____ m f $514\ m =$ _____ km

g $4\frac{1}{2}\ cm =$ _____ mm h $1\frac{1}{4}\ km =$ _____ m i $\frac{1}{5}\ m =$ _____ cm

7 The cards shown below are placed in a line.
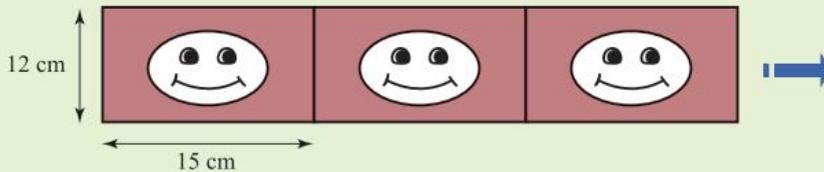
Find the length (in metres) of the cards when the following number of cards are used:

a 3 b 5 c 20 d 24 e 38

Exercise 4G

8 Find the sum or difference in lengths and express the answer in the smaller unit:

a $23\ mm + 1·8\ cm$ b $4500\ m − 2·4\ km$ c $1·2\ m + 56\ cm − 450\ mm$

9 The heights of some students are shown below:

Student	Height
John	1591 mm
Manuel	1·67 m
Lulu	1365 mm
Valda	142 cm

a How much shorter than 2 metres is each person?

b What is the sum of their heights expressed in each of the units used in the table?

10 Len's hobby is collecting silver chains. For Christmas he was given chains 12 cm, 230 mm, $30\frac{3}{4}$ cm and 512 mm long. The chains in his collection prior to this totalled 2 m. What is the length of his chain collection now? Express the answer in centimetres.

Exercise 4H

11 Find the perimeter of the following shapes:
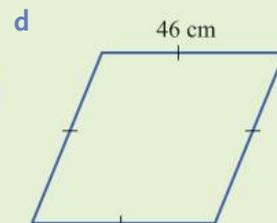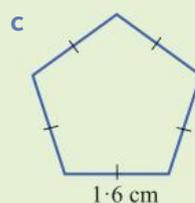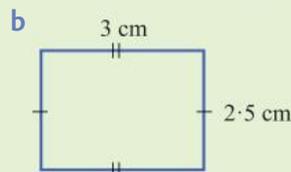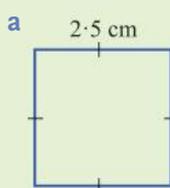
Statistics

Statistics

Data about the Solomon Islands community is collected in a census every 10 years by the government under the Census Department, Ministry of Inland Revenue. Qualitative and quantitative information is collected by the government to help them make rational decisions for the country and plan for future developments. Statistical investigations begin with *identifying a problem*, *planning how to find answers*, then *collecting the data*, *analysing it* and *drawing conclusions*.

This chapter covers the following skills:

- Recognising the different types of data
- Discrete numerical data is numerical data that involves distinct values
- Continuous numerical data is numerical data where every number on a scale has meaning
- Collecting and organising different types of data
- Designing a simple database to collect data
- Representing numerical data in histograms, dot plots and stemplots
- Finding the angle in a pie graph

$$\frac{\text{frequency of the category}}{\text{total frequency}} \times 360 = 60°$$

- Finding summary statistics
- The **mode** is the most frequently occurring value
- The **mean** $= \dfrac{\text{sum of the numerical values}}{\text{number of values}}$
- The **median** is the middle value when the results are written in order. If there is an even number of results, it is the average of the middle pair
- The **range** is a measure of the spread of the data. It is the difference between the highest and the lowest result
- Using means to compare two data sets
- Using Venn diagrams and two-way tables to display data
- Interpreting line graphs

Specific Learning Outcome (SLO)

Learners should be able to:

7.5.1.1	Define statistics.
7.5.1.2	Identify ways of collecting data: *questionnaires, polls and surveys*.
7.5.2.1	Identify two types of data that can be collected.
7.5.2.2	Define and differentiate between *discrete* and *continuous data*.
7.5.3.1	Tabulate collected data into frequency table.
7.5.3.2	Solve word problems.
7.5.4.1	Read and interpret data that are given in a table.
7.5.4.2	Construct tables to display collected data.
7.5.5.1	Define and differentiate column and bar graphs.
7.5.5.2	Construct column and bar graphs to represent the collected data.
7.5.6.1	Interpret given bar and column graphs to get extra information.
7.5.7.1	Interpret and get information from data summarised in line graphs.
7.5.8.1	Read and interpret data collected and represented by pie graphs.
7.5.9.1	Construct pie graphs by converting data collected into number of degrees.
7.5.10.1	Identify dot plot graphs.
7.5.10.2	Display given data as a dot plot and identify their frequencies.
7.5.11.1	Find the mode for a set of scores using dot plots.
7.5.11.2	Interpret and analyse dot plot graphs.
7.5.12.1	Define and identify mean.
7.5.12.2	Find the mean of set of scores.
7.5.12.3	Compare sets of scores using the mean from the set of scores.
7.5.13.1	Define median and range of the set of scores.
7.5.13.2	Find the median of a set of score.
7.5.14.1	Find the range of the set of scores.
7.5.15.1	Find median and range using stemplot.
7.5.16.1	Tabulate and display information (data) using stem-and-leaf format.
7.5.17.1	Identify different parts of the Venn Diagram.
7.5.17.2	Interpret and analyse data that are given in a Venn Diagram.
7.5.18.1	Identify elements that are shared and classified in both circles which appear in the intersection area of the Venn Diagram.
7.5.19.1	Read information from two-way tables and construct two-way tables display categorical data.

5A Collecting data

The study of statistics begins with the collecting of information or data. The Statistics Department of the Ministry of Inland Revenue in Solomon Islands regularly collects data about Solomon Islanders. Some of this data can also be obtained from other sources such as the Solomon Islands Tax Office. Every few years the Statistics Department carries out a national survey of every household to determine the total number of people in Solomon Islands. This is known as a **census**. Generally, however, information is collected by surveying a smaller group of people (a sample). For example, when a company wants to know if its products are well known, it may choose to do a survey, or a political party may survey a sample of people to see how popular it is.

Three common ways of surveying are:

- questionnaires in magazines
- phone polls
- street surveys.

There are different types of data.

Type of data	Example
Discrete numerical data: This is data that involves distinct values. These are often whole numbers, but not always. If collecting data involves counting then it will be discrete numerical data. When there is a large range of numbers, this data may need to be grouped into classes so that it can be analysed.	- The number of children in a family: 1, 2, 3, 4, 5 - Shoe size: $7, 7\frac{1}{2}, 8, 8\frac{1}{2}, 9, 9\frac{1}{2}, 10, 10\frac{1}{2}$ - Ages: 11–20, 21–30, 31–40, 41–50 It is important to ensure that a number is not included in more than one class.
Continuous numerical data: This is numerical data where every number on a scale has meaning. If collecting data involves measuring, then it is probably continuous numerical data. This type of data always needs to be grouped into classes so that it can be analysed.	Heights in cm: 150–<160, 160–<170, 170–<180, 180–<190 Times in a race (seconds): 25–<30, 30–<35, 35–<40 For continuous data the class goes right up to but does not include the number at the start of the next class, represented by <.

A good survey involves lots of people. A frequency table or tally is often used to display data collected in a survey. When you do a tally you record your results in groups of five because it is easy to count in fives.

Example

I The ages of audience members at a Youth Convention held at CYP, Panatina, are shown below. Display the results in a frequency table and find the most frequent age group in the audience.

12, 14, 14, 14, 15, 14, 14, 16, 11, 14, 15, 12, 12, 11, 13, 14, 16, 14, 14, 13, 13, 13, 14, 15.

2 The results of a survey to find the most popular subject in a class are given below. Display the results in a frequency table:

Agriculture, Maths, Science, Agriculture, English, Industrial Art, Maths, Industrial Art, Industrial Art, Social Science, Industrial Art, Industrial Art, Industrial Art, Maths, Maths, Maths, Industrial Art, Agriculture, English, Agriculture, Industrial Art, Science, Industrial Art, Industrial Art, Maths, Agriculture, Maths, English, Industrial Art, Industrial Art.

3 The ages of the people playing on a beach are shown below:

12, 24, 46, 34, 45, 16, 56, 26, 41, 38, 25, 22, 32, 31, 28, 49, 23, 44, 31, 37, 18, 19, 21, 24.

Display the results on a frequency table.

Solution

Age	Tally	Frequency
11	||	2
12	|||	3
13	||||	4
14	₩₩ ₩₩	10
15	|||	3
16	||	2
	TOTAL	24

The most frequently occurring age was 14 and nearly $\frac{3}{4}$ of the group were 13–15 year olds.

Subject	Tally	Frequency
Agriculture	₩₩	5
Maths	₩₩ ||	7
Science	||	2
English	|||	3
Industrial Art	₩₩ ₩₩ ||	12
Social Science	|	1
	TOTAL	30

Age	Tally	Frequency
11–20	||||	4
21–30	₩₩ |||	8
31–40	₩₩ |	6
41–50	₩₩	5
51–60	|	1
	TOTAL	24

Exercise 5A

1 Write down three examples of:
   a discrete numerical data   **b** continuous numerical data

2 For the following data describe whether they are discrete or continuous:
   a The number of people in each of the checkout queues in a supermarket
   b How long it takes each person to get through the checkout
   c The number of blue cars that pass in front of your school in a day
   d The number of people in each car that passes the front of your school
   e The speed of each car that passes the front of your school
   f The number of children in the family of each of the students in your class
   g The number of teenagers who have their own bedroom
   h The number of ways of travelling to school
   i The number of people who agree that the wearing of uniforms should be compulsory
   j The distance students travelled to school

3 In pairs, conduct your own survey to find the most popular subject in a class at your school. Display the results in a frequency table as shown in Example 2 on page 111. Present your findings to your classmates.

4 In a survey to see how students travel to school, 30 students were surveyed and the responses are listed below:
   Car, Bus, Car, Bike, Walk, Car, Walk, Walk, Bus, Bus, Car, Bike, Bus, Car, Bus, Bus, Walk, Bike, Car, Walk, Car, Bus, Bus, Car, Bus, Walk, Car, Bus, Walk, Walk
   a Display this information in a frequency table with a tally.
   b How many students walk to school?
   c What was the most frequently occurring way of getting to school?

5 The following is a record of fruits and vegetables bought at the Honiara Central Market on one day:

Fruits and Vegetables	Tally
Mango	卌 卌 II
Beans	卌 卌 卌 卌 卌 III
Coconut	卌 卌 卌 IIII
Banana	卌 卌 卌 卌 卌 卌 卌 I
Pawpaw	卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 III
Eggplant	卌 卌 卌
Cucumber	卌 卌 卌 卌 卌 卌 卌 卌 II

   a What was the most popular fruit on that day?
   b What was the most popular vegetable bought that day?
   c How many mango were bought that day?
   d How many pawpaw were bought that day?
   e How many cucumbers were bought that day?

6 The score sheet from a recent netball match is shown. The goals scored by the Goal Attack (GA) and the Goal Shooter (GS) for the Home team and the Visitors team are shown for each quarter:

  a Copy and complete the score sheet.

  b How many goals did the home team get in the second quarter?

  c How many goals did each of the teams get? Who won?

  d If the players remained in the same position throughout the game, which player scored the most goals? (GA or GS? Home team or Visitors?)

Qtr	Home team	Total	Visitors	Total
1	GS ‖		GS ‖‖‖	
	GA ‖		GA ‖‖‖‖	
2	GS ‖‖‖		GS ‖‖‖	
	GA			GA ‖‖‖	
3	GS ‖‖‖		GS	
	GA ‖‖‖		GA ‖‖	
4	GS ‖‖‖		GS		
	GA ‖‖		GA ‖‖‖	
	Final Score		**Final Score**	

7 The Customs Department of the Ministry of Inland Revenue kept records of vehicles that were imported into the Solomon Islands by a car dealer between 2008 and 2009.

Types of Vehicle	Year 2008	Year 2009
Pick-up Truck	‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖‖	‖‖‖ ‖‖‖ ‖
Bus	‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖	‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖‖
Car	‖‖‖ ‖	‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖‖ ‖‖

  a How many pick-up trucks were imported in Year 2008?

  b How many cars were imported in Year 2008?

  c Which year had the lowest number of imported vehicles?

  d What was the most popular type of vehicle for both years? Why do you think this was?

8 Matangi bought 24 boxes of matches, which he wanted to send home to his mother. He counted and recorded the number of matchsticks in each of the boxes as follows:

45, 32, 42, 51, 55, 38, 52, 37, 43, 31, 51, 37, 60, 51, 67, 42, 53, 60, 75, 64, 49, 52, 39, 42

Show the number of matchsticks per box in a frequency table, using the groups 31–40, 41–50 …

9 Tom, a farmer from the Guadalcanal Plains, normally sells his produce at the Central Market in Honiara. He sells 32 cucumbers after he has measured and recorded the length of each of them. The frequency table shows the results.

  a Is this an example of discrete or continuous data? Explain.

  b How many of the cucumbers were longer than 6 cm?

  c How many of the cucumbers were less than 5 cm long?

  d How many of the cucumbers were between 4 cm and 7 cm long?

Length (cm)	Frequency
3–<4	4
4–<5	7
5–<6	14
6–<7	5
7–<8	2
Total	32

5B Creating and interpreting tables

The simplest way of displaying data is as a table. We can simplify information into a table and we interpret the information in tables every day.

Here is some information about 6 students:

■ Mary is a Year 8 student. Her favourite subject is English and she studies French. She is at boarding school and has two sisters. She misses her horse when she is away at school.

■ Anthony is a Year 7 day student. His favourite subject is Music and he studies Chinese. He has two sisters and a brother. He has two dogs.

■ Edwina is a Year 8 day student. Her favourite subject is English and she studies French. She has two younger brothers. She doesn't have any pets.

■ Tim is a Year 7 day student. His favourite subject is Maths and he studies French. He has an older brother. He has a cat and a dog.

■ Diana is a Year 7 student. Her favourite subject is Music and she studies Chinese. She is at boarding school because her family lives overseas. She has one sister. She misses her two cats when she is away at school.

■ Freddie is a Year 8 day student. His favourite subject is Science and he studies Chinese. He is an only child but he does have two cats and a dog.

This information is difficult to read even though it is in short sentences. We could make it easier to interpret by putting the information into a table.

Name	Gender F or M	Year level	Boarding or day	Favourite subject	Language	Siblings	Pets
Mary	F	8	Boarding	English	French	2	1
Anthony	M	7	Day	Music	Chinese	3	2
Edwina	F	8	Day	English	French	2	0
Tim	M	7	Day	Maths	French	1	2
Diana	F	7	Boarding	Music	Chinese	1	2
Freddie	M	8	Day	Science	Chinese	0	3

Example

1 How many of the students are at boarding school?

2 Who has no brothers or sisters?

3 Whose favourite subject is Maths?

4 How many students study Chinese?

Solution

There are 2 students at boarding school.

Freddie has no brothers or sisters.

Tim's favourite subject is Maths.

Three students study Chinese.

Tables containing information like this can also be called **databases**.

Exercise 5B

1 The results of a World Cup qualifier competition are given in the table below:

	Won	Drew	Lost	Goals for	Goals against	Points
Saudi Arabia	3	2	1	11	6	11
Iran	2	4	0	7	4	10
Iraq	2	1	3	6	6	7
Bahrain	1	3	2	4	7	6
Thailand	0	4	2	4	10	4

    a   How many games did Bahrain win?

    b   How many points did Iraq get?

    c   Which team has had 10 goals kicked against them?

    d   Which teams drew four games?

    e   Which team won no games?

    f   Which team lost the most games?

    g   Which team lost the least number of games?

    h   Which teams kicked only four goals?

2 Construct a table to display the information about these students:

    ■ Beth is a Year 7 student. Her favourite subject is Maths and she studies French. She is at boarding school and has two sisters. She misses her horse when she is away from school.

    ■ Kyle is a Year 8 day student. His favourite subject is PE and he studies Chinese. He has an older sister. He has a dog, a cat, a hamster and a rabbit.

    ■ Sarah is a Year 8 day student. Her favourite subject is Music and she studies Chinese. She has an older sister and brother. She has two horses and a dog.

    ■ Leo is a Year 8 student. His favourite subject is Maths and he studies Chinese. He is at boarding school because his family lives overseas. He has a younger brother but no pets.

    ■ Henry is a Year 8 day student. His favourite subject is Maths and he studies Chinese. He has two brothers and a sister. He has three dogs.

    ■ Laura is a Year 8 day student. Her favourite subject is Art and she studies French. She has two younger sisters. Laura likes birds and has six in a big aviary in her garden.

3 Use the table from Question 2 to answer the following

    a   How many of the students are boarders?

    b   How many of the students have two siblings?

    c   Which students have no pets?

    d   How many students study Chinese?

    e   Name the Year 7 day students.

    f   Who are the Year 8 male students?

Another way of displaying data is using bar graphs or column graphs. These are more useful than pie charts because they can also be used to compare the results of two different groups that have been surveyed.

Example

Two groups of 100 students from two different schools were surveyed to find their opinions on school uniforms. The students were asked to consider whether all schools should abolish school uniforms and whether they agree, don't care or disagree with this statement. The results for the two schools are given here:

School A	Results
Agree	54
Don't care	25
Disagree	21

School B	Results
Agree	83
Don't care	10
Disagree	7

Solution

The results for school A could be displayed as a horizontal bar graph or a vertical column graph.
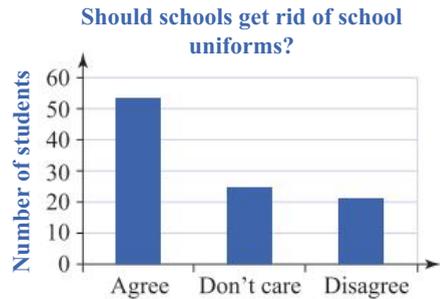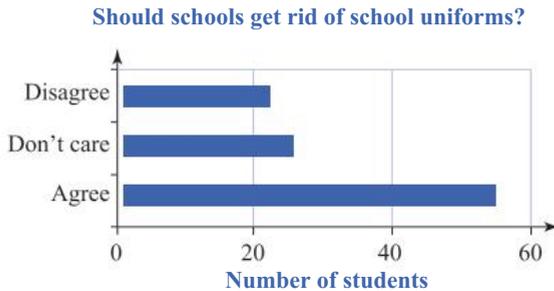
We can compare the two schools by using double columns or stacked column graphs like this:
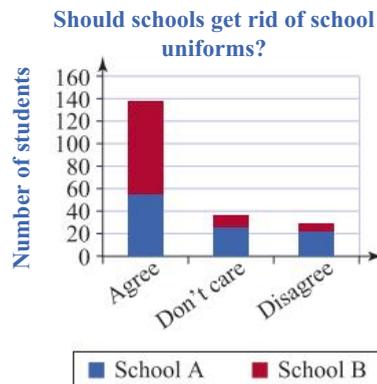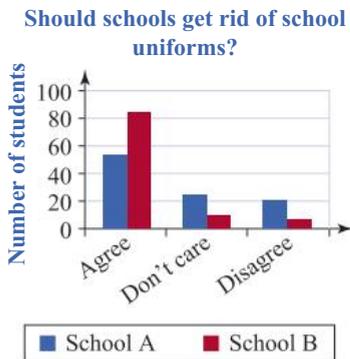
These graphs can also be drawn using an Excel spreadsheet.

Exercise 5C

1 The number of cities with a population greater than 1 million is shown in the column graph below:

Number of cities with a population greater than 1 million
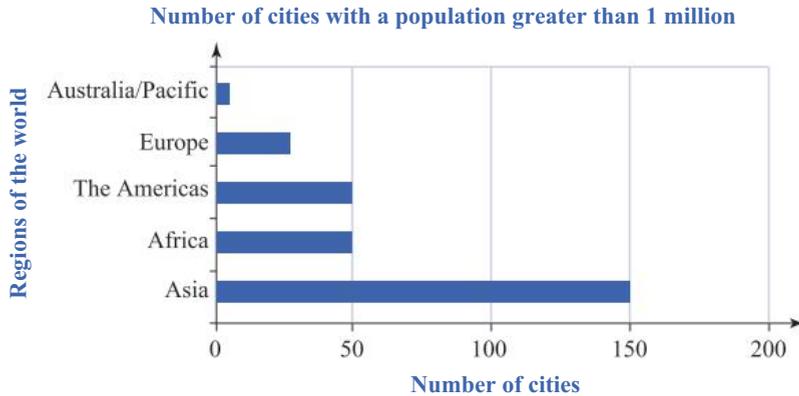
Number of cities

  a Which region of the world has the largest number of cities with a population greater than 1 million?

  b Which region of the world has the smallest number of cities with a population greater than 1 million?

  c How many cities with a population greater than 1 million are there in Europe?

  d Which two regions have a similar number of cities with a population greater than 1 million?

  e How many cities with a population greater than 1 million are there in the Americas and Africa, in total?

2 A survey to find the religious beliefs of Honiara residents gave these results:

Different beliefs
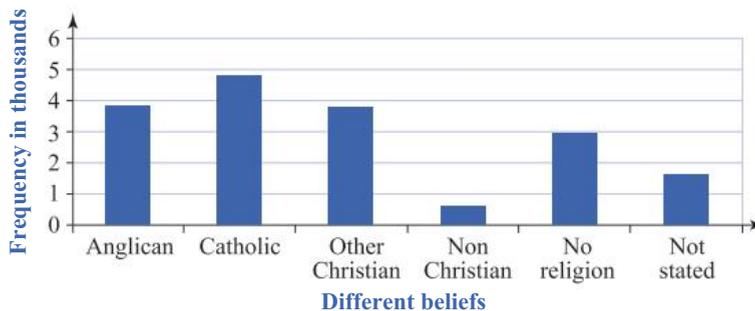
  a What was the most common religious belief?

  b Approximately how many people claimed to have no religion?

  c Approximately how many people claimed have a non-Christian belief?

  d What is the total number of people who claim to have a Christian belief?

  e How many of the religious beliefs had more than 3 thousand followers?

3 A group of school students did a survey to find out the most popular colour of car. The results were:

Colour	Frequency
Red	42
Blue	26
White	53
Green	45
Brown/maroon	5
Black	12

Display this information as a bar graph.

4 Work with a partner to survey your classmates to find out their favourite sports. Survey the girls and boys separately. Record your results in a frequency table (like the one given below) to display the information as a double column or stack column graph. Present your findings to the class.

Favourite Sports	Tally	Frequency

5 In a survey to find who does the most housework, a country's Bureau of Statistics obtained the results shown in the graph:

a What type of housework is more likely to be done by a woman?

b What type of housework is more likely to be done by a man?

c In how many families out of a hundred do the women do the gardening?

d In how many families out of a hundred do the men do the shopping?

Who does the most housework?

Number of people

Housework

■ Men   ■ Women
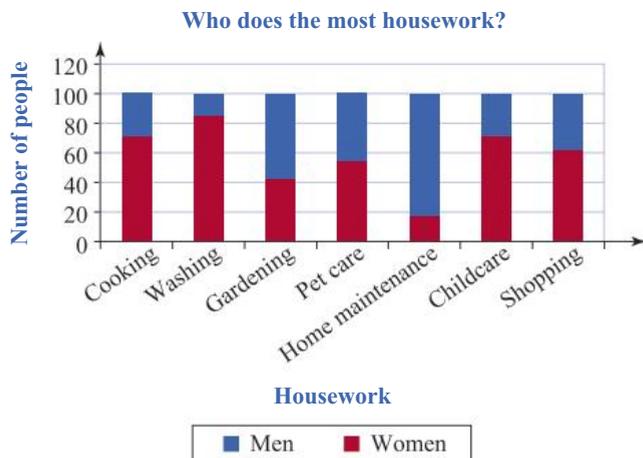
6 The top 10 medal-winning countries won these medals in the 2000 Sydney Olympics:

Olympic medals
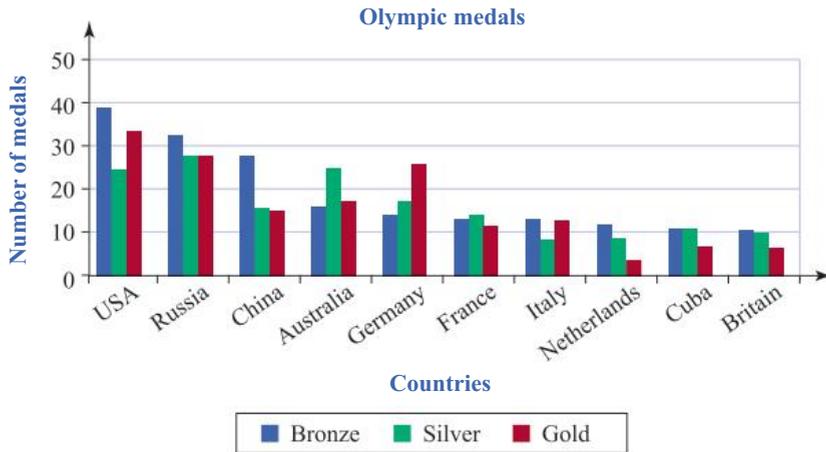
- **a** Which country won the most gold medals?
- **b** Which country won the most silver medals?
- **c** Which country won the most bronze medals?
- **d** Which country won the most medals in total?
- **e** Which country won the same number of bronze and silver medals?
- **f** How many silver medals did Britain win?
- **g** Which country won more gold medals than any other medal?

Interpreting line graphs

Line graphs are used to give visual summaries of real-life situations for **continuous data**..

Example

The graph shows the average temperature of Perth over the last 40 years.

The horizontal axis shows the months of the year.

The vertical axis shows the average temperature.

a Which month is the hottest?

b Which month is the coldest?

c How much hotter is it in March than in June?

d How does the temperature in May compare with that in October?

e Mary prefers to scuba dive in waters that have a surface temperature in the range 21–23°C. For how many months of the year is the temperature in this range?

Average temperature in Perth over 40 years

Months of the year
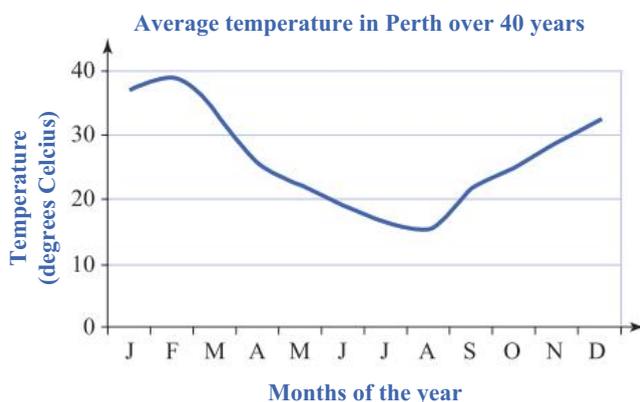
Solution

a The hottest month is February.

b The coldest month is August.

c March = 34°C
June = 19°C
Difference = 34 – 19
           = 15°C

March is 15°C hotter than June on average.

d May = 22°C
October = 24°C
Difference = 24 – 22
           = 2°C

Therefore October is hotter by 2°C on average.

e Four months have an average temperature in the range 21–26°C: April, May, September and October.
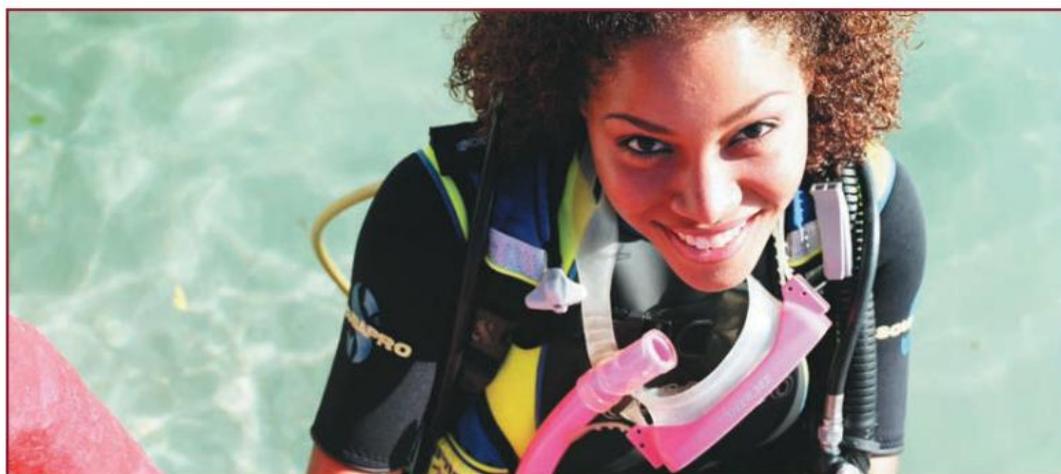
Exercise 5D

1 The number of Australian cents per Solomon Islands dollar was recorded monthly starting 1 April 2010 and the results summarised into the following graph:
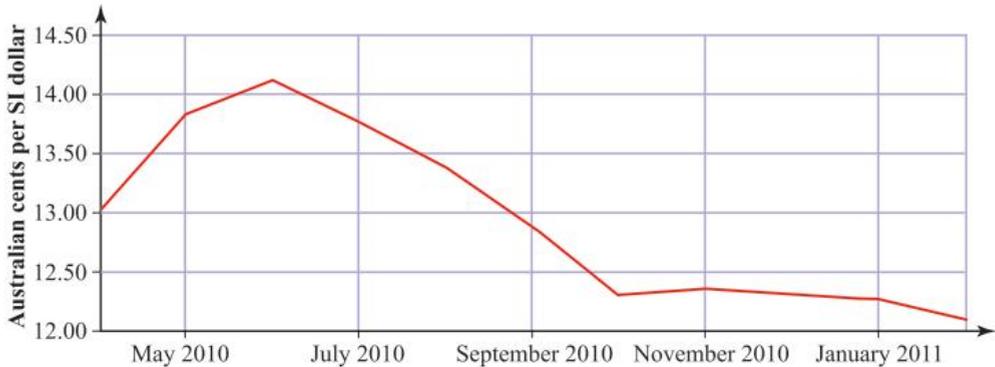
a What does the horizontal axis represent?

b What does the vertical axis represent?

c How many Australian cents was one Solomon Islands dollar worth on 1 April 2010?

d What was the highest number of Australian cents per SI dollar and when did this occur?

e What was the lowest number of Australian cents per SI dollar and when did this occur?

f Was the overall trend for the value of the SI dollar to rise or fall during this period?

2 Angela's pulse rate was measured before, during and after strenuous exercise. The results were summarised into this line graph:
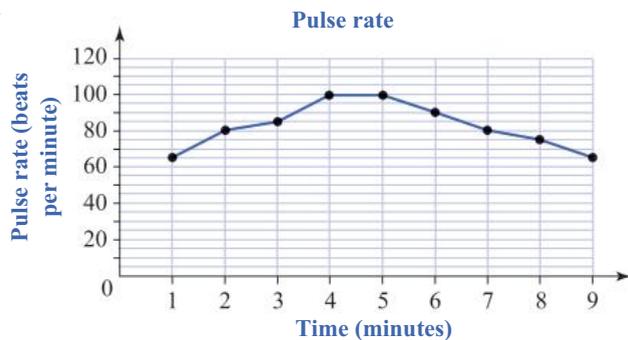
a What does the horizontal axis represent?

b What does the vertical axis represent?

c How many beats per minute did Angela have after 2 minutes?

d How many beats had her heart done altogether after 5 minutes?

e After how many minutes was Angela's pulse rate at 100 beats per minute?

f i When was there a large increase in the heart rate?

ii How can you tell this from looking at the graph?

g i When was the pulse rate the same?

ii How can you tell this from looking at the graph?

h i From what time was the heart rate decreasing?

ii What part of the line graph shows that there is a decrease?

i How long did it take for the pulse rate to go back to the rate before exercise?

5E Pie graphs

Pie graphs are often used to display categorical data. Pie graphs can also be called sector graphs. Each category is shown as a sector of a circle. It is useful to find the percentage for each category and then convert that to an angle. Remember that there are 360° in a full turn.

Example

Thirty Year 7 students were asked to nominate their favourite subject.
The results were:

Agriculture   5
Maths   7
Science   2
English   3
Industrial Art   12
Social Science   1

Display the results in a pie graph.

Solution

Five of the 30 students surveyed think that Agriculture is their favourite subject.

Write this as a fraction: $\frac{5}{30}$

To find the angle: $\frac{5}{30} \times 360° = 60°$

Now find the angles for the other subjects.

Subject	Frequency	Fraction	Angle
Agriculture	5	$\frac{5}{30}$	60°
Maths	7	$\frac{7}{30}$	84°
Science	2	$\frac{2}{30}$	24°
English	3	$\frac{3}{30}$	36°
Industrial Arts	12	$\frac{12}{30}$	144°
Social Science	1	$\frac{1}{30}$	12°
Total	30	$\frac{30}{30}$	360°

When you have found the angles you can carefully draw a pie graph using your protractor.

Favourite subjects
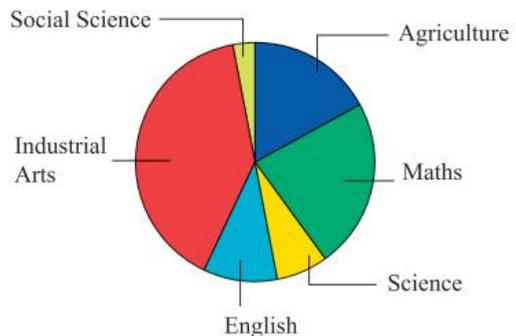
Exercise 5E

Population

1 The pie graph shows the populations of various islands in the Solomons as percentages of the total population.

   a Which island has the largest population?

   b What percentage of the population lives in New Georgia?

   c In which island does 19% of the population live?

   d Which island has the smallest population?
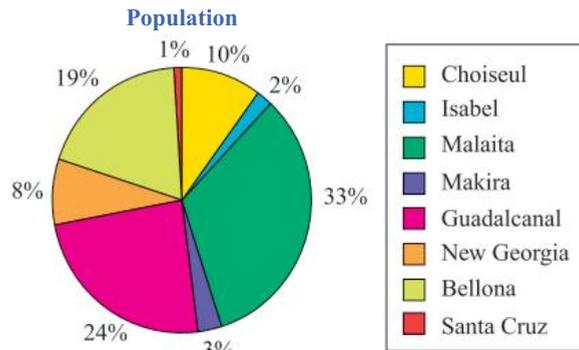
2 The table below indicates the number of participants from various provinces in the Solomon Islands for the Curriculum Workshop that was held at the King George Sixth National Secondary School during the June holidays.

Provinces	No. of participants
Choiseul	10
Renbel	5
Malaita	22
Western	16
Isabel	11
Temotu	9
Guadalcanal	12
Makira	8
Central	7
Total	100

   a Find the sector angles for each province and display this information as a pie graph.

   b Which province has the highest number of participants?

   c Which province has the lowest number of participants?

3 Ben gets $10 pocket money each day. He buys a magazine that costs $2·50, spends $4 on sweets and saves the rest.

   a How much does Ben save each week?

   b What percentage of his pocket money does he:

     i spend on sweets?   **ii** spend on a magazine?   **iii** save?

   c Display this information as a pie graph.

4 The table below shows the weights of fruits and vegetables before they were sold at the market.

Item	Weight (Kg)
Cucumber	9·0
Melon	23·5
Pineapple	7·5
Tomato	5·0
Total	45·0

   a What percentage of the fruits and vegetables does the cucumber make up?

   b Calculate the percentages for each of the other fruits and vegetables.

   c Display this information as a pie chart.

5F Dot plots and the mode

Dot plots are a pictorial way of displaying discrete numerical data. Dots corresponding to each of the numbers are placed above a number line.

The **mode** or **modal number** is the most frequently occurring value or number.

Dot plots are sometimes called dot frequency graphs.

Example

The ages of audience members at a rap concert were recorded.

These results were:

12, 14, 16, 14, 15, 16, 16, 16, 11, 14, 15, 12, 12, 11, 13, 15, 16, 14, 14, 13, 13, 13, 14, 15

Display these results as a dot plot or dot frequency graph.

Solution

■ To display this data as a dot plot first draw a number line from, say, 11 to 16.

■ Then place a dot above the 12 for the first person.

■ Place a dot above the 14 for the second person and so on.

■ When you get to an age where there is already a dot, place a dot above the first dot.

Remember to keep the dots evenly spaced or the picture will not be accurate.
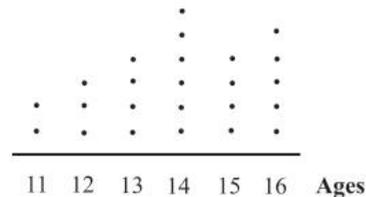
The mode is 14. This means that the most frequent age is 14. Six fans were 14 years old.

Exercise 5F

l The speed limit at the Philip's Highway, Renadi was reduced from 60 km/h to 50 km/h. A group of school students recorded the speeds of 40 vehicles on their streets and the speeds in km/h were:

45, 52, 46, 46, 49, 51, 50, 45, 43, 54, 46, 52, 53, 50, 49, 48, 47, 48, 50, 49, 52, 49, 52, 48, 47, 46, 49, 50, 50, 51, 52, 49, 48, 50, 49, 51, 49, 48, 46, 47

  a What was the slowest speed in this sample?

  b What was the fastest speed in this sample?

  c Display this information as a dot plot or dot frequency graph.

  d What is the mode for this sample?

  e How many cars were driving faster than the speed limit?

2 The number of goals scored in a netball season was recorded for 20 teams. The results are shown below:

45, 47, 46, 47, 46, 48, 50, 45, 46, 51,
47, 48, 48, 50, 46, 47, 49, 46, 48, 49

a What was the highest number of goals scored in the season?

b What was the lowest number of goals scored?

c Display this information as a dot plot.

d What was the modal number of goals?

3 To pass a keyboarding class, the students need to have a typing speed of 30 words a minute. In a test the results were:

36, 45, 43, 32, 29, 28, 34, 38, 39, 34, 36, 32, 34, 35, 34,
37, 34, 38, 29, 31, 32, 35, 41, 36, 35, 32, 31, 36, 37, 39

a What was the best typing speed?

b What was the worst typing speed?

c Display the results as a dot plot.

d What was the modal score?

4 The amount of homework Year 7 students did each week is shown in the table below:

No. of hours of homework	Frequency
6	4
7	8
8	5
9	3
10	2

a What was the mode for the number of hours of homework?

b Display this information as a dot plot.

5 The number of goals kicked in each soccer game of the season is recorded below:

2, 2, 3, 4, 5, 2, 5, 1, 1, 3, 2, 2, 4, 1, 1, 3, 3,
2, 2, 3, 2, 2, 3, 2, 2, 3, 1, 4, 2, 2, 3, 4, 1

a Draw up a tally and frequency table for these results.

b What was the mode?

c Display this information as a dot plot.

6 To improve the spelling skills of the students in the class, a teacher decided to test the students and then retest them a week later.

The results of the first test were:

3, 4, 5, 8, 6, 2, 5, 3, 4, 9, 1, 5, 4, 6, 5, 5, 3, 1, 2, 4, 5, 2, 3, 6, 7, 2, 3

In the retest the results were:

5, 6, 8, 9, 9, 10, 6, 8, 9, 7, 5, 7, 6, 9, 8, 8, 9, 9, 10, 10, 10, 9, 8, 6, 7, 9, 10

- **a** Display the results of the first test as a dot plot from 1 to 10.
- **b** Use the same scale to display the results of the second test.
- **c** Comment on the difference in the test results.

7 In an experiment, 24 students were asked to guess the length of a piece of string. The string was exactly 12·5 cm long and the students were asked to estimate to the nearest 0·5 cm. Their results, in centimetres, were:

13, 12·5, 10, 11·5, 12, 12·5, 12, 11, 10·5, 13·5, 13, 12·5,
13, 14, 14·5, 11·5, 12·5, 12, 13, 13·5, 11, 10·5, 12, 13

- **a** What type of data is this?
- **b** How many of the students estimated correctly?
- **c** Display this data as a dot plot.
- **d** How many students gave estimates that were too short?
- **e** What was the modal length?
- **f** What does the data tell us about the ability of students to estimate length?

8 Repeat the experiment described in Question 7 for your class but follow the instructions below:

Instructions:

- • Pick a partner. Each pair of learners (students) to choose a different length of string.
- • One learner to ask questions to other pairs of classmates while the other makes the recordings.
- • Answer the same six questions as Question 7.
- • Are your classmates better or worse at estimating string length than the 24 students in Question 7?

9 A farmer from Kolobangara, Western Province, counted the number of bags of copra he produced each month for a year. The results are shown below:

16, 4, 10, 4, 8, 12, 10, 6, 10, 5, 8, 10

- **a** What type of data is this?
- **b** Display the data in a dot plot.
- **c** In how many months were there at least 10 bags of copra?
- **d** In how many months were there fewer than 8 bags of copra?
- **e** What is the mode?

10 A farmer from Isabel Province counted the number of bags of kava he produced each month for a year. The results are shown below:

4, 8, 4, 10, 4, 7, 14, 5, 4, 16, 4, 3

- **a** Display the data as a dot plot, and state the mode.
- **b** In how many months were there at least 10 bags of kava?
- **c** In how many months does he produce more than 10 bags of kava?

The mean — 5G

When analysing data it is often useful to know a measure of the centre. If your class all sat the same test, knowing the average test result would give you an indication as to how you went in the test. Did you do better or worse than the average?

The most commonly used measure of the centre is called the **mean** or the average. To find the mean add up all the results and then divide the total by the number of results.

Example

The test results for a Year 7 group are:

100, 77, 93, 87, 93, 40, 73, 27, 100, 87,
100, 87, 87, 100, 100, 83, 93, 100, 83,
74, 89, 81, 52, 94

a Malcolm was the student who got 74. How does he compare with the rest of the group?

b Jed's results in his first four tests for the term are 67, 83, 72, 91 (all tests are out of 100). If he gets an average of 80 or above for the term, his mother will buy him a new computer game. What does he need to get in his fifth and final test?

Solution

The total of these results is 2000.

There are 24 students in the class.

The mean $= \frac{2000}{24} = 83 \cdot 3$

Malcolm's score was below the average.

To get a mean of 80 in five tests his total for the five tests will be $5 \times 80 = 400$.

Jed's total for the first four tests is 313.

He needs to get $400 - 313 = 87$.

Exercise 5G

1 Find the mean speed for 40 cars, if their speeds (km/h) are:

45, 52, 46, 46, 49, 51, 50, 45, 43, 54, 46, 52, 53, 50, 49, 48, 47, 48, 50, 49,
52, 49, 52, 48, 47, 46, 49, 50, 50, 51, 52, 49, 48, 50, 49, 51, 49, 48, 46, 47

2 In an experiment, 24 students were asked to guess the length of a piece of string. Find the mean of the estimates of the length of the string if the estimates (in centimetres) were:

13, 12·5, 10, 11·5, 12, 12·5, 12, 11, 10·5, 13·5, 13, 12·5,
13, 14, 14·5, 11·5, 12·5, 12, 13, 13·5, 11, 10·5, 12, 13

3 Find the mean typing speed (words per minute) of the students whose test results were:

36, 45, 43, 32, 29, 28, 34, 38, 39, 34, 36, 32, 34, 35, 34,
37, 34, 38, 29, 31, 32, 35, 41, 36, 35, 32, 31, 36, 37, 39

4 Find the mean number of children in a family if the results of a survey were:

2, 2, 3, 4, 5, 2, 5, 1, 1, 3, 2, 2, 4, 1, 1, 3, 3, 2, 2, 3, 2, 2, 3, 2, 2, 3, 1, 4, 2, 2, 3, 4, 1

5 Conduct a survey to find the mean number of children in each family in your village. Be prepared to present your findings to your classmates.

6 Find the mean height for a group of Year 7 students if their heights, in centimetres, were:

144, 153, 167, 178, 171, 149, 153, 161, 167, 166, 156, 154, 162, 156, 166, 162, 160, 164, 148, 157, 170, 165, 163, 174, 168, 162, 158, 161, 169, 163

7 A survey of a class of 20 Year 7 students revealed that they were paid the following amounts for pocket money each week (Note: Some students were not given pocket money and so estimated the total amount they were given to buy sweets, magazines etc.):

$12, $7·50, $8, $15, $5, $50, $3·50, $15, $10, $12, $12·50, $9, $12, $5, $7, $14·50, $17, $9·50, $8, $7·50

  a What was the mean amount of pocket money?

  b How many of the students received less than the mean?

  c One value was much higher than the rest.

    i Which was it?

    ii Calculate the mean by ignoring this amount.

    iii Which value for the mean is more reliable and why?

8 **a** Find the mean for each spelling test when:

    i the results of the first test were
3, 4, 5, 8, 6, 2, 5, 3, 4, 9, 1, 5, 4, 6, 5, 5, 3, 1, 2, 4, 5, 2, 3, 6, 7, 2, 3

    ii the results of the second test were
5, 6, 8, 9, 9, 10, 6, 8, 9, 7, 5, 7, 6, 9, 8, 8, 9, 9, 10, 10, 10, 9, 8, 6, 7, 9, 10

  b What does the difference between the means tell us?

9 Edwin wanted to improve his typing so he practised and tested himself regularly. His mean typing speed after nine tests was 38·5 words per minute. What speed would he need in the next test to increase his average to 40 words per minute?

10 Jane is at risk of being dropped from the netball team unless she can improve her accuracy in getting goals. She needs to get an average of 24 goals per game. In her last 11 games she scored 23, 25, 12, 16, 13, 26, 28, 15, 20, 27 and 22 goals. What would she need to get in her last game to keep her place on the team?

11 The number of dogs in each village was recorded in two wards:

Ward 1: 15, 16, 20, 14, 27, 13, 12, 10, 28, 5
Ward 2: 10, 11, 41, 14, 32, 13, 10, 7, 12, 30

  a Find the mean number of dogs for each ward.

  b What does the difference between the means tell us?

  c The last value for Ward 2 was incorrect. What should be the value of the last result to give the same mean for each ward?

The median and the range 5H

The **median** is the middle value when the results are written in order. It is an alternative to using the mean as a measure of the centre. The median is more commonly used when there are some extreme or unusual values in the data set.

To find the median:

- Arrange the results in order from smallest to largest.

- If you have an odd number of results, the median is the middle number,
  e.g. 1, 4, ⑪, 12, 16
  Median is 11.

- If you have an even number of results, the median is the average of the two middle
  numbers, e.g. 3, ⑦ ⑧ 14
  Median is 7·5.

When we use the median as a measure of the centre we can also use the **range** as a measure of the spread of the data. The range is the difference between the highest and the lowest result.

Example	**Solution**
1 The results of a Year 7 test are: 100, 77, 93, 87, 93, 40, 73, 27, 100, 89, 100, 87, 87, 100, 100, 83, 93, 100, 83, 74, 89, 81, 52, 94 Find the median.	When finding the median, you need to write the results in order: 27, 40, 52, 73, 74, 77, 81, 83, 83, 87, 87, ㊇㊉ 89, 93, 93, 93, 94, 100, 100, 100, 100, 100, 100 There are 24 results and the middle pair is the 12th and 13th results. These are 87 and 89 so the median is 88.
2 What is the range for the test results above?	The highest value is 100. The lowest value is 27. The range = 100 − 27 = 73. There is a large variation in these test results.

Exercise 5H

1 Find the median speed and the range for the 40 vehicles if their speeds are:

45, 52, 46, 46, 49, 51, 50, 45, 43, 54, 46, 52, 53, 50, 49, 48, 47, 48, 50, 49,
52, 49, 52, 48, 47, 46, 49, 50, 50, 51, 52, 49, 48, 50, 49, 51, 49, 48, 46, 47

2 a Find the mean, median and range for the following:

    i 230, 242, 256, 274, 301, 323   **ii** 100, 242, 256, 274, 301, 323

    iii 230, 242, 256, 274, 301, 487   **iv** 100, 242, 256, 274, 301, 487

  b Comment on these results.

3 Students surveyed their class to find the number of children in each family. Find the median if the results were:

2, 2, 3, 4, 5, 2, 5, 1, 1, 3, 2, 2, 4, 1, 1, 3, 3, 2, 2, 3, 2, 2, 3, 2, 2, 3, 1, 4, 2, 2, 3, 4, 1

4 Look again at the survey you did of the number of children in each family in your village for Exercise 5G, Question 5. Find the median number of children per family. Is your median bigger or smaller than the mean? Is this always true? Compare your results with those of your classmates.

5 In an experiment, 24 students were asked to guess the length of a piece of string. The estimates (in centimetres) were:

13, 12·5, 10, 11·5, 12, 12·5, 12, 11, 10·5, 13·5, 13, 12·5,
13, 14, 14·5, 11·5, 12·5, 12, 13, 13·5, 11, 10·5, 12, 13

  a Find the median of the estimates for the length of the string. Comment on your result.

  b What was the range of the lengths?

6 A survey of a class of 20 Year 7 students revealed that they were paid the following amounts for pocket money each week:

$12, $7·50, $8, $15, $5, $50, $3·50, $15, $10, $12, $12·50,
$9, $12, $5, $7, $14·50, $17, $9·50, $8, $7·50

  a What was the median and range of pocket money?

  b What is the mean for the pocket money results?

  c   **i** How does the mean compare with the median?

     ii Which is more reliable, the mean or the median? Why?

7 This dot frequency graph shows the ages of the members of a sports club.

What was the median age of the members?

11 12 13 14 15 16 **Ages**

8 The heights, in centimetres, of the players in two basketball squads were:

A: 152, 156, 163, 167, 172, 174, 176, 200
B: 154, 170, 171, 171, 172, 173, 174, 175

  a Find the mean height for each squad.

  b Find the median height and the range for each squad.

  c Find the range of the heights for each squad.

  d Comment on the results.

Stem-and-leaf plots or stemplots are a convenient way of displaying the data and showing the distribution. For two-digit numbers, the tens values are the stems and units are the leaves. An ordered stem-and-leaf plot has the numbers in numerical order and can be used to find the median and the range.

Example

Here are the daily absence data for a large secondary school over a 5-week period. Each of the numbers has two digits. Show the data in a stemplot and find the **median** and **range**.

67, 85, 56, 69, 99, 97, 59, 65, 84, 97, 49, 72, 89, 78, 66, 81, 92, 88, 87, 73, 79, 85, 82, 53, 61

Solution

Daily Absences

```
4 | 9
5 | 3 6 9
6 | 1 5 6 7 9
7 | 2 3 8 9              Leaves
8 | 1 2 4 5 5 7 8 9
9 | 2 7 7 9
Stem
    4 | 9 means 49
```

There are 25 results in this table. The middle number is the 13th number. So the **median** absence is **79**. The largest daily absence was 99, and the smallest, 49. So the **range** of absences is $99 - 49 = 50$.
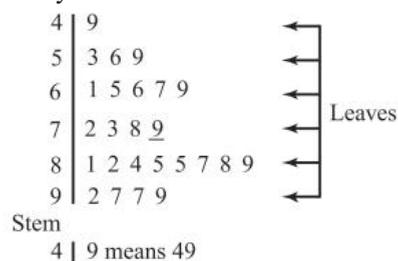
Exercise 5I

1 Find the median score and the range for each set of data:

a
```
2 | 0 2 3
3 | 5 9
4 | 6 6 7
5 | 1 4
6 | 8
```

b
```
5 | 1 2 2
6 | 3 4 5
7 | 0
8 | 6 8
9 | 4 9
```

c
```
10 | 1 3 5
11 | 4
12 | 6
13 | 0 0 8
```

2 The life expectancies for the people of 20 countries are:

74, 72, 66, 48, 71, 41, 74, 73, 44, 50, 61, 64, 44, 58, 49, 75, 65, 72, 68, 48

  a Display this information as a stem-and-leaf plot.

  b What are the highest, lowest and range of life expectancies?

  c What is the median life expectancy?

3 a Display these typing speeds as a stem-and-leaf plot:

  26, 45, 43, 62, 29, 28, 34, 58, 49, 54, 36, 62, 74, 35, 74,
  17, 24, 38, 29, 62, 82, 35, 41, 56, 65, 72, 81, 36, 57, 39

  b Redraw the stem-and-leaf plot as an ordered stem-and-leaf plot.

  c Use your stem-and-leaf plot to find the median and the range of the typing speeds.

4 The number of absentees for a large secondary school was recorded each day. The results were:

  23, 34, 56, 43, 12, 56, 37, 65, 55, 43, 46, 61, 50, 54, 32, 25, 27, 36, 28, 41, 42, 18,
  63, 69, 63, 27, 53, 52, 56, 37, 49, 52, 45, 26, 51, 62, 48, 39, 40, 51, 58, 38, 56, 29

  a Display the number of absentees as an ordered stem-and-leaf plot.

  b Use your stem-and-leaf plot to find the median and the range of the number of absentees.

Venn diagrams are a useful way of classifying and displaying data or elements. The **intersection** is where the two circles overlap. Elements that can be classified in both circles are placed in the intersection.

Examples

1 Six students are surveyed about their height and eye colour. The information is represented in this Venn diagram. Write a description of the eye colour and height of Anna, David and Ellie.
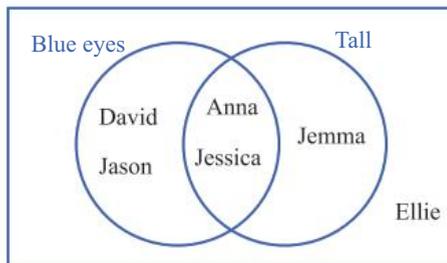
2 A group of Year 7 students walked to the main road to count cars. They wanted to find out how many cars were green and how many were Toyotas. A tally chart was completed with a tally mark for each car that passed. The students counted the tally marks in each category and found that the best way to display the results was in a Venn diagram.

Use the information in the Venn diagram to answer the following questions:

   a How many green Toyotas were counted?

   b How many Toyotas were counted?

   c How many cars were counted?

Total

Toyotas Green	⊞ |||	8
Toyotas Not green	⊞ ⊞ ||||	14
Not Toyotas Green	|||	3
Not Toyotas Not green	⊞ ⊞ ⊞ ⊞ ⊞	25
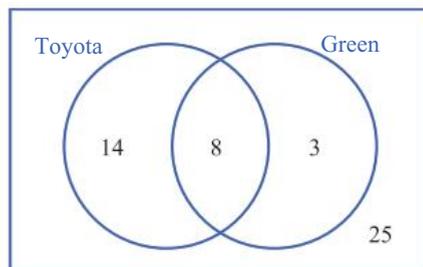
Solutions

1 Anna is inside the circle for 'blue eyes' and is also inside the circle for 'tall'. Anna is tall and has blue eyes. David is inside the circle for 'blue eyes' but is not in the circle for 'tall'. David has blue eyes and is not tall. Ellie is outside both circles, and so does not have blue eyes and is not tall.

2 **a** There were 8 cars that were green Toyotas.

   b The number of Toyotas altogether is $8 + 14 = 22$.

   c Total number of cars is $8 + 14 + 3 + 25 = 50$.

Example

3 A group of 84 boys enrolled at a particular school are surveyed to find out what sports they play. Of these students, 41 say they play soccer, 49 say they play basketball and 10 say they play both soccer and basketball. Display this as a Venn diagram and find out how many of the students play neither soccer nor basketball.

Solution

3 41 is the total for the whole soccer circle.
49 is the total for the whole basketball circle.
10 is the number in the overlap or intersection,
i.e. 10 students play both soccer and basketball.

So there are 31 who play only soccer and
39 who play only basketball.

Number who don't play either game
$= 84 - 10 - 31 - 39$
$= 4$ students

There are 4 students who do not play either soccer or basketball.
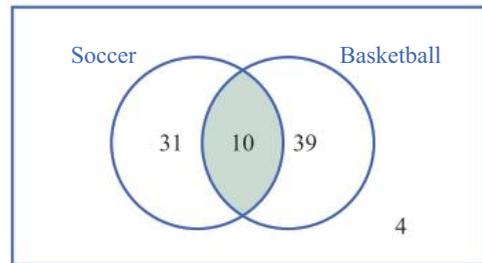
Exercise 5J

1 The Venn diagram shows the results of a survey of a group of teenagers. The group was asked if they listened to reggae music and rock music.

  a How many students were surveyed?

  b How many students didn't like reggae or rock music?

  c How many students listened to both reggae and rock music?

  d If you were surveyed, into which part of the Venn diagram would you fit?

2 A large number of students were asked about the type of root crops grown by each of their families. The categories were cassava crops and potato crops. The results of the survey are shown in the Venn diagram.

  a How many students were surveyed?

  b How many families grew cassava and potatoes?

  c How many families grew potatoes?

  d What type of crops could be grown by the 23 people who grew neither cassava nor potatoes?

  e What percentage of the total group surveyed grew any potatoes?
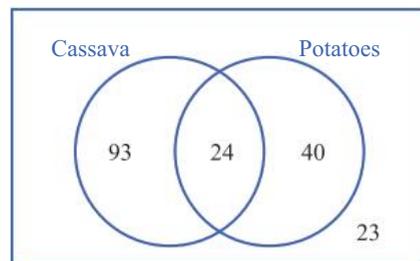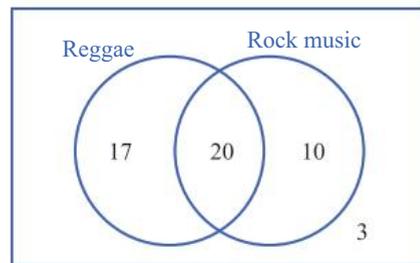
3 The Venn diagram shows the numbers of Year 7 students who ate bananas or rice last evening.

   a What is the total number of students?

   b How many students ate bananas last evening?

   c How many students ate both bananas and rice last evening?

   d How many students ate neither bananas nor rice last evening?
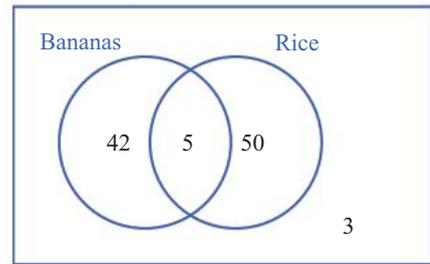
4 The Venn diagram shows the sports played by a group of students.

   a What is the total number of students?

   b How many students in total play soccer?

   c How many students play both sports?
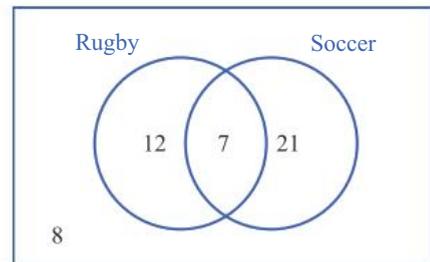
5 Travellers were asked about the modes of transport they had used in the last year. The questions they were asked were:

   i Have you travelled by plane in the last year?

   ii Have you travelled by boat in the last year?

The responses were that 120 had travelled on a plane and 156 had travelled by boat. Of those surveyed 104 people had been on both a plane and a boat, while 12 people had not used either a plane or a boat.

   a Draw a Venn diagram to represent the information.

   b How many people were surveyed?

   c How many people travelled on a plane but not a boat?

   d How many people had travelled on either a plane or a boat in the last year?

6 Kelly thought that most children who attended Selwyn College were either from Isabel or Malaita. In order to find out if this were true she went to the College and did a survey. Of the 30 children in the survey group, Kelly found that 20 students were from Malaita and 17 from Isabel. The families of seven children lived on both Malaita and Isabel. Use a Venn diagram to find out if she was right.

7 Survey your class to find out who come from the province where the school is and who comes from other provinces. Represent the information in a Venn diagram.

8 In a survey of 65 people, 13 people liked fish and chips only, 17 liked hamburgers only, and 15 did not eat takeaway food.

   a Draw a Venn diagram to represent the information.

   b How many liked both hamburgers and fish and chips?

Two-way tables can be used to display categorical data.

Example

A group of 84 boys enrolled at a particular school are surveyed to find out what sports they play. Of these students:

■ 41 say that they play soccer

■ 49 say that they play rugby

■ 10 say that they play both soccer and rugby.

Display this in a two-way table and find out how many of the students surveyed play neither soccer nor rugby.

Solution

	Soccer	Not soccer	Total
Rugby	10		49
Not rugby			
Total	41		84

The total for football is 41, the total for hockey is 49, the total for football and hockey is 10, and the grand total is 84. The remainder of the table can be completed by subtraction.

	Soccer	Not soccer	Total
Rugby	10	39	49
Not rugby	31	4	35
Total	41	43	84

The number in the area representing 'not soccer, not rugby' is 4. There are four students who do not play soccer or rugby.

Exercise 5K

1 This two-way table shows the results of a survey of a group of teenagers. The teenagers were asked if they listened to SIBC Local Music and Z-FM Island Music.

	SIBC Local Music	Not SIBC Local Music	Total
Z-FM Island Music	12	10	
Not Z-FM Island Music	35	23	
Total			

a Complete the totals to find out how many students were surveyed.

b How many students didn't like Local Music or Island Music?

c How many students listened to both Local Music and Island Music?

2 A large number of students were asked about the type of car owned by each of their families. The categories were sedan and wagon. The results of the survey are shown in the two-way table.

	Sedan	Not sedan	Total
Wagon	14	10	
Not wagon	51	25	
Total			

   a Complete the totals to find out how many students were surveyed.

   b How many families owned a sedan and a wagon?

   c What percentage of the total group surveyed owned only a wagon?

3 Kathy thought that most children used mobile phones and rode bicycles. She wanted to find out if this was the case, so she surveyed a group of school children. Of the 30 children in the group, Kathy found that:

   ■ 12 used a mobile phone

   ■ 17 rode bicycles

   ■ 7 children did not use mobile phones or ride bicycles.

   Use a two-way table to find out if she was right.

4 a Copy and complete the two-way table for jean sales.

   b How many long jeans were sold?

   c Which type of jean is the most popular?

   d What percentage of the jeans sold were long cotton?

	Cotton	Not cotton	Total
b ng		48	
Not long	12		
Total	35		120

5 Villagers who normally travel to the Lata Station were asked about the modes of transport they had used in the past year. They were asked the following questions:

   i Have you travelled by ship in the past year?

   ii Have you travelled by canoe in the past year?

   The responses were that 65 had travelled on a ship and 56 had travelled by canoe. Of those surveyed, 34 people had been on both a ship and a canoe, while 12 people had not used either a ship or a canoe.

   a Put this data into a two-way table.

   b How many people were surveyed?

   c How many people travelled on a ship but not a canoe?

   d How many people had travelled on either a ship or a canoe in the last year?

6 Fifty tourists who were passengers on a flight from Brisbane to Honiara were surveyed on the countries they had visited:

- 24 had visited both Indonesia and Japan.
- 30 had visited Japan.
- 8 had not visited either Indonesia or Japan.

a Display the data in a two-way table.

b Which was the more popular destination?

c What percentage of the passengers had visited Indonesia?

7 One hundred passengers on a flight from Europe were surveyed on the cities they had visited:

- 17 had not visited Moscow or Paris.
- 21 had visited both Moscow and Paris.
- 30 had visited Moscow but not Paris.

a Display the data in a two-way table.

b Which was the more popular city?

c What percentage of passengers had visited Paris?

8 Conduct a survey of at least 20 students at your school.

a Record how many of the students have visited the provincial capital and how many have visited Honiara this year.

b Display the information in a two-way table.

c Present your table to your classmates and justify at least four correct conclusions you can draw from your data.
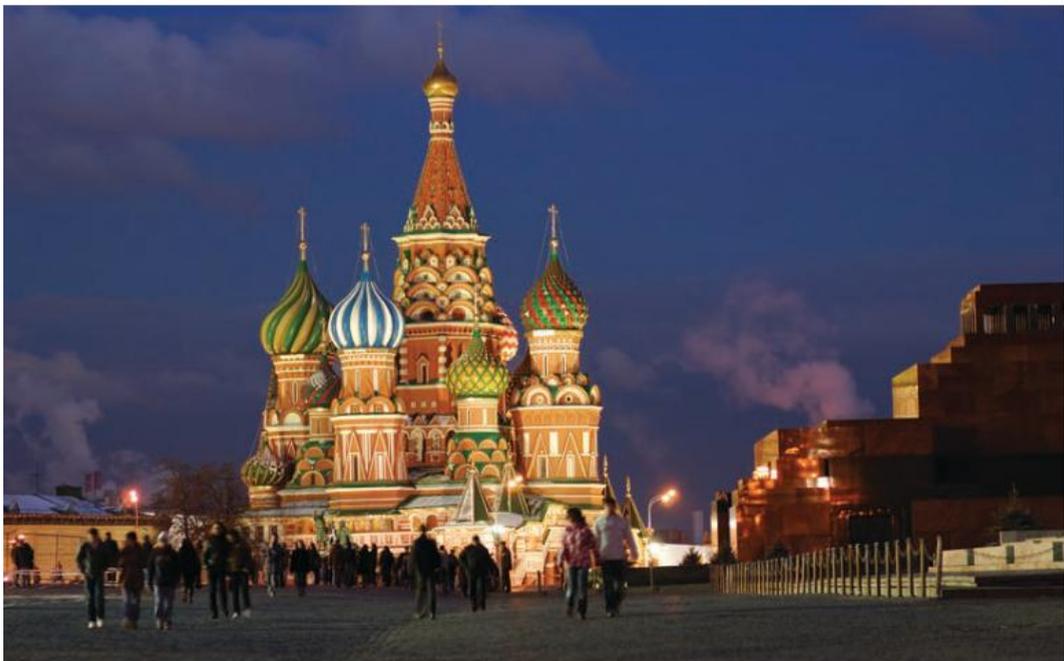
I Which team do you support?

Many people in Honiara were asked which football team they supported. The graph shows their responses.

Use the graph to answer the questions about supporters. Look for your answers in the grid below. Cross out the correct answers. When you finish there will be some boxes left. Write them in order from left to right.

- How many people said they were Naha supporters?
- How many people were surveyed altogether?
- Which team has the most supporters?
- How many more people support the Koloale than the Makuru?
- Which team has the fewest supporters?
- How many supporters do Naha and Uncles have altogether?
- How many supporters would you expect Koloale to have if twice as many people were surveyed?

Teams

| Makuru FC | Koloale FC | Naha FC | Uncles FC | Marist FC |

👤 represents 100 supporters

Marist B	500 K	700 O	Uncles O
400 L	2400 Q	Makuru O	900 A
1200 B	600 L	300 K	Koloale E
100 F	1100 C	200 R	Naha S

- If half the Makuru supporters attended a match, how many Makuru supporters would there be at that match?

2 Find the missing numbers in the stemplots. Match the numbers to the letters below to solve the riddle:

What happened to a ship carrying a cargo of blue paint when it collided with a ship carrying a cargo of red paint?

12 24 62 30 44 53 14 23 24 16 18

```
1 | A 4 6 5
2 | 1 3 4
3 | 0 D
4 | 4 4 5 H 5
5 | E 5
C | 2
7 | 0 7
```

39 55 44 45 45 70 21 45 77

101 110 122 148 147 154 115 147

```
10 | M 2 7
 S | 0 5 5
12 | 2 3 6
13 | N
 O | R 7 T
15 | W
```

130 123 115 102 107 126

8	5	3		6	7	3	4		4	2	11

1	2	7	14	14	0	3	9

3 Calculate the values below for each set of data. Match the letter with the correct number to solve the riddle:

Did you hear about the duck that flew upside down?

5 9 9 4 8 7	1 3 30 14 2
A mean **C** range	**E** mean **D** median
4 6 4 6 12 4	13 12 13 12 12 12
I mean **K** mode	**P** median **Q** range
1·4 3·2 4·8 2·6 3·5	$4\frac{1}{2}$ $2\frac{1}{4}$ $1\frac{2}{3}$ $3\frac{1}{2}$ $\frac{3}{4}$ $1\frac{1}{3}$
U mean **R** range	**S** mean **T** range

6	$3\frac{3}{4}$		1	3.1	7	5	4	10	3		3.1	12

Applications

Fact files

What do you know about your Maths class?

a   Do a survey of the Maths group and find out 10 interesting things about each student. You will need to decide on these 10 things as a group. They could include:

- favourite football teams
- favourite subject
- month of birthday
- time to run 200 m
- favourite colour
- family size

b   Choose one of these, present the data as an appropriate graph and display it.

c   Create a database of interesting information about your Maths group.

What does your school think about …?

a   Choose an issue that may be controversial at your school. For example:

- What do the students at your school think about school uniform?
- Do students get too much homework?
- Should physical education be compulsory?

b   Survey 30 students, teachers and parents for their opinion.

c   Present this information as an appropriate graph and comment on what it shows.

Estimating

How good are your friends at estimating length?

a   Ask 20 of your friends or family members to draw a line that is 15 cm long.

b   Measure the lines they have drawn and record the results.

c   Display this information as a dot frequency graph.

d   What was the median length?

e   What was the range?

Quality control

Who counts the number of matches in a matchbox?

a   Working in a group, count the number of matches in a number of boxes.

b   Collect the results as a group and display as a stem-and-leaf plot.

c   Find out how food manufacturers control the quantities of items in boxes.

Maths in the media

a Collect articles from newspapers and magazines that contain statistics or statistical graphs. Choose one that you think is interesting and informative. Present it to your teacher with an explanation as to why you feel it is a good use of statistics.

b Find examples of misleading graphs in which data has been distorted to create an impression. Write a paragraph explaining how the information has been manipulated.

Research

Choose a topic that you think is interesting, e.g. smoking habits of young people, results in sport etc. Search the Internet and find interesting and relevant data. Present the results of this search to your class.

Trends

Collect data over a period of time to investigate trends. You could record the data yourself or use information from another source such as a newspaper or the Internet. Possible topics are:

■ the temperature each day
■ local tide times
■ stock market trends
■ the number of absences at your school each day
■ the heart rate of a student during exercise
■ house prices in your village or town.

Display this information as a graph and comment on the results.

Home and away

As more sporting competitions become national, players travel longer distances for matches.

To find out if there is such a thing as a home-game advantage, collect the scores for a football team over one complete season. Compare the results of home games with those of games played between the provinces. Analyse your results using mean, median and range, and use graphical displays such as dot frequency graph, stemplots or bar charts.

Enrichment

1 The people fishing from a jetty were surveyed to find what bait they used. The results are displayed in this Venn diagram.

   a How many people used mamu fish only?

   b If you worked out that a total of 50 people used prawns, would you be right? Write a sentence to explain your results.

   c How many people were surveyed altogether?

   d What number of people used prawns or mamu fish but not both?

   e How many used only one type of bait?
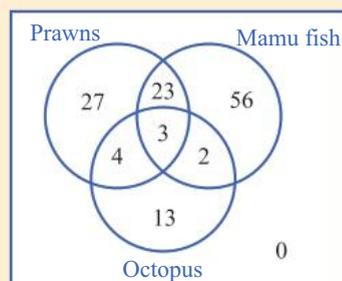
2 In a group of 20 students, 12 like tennis, 18 like basketball and some like both. They all like at least one of the sports. Display this in a Venn diagram. If one person is chosen at random, what is the probability that the person:

   a likes tennis?

   b doesn't like tennis?

   c likes basketball?

   d likes both sports?

3 Two lots of data can be compared when drawn back-to-back on the same set of axes.

   a Display the maximum and minimum temperatures shown here on a graph. Draw a bar or line graph.

   b When was the difference between the maximum and minimum temperatures biggest?

   c When was the difference between the temperatures smallest?

Month	Maximum temp (°C)	Minimum temp (°C)
January	26	14
February	26	14
March	24	13
April	20	11
May	17	8
June	14	7
July	13	6
August	15	6
September	17	8
October	20	9
November	22	11
December	24	13

4   The heights, in cm, of a group of 30 Year 8 students were:

144, 153, 167, 178, 171, 149, 153, 161, 167, 166, 156, 154, 162, 156, 166, 162, 160, 164, 148, 157, 170, 165, 163, 174, 168, 162, 158, 161, 169, 163

a   The data can be grouped into classes such as 140–<150, 150–<160 and so on. Copy and complete the frequency table below.

Height (cm)	Tally	Frequency
140–<150		
150–<160		
160–<170		
170–<180		
	Total	

b   Display this as a histogram or a bar graph.

   i   Divide the horizontal axis into 10s as in a line graph.

   ii   The first bar would start at 140 and finish at 150.

   iii   Display frequency on the vertical axis.

c   Display the heights as a stem-and-leaf plot using 14, 15, 16 etc. as the stem and the units as the leaves. Compare the stem-and-leaf plot with the histogram. What conclusions can you draw?

5   A group of people was surveyed in the street to collect data for a comparison of male and female salaries. Each person was asked to select the code that would best describe their annual salary.

Code	Salary
A	Less than $20 000
B	$20 000 to less than $40 000
C	$40 000 to less than $60 000
D	$60 000 or more

The results were:

Male	D, C, D, C, B, C, D, B, D, C, C, B, B, C, C, C, D, B, B, C, C, C, D, D, C, C, B, C, D, B, B, C, C, D, D, C, C, C, B, B, B, C, C, C, D
Female	A, C, C, D, B, B, A, A, B, B, A, A, B, B, C, A, C, C, B, B, A, A, D, C, B, B, B, B, C, C, A, B, B, B, A, A, C, C, D, B, A, C, D, A, B, B, C, C, D, D, B, A, C, B

a   Display the data in:

   i   a frequency table

   ii   as a double bar graph

b   What conclusions can you draw?

Revision/Assessment

Exercise 5A

1 When 25 students were surveyed to find their favourite fast foods, the results were:

hamburgers, pizza, chips, pizza, chicken, hamburgers, pizza, chicken, chips, pies, pizza, hamburgers, pizza, chicken, pizza, chicken, chips, hamburgers, chips, pizza, pies, hamburgers, chicken, pizza, pies

  a Is the data categorical or numerical?

  b Display this information in a frequency table with a tally.

  c What was the most popular favourite fast food?

Exercise 5C

2 A group of 20 male and 20 female teenagers were asked their opinion on whether physical education should be compulsory. The results are displayed in this double column graph:
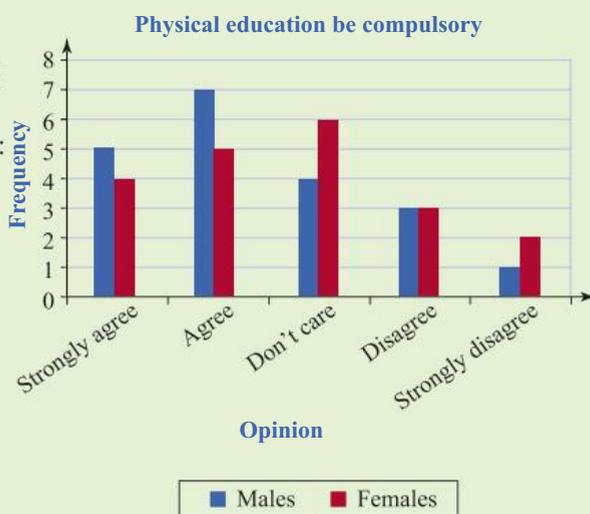
  a How many females strongly agree with compulsory physical education?

  b How many males strongly agree with compulsory physical education?

  c What is the total number of students who strongly disagree with compulsory physical education?

Physical education be compulsory

3 The results of a survey are shown in the frequency table below:

Subject	Tally	Frequency
Agriculture	ﬀﬀ	5
Maths	ﬀﬀ ‖	7
Science	‖	2
English	‖‖	3
Industrial Art	ﬀﬀ ﬀﬀ ‖	12
Social Science			1
	Total	30

  a Draw a column graph to display the information.

  b Which was the most popular subject?

4 Male and female students were asked if they preferred hockey or soccer. The results are shown in this stacked column graph.

  a What percentage of males preferred soccer?

  b What percentage of females preferred hockey?

Favourite sports
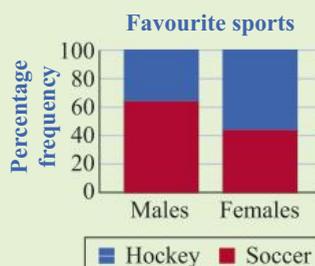
Exercise 5D

5 A Holden Commodore was tested to determine petrol consumption when travelling at varying speeds. The results were displayed in the following line graph.
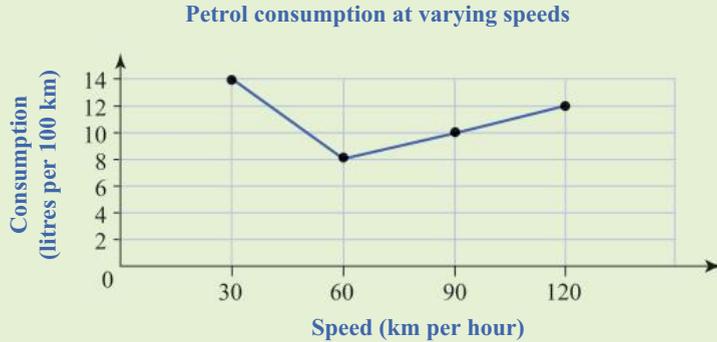
Petrol consumption at varying speeds

a What does the horizontal axis represent?

b What does the vertical axis represent?

c What is the petrol consumption when travelling at 60 km/h?

d How does the petrol consumption when travelling at 120 km/h compare to that when travelling at 90 km/h?

e What is the most efficient speed at which to drive the car?

f What is the least efficient speed at which to drive the car?

Exercise 5E

6 Eighteen students were interviewed and asked what they considered to be the most worrying social issue for teenagers. The results are given in the table below:

Issue	Frequency
Environment	9
Unemployment	5
War	3
The economy	1

Display this information as a pie graph.

Exercise 5F

7 The Red Devils football team has had a very successful season. The dot frequency graph shows the number of goals scored in their games.

a How many games were played?

b What was the modal number of goals scored?
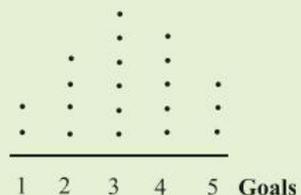
Exercise 5G

8 The number of absentee days, in the first term, for each student in a Year 7 class was recorded. The results were:

7, 8, 9, 3, 5, 5, 6, 3, 7, 8, 4, 4, 5, 6, 6, 4, 5, 2, 3, 8, 4, 3, 5, 5, 4, 3

   a Display this data as a bar graph.

   b What was the mean number of absentee days for that class?

9 The mean number of sweets in a bag should be 35. The quality control person took a sample of 10 bags to check that this was the case.

In the first nine bags there were 35, 42, 31, 43, 36, 33, 32, 31, 35

   a What was the mean number of sweets in the first nine bags?

   b What was total number of sweets in the first nine bags?

   c How many sweets must be in the tenth bag so that the mean number of sweets for the 10 bags is 35?

Exercise 5H

10 Peter has a huge variation in his batting scores when he plays cricket. His scores are:

56, 66, 65, 32, 45, 72, 21, 10, 11, 25, 17, 23, 85, 54, 65, 73, 87, 23, 4,
15, 26, 16, 36, 27, 99, 65, 74, 85, 34, 56, 73, 75, 59, 63, 48, 32, 12,
75, 56, 84, 45, 55, 69, 74, 34, 58, 50, 64, 37, 86, 54, 62, 51, 73, 67

   a Display his batting scores as an ordered stem-and-leaf plot.

   b What is his median score?

   c What is the range?

   d What is his mean score?

11 The number of thefts from parked cars in a large town was recorded for 18 months:

Month	Number of thefts	Month	Number of thefts
January	54	October	74
February	63	November	78
March	78	December	82
April	82	January	90
May	56	February	81
June	34	March	72
July	45	April	53
August	61	May	42
September	65	June	31

   a Display this data as a line graph.

   b When did the number of thefts peak?

   c When in the year do the police see a decrease in the number of thefts?

   d Calculate the mean number of thefts for the 18 months.

12 A parent of a Year 7 student complained that the students were given too much homework. The principal surveyed 50 students, 50 teachers and 50 parents asking if they believed that Year 7 students had too much homework. These are the results:

	Students	Teachers	Parents
Yes	35	28	6
No	15	22	44

Display this information as a stacked column graph. You should have columns for the students, the teachers and the parents. Analyse the data and comment on what the graph shows.

Exercise 5I

13 The Police netball team has had a really successful season. The stemplot shows the number of goals scored in their games:

```
Stem │ Leaf
   1 │ 8 9
   2 │ 3 1 3 6 7 8 9 9
   3 │ 0 2 5
   4 │ 2 8
   5 │ 1 2 8
   6 │ 3 6        (3│2 means 32)
   7 │ 2
```

Find the median and range of the number of goals scored.

Exercise 5J

14 The Venn diagram shows the sports played by a class of Year 7 students:

  a How many students are in the class?

  b How many play both sports?

  c How many students play football?

  d How many students don't play netball?
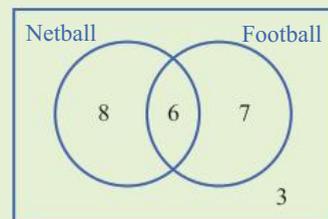
15 The two-way table shows the number of shirts sold in a week.

  a Copy and complete the table:

	Hoods	No hoods	Total
Long-sleeved	15	18	
Short-sleeved			67
Total		68	

  b How many shirts were sold in total during the week?

  c Which was the most popular style of shirt?

  d What percentage of shirts sold had hoods?

Algebra Symbols

Algebra was originally devised in Ancient Babylon. The word actually derives from the Arabic term *al-jabr* which means 'the reunion of broken parts', and one of the earliest algebra problems was documented on the Rhind Papyrus (1650 BC) in ancient Egypt. The first treatise on algebra was written in the third century AD by Diophantus of Alexandria.

The Rhind Papyrus, now in the British Museum, poses the following problem: 'Divide 100 loaves among 10 men including a boatman, a foreman and a doorkeeper who receive double portions. What is the (exact) share of each?'

The ancient Egyptians could solve this problem using their early notions of algebra.

This chapter covers the following skills:

- Simplifying expressions and collecting like terms
- Working with symbols and pronumerals
- Translating verbal statements into mathematical expressions
- Substituting into expressions
- Writing algebraic rules
- Applying the distributive law
  $a(b + c) = ab + ac$
- Exploring triangular, square and pentagonal numbers
- Applying simple formulas
- Deducing a formula in a modelling situation and testing its validity

Specific Learning Outcome (SLO)

Learners should be able to:

7.6.1.1	Define algebra.
7.6.1.2	Define terms and expressions.
7.6.2.1	Translate maths problem statements into algebraic expressions by using symbols and objects.
7.6.3.1	Use symbols, pronumerals and other objects to create maths expressions by grouping same symbols, pronumerals and objects together.
7.6.4.1	Define pronumerals and variables.
7.6.4.2	Use letters to represent missing numbers.
7.6.5.1	Simplify expressions by matching and grouping objects, symbols etc. of the same kind.
7.6.6.1	Simplify expressions by multiplying their algebraic terms.
7.6.7.1	Simplify expressions by dividing their algebraic terms.
7.6.8.1	Use the 'Distributive Law' to expand expressions with brackets e.g. $a(b + c) = ab + ac$.
7.6.9.1	Evaluate algebraic expressions by substituting values into variables in the expressions.
7.6.10.1	Create triangular, squares and pentagonal shape patterns with dots and match sticks.
7.6.11.1	Use rules and formulas to evaluate and solve for missing numbers represented by pronumerals e.g. $P = 2L + 2W$ (U).

6A Writing expressions

Algebra is the language of mathematics. To solve problems, we can translate information into mathematical sentences called expressions. We use symbols or letters to represent unknown numbers. For example, Morgan has some birds and cats. We can use the symbol 🐈 to stand for the **number** of cats and 🐦 to represent the **number** of birds. The total number of birds and cats is represented by the expression 🐈 + 🐦.

Example

1 I think of two different numbers ♥ and ■. Write an expression representing the sum of ♥ plus twice ■.

2 It costs $5 per week to feed a cat and $2 per week to feed a bird. Write an expression for the total cost of pet food for a week.

3 Write an expression for the perimeter of this rectangle.

W | rectangle with L on top and L on bottom | W
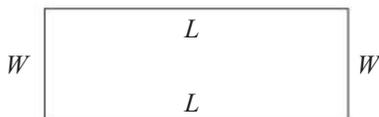
Solution

♥ + 2■ represents the sum of ♥ plus twice ■.

The cost for a week = 5 🐈 + 2 🐦.

$2L + 2W$ represents the perimeter.

Exercise 6A

1 Write expressions for each of the following statements:

  a the sum of ☺ and four

  b three less than ■

  c one quarter of ☽

  d five times the value of ☾

  e ■ divided by five

  f five divided by ◈

  g the product of ☾ and ☿

  h the term 3■ subtracted from the term 5◈

  i ◈ multiplied by 3 then add 2

  j ☺ minus 4 times ◈ then add three

2 Write an expression for the following statements:

  a A number n is multiplied by five then four is added.

  b A number x is divided by three then two is subtracted.

  c A number y is multiplied by 3 and six is added.

  d A number p is halved and thirty is added.

  e Two is added to the number q and the result is divided by y.

  f Three is added to the number x and the result is divided by 4.

  g A number y is multiplied by four and then 10 is subtracted.

  h A number x is multiplied by 3 and the result is divided by 5.

  i A number x is multiplied by itself and then 7 is added.

3 Write algebraic expressions that represent the perimeters of these particular figures:

a

b

c
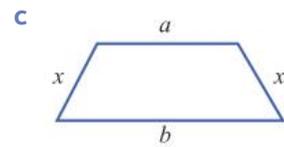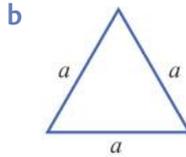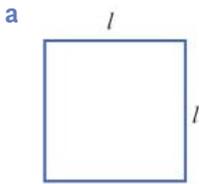
4 The basketball team has ♀ girls and ♂ boys. Write an expression for each of the following:
   a the total number of students in the team
   b the number of boys if three more boys join
   c the number of girls if two girls leave
   d the new total number of team members

5 Adult tickets to the school concert cost $d and a program costs $p. Write expressions for the cost of:
   a five adult tickets
   b a half-priced ticket for a child
   c three half-priced tickets
   d two adult tickets and one program
   e two half-priced tickets and two programs

6 The cost of travelling by taxi is f (dollars) for the 'flag fall' (the cost of engaging the taxi) plus d (dollars) for each kilometre travelled. Write an expression for the cost of:
   a travelling 2 kilometres
   b travelling 10 kilometres
   c travelling n kilometres
   d each person travelling n kilometres when the cost is shared equally among four people

7 Ice creams at the school canteen cost x (dollars) and drinks cost y (dollars). Write an expression for the cost of:
   a four ice creams and three drinks
   b three ice creams and four drinks
   c m ice creams and n drinks

8 An aquarium has f fish, r rays and s sharks. Write an expression for the following:
   a the total number of marine animals
   b the number of fish if they double the number
   c the number of rays if three are eaten by sharks
   d the number of sharks if half of them are removed

9 After another m dives, a scuba diver will have made n dives in total.
   a Write an expression for the current number of dives.
   b Write an expression for the number of dives made p dives ago.

6B Pronumerals

Letters that are used to represent unknown numbers in expressions are called **pronumerals** or variables. To simplify expressions with pronumerals add or subtract like terms. This is sometimes called collecting the like terms. We usually write the pronumerals in a term in alphabetical order.

Example

Simplify the following expressions:

a   ☺ + ☺ + ☺ + ☾

b   4⬡ + 3⬡

c $x + x + x$

d $9abc + 3bac - cba$

Solution

You can only add like terms:

☺ + ☺ + ☺ + ☾
= 3☺ + ☾

4⬡ + 3⬡
= 7⬡

$x + x + x$
= $3x$

$9abc + 3bac - cba$
= $9abc + 3abc - abc$
= $11abc$

Exercise 6B

1 Simplify the following collections:
   a dog, cow, dog, cat, cat, dog, cow, dog, cat
   b guava, coconut, banana, guava, guava, orange, coconut, guava, banana, guava
   c pencil, pencil, eraser, pen, pen, pen, pen, pencil, scissors, pencil, pen
   d bus, car, car, truck, motor cycle, car, car, motor cycle, truck, car, car, truck

2 Write down the pairs of like terms: 3□, 4⬡, 2✿, 6✿□, 10⬡, 3✿, 5✿□, 10□

3 Write down the pairs of like terms: 8f, 10ab, 8kz, 3pq, 2f, 9jg, 12qp, 5kz, 2gj, 6b, 3ba, b

4 Simplify the following expressions:
   a ✿ + ✿ + ✿ + ✿
   b ▭ + ▭
   c 2☆ + 3☆ − 2☆
   d 4☺ + 4☺ − 2☺ + ☺
   e 10☆ + 10☆ + 10▭
   f 3✿ + 4☺ + 2✿
   g 4△ + 3△ − △ + □
   h 6□ + 4○ − 2□
   i 3♡ + ♡ + △ + 2△
   j 5☺ + 6☺ − ○ + ☺
   k 4□ − △ + 4△
   l 6♡ − 3♡ + 2○
   m 2☆ + 5☆ + 3△ + 2△
   n 5□ + 2□ + 3△ + 2△

5 Simplify the following expressions:

a $m + m + m$ b $x + x + x + x$ c $x + x + x + y + y$

d $a + b + a + a + b + a$ e $10x + 5x$ f $5a + 2a$

g $12x - 7x$ h $15y - 8y$ i $27t + 18t$

j $25p - 17p$ k $9x - 8x$ l $8y - 8y$

6 Simplify the following like terms:

a $2xy + 6xy$ b $7xy + 9yx$

c $12ab - 5ab$ d $18ab - 6ba$

e $5pq + 8pq + 9pq$ f $7pq + 2pq + 4qp$

g $18mn + 16mn - 28mn$ h $15mn + 17nm - 5nm$

i $23xy - 15xy - 6xy$ j $28xy - 16yx - 9xy$

k $13wx - 12wx$ l $6rs + 2rs - 8rs$

7 Simplify the following expressions by combining like terms:

a $4x + 5x + y$ b $5m - 2m + 3n$

c $6xy + 2xy + zy$ d $6pq - 3q + 2qp$

e $2x + 3y + 4x + 5y$ f $3x + 2 + 4x + 5$

g $a + 5 + 2a - 2$ h $4 + 3x - 2 - x$

i $6x + 3y + 2 + 4x + 5y + 1$ j $8x + 2y - 3 - 6x + y + 7$

8 Simplify the following expressions by combining like terms:

a $2a + 3b - c - a + b + 2c + 3a - b + c$

b $6ab + 3bc - ca - 2ab + 4bc - ab + ca$

c $7xy + 5yz - 2zy + 3zx + 4xy - 3yz + 6zx$

9 Copy and complete the following table:

+	3	5y	2x	5xy
2				
3y				
4x				
2xy				

10 Copy and complete the following table, taking away the black terms from the green ones:

−	6	8a	10b	7ab
4				
3a				
5b				
2ab				

Multiplying and dividing pronumerals

Tom has some puppy dogs. The initial number of dogs is represented by the letter d. The dogs breed until there are three times as many dogs or $3 \times d$ or $3d$. To simplify expressions, leave out the multiplication sign. For example, $3a$ means 3 lots of a, or 3 multiplied by a.

Example	**Solution**
1 Simplify these expressions:	
a $6 \times z \times y$	$6 \times z \times y$ $= 6zy$
b $5y \times 7y$	$5y \times 7y$ $= 5 \times 7 \times y \times y$ $= 35y^2$
c $2 \times a \times b$	$2 \times a \times b$ $= 2ab$

If the puppy dogs are divided equally between 2 people, each person would have $d \div 2$ or $\dfrac{d}{2}$

or $\dfrac{1}{2}d$. To simplify expressions with division, write as a fraction and cancel common factors.

Example	**Solution**
2 Simplify:	
a $\dfrac{16x}{12}$	$\dfrac{\overset{4}{16}x}{\underset{3}{12}} = \dfrac{4x}{3}$
b $14x \div 2y$	$\dfrac{\overset{7}{14}x}{\underset{1}{2}y} = \dfrac{7x}{y}$

Exercise 6C

1 Choose a symbol to represent the original number of pigs and write an expression for the following situations:

a Pigs are bred until the population doubles in size.

b Pigs are bred until there is five times the original number.

c A disease wipes out half the original number of pigs.

d Pigs are divided equally among three different people.

e Pigs are divided equally among six different people.

f Pigs are bred until the population doubles in size and then four are given away.

g Pigs are bred until the population triples and then five more are added.

2 Simplify the following products as far as possible:

a $4 \times y$ b $5 \times y$ c $a \times 10$

d $b \times 6$ e $a \times b$ f $m \times n$

g $12 \times y \times z$ h $m \times n \times 9$ i $a \times b \times c$

j $y \times 6 \times 5$ k $y \times 8 \times 6$ l $4 \times 7 \times p$

m $3 \times a \times 7 \times b$ n $3 \times y \times 8 \times z$ o $a \times b \times b$

p $8 \times z \times 9 \times z$ q $4 \times y^2 \times z \times 9$ r $3 \times m \times n \times m$

3 Simplify the following products as far as possible:

a $5 \times 2x$ b $6 \times 8y$ c $3a \times 7$

d $y \times 5x$ e $m^2 \times 6n$ f $7c \times 5b$

g $5y \times 6z$ h $7p \times 9q$ i $6z \times 6z$

j $4y \times 5y$ k $2a \times 4b \times 7$ l $6m \times 2n \times 9p$

m $3p \times 5q \times 2r$ n $3a \times 6b \times 7c$ o $4y \times 3z \times 5y$

4 Express the following quotients in fraction form:

a $x \div 3$ b $m \div 6$ c $p \div 10$

d $5 \div x$ e $7 \div 2x$ f $3x \div 5y$

5 Simplify the following algebraic fractions by cancelling:

a $\dfrac{3a}{15}$ b $\dfrac{7a}{14}$ c $\dfrac{2y}{8}$ d $\dfrac{12}{6x}$ e $\dfrac{18}{9y}$

f $\dfrac{21}{7m}$ g $\dfrac{8}{24p}$ h $\dfrac{5}{20q}$ i $\dfrac{16}{64xy}$ j $\dfrac{10x}{8}$

k $\dfrac{12x}{10}$ l $\dfrac{18y}{12}$ m $\dfrac{32}{12x}$ n $\dfrac{12}{30b}$ o $\dfrac{21}{35w}$

6 Copy and complete the following table:

×	3	5y	2x	5xy
2				
3y				
4x				
2xy				

7 Copy and complete the following table. Divide the terms in green by the terms in black:

÷	24	48a	72b	96ab
3				
4a				
2b				
8ab				

The distributive law: Expanding brackets

The perimeter of a rectangle is twice the length plus twice the width:

Perimeter $= 2L + 2W$

Alternatively, we could add the length L to the width W and take twice the total:

Perimeter $= 2 \times (L + W)$.

The two expressions are the same, and so

$2 \times (L + W) = 2L + 2W$

This illustrates the **distributive law**, in which the term outside the bracket multiplies each term inside the bracket, when the brackets are removed:

$a(b + c) = ab + ac$ and $a(b - c) = ab - ac$

The term a can also come after the bracket so that we would have:

$(b + c)a = ba + ca$ and $(b - c)a = ba - ca$
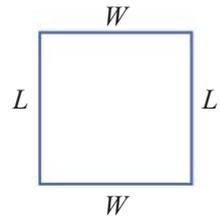
Example	**Solution**
Expand the following expressions (i.e. remove the brackets):	
a $5(x + 4)$	$5(x + 4)$ $= 5 \times x + 5 \times 4$ $= 5x + 20$
b $6x(2x - 5)$	$6x(2x - 5)$ $= 6x \times 2x - 6x \times 5$ $= 12x^2 - 30x$
c $7x + 5(x + 2)$	$7x + 5(x + 2)$ $= 7x + 5x + 10$ $= 12x + 10$

Exercise 6D

1 Complete the following:

a $4 \times (7 + 3)$
$= 4 \times \underline{\quad}$
$= \underline{\quad}$

b $4 \times 7 + 4 \times 3$
$= \underline{\quad} + \underline{\quad}$
$= \underline{\quad}$

c $8 \times (12 - 4)$
$= 8 \times \underline{\quad}$
$= \underline{\quad}$

d $8 \times 12 - 8 \times 4$
$= \underline{\quad} + \underline{\quad}$
$= \underline{\quad}$

2 Expand each of the following:

a $3(x + y)$	**b** $7(a + b)$	**c** $7(m + n)$	**d** $9(x + 4)$
e $6(y + 7)$	**f** $10(p + 8)$	**g** $(a + 4)8$	**h** $(c + 5)9$
i $(b + 9)5$	**j** $(6 + p)6$	**k** $(12 + q)7$	**l** $(5 + n)8$
m $(x + 5)3$	**n** $(a + b)7$	**o** $(m + n)10$	**p** $7(r + s)$

3 Expand each of the following:

a $5(x - y)$ b $7(a - b)$ c $9(m - n)$

d $8(x - 7)$ e $3(x - 9)$ f $9(x - 12)$

g $2(13 - m)$ h $8(7 - q)$ i $4(9 - p)$

j $(7 - x)8$ k $(18 - b)3$ l $(15 - m)4$

4 Expand each of the following:

a $x(y + z)$ b $m(p + q)$ c $a(b + c)$

d $r(s - t)$ e $p(q - r)$ f $l(m - n)$

g $m(n - 8)$ h $a(b - 12)$ i $z(y - 8)$

j $c(9 - b)$ k $p(14 - q)$ l $m(9 - n)$

5 Expand each of the following:

a $8(3x + 2)$ b $5(4y + 6)$ c $7(9b + 4)$

d $5(7q - 6)$ e $9(6p - 12)$ f $8(3s - 7)$

g $4(2x + 5y)$ h $5(6m + 9n)$ i $7(8a + 12b)$

j $(3a - 7b)6$ k $(8m - 6n)11$ l $(2m - 3n)9$

6 Expand each of the following and simplify as far as possible:

a $3(2x + 6) + 9$ b $7(7y - 1) + 10$

c $4 + 5(3m + 6)$ d $30 + 9(b - 2)$

e $4(2a + 3b + 4c) + 5b$ f $4x(3x + 2)$

g $2x(3x + 2) + 3(3x + 2)$ h $6y(5y - 8)$

i $3x(2x + 5) + 4x(3x - 2)$ j $5p(4p + 2m) - 20p^2 - 8mp$

7 Write an algebraic expression for the following using brackets, then remove the brackets.

a I think of a number n, add 3 and then multiply the total by 6.

b I think of a number n, subtract 4, then multiply the result by 7.

c I think of a number n, double it, add 3, then multiply the result by 4.

d I think of a number n, multiply it by 4, subtract 6, then multiply the result by 3.

e I think of a number n, halve it, subtract 3, then multiply the result by 4.

8 On a particular day a adults and c children went for a picnic at Lella Beach.

a Write an expression for the total number of people at the picnic.

b If adults pay $3 each to enter and children pay $1·50, write an expression for the total amount collected by the gatekeeper?

c Assuming the attendance pattern is the same each day, write an expression (using brackets) for the gatekeeper's takings over a 5-day period.

d Remove the brackets from your expression in part **c**.

6E Substituting into expressions

Each pronumeral or variable represents an unknown number. Numbers can be *substituted* into pronumerals and a result is worked out to *evaluate* the expression. Remember to use the correct order of operations or BODMAS.

Example

Solution

1 Find the value of $3\blacksquare + 2\heartsuit$
if $\blacksquare = 4$ and $\heartsuit = 5$.

$3\blacksquare + 2\heartsuit$
$= 3 \times 4 + 2 \times 5$
$= 12 + 10$
$= 22$

2 Find the values of the following expressions, where $x = 3$ and $y = 4$:

a $8x - 2y$

$8x - 2y$
$= 8 \times 3 - 2 \times 4$
$= 16$

b $\dfrac{2x + y}{5}$

$\dfrac{2x + y}{5}$

$= \dfrac{2 \times 3 + 4}{5}$

$= \dfrac{10}{5}$

$= 2$

Exercise 6E

1 Find the values of the following expressions where $\clubsuit = 4$:

a $2\clubsuit$ **b** $\clubsuit + 5$ **c** $\dfrac{\clubsuit}{2}$ **d** $\clubsuit - 3$

2 Find the values of the following expressions where $\bullet = 8$:

a $3\bullet$ **b** $7\bullet$ **c** $\frac{1}{2}\bullet$ **d** $\bullet + 9$

3 Find the values of the following where $x = 5$ and $y = 4$:

a $6xy$ **b** $2xy - 1$ **c** $\frac{1}{4}xy - 1$

d $2x + 6y$ **e** $9x - 8y$ **f** $4y + 3x$

4 If $a = 5$, $b = 6$, $c = 3$, evaluate the following expressions:

a $\dfrac{ab}{c}$ **b** $\dfrac{2ac}{b}$ **c** $\dfrac{b + 4}{a}$

d $\dfrac{b + c}{c}$ **e** $\dfrac{2a + 2}{b}$ **f** $\dfrac{bc - 8}{a}$

g $a(2c + 4)$ **h** $a(b + 4)$ **i** $2c(a + b)$

j $5c^2$ **k** $b^2 - 2c$ **l** $(2a)^2$

m $2a^2$ **n** $a^2 + b^2$ **o** $(a + b)^2$

p $b^2 - c^2$ **q** $(b - c)^2$ **r** $(3c)^3$

5 Complete the following tables by substituting each value of x into the given expression:

a

x	1	2	3	4	5
$2x + 1$					

b

x	1	2	3	4	5
$x + 2$					

c

x	1	2	3	4	5
$8 - x$					

d

x	1	2	3	4	5
$3x - 2$					

6 Sam has c CDs and d DVDs in his music collection:

a Write an expression for the total number of disks (n) in his collection.

b If $c = 24$ and $d = 16$, find n.

7 Tamou has won m magazines and b books during Solomon Islands College of Higher Education (SICHE) library week.

a Write an expression for the total number (n) of books that Tamou won.

b If Tamou has 5 magazines and 12 books, find n.

8 CDs cost \$15 each and DVDs cost \$20 each:

a Write an expression for the cost (c) of x CDs and y DVDs.

b By substituting 5 for x and 3 for y, find the cost of 5 CDs and 3 DVDs.

c If \$120 was spent in total, how many CDs and DVDs were purchased? Can you find more than one answer here?

9 At the 30th Independence Anniversary Trade Show held at Panatina Ground, ice cream was sold at \$5 per cone and green coconuts at \$3 per fruit.

a Write an expression for the cost (c) of x cones of ice cream and y coconuts.

b By substituting 3 for x and 4 for y, find the cost of three cones of ice cream and four coconuts.

c If \$60 was spent in total, how many cones of ice cream and how many coconut fruits might have been bought? Can you find more than one answer here?

10 Hot dogs cost \$12 each and egg burgers cost \$8 each:

a Write an expression for the cost (c) of x hot dogs and y egg burgers.

b By substituting 2 for x and 5 for y, find the cost of two hot dogs and five egg burgers.

c If \$96 was spent in total, how many hot dogs and egg burgers would it have been possible to buy?

6F Exploring dot patterns

Learning task 6F

Triangular numbers

1 Dots are arranged in the shape of a triangle and counted to form 'triangular numbers'. The first four terms are drawn below:

1 dot   3 dots   6 dots   10 dots
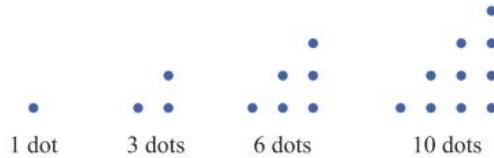
  a Draw the next two shapes in this pattern.

  b Write down the number of dots in each of the first 10 triangular numbers.

  c Describe the pattern for triangular numbers.

Square numbers

2 Dots can make the shape of a square and are called 'square numbers'. The first three square numbers are drawn below:
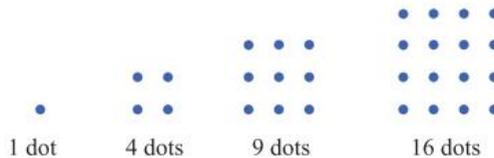
1 dot   4 dots   9 dots   16 dots

  a Draw the next two shapes in this pattern.

  b Write down the number of dots in each of the first 10 square numbers.

  c Describe the pattern for square numbers.

Pentagonal numbers

3 The first three pentagonal numbers are drawn below:

1 dot   5 dots   9 dots
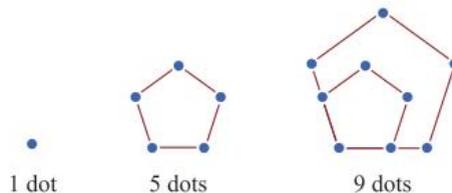
  a Explain why these are called 'pentagonal numbers'.

  b Draw the next two shapes in this pattern.

  c Write down the number of dots in each of the first 10 pentagonal numbers.

  d Describe the pattern or rule for pentagonal numbers.

4 **a** Find two numbers that are greater than 1 and are both pentagonal and square.

  b Find a number that is greater than 1 and is both triangular and square.

Exploring match patterns 6G

Whole numbers produce some interesting patterns when the four basic operations, +, −, ×, ÷, are applied to them. Patterns are a part of our everyday life and giving them rules can save us time and help us to make predictions.

Learning task 6G

1 Use matches to make the following shapes:

3 matches   5 matches   7 matches
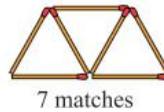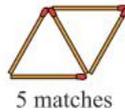
   a Draw the next three shapes by continuing the pattern of matches.

   b Complete this sequence 3, 5, 7, ____, ____, ____, ____, ____, ____.

   c Explain how you found each number.

   d Predict how many matches would be needed to make the 15th shape (term) in this pattern.

   e Test your prediction for the 15th term, by making it with matches.

2 Build these first three shapes with matches:
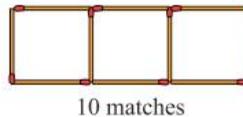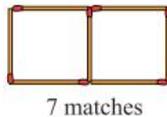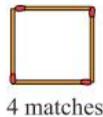
4 matches   7 matches   10 matches

   a Predict what the next term in this pattern might be.

   b Make the fourth term of this sequence with matches.

   c Was your prediction correct? Explain your answer.

   d Complete the statement:
'The rule for this pattern is: We start with 4 matches, then add _____ matches each time'.

3 Build these first three shapes with matches:
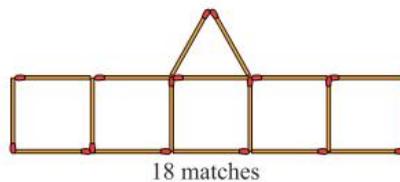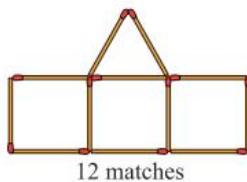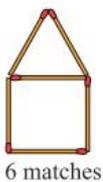
6 matches   12 matches   18 matches

   a Predict what the next term in this pattern might be.

   b Make the fourth term of this sequence with matches.

   c Was your prediction correct? Explain your answer.

   d Copy and complete the statement:
'The rule for this pattern is: We start with _____ matches, then add _____ matches each time'.

When we use an identifying symbol and an equals sign before an expression, the result becomes a formula. A **formula** explains the process for working out a mathematical result.

For example, we have developed $2L + 2W$ as the expression for finding the perimeter of a rectangle.

$P = 2L + 2W$ is the formula that works out the perimeter of a rectangle.

P (perimeter) is the **subject** of the formula. The pronumerals in any formula are often referred to as **variables**, because the values we substitute for them usually vary, depending on the situation.

Example	Solution
1 Use the formula to find the perimeter of this rectangle: 3 m 4 m	$P = 2L + 2W$ $P = 2 \times 4 + 2 \times 3$ $P = 8 + 6$ $P = 14$ metres
2 The cost C ($) of hiring a surfboard for t hours is given by the formula: $C = 10 + 3t$ where there is a $10 initial charge, plus a charge of $3 for each hour the board is in use. Find the cost of hiring the board for:	
a 1 hour	$C = 10 + 3 \times 1$ $\quad = \$13$ It costs $13 to hire the board for 1 hour.
b 4 hours	$C = 10 + 3 \times 4$ $\quad = \$22$ It costs $22 to hire the board for 4 hours.
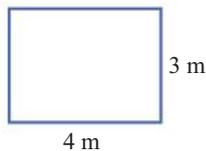
Exercise 6H

1 The perimeter of the isosceles triangle shown is given by the formula $P = 2x + y$.

  a Find the perimeter where $x = 5$ cm and $y = 3$ cm.

  b Find the perimeter if $x = 8$ m and $y = 4$ m.

2 The area A of a rectangle of length L and width W is given by the formula $A = LW$.

  a Find the area of a rectangle where $L = 12$ cm and $W = 9$ cm.

  b Find the area of a rectangle where $L = 6$ m and $W = 7$ m.

3 The area of a triangle of base b and height h is given by the formula $A = \frac{1}{2} \times b \times h$. Find the area of a triangle with base 8 cm and height 6 cm.
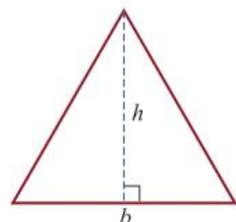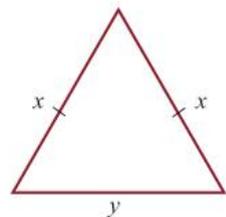
4 The number of points P gained by an Australian Rules football team is given by the formula $P = 6g + b$, where g is the number of goals kicked and b is the number of behinds kicked.

   a Find the points score for two teams that have scored:

   i 2 goals and 10 behinds   **ii** 3 goals and 4 behinds

   b Which team won the match?

5 The number of matches N needed to tessellate T equilateral triangles in a straight line is given by $N = 1 + 2T$:

   a How many matches are needed to tessellate 5 triangles?

   b How many matches are needed to tessellate 20 triangles?

   c How many triangles can be tessellated with 33 matches?
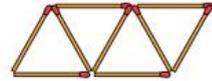
6 The diagram shows a linear tessellation of rhombi.

   a How many matches are needed to tessellate:

   i four rhombi?   **ii** five rhombi?

   b List as a sequence the number of matches needed for 1, 2, 3 … 10 rhombi.

   c Can you find the formula that works out N the number of matches needed to tessellate R rhombi? Test your formula using your results to part **a** above.
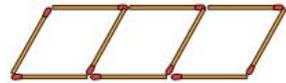
7 The diagram shows a linear tessellation of an arrow.

   a How many matches are needed to tessellate:

   i four arrows?   **ii** five arrows?

   b List as a sequence the number of matches needed for 1, 2, 3 … 10 arrows.

   c Can you find the formula that works out N the number of matches needed to tessellate A arrows? Test your formula using your results to part **a** above.
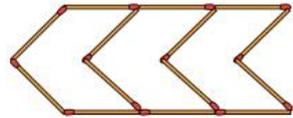
8 The cost in dollars of printing programs for the school production is made up of a fixed 'set up' cost of $50 plus $0·50 for each program printed.

   a Find the cost of printing:

   i 10 programs   **ii** 25 programs   **iii** 50 programs   **iv** n programs

   b Write a formula to work out the cost C of printing n programs.

   c Check your formula by using it to find the cost of printing 10 programs.

   d Use your formula to find the cost of printing 150 programs.

9 A student starts saving for a new skateboard. She opens an account with a $30 birthday gift and adds $5 to this each week from her pocket money.

   a How much has she saved after:

   i 2 weeks?   **ii** 5 weeks?   **iii** 8 weeks?   **iv** n weeks?

   b Write a formula to find A, the amount saved after n weeks.

   c Check your formula by using it to find A when n equals 5.

   d How long will it take her to save $135, the cost of the skateboard?

1 Simplify these expressions, then substitute the letter for the answer below to solve the riddle:

What happens to the cassava gardens that stay very close to the river?

A	$m + m + 3m$	**M**	$5m - m + 3m$	**D**	$4m + 3 - 3m + 4$
F	$10m - 5m + 5$	**H**	$5a + 2a$	**Y**	$4a - 3a + 7$
L	$12a - a$	**E**	$4a + 12 - 4a$	**O**	$3x - x + 2$
W	$3x + 4x$	**T**	$8x - 8x$	**S**	$7x - 4x + x$

$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$
$5m + 5$	$11a$	$2x + 2$	$2x + 2$	$m + 7$

$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$		$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$
$7x$	$5m$	$4x$	$7a$	12	$4x$		0	$7a$	12	$7m$

$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$
$5m$	$7x$	$5m$	$a + 7$

2 Expand the brackets in each of the following expressions, then match the letter to the correct answer below to solve the riddle:

What did the water say to the boat?

A	$3(x + y)$	**D**	$2(a + b)$	**E**	$4(m + n)$
G	$2(x - 4)$	**H**	$3(a + 2)$	**I**	$5(b - 1)$
J	$2(4 - a)$	**N**	$5(3 - b)$	**O**	$2(1 - m)$
S	$s(s + 2)$	**T**	$x(x + 1)$	**U**	$y(y - 3)$
V	$3(2a + 1)$	**W**	$4(3m - 1)$	**Y**	$2(2b + 2)$

$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$		$\overline{}$	$\overline{}$
$15 - 5b$	$2 - 2m$	$x^2 + x$	$3a + 6$	$5b - 5$	$15 - 5b$	$2x - 8$		$5b - 5$	$x^2 + x$

$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$		$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$
$8 - 2a$	$y^2 - 3y$	$s^2 + 2s$	$x^2 + x$		$12m - 4$	$3x + 3y$	$6a + 3$	$4m + 4n$	$2a + 2b$

3 Simplify the expressions below, then match the letters to the answers that appear below to answer the riddle:

What did the spider do on the computer?

A $4 \times a \times b$

B $5 \times a \times a$

C $3 \times m \times n \times m$

D $2 \times p \times 3 \times q$

E $a \times b \times a$

G $4 \times a \times 2 \times b$

I $2m \times 3n$

K $4p \times 3q \times 2q$

M $m \div 6$

N $3p \div 6$

S $3a \div 9b$

T $2a \div 4b$

W $\dfrac{3a}{15}$

X $\dfrac{4b}{12}$

$6mn$	$\dfrac{a}{2b}$		$\dfrac{m}{6}$	$4ab$	$6pq$	a^2b	$4ab$

$\dfrac{a}{5}$	a^2b	$5a^2$	$\dfrac{a}{3b}$	$6mn$	$\dfrac{a}{2b}$	a^2b	

4 Use your calculator to help complete the cross-number puzzle. If $a = 6$, $b = 4$, $c = 5$, find:
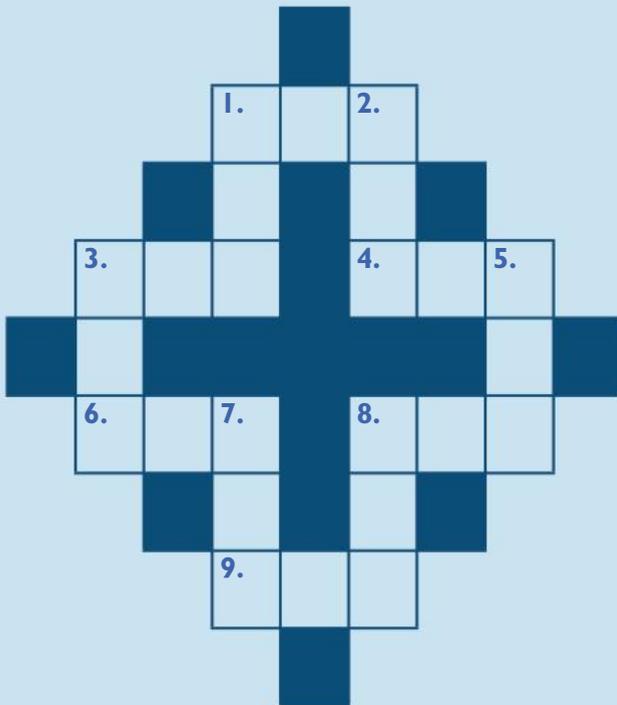
Across

1. $10a + 9c$

3. $7a + 3b + 15c$

4. $3b^2c + 2$

6. $a + 3bc^2$

8. abc

9. $9ac$

Down

1. $b^3 + c^3$

2. $2(a + c) + 110c$

3. $3(a^2 + c)$

5. $10c^2$

7. $a + 6(a + b)^2 - b$

8. $5ab + 4c$

Applications

The body mass index of a person is worked out by dividing his/her mass in kilograms by the square of his/her height, measured in metres. As a formula this is expressed as $I = \dfrac{m}{h^2}$.

For example, a student of mass $m = 70$ kg and height $h = 1\cdot75$ metres would have a body mass index calculated by $I = \dfrac{70}{1\cdot75^2}$, which works out to $22\cdot9$.

A person of normal weight should have a body mass index in the range 20 to 25. An index outside this range indicates the person is either underweight or overweight.

1 Calculate your own body mass index. Is it in the preferred range?

2 Calculate the body mass indices for other people, perhaps for members of your family or classmates.

The formula $I = \dfrac{m}{h^2}$ can be rearranged to work out a range of preferred weights from a person's height. The formula $m_{min} = 20h^2$ will work out the preferred minimum weight (mass), and $m_{max} = 25h^2$ will work out the preferred maximum weight.

For someone whose height is $1\cdot75$ metres, the range of preferred weights is given by:

$m_{min} = 20 \times 1\cdot75^2$ and $m_{max} = 25 \times 1\cdot75^2$, which results in the range $61\cdot25$ kg to $76\cdot3$ kg.

3 Using your own height, work out your preferred weight range.

4 Complete the following table, which lists a person's possible height h and their preferred minimum and maximum weights.

h (m)	1·2	1·3	1·4	1·6	1·7	1·8	1·9	2·1	2·2	2·3
$20 \times h^2$										
$25 \times h^2$										

5 Draw up a set of graphical axes of your own, with height h on the horizontal axis and mass m on the vertical axis. Carefully scale and label your axes.

Plot the middle row of the table (m_{min}) and join the plots with a smooth curve.

Next plot the third row (m_{max}) and join these plots with a smooth curve as well. Colour in the region between the two curves.

6 What can you say about the preferred weight range for people who are taller?

Energy expended during physical activity

The amount of energy expended each hour when you perform different types of physical activity can be worked out by using the metabolic rate for that particular activity.

One unit of **metabolic rate**, called a MET, is 1 calorie expended per kilogram of body mass per hour.

For someone at rest (sitting still), the rate is 1. So the energy expended by a student of mass 60 kg sitting in class for an hour and a half would be given (approximately) by $1 \times 60 \times 1.5 = 90$ calories. This answer can be multiplied by 4.18 to convert it to kilojoules, so 90 calories = 376.2 kilojoules.

As a formula, the calculation can be expressed as:

$$E = rmt$$

where E is the energy expended in calories, r is the metabolic rate for the particular activity, m is body mass (weight) in kilograms, and t is time measured in hours.

If you jog or walk at a speed of 6 kilometres per hour, the metabolic rate is 6. In fact, for this type of walking or running activity the rate is just the speed in km/h. For example, a student of mass 65 kg who jogs at 6 km/h for 45 minutes would expend:

$E = 6 \times 65 \times 0.75 = 292.5$ calories, which is 1223 kilojoules (292.5×4.18).

1   Using your own body mass, work out the energy you expend sitting in class during a day at school. Take the rate as 2, to include the activity of writing etc.

2   The metabolic rates for a variety of sports are listed:

Golf 3–4   Volleyball 3–6

Tennis (singles) 4·25–6·5   Dancing 3·5–5

Tennis (doubles) 3·5–4·5   Cricket 2–5·5

Swimming 4–12   Cycling 5–9

Basketball 5–8   Squash 9–12

Water skiing 5–7   Football 5–10

Select a sport that you play and from the given range estimate the appropriate metabolic rate, depending on how vigorously you participate. State how long the activity usually lasts and then calculate the energy you expend in calories as well as kilojoules.

3   Select another sport you play (or would like to play), choose a time and calculate the energy expended.

4   If a slice of bread supplies 100 calories (418 kilojoules), how many slices of bread would you need to eat to replace the energy expended in questions 1, 2 and 3?

1 Use the numbers in the table below to discover the rule relating the values of Q to those of P. The first is done for you:

$Q = 2P - 1$

P	1	2	3	4
Q	1	3	5	7

a

P	10	20	30	40
Q	6	11	16	21

b

P	5	6	7	8
Q	12	15	18	21

c

P	1	2	3	4
Q	0	2	6	12

2 Copy and complete the Table Tangle using the clues given:

m	9	1		2	8		10		
$m + 1$									
$5m$			25						
m^2									
$\frac{m}{2}$									
$3m + 1$						22			
$2m^2$									
$(2m)^2$									64
$17 - m$									
m^3								27	

3 Try this problem using different starting numbers:

Think of a number, double it, add 3, multiply the result by 5, subtract 15, then divide by 10.
What answer do you end up with? Can you explain what is happening?
To assist, use n for the number first thought of and write an algebraic expression that shows the steps performed, then simplify it.
Make up your own number puzzle with different mathematical steps.
Show your teacher the number puzzles you devise.

Reversing an expansion or reinserting the brackets is called **factorisation**.

4 Copy and complete the following:

a $8x + 12y = 4(\underline{\hspace{1cm}} x + \underline{\hspace{1cm}} y)$

b $10m + 15n = \underline{\hspace{1cm}}(2m + 3n)$

c $6x^2 + 9x = 3x(\underline{\hspace{1cm}} + \underline{\hspace{1cm}})$

d $x^2 + 6xy = \underline{\hspace{1cm}}(\underline{\hspace{1cm}} + \underline{\hspace{1cm}})$

e $3x^2 - 6x = 3x(\underline{\hspace{1cm}} - \underline{\hspace{1cm}})$

f $x^2 - 4xy = \underline{\hspace{1cm}}(\underline{\hspace{1cm}} - \underline{\hspace{1cm}})$

g $5x^2 - 10 = \underline{\hspace{1cm}}(\underline{\hspace{1cm}} - \underline{\hspace{1cm}})$

h $2x^2 + 8x = \underline{\hspace{1cm}}(\underline{\hspace{1cm}} + \underline{\hspace{1cm}})$

5 Factorise the following:

a $14x + 21y$

b $16x + 20y$

c $25a + 30b$

d $8a - 12b$

e $x^2 + 5x$

f $x^2 - 7x$

g $6x^2 - 12x$

h $4x^2 - 6x$

i $6x^2 - 14xy$

6 The speed *s* kilometres per hour attained by a free-falling parachutist can be found approximately using the formula $s = 36t$, where *t* seconds is the time for which the parachutist falls before the parachute opens.

  a Find the speed of the parachutist after:

   i 1 second

   ii 2 seconds

  b Complete the following table, which shows the speed of the free-falling parachutist over the first 5 seconds:

t (seconds)	0	1	2	3	4	5
s (km/h)	0					180

  c Plot the points on a coordinate plane.

  d Join up the points with a straight line and label your graph with the formula $s = 36t$.

  e In reality, due to air resistance the speed of a free-falling parachutist levels out at a maximum of 180 km/h and this is called the *terminal velocity*. With this information continue the graph in part d over the first 10 seconds.

7 The distance *p* metres, covered by another free-falling parachutist while falling for the first 5 seconds is given approximately by the formula $p = 5t^2$.

  a Complete the following table to show the distance the parachutist falls:

t (seconds)	0	1	2	3	4	5
p (metres)	0		20			125

  b Plot the points on a coordinate plane.

  c Join the points to form a smooth curve and label your graph.
    From 5 seconds onwards, after the parachutist has reached terminal velocity, the distance fallen is given by the formula $d = 125 + 50(t - 5)$.

  d Use this formula to complete the following table:

t (seconds)	5	6	7	8	9	10
d (metres)	125			275		

  e Plot these values on the axes in part b and join up the points with a straight line.

  f Find how long it takes the parachutist to fall:

   i 80 metres

   ii 400 metres

   iii 600 metres

  g What is the terminal velocity of the parachutist, in metres per second?

Exercise 6A

1 Write expressions for the following statements:

   a the sum of ♣ and 9   **b** 12 less than ♡

   c one-fifth of ♥   **d** three times the value of ⊖

   e ● divided by 7   **f** the sum of ● + ♡

2 Write the following algebraic expressions in words:

   a $c + 10$ **b** $8a$ **c** $\dfrac{y}{9}$ **d** $\dfrac{x+2}{3}$ **e** $\dfrac{4b}{3}$ **f** $(x+6) \times 3$

Exercise 6B

3 Simplify the following:

   a $8♡ + 9♡$ **b** $6♥ + 5♥$ **c** $13▲ - 5▲$

   d $19⊖ - 4⊖$ **e** $7☺ + 2☺$ **f** $▲ + ▲ + ▲$

   g $7▲ + 3▲ + 2■ + 4■$ **h** $4♡ + 3♡ + 6★ + 2★$ **i** $5▲ - 2▲ + 8■ - 6■$

4 Simplify the following expressions by combining like terms:

   a $8a + 4b - c - 2a + 3b + 5c + 3a - b + c$ **b** $4x + 3y - 2x - y + 1 + 3$

   c $7ab + 5bc - ca - 3ab + 4bc - ab + 2ca$ **d** $5x + 4y + 7 - 2x + y - 3$

   e $8xy + 9yz - 2zy + 3zx + 4xy - 3yz + 5zx$ **f** $9a + 7b + 6c - 6a - 6b - 5c$

Exercise 6C

5 Simplify the following products as far as possible:

   a $7 \times a$ **b** $9 \times y$ **c** $a \times 15$

   d $b \times 8$ **e** $a \times c$ **f** $m \times p$

   g $16 \times y \times z$ **h** $m \times n \times 6$ **i** $a \times p \times q$

   j $p \times 8 \times 9$ **k** $y \times 4 \times 2$ **l** $8 \times 7 \times p$

6 Express the following quotients in simplest fraction form:

   a $x \div 5$ **b** $m \div 9$ **c** $p \div 12$

   d $5 \times y \div z$ **e** $9 \times y \div 4x$ **f** $5x \div 7y$

   g $5x \div 15$ **h** $16 \div 32x$ **i** $28 \div 35w$

Exercise 6D

7 Expand (remove brackets) each of the following and simplify:

   a $4(x + y)$ **b** $9(a + b)$ **c** $6(m + n)$

   d $y(x + 4)$ **e** $y(y + 7)$ **f** $p(p + 8)$

   g $(a - 4)5$ **h** $(c + 5)4$ **i** $(b - 9)5$

   j $(6 + p)p$ **k** $(12 - q)3q$ **l** $(5 - n)8n$

   m $x(x + 1)$ **n** $x(x - 3)$ **o** $x(2x + 5)$

   p $6y(5y - 2)$ **q** $5q(2q - 4)$ **r** $2x(x + 1) + x(x + 1)$

   s $x(2x - 1) + 2x(x + 1)$ **t** $3x(x + 5) - 3x^2$ **u** $mp(m - p)$

Exercise 6E

8 The perimeter of the isosceles triangle shown is given by the formula $P = 2x + y$.
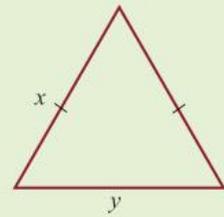
   a Find the perimeter where $x = 7$ cm and $y = 4$ cm.

   b Find the perimeter if $x = 4$ cm and $y = 3$ cm.

   c If the perimeter of the isosceles triangle is 13 cm, and side y is 1 cm longer than side x, find the sides x and y.

9 Find the values of the following where $x = 6$ and $y = 8$:

   a $8xy$ **b** $5xy - 1$ **c** $\frac{1}{4}xy - 2$

   d $6x + 2y$ **e** $10x - 7y$ **f** $4y + 3x$

   g $5(2x + 1) + y$ **h** $3(2x - 1) + 2y$ **i** $2(2x - 4) + 3y$

   j $6 + y^2$ **k** $2y^2 + 3y + x$ **l** $2x^2 \div y$

10 At the Central Market in Honiara, a plastic of popcorn costs \$3 per plastic while mangoes cost \$2 each:

   a Write an expression that shows the cost of x plastics of popcorn and y mangoes.

   b By substituting 3 for x and 5 for y, find the cost of three plastics of popcorn and five mangoes.

   c If \$24 was spent in total, suggest some possible numbers of mangoes and plastics of popcorn that were purchased. If twice as many plastics of popcorn as mangoes were purchased, how many of each were bought?

Learning task 6F

11 Shapes made of dots can form interesting patterns, like this star:

   a Draw the next star shape in this pattern.

   b Write down the number of dots in each of the first 10 star numbers.

   c Describe the pattern or rule for star numbers.

_____   _____   _____ dots
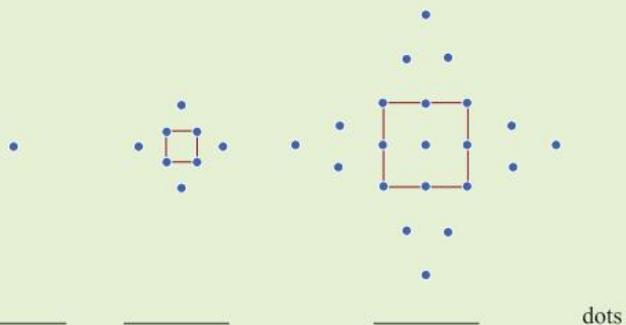
Exercise 6H

12 The area A of a rectangle of length L and width W is given by the formula $A = LW$:

   a Find the area of a rectangle where $L = 12$ cm and $W = 8$ cm.

   b Find the area of a rectangle where $L = 16$ cm and $W = 4$ cm.

   c Find the perimeter of each of the rectangles in parts a and b.

   d If the dimensions of the rectangle in part b are halved, what is the new area? How does this area relate to the previous area?

Angles

Thousands of years ago, the Ancient Babylonians believed that the Sun moved around the Earth and recorded this journey as 360 days. From this they decreed that 360 units or 360 degrees would be used to describe anything that turned through a full circle. An angle is formed when two lines, or rays, meet at a point called a vertex. Angles are measured in degrees. Angles are a useful mathematical tool in many areas of employment, such as architecture, design, surveying, building and construction, navigation and astronomy.

This chapter covers the following skills:

- Naming and classifying different types of angles
- Identifying the relationships of complementary and supplementary angles
  Complementary angles add to 90°
  Supplementary angles add to 180°
  Angles in a circle add to 360°
- Solving simple problems involving complementary and supplementary angles and angles in a circle
- Measuring an angle of any size using a protractor
- Using a protractor to draw an angle of any size

Specific Learning Outcome (SLO)

Learners should be able to:

7.7.1.1	Identify the vertex of an angle.
7.7.2.1	Draw and name angles using alphabetical letters such as ∠*ABC*.

7.7.3.1	Group angles together and give them names according to the amount and size of degrees they have.
7.7.4.1	Identify different types of angles and give their names according to their sizes *Acute angle, right angle, obtuse angle, straight line angle, reflex angle and perigon or full circle.*
7.7.5.1	Use a protractor to measure given angles in degrees.
7.7.6.1	Use a protractor to draw angles of any sizes.
7.7.7.1	Define and identify 'complementary (adjacent) angles'. *Complementary angles*: *angles that stay next to each other (adjacent) and* add to 90° (degrees).
7.7.1.1	Use the properties of complementary angles to find the size of missing angles represented by the pronumerals.
7.7.9.1	Define supplementary angles: *Supplementary Angles: angles next to each other that add to 180° (degrees).*
7.7.10.1	Use the properties of supplementary angles to find the size of missing angles represented by the pronumerals.
7.7.11.1	Find the total number of degrees in a full turn or perigon.
7.7.12.1	Find the size of missing angles represented by letters.

An angle is formed when two lines, or rays, meet at a point called a **vertex**.
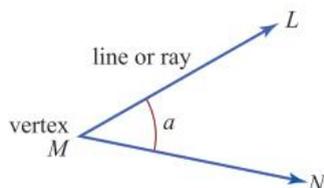
When naming angles we can use the three letters positioned at the endpoints of the lines that form the angle. The letter at the vertex is placed in the middle. The symbol for angle is $\angle$, so the angle LMN shown above could be named $\angle LMN$ or $\angle NML$. It can also be named $a°$, $\angle M$ or $L\hat{M}N$.

Exercise 7A

1 Give two names for the angles shown below:

a

b

c

d
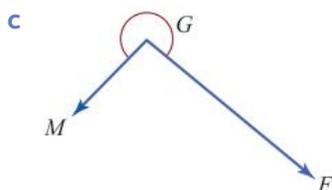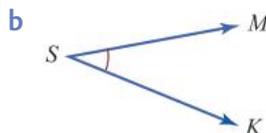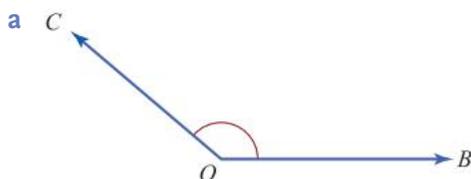
2 Name as many angles as possible using the diagram shown below:
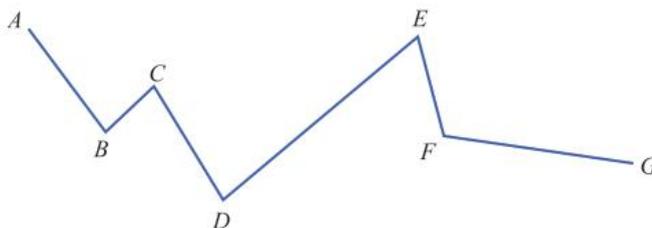
3 Draw clearly labelled diagrams to represent the angles known as:

a $\angle ABC$	**b** $\angle KLM$	**c** $\angle PQR$	**d** $\angle HYT$
e $s°$	**f** $t°$	**g** $r°$	**h** $x°$
i $A\hat{M}K$	**j** $W\hat{V}Y$	**k** $B\hat{D}F$	**l** $S\hat{A}C$
m $\angle A$	**n** $\angle M$	**o** $\angle R$	**p** $\angle s$
q $m°$	**r** $y°$	**s** $t°$	**t** $a°$
u $A\hat{B}C$	**v** $L\hat{M}N$	**w** $O\hat{P}Q$	**x** $R\hat{S}T$

Types of angles **7B**

When we talk about angles we can describe them according to their size. Angles may be classified as one of the following types:

Type of angle	Diagram	Description
Acute angle		An angle between 0° and 90°
Right angle		90° or one quarter turn indicated by the little square
Obtuse angle		An angle between 90° and 180°
Straight angle		180° or one half turn
Reflex angle		An angle between 180° and 360°
Perigon or full circle		360° or one full revolution
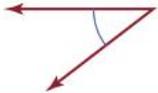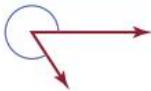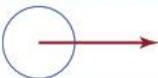
Exercise 7B

1 What type of angle is each of the following?

a   b   c

d   e   f

g   h   i

j   k   l

m   n   o
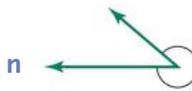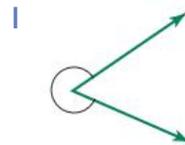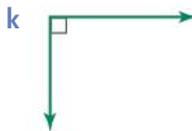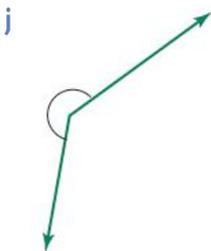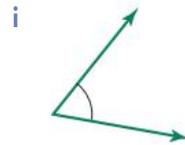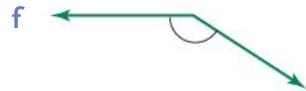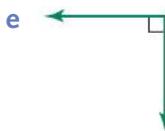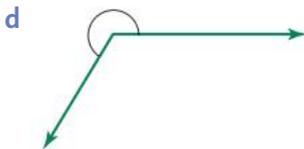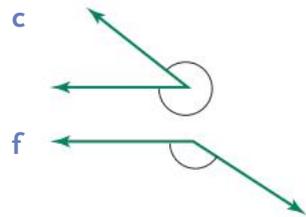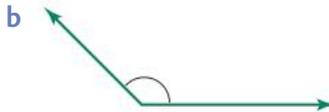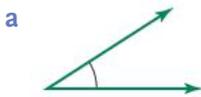
2 For each of the polygons shown below, classify their **internal angles** (those contained within the polygon) and their **external angles** (angles adjacent to the internal angles that add together to give 360°) as acute, right, obtuse etc.:

a

b

c

d

e
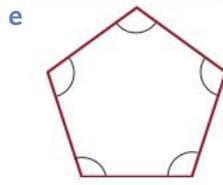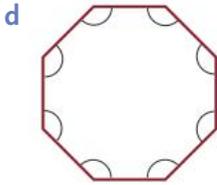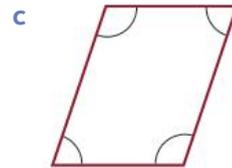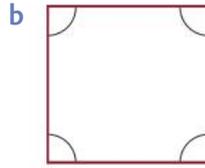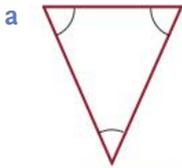
3 From the diagram shown name:

    a two acute angles

    b two right angles

    c two obtuse angles

    d two straight angles

    e two reflex angles

    f a full circle or perigon
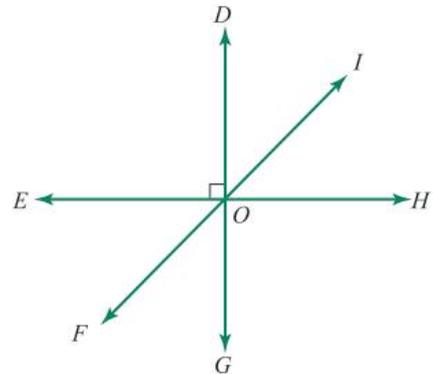
4 Identify the angles in the following photographs as acute, obtuse or reflex:

a

b

c

d

e

f
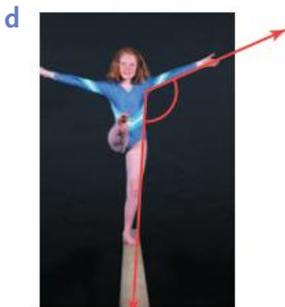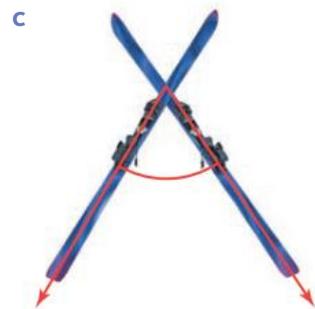
Angles are measured by using an instrument called a protractor. The unit in which they are measured is called the degree (°). Protractors are semicircular (i.e. the shape of a half circle) and can measure any angle up to a straight line or 180°. They have two sets of numbers from 0 to 180° so that you can measure angles from either direction. When you measure an angle with a protractor, place the centre of the protractor on the vertex and one arm on the baseline.

Read angle here

Measure angle from 0°

Vertex

Place baseline of protractor on arm of angle
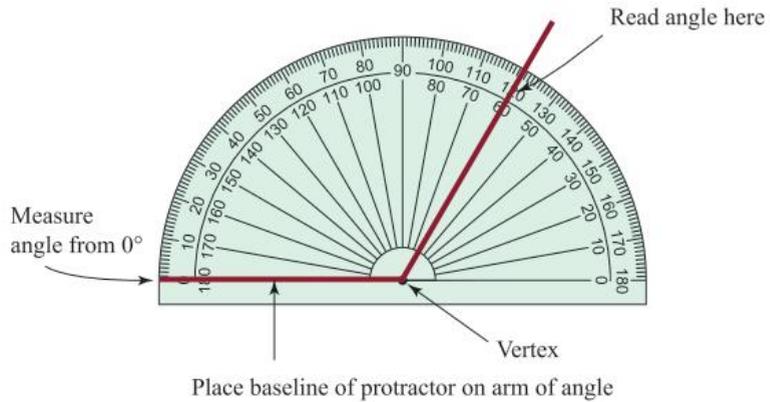
Example

1 Use a protractor to measure the following acute angle:

Solution

53°
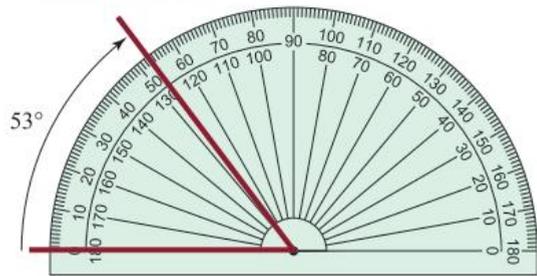
Make sure that the vertex of the angle is at the centre point and that one arm of the angle is on the baseline of the protractor. The angle is 53°.

For angles greater than 180°, measure the smaller angle on the other side of the angle and add this value to 180° to obtain the measure of the required angle.

Example

2 Use a protractor to measure the following reflex angle:

Solution

23°
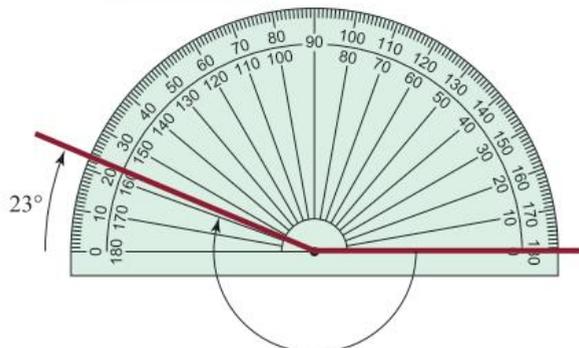
23° + 180° = 203°
The reflex angle is 203°.

Exercise 7C

1 Read off the size of each of the angles on the diagrams below:
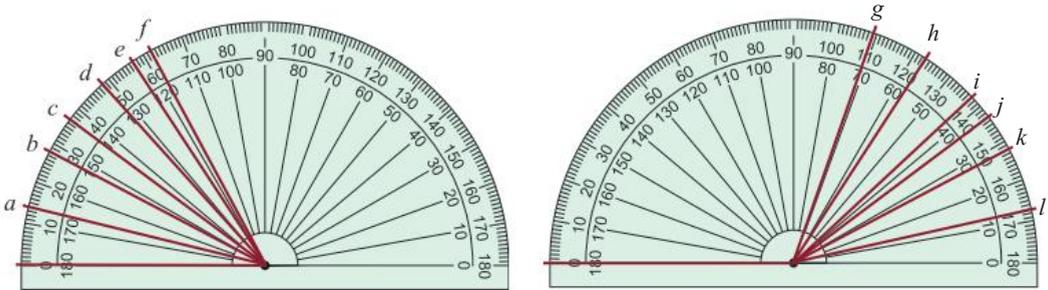
2 Without measuring the angles below, estimate whether they are:
   i   between 0° and 90°   **ii** between 90° and 180°
   iii between 180° and 270°   **iv** between 270° and 360°

   Measure the angles using a protractor and check your estimate.
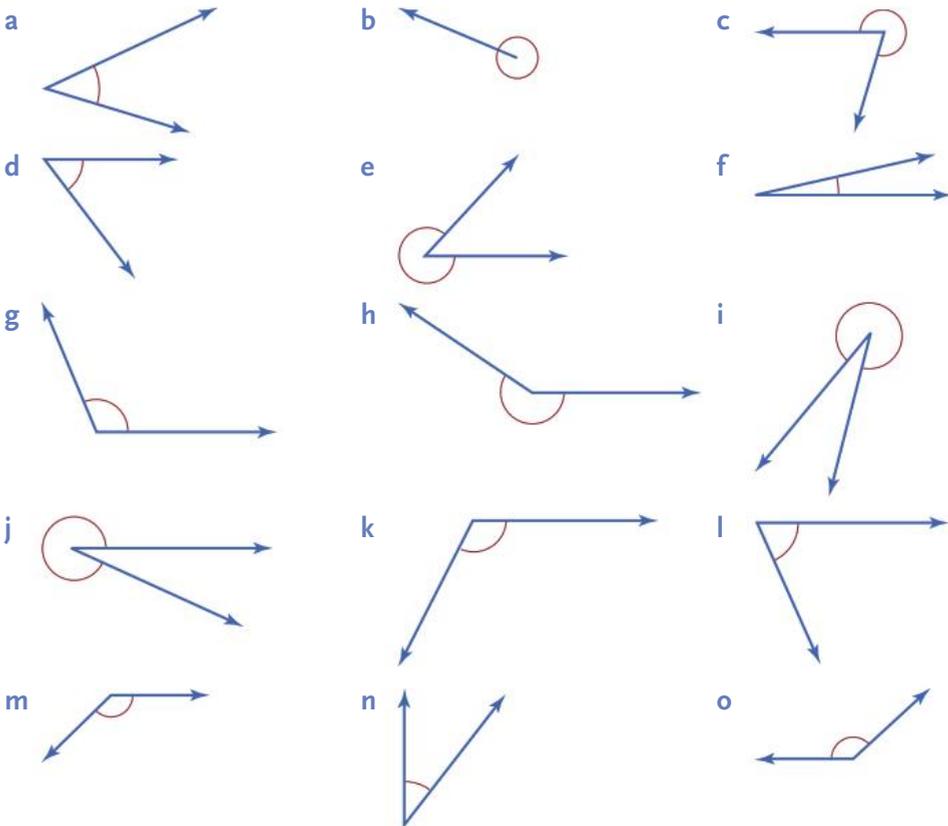
3 Carefully consider the following pairs of angles:

   i   Without measuring, estimate which angle is the larger, ∠Z or ∠M.

   ii Use your protractor to measure these two angles.

  iii Compare your answers to parts i and ii. How accurate were your estimations?
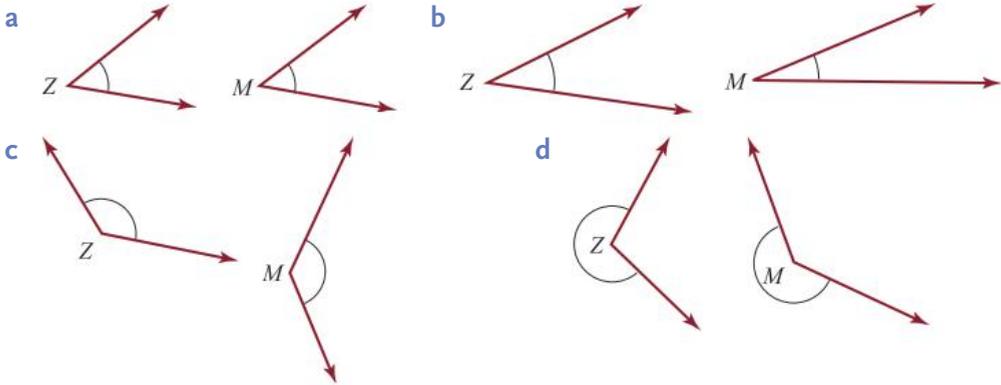
4 Using a protractor, measure the size of each of the angles below to the nearest degree:
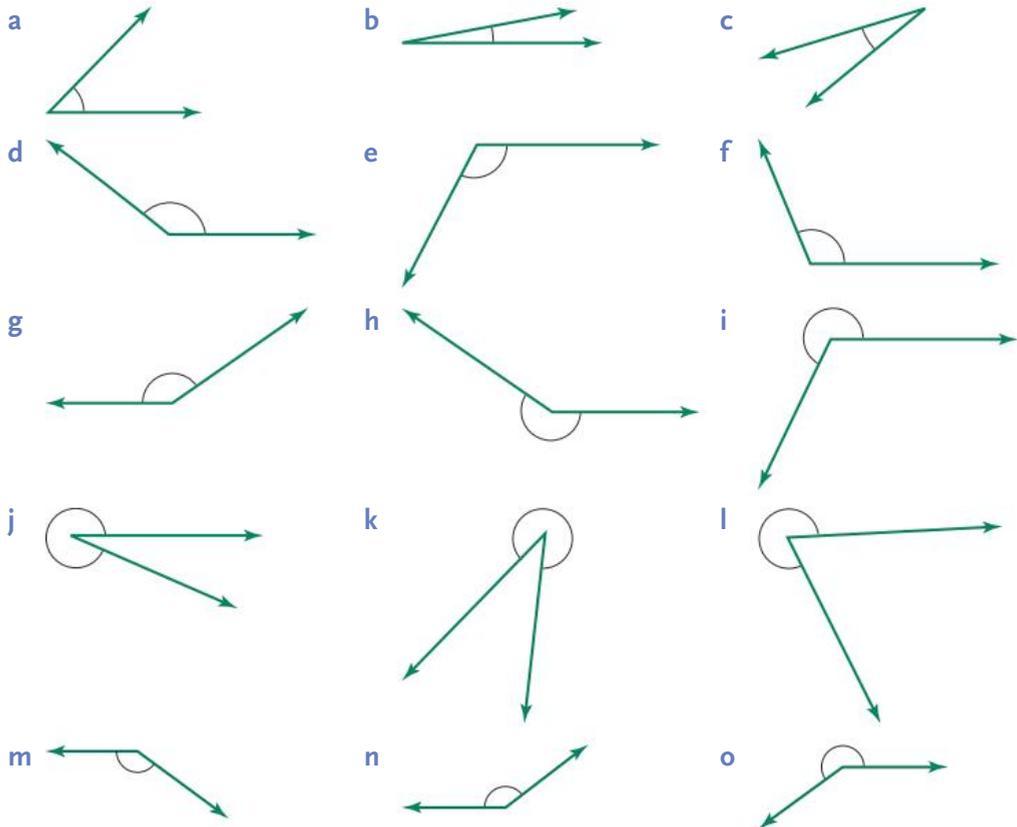
5 Measure the size of the angles shown in the illustrations:

a

b

c

d

e

f

6 Draw a clockface showing the following times and then measure in a clockwise direction the size of the angle between the minute hand and the hour hand at:

a 2 o'clock   **b** 3 o'clock

c 5 o'clock   **d** 6 o'clock

e 8 o'clock   **f** 11 o'clock

7 What is the time when the minute hand is on 12 and the hour hand is at the following angles, measured in a clockwise direction?

a 0°   **b** 90°

c 180°   **d** 360°

e 30°   **f** 120°

g 210°   **h** 270°

Example

Use a protractor to draw the angle $\angle M = 65°$.

Solution

Step 1: Draw a baseline and mark the vertex at one end with a dot.

Step 2: Place the protractor on the baseline with its centre, 0, on the vertex dot.

Step 3: Place another dot at the desired angle marked 65°.

Step 4: Remove the protractor and draw a line between the vertex dot and the second dot you have drawn.

Step 5: Mark in the desired angle with an arc.
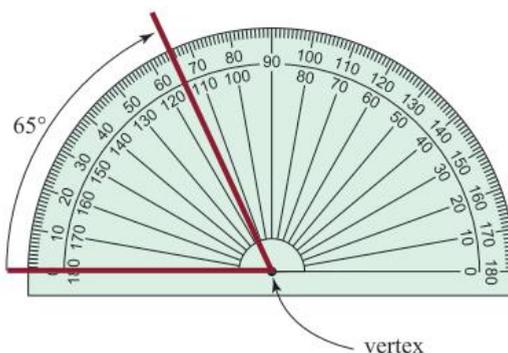
Exercise 7D

1 Use your protractor to draw the following acute and obtuse angles. Ensure that they are correctly labelled:

a $\angle M = 35°$
b $d = 42°$
c $\angle XYZ = 55°$
d $\angle F = 75°$
e $h = 105°$
f $\angle ABC = 158°$
g $k = 167°$
h $\angle AGY = 178°$

2 Use your protractor to draw the following reflex angles. Ensure that they are correctly labelled:

a $\angle M = 185°$
b $d = 197°$
c $\angle XYZ = 205°$
d $\angle F = 214°$
e $h = 224°$
f $\angle ABC = 239°$
g $k = 275°$
h $\angle AGY = 315°$

3 Draw a house by using four 90° angles and three 60° angles.

4 Draw a kite that has two 125° angles, a 40° angle and a 70° angle. Use a protractor to draw accurate angles and decorate your kite with an interesting design.

Complementary angles

Two or more angles that are next to each other and have a common vertex are called **adjacent angles**. Adjacent angles are **complementary** if they add up to 90°.

The sum of the angles ∠LMN and ∠NMO is 90°; therefore ∠LMN and ∠NMO are complementary.
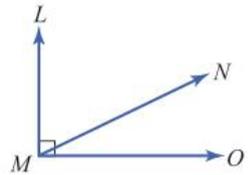
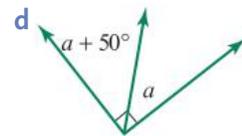| **Example**	**Solution**
1 What is the complement of 63°?	The complement of 63° is 27° because $90° - 63° = 27°$
2 Find the size of angle t in the diagram below:	t and 21° are complementary, so subtract 21° from 90° to find the complement. $$90° - 21° = 69°$$ $$t = 69°$$ Angle $t = 69°$
3 Find the size of angle t in the diagram below:	$8t$ and t are complementary, so $8t$ and t add to give 90° $$8t + t = 90°$$ $$9t = 90°$$ $$9 \times t = 90°$$ $$9 \times 10 = 90°$$ $$\text{so } t = 10°$$ Angle $t = 10°$
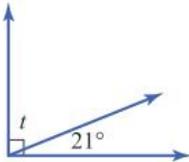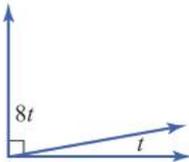
Exercise 7E

1 Find the size of angle a in each of the following:
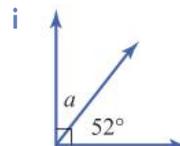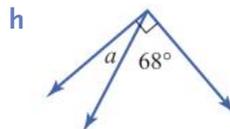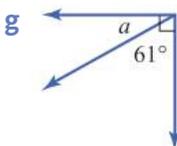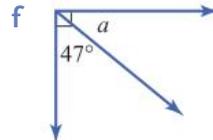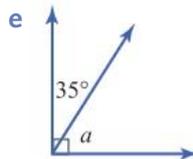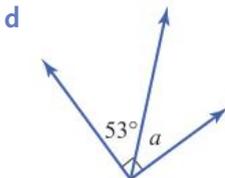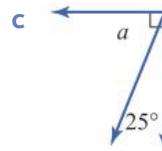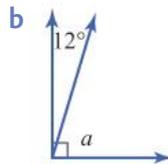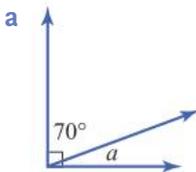
a

b

c

d

e

f

g

h

i

2 Find the size of *a* in each of the following:

a 17° 36° *a*

b 10° 35° *a*

c 34° *a* 25°

d 5° 50° *a*

e 25° *a* 20°

f 17° *a* 17°

3 Find the size of *a* in each of the following:

a 2*a* *a*

b 5*a* *a*

c *a* *a* + 30°

d *a* + 50° *a*

e *a* + 10 *a* + 60

f 2*a* 2*a* + 10

g 7*a* 2*a*

h 2*a* 4*a*
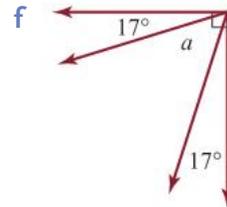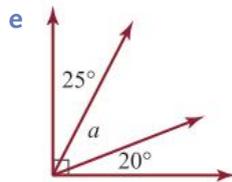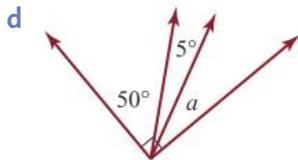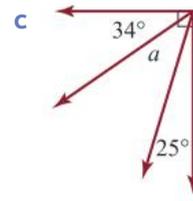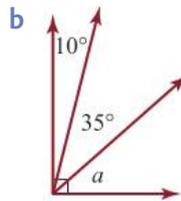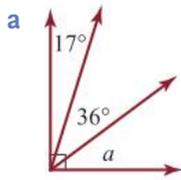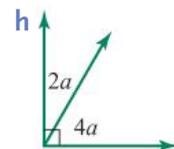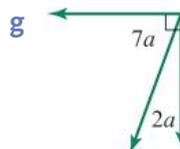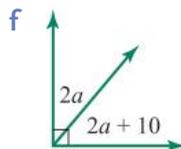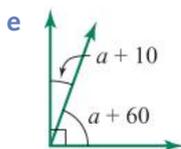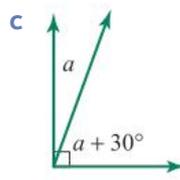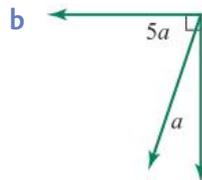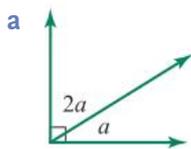
4 Which of the following adjacent angles are complementary?
   a 25°, 73°   **b** 34°, 66°   **c** 43°, 47°   **d** 52°, 28°   **e** 67°, 23°

5 Find the complement of:
   a 15°   **b** 36°   **c** 58°   **d** 71°   **e** 89°

6 If ∠*PBR* = 35° and ∠*PBC* = 55°, are they complementary angles?

7 Give an angle ∠*AMN* that is complementary to ∠*LMN* = 75°.

8 Draw and label any two angles that are complementary. How do you know they are complementary?

9 **a** What time is showing on this clockface?
   b What is the size of the smaller angle between the two hands of the clock to the nearest degree?
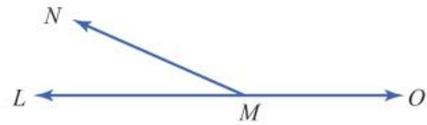   **c** What are two times when the two hands could make an angle of 90°?

Supplementary angles
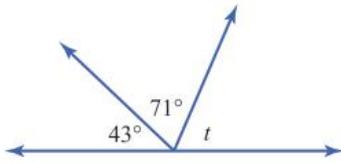
Adjacent angles that join to form a straight angle, (that is, they add up to 180°), are known as **supplementary angles**.

The angle sum of ∠LMN and ∠NMO is 180°, therefore ∠LMN and ∠NMO are supplementary.

Example	**Solution**
1 What is the supplement of 68°?	$180° - 68° = 112°$ The supplement of 68° is 112°.
2 Find the angle t in the diagram below:	43°, 71° and angle t are supplementary, so subtract 43° and 71° from 180° to find the supplement.
	$180° - 43° - 71° = 66°$ $\qquad\qquad\qquad t = 66°$ Angle $t = 66°$

Exercise 7F

1 Find the size of angle a in each of the following:
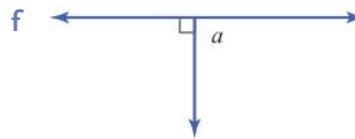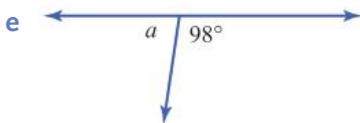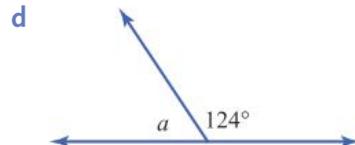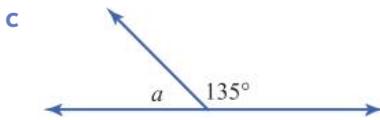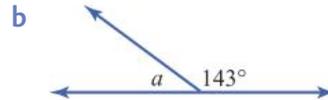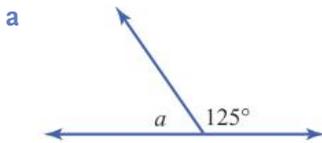
a

125°

b

a 143°

c

a 135°

d

a 124°

e

a 98°

f

a

2 Find the size of angle a in each of the following:

a

36°
a 125°

b

40° a 35°

c

20°
25°
a 35°

d

87° 60°
a

3 Find the size of angle *a* in each of the following:

a

$2a$ $140°$

b

a $30°$ $2a$

c

$20°$ $25°$ $100°$ a

d

a $5a$ $60°$

e

$53°$ a

f

a $110°$ a

g

a a a a

h

$2a$ a
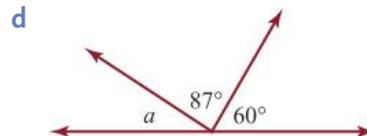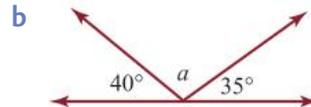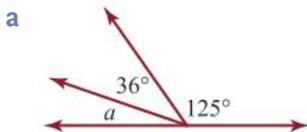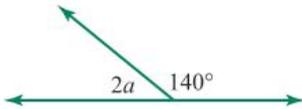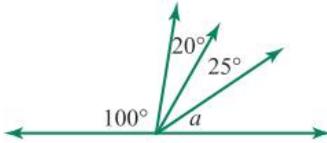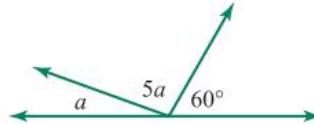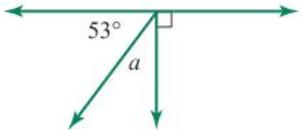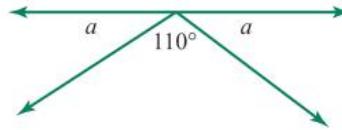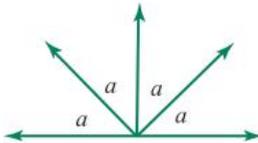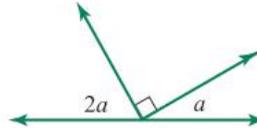
4 Which of the following sets of adjacent angles are supplementary?

   A 10°, 170°   **B** 43°, 137°   **C** 118°, 72°   **D** 13°, 56°, 111°

5 Find the supplement of:

   a 15°   **b** 56°   **c** 98°

   d 111°   **e** 159°

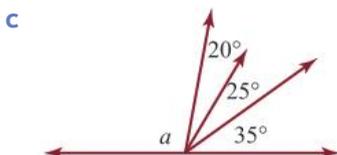**6** If $\angle PQR = 165°$ and $\angle PQC = 15°$ are they supplementary angles?

7 Give an angle $\angle LBC$ that is supplementary to $\angle LBN = 75°$.

8 Draw and label any two angles that are supplementary. How do you know they are supplementary?

9 Draw and label any three angles that are supplementary. How do you know they are supplementary?

10 a Use a protractor to measure the two angles made by the crane's arm and tower.

   b Check that the two angles are supplementary.

11 Write down a real-life situation in which supplementary angles are used.

From the diagram below we can see that there are 360° in a full circle, or one complete revolution. Another name for one complete revolution is a **perigon**. Smaller angles can be added together to form 360°.
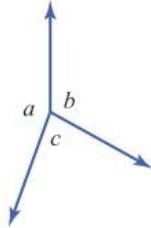
Angles $a + b + c = 360°$

Example

Find the size of angle y in each of the following:

a

276°

b

150° y

45°

c

y

3y 2y
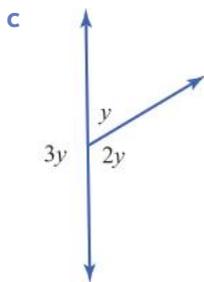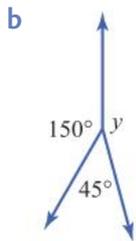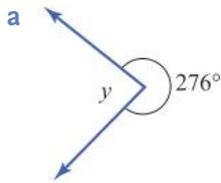
Solution

y and 276° add together to 360°.
To obtain y, subtract 276° from 360°.

$y = 360° - 276°$
$\quad = 84°$

Angle $y = 84°$

150°, 45° and y add together to 360°.
Therefore to obtain y subtract the other two angles from 360°.

$y = 360° - 150° - 45°$
$\quad = 165°$

Angle $y = 165°$

The sum of the angles shown is 360°.

$y + 2y + 3y = 360°$
$\qquad 6y = 360°$
$\qquad y = 360° \div 6$
$\qquad\quad = 60°$

Angle $y = 60°$

Exercise 7G

1   Find the size of angle x in each of the following:

a

x

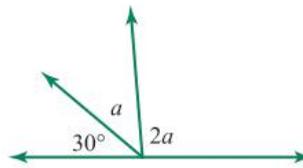288°

b

x

272°

c 289° x

d x 144°

e x 251°

f x 92°

2 Find the size of angle *a* in each of the following:

a 133° a 136°

b a 88° 221°

c a 127° 99° 81°

d 178° a

e 109° a 71° 68°

f 46° 62° a 118°
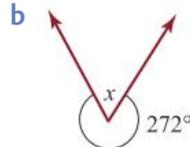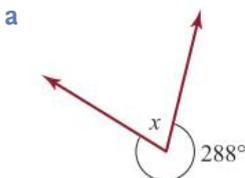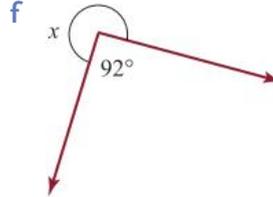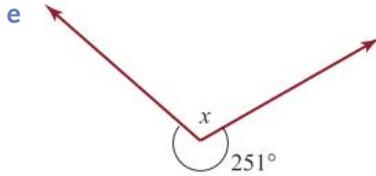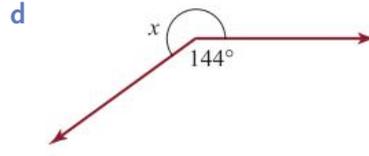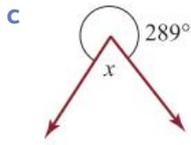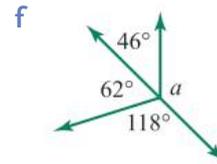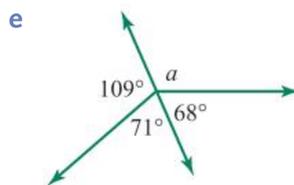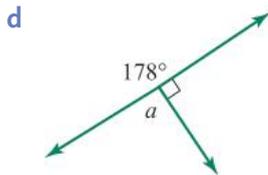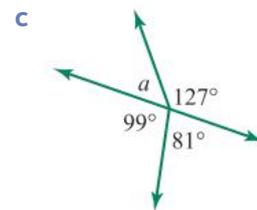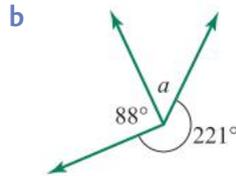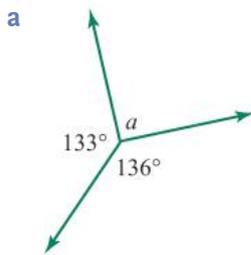
3 Find the size of *k* in each of the following:

a k 5k

b 8k k

c 2k 8k 8k

d 2k 3k

e k 120° 2k

f k k k
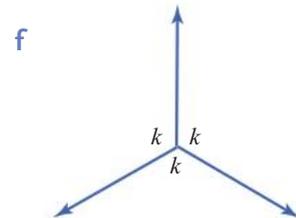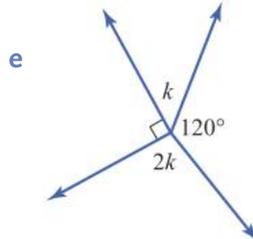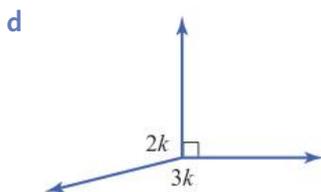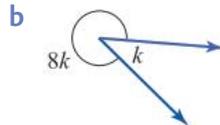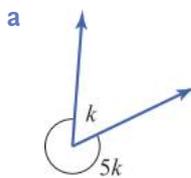
4 If ∠PQR = 165° and ∠AQR = 15°, what is the measure of ∠AQP so that the angle sum is 360°?

5 Give an angle ∠AMN that joins with ∠LMN = 75° to form one complete revolution.

6 Draw and label any two adjacent angles whose angle sum is 360°.

7 Draw and label any three adjacent angles whose angle sum is 360°.

1 Measure the angles below and match the letter to the correct angle to solve the riddle:

Why did the spider want to use a computer?
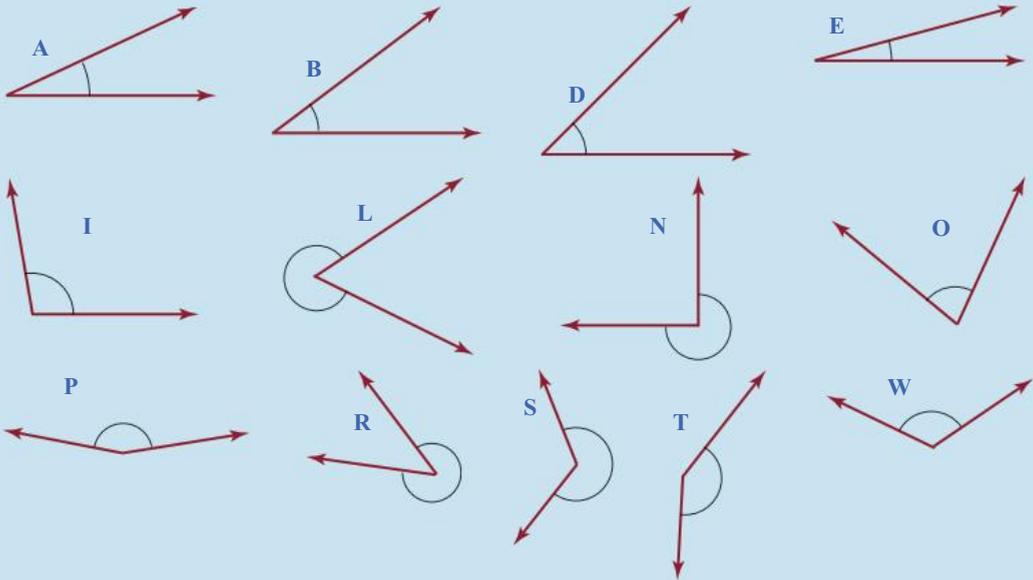
145°	75°		240°	160°	100°	270°		25°
120°	75°	315°	300°	46°		120°	100°	46°	15°		120°	15°	37°

2 Calculate the missing angle and match it to the correct letter below to solve the riddle:

Name the offence committed in Rugby Union when the ball carrier is tackled after he has already passed the ball.
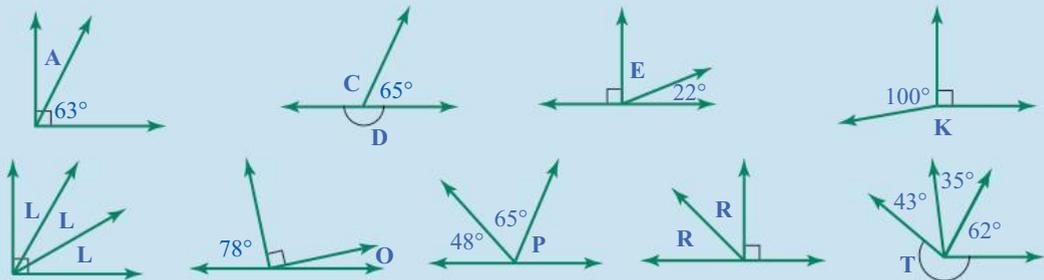
30°	27°	220°	68°		220°	27°	115°	170°	30°	68°

3 Decide whether each statement is true or false. Colour in the squares in the grid below that contain the numbers of the correct answers. You should find the name of a quadrilateral.

	True	False
An acute angle is between 180° and 360°.	10	1
A straight angle is 180°.	11	6
Complementary angles add to 90°.	9	7
Angles in a circle add to 180°.	2	19
Obtuse angles are between 90° and 180°.	20	3
150° and 30° are complementary.	5	12
Supplementary angles add to 360°.	8	4
A reflex angle is between 0 and 90°.	18	13
A right angle is 90°.	16	17
160° and 200° form a full circle.	15	14

15	2	5	13	10	15	3	1	19	20	3	20	15	1
19	3	4	10	18	4	3	8	20	6	7	9	6	7
13	12	18	7	2	4	8	5	11	2	5	16	1	9
16	17	12	8	17	9	6	7	9	17	2	13	14	10
1	14	6	9	14	16	10	14	11	5	18	19	4	12

The quadrilateral is a _____.

Applications

Arrow angles

Trace onto thick paper the two big arrows shown below, then cut them out.
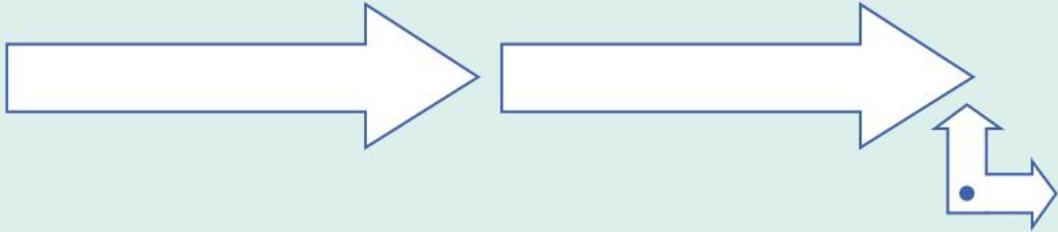
On one write the word 'baseline'. Hold them together with a paper fastener.

a Start with the two strips together. Keep the baseline fixed and move the other arm, or ray, to create an acute angle, a right angle, an obtuse angle, a straight angle, a reflex angle and a full circle.

b Choose an angle from those you've made in part a and show it to a partner. Ask them to classify your angle. Now get them to create an angle for you. Repeat this activity five times each.

Paper angles

a Fold a piece of A4 paper lengthwise and label the ends of the fold *LM*.

b Fold the paper in half widthwise. Label this line *NP* and the centre where the lines intersect mark *O*.

c Fold the paper diagonally through the point *O*. Label these lines *QR* and *ST*.

d From your piece of paper, name:

   i three acute angles   **ii** three right angles

   iii three obtuse angles   **iv** three straight angles

Pizza angles

Stephanie was cutting up her pizza when she noticed that she had formed four adjacent angles.

a Measure the four angles Stephanie has created.

b What is their sum?

c What do you notice about the opposite angles?
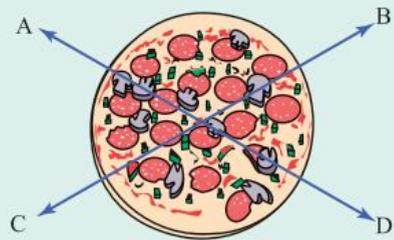
Light angles

When submarine commanders want to spy on the enemy they put the periscope up out of the water. Use the Internet to research how a periscope works. Write down your findings or create a small presentation to share with your class.

Angles on a compass

Different angles can be formed between the points of a compass. Begin at north (N) and continue clockwise around the compass estimating and then calculating the size of the angles formed.

Angle formed between N and the compass point	Estimate of angle (in degrees)	Size of angle (in degrees)
NE		
E		
SE		
S		
SW		
W		
NW		
N		

Angles in polygons

  i Find out the name of each of the polygon shapes shown below.
 ii Measure the internal angles in each of the shapes.
iii Add up all internal angles and find the angle sum of each of the shapes.

a GIVE WAY   b WRONG WAY   c DO NOT ENTER   d STOP

1 This diagram shows a number of angles. List angles of the following types:

   a   5 acute angles

   b   1 right angle

   c   5 obtuse angles

   d   1 straight angle
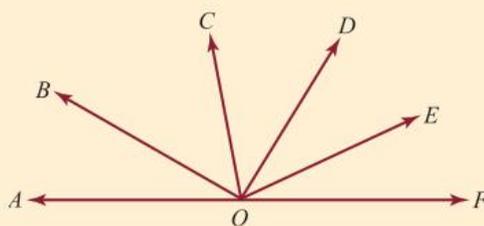
2 NASA has a new satellite it wishes to launch into space. This satellite, which is shown here, will help scientists track ships at sea as a means of improving safety.

   a   Measure the angles formed between the four panels shown on the satellite.

   b   Identify pairs of supplementary angles.

3 Karen's grandparents arrive home from their overseas trip with a new watch for her. Karen notices that the hands on her watch complete many revolutions each day. In one 24-hour period, how many revolutions does:

   a   the hour hand make?   b   the minute hand make?   c   the second hand make?

4 Parallel lines travel in the same direction and are always the same distance apart. We indicate parallel lines by using arrows as shown below:
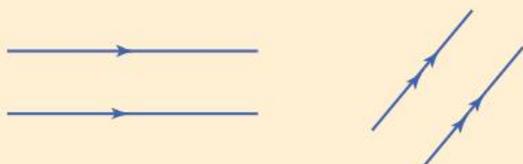
   i   List five different examples of parallel lines occurring in everyday life.

   ii Label the parallel lines in the following figures, using the pairs of arrows shown above:

   a   b

   c   d   e
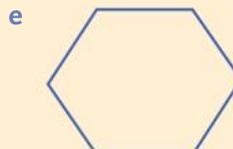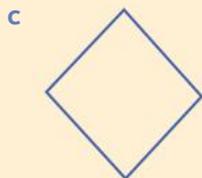
   iii List three examples of parallel lines you observe on your trip to school each day.

5 i Using your protractor measure the angles marked:

a
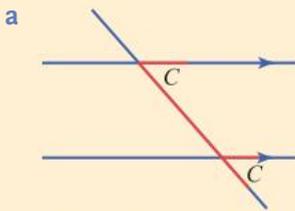
The angles marked *C* are called **corresponding** angles.

b
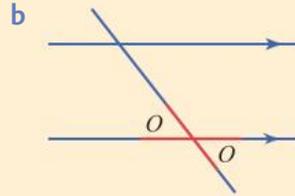
The angles marked *O* are called **vertically opposite** angles.

c
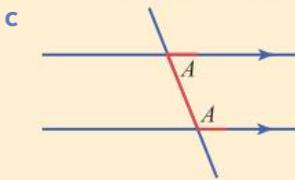
The angles marked *A* are known as **co-interior** angles.

d
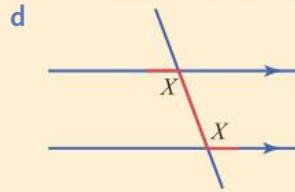
The angles marked *X* are called **alternate** angles.

ii Using your findings from part i, give a definition for corresponding angles, vertically opposite angles, co-interior angles and alternate angles.
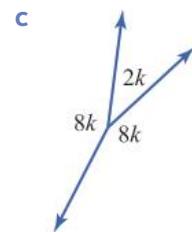
6 Find the size of the marked angle for each of the following diagrams and choose one of the words to describe the relationship between the angles:

alternate (X)   **co-interior (A)**   **corresponding (C)**   **vertically opposite (O)**

a

70°

b

105°

c

60°

d

52°

e

58°

f

118°
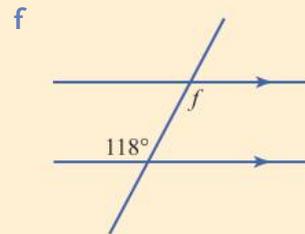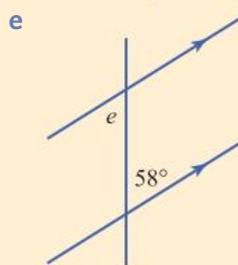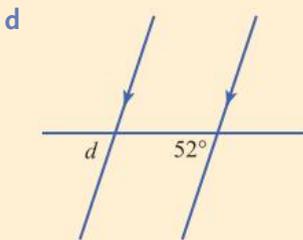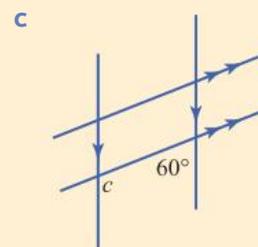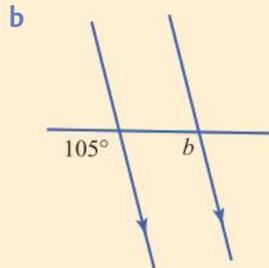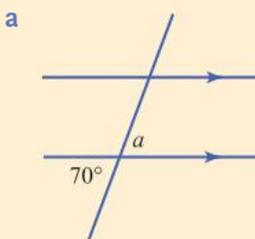
7 From this diagram calculate the size of these angles:

    a ∠*AMC*

    b ∠*CMN*

    c ∠*MNE*

    d ∠*BNF*

    e ∠*FNM*
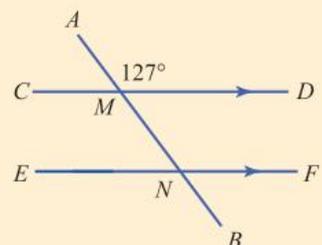
Exercise 7A

1 Give two names for the angle shown:
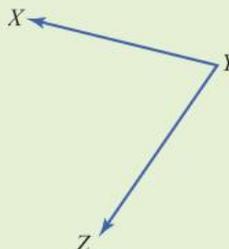
2 Draw clearly labelled diagrams to represent the angles known as:

    a $\angle ALM$ **b** $\angle PMQ$ **c** $\angle HTY$ **d** $\angle RSB$

    e $A\hat{F}G$ **f** $O\hat{M}Q$ **g** $R\hat{S}Y$ **h** $L\hat{X}Y$

Exercise 7B

3 For each of the following angles state its type:
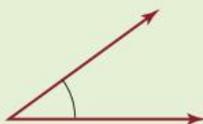
    a   **b**   **c**
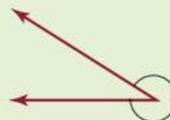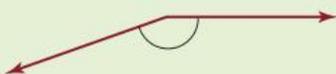
    d   **e**   **f**

    g   **h**   **i**
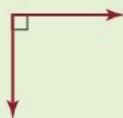
Exercise 7C

4 Using your protractor, measure the size of the following angles:
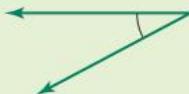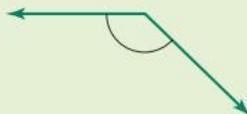
    a   **b**   **c**
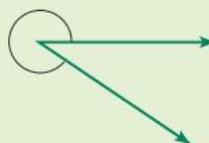
5 Kathy is a keen golfer and has been practising her game on the seventh hole. She can now reach the green in three shots. Measure the angle between each of her fairway shots.

Tee
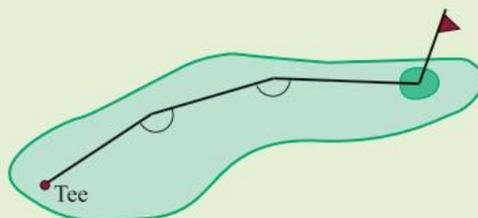
Exercise 7D

6 Use your protractor to draw the following angles:

    a $\angle A = 25°$ **b** $a = 137°$ **c** $\angle UVW = 312°$

    d $\angle LPQ = 98°$ **e** $\angle S = 123°$ **f** $h = 165°$

Exercise 7E

7 The angle sum of complementary angles is _____ degrees.

8 Find the size of angle a in each of the following:

a

a

$69°$

b

$56°$

a

c

a

$6°$

d

a

$3a$

e

$3a$

$6a$

f

$4a + 10°$

$4a$
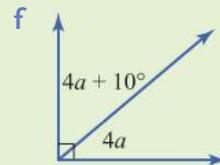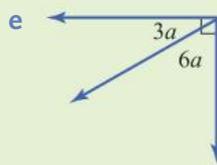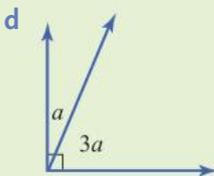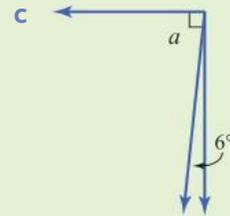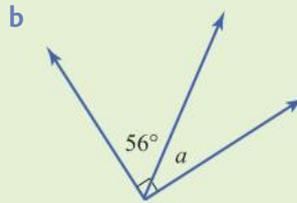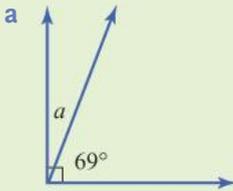
Exercise 7F

9 The angle sum of supplementary angles is _____ degrees.

10 Find the value of h in each of the following:

a

h $139°$

b

$37°$ h

c

h $46°$

d

h h
$94°$

e

$48°$

h $2h$

f

$2h$

$4h$
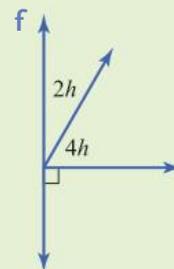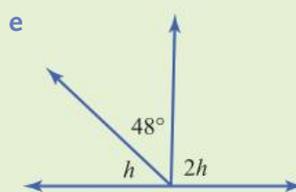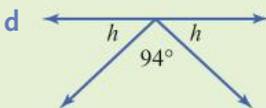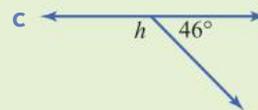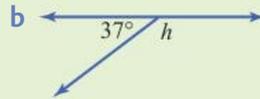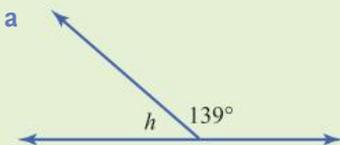
Exercise 7G

11 One revolution is _____ degrees.

12 Find the value of the pronumerals in each case.

a

$68°$ $68°$

p

b

m

s $147°$

c

$112°$

n
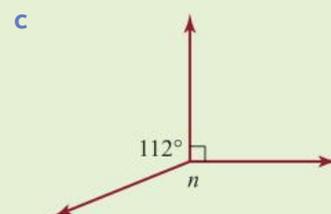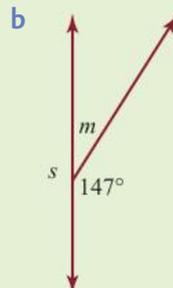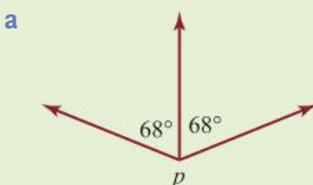
Answers

These are selected answers only.

Chapter 1

Exercise 1A

2 a LIX **b** CXXXVII **c** LXXIII
  d XIV **e** CCCCLXXXII **f** CXXIV

3 a 24 **b** 255 **c** 311 **d** 309 **e** 45 **f** 99

4 a **b**

  c **d**

  e **f**

5 a 26 **b** 8 **c** 79
  d 327 **e** 1012 **f** 556
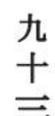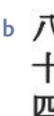
6 a **b** **c**
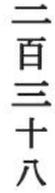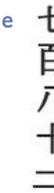
  d **e** **f**

Exercise 1B

1 a 24 **b** 612 **c** 204
  d 6458 **e** 37 000 **f** 5 006 001
  g 600 000 **h** 40 000 067 **i** 215 099
  j 140 530 **k** 809 087 920

2 a Forty-eight
  b Two hundred and ninety-one
  c One hundred and twenty-five thousand, nine hundred and nine
  d Three thousand, four hundred and ninety
  e Two thousand and sixty-three
  f Nine million, seven hundred and forty-five thousand, one hundred
  g Sixty-seven thousand, four hundred and five
  h Nine thousand and three
  i Two hundred and twenty-four million
  j Eight hundred and seventy-two thousand and four
  k Four million and sixteen
  l Two hundred and thirteen thousand, five hundred

3 a Units **b** Thousands
  c Millions **d** Hundreds
  e Tens **f** Ten thousands
  g Ten thousands **h** Units
  i Hundred millions **j** Tens
  k Hundred thousands **l** Hundreds

4 a Three **b** Thirty
  c Three thousand **d** Three hundred
  e Three hundred thousand **f** Thirty thousand
  g Three million **h** Three million

5 a 32 343 **b** 420 520 **c** 940 311
  d 45 481 **e** 3 040 300 **f** 12 578

6 a 860 **b** 30 056 **c** 4830
  d 80 050 030 **e** 10 687 **f** 5 406 007

7 a 841 **b** 9853 **c** 61
  d 96 421 **e** 976 410 **f** 98 743 210

8 a 58 **b** 013 567 **c** 3569
  d 0 234 579 **e** 478 **f** 23 467

9 a 12, 16, 35, 123, 145, 245, 321
  b 303, 306, 316, 360, 366, 603, 660
  c 4007, 4070, 4707, 4770, 4777
  d 55 789, 55 796, 55 809, 55 976, 55 980
  e 3, 34, 56, 345, 467, 721, 5005
  f 12 405, 20 451, 42 510, 52 401

10 a $303 **b** $256 **c** $88

Exercise 1C

1 a 157 **b** 1138 **c** 3840 **d** 392
  e 1570 **f** 9682 **g** 16 825 **h** 6820
  i 4821 **j** 5833 **k** 9068 **l** 9608

2 a 13 358 **b** 134 736 **c** 49 110
  d 4553 **e** 12 517 **f** 491 665

3 $187 **4** $645 **5** $4293

6 $146 590 **7** 5 km 97 m

8 a 3750 m **b** 6260 m **c** 4500 m
  d Alice **e** 14 510 m
  f Alice – 10 010 m, Regina – 10 760 m

9 a Western 12 917, Malaita 13 006, Isabel 9172, Company 35 095
  b Malaita
  c October – $13 489, November – $12 292, December – $9314
  d October

Exercise 1D

1 **a** 824 **b** 312 **c** 111 **d** 44
e 146 **f** 4943 **g** 5633 **h** 2791
i 584 **j** 1690 **k** 7576 **l** 2677
2 **a** 4791 **b** 43 903 **c** 4652
d 29 624 **e** 23 121 **f** 33 573
3 $312 **4** $201 250 **5** 174 days
6 11 255 kg **7** 117 m
8 **a** 33 km **b** 16 800 m **c** 25 900 m
d 6200 m **e** 28·5 km
9 **a** 288 120 ML **b** 3019 ML **c** 228 262 ML
d 61 182 ML **e** 571 618 ML

Exercise 1E

1 **a** 6 **b** 16 **c** 13
2 **a** 568 **b** 855 **c** 1664
d 6335 **e** 10 246 **f** 16 430
g 81 673 **h** 294 831 **i** 41 976
j 31 518 **k** 407 442 **l** 1 538 570
3 **a** 57 500 **b** 1428 **c** 6888
d 66 420 **e** 34 874
4 $66 **5** $3060
6 $323 **7** $25 425
8 **a** 1600 h **b** $32 500 **c** $3150
d $1500 **e** $21 600
9 192 min, or 3 h 12 min
10 **a** 21 km **b** 210 km **c** 658
d 34 216 **e** $336 **f** $2184

Exercise 1F

1 **a** 2143 **b** 211 **c** 310 **d** 433
e 208 **f** 53 **g** 6589 **h** 510
i 267 **j** 562 **k** 914 **l** 982
2 **a** 215 **b** 367 **c** 601 **d** 99
e 291 **f** 1270 **g** 999 **h** 480
i 2651 **j** 6247 **k** 508 **l** 20 613
3 **a** 1525 **b** 3284 **c** 604 **d** 68
4 $96 **5** 11 880 **6** 16 km
7 **a** 1980 **b** 220 **c** 594
8 1574 **9** **a** 24 **b** 6
10 **a** 120 km **b** 8 h
11 **a** 144 000 **b** 28 800 **c** 60 **d** 2 litres
12 **a** $2031·12 **b** $677·04 **c** $156·24
13 $67·65

Exercise 1G

1 **a** 400 **b** 900 **c** 5600 **d** 3700
e 32 100 **f** 3400 **g** 6600 **h** 1900
i 9900 **j** 3300 **k** 7100 **l** 1500
2 **a** 30 **b** 550 **c** 280 **d** 72
e 600 **f** 280 **g** 64 **h** 210
i 150 **j** 560 **k** 600 **l** 770
3 **a** 1680 **b** 420 **c** 1120 **d** 900
e 6800 **f** 6000 **g** 900 **h** 3400
i 570 **j** 1150 **k** 1620 **l** 1320
4 **a** 1400 **b** 4550 **c** 18 000 **d** 26 000
e 1935 **f** 230
5 $98 **6** $40 **7** 6 min

Exercise 1H

1 **a** 19 **b** 7 **c** 12 **d** 14 **e** 40 **f** 6
g 15 **h** 34 **i** 58 **j** 28 **k** 240 **l** 52
m 16 **n** 3 **o** 6 **p** 4 **q** 3 **r** 8
s 7 **t** 100 **u** 43 **v** 25 **w** 9 **x** 10
2 **a** 34 **b** 2 **c** 15 **d** 6 **e** 58 **f** 10
3 **a** $6 + 8 - 1 = 13$
b $54 \div (6 + 3) + 2 = 8$
c $(6 + 34 \div 2 + 3) \div 2 = 13$
d $42 \div (5 + 2) \times 5 = 30$
e $15 + 4 \times (5 - 5) = 15$
f $81 \div 9 \div (2 + 1) = 3$
g $(12 - 2) \times 5 = 50$
h $120 \div (10 + 2) + 5 = 15$
i $8 + (4 - 3) \times 2 = 10$
j $45 \div 3 \times 2 + 16 = 46$
k $18 \div 9 \times (5 + 7) = 24$
l $2^2 + 3 \times (3 + 4) = 25$
m $(4 - 2) \times 100 \div 25 = 8$
n $100 \div 25 \times 5 + 6 = 26$
o $(48 \div 16 + 5) \times 2 = 16$
4 **a** $(2 + 8) \div 5 = 2$ **b** $(14 - 5) \times 9 = 81$
c $6 \times (8 - 3) = 30$ **d** $(21 + 5) \div 2 = 13$
e $12 - 8 + 5 = 9$ **f** $40 - (14 \div 7) = 38$
g $(10 - 8) \times (5 + 4) = 18$
h $(34 - 12) \times (12 \div 4) = 66$
i $(36 \div 9) + (10 - 4) = 10$
j $(64 \div 16) \times (16 \div 8) = 8$
k $20 + 100 \div 25 = 24$
l $(9 + 3) \times (8 - 3) = 60$

5 a False **b** False **c** True **d** False **e** True
f True **g** True **h** False **i** False **j** True
6 a ii **b** i **c** ii **d** i **e** i **f** ii

Exercise 1I

1 a 250 **b** 1090 **c** 1020 **d** 1950
e 710 **f** 300 **g** 240 **h** 1110
i 4500 **j** 5000 **k** 400 000 **l** 24 000
m 8 **n** 10 **o** 20
2 $1800 **3** 2070 km
4 a Answers may vary **b** Answers may vary

Applications

Number puzzle

A possible answer is 1, 2, 4, 6, 8, 10, 9, 7, 5, 3.

Magic squares

1 Magic number is 262

97	27	20	118
62	76	83	41
90	48	55	69
13	111	104	34

2 Magic number is 584

101	185	179	119
167	131	137	149
143	155	161	125
173	113	107	191

3 Magic number is 558

107	118	217	116
140	193	125	100
128	134	106	190
183	113	110	152

Basketball ladder

Team	Foul	Goal	3 pointer	Total	WLD	%
Arasina	5	30	5	80	W	160
Avaiki	6	22	2	56	W	137
SOSSA	5	17	1	42	W	108
QQQ Marist	0	26	4	64	W	102
Andel (Bullets)	1	15	5	46	D	100
KOSSA	2	22	0	46	D	100
Lakers	4	28	1	63	L	98
Mt Dazza	3	15	2	39	L	93
Sunrise	2	15	3	41	L	73
JJ Auto	1	23	1	50	L	63

Word sums

a
$$\begin{array}{r} 79\,422 \\ +\ \ 3\,104 \\ \hline 82\,526 \end{array}$$

b
$$\begin{array}{r} 1960 \\ +\ 1875 \\ \hline 3835 \end{array}$$

Enrichment

1 a
$$\begin{array}{r} 246 \\ +\ 183 \\ \hline 429 \end{array}$$
b
$$\begin{array}{r} 628 \\ +\ 399 \\ \hline 1027 \end{array}$$
c
$$\begin{array}{r} 416 \\ +\ 495 \\ \hline 911 \end{array}$$
d
$$\begin{array}{r} 1212 \\ +\ 643 \\ \hline 1855 \end{array}$$

2 a
$$\begin{array}{r} 294 \\ -\ 184 \\ \hline 110 \end{array}$$
b
$$\begin{array}{r} 1628 \\ -\ 448 \\ \hline 1180 \end{array}$$
c
$$\begin{array}{r} 692 \\ -\ 199 \\ \hline 493 \end{array}$$
d
$$\begin{array}{r} 4243 \\ -\ 1951 \\ \hline 2292 \end{array}$$

3 a
$$\begin{array}{r} 128 \\ \times\ \ 4 \\ \hline 512 \end{array}$$
b
$$\begin{array}{r} 224 \\ \times\ \ 8 \\ \hline 1792 \end{array}$$
c
$$\begin{array}{r} 426 \\ \times\ \ 34 \\ \hline 1\,704 \\ 12\,780 \\ \hline 14\,484 \end{array}$$
d
$$\begin{array}{r} 283 \\ \times\ \ 67 \\ \hline 1\,981 \\ 16\,980 \\ \hline 18\,961 \end{array}$$

4 a $7\overline{)315}$ = 45 **b** $11\overline{)5797}$ = 527 **c** $8\overline{)49\,736}$ = 6 217

5 a 257 **b** 241 **c** 3287
d 6587 **e** 549 **f** 1620
g 254 **h** 6857 **i** 4261

6 a 5 **b** 8 **c** 13 **d** 28 **e** 85
f 469 **g** 56 **h** 512 **i** 2925

7 a 10110 **b** 1001111 **c** 100011
d 111000 **e** 1000000 **f** 1100100
g 10100100 **h** 100000000 **i** 1001010111
j 10000000000

8 a 1010 **b** 10000 **c** 10010
d 100010 **e** 1010000 **f** 110000000
g 1001101 **h** 1101011 **i** 10010100

9 a 100100 **b** 1010100 **c** 11000110011

Revision

1 a 19 = XIX **b** 127 = CXXVII
c 63 = LXIII **d** 34 = XXXIV
e 401 = CDI **f** 1234 = MCCXXXIV
2 a XIV = 14 **b** CCLVI = 256
c CCXXII = 222 **d** CVI = 106
e XLV = 45 **f** CL = 150
3 a 90 876, 3258, 2348, 567, 543, 65
b 726, 627, 626, 276, 267, 266
c 444, 440, 404, 400, 44, 40, 4
4 a Two hundred and thirty

b One hundred and twenty-three thousand, five hundred and sixty-two

c One thousand, eight hundred and seventy-two

d Twenty-one **e** Eight

5 a 4620 **b** 1 249 016 **c** 19 465

d 50 925

6 a **i** 7570 **ii** 15 177 **iii** 11 309

b 7179 **c** 1199

7 a **i** 464 **ii** 3168 **iii** 14 204

b 641 **c** 2738

8 a **i** 3672 **ii** 33 150 **iii** 1 852 745

b 8880 **c** 19 071

9 a **i** 158 **ii** 1402 **iii** 4403

b 472 **c** 985

10 a 22 000 **b** 350 **c** 700

d 7800 **e** 6900 **f** 9500

g 670 **h** 240 300 **i** 4710

j 23 550 **k** 6800 **l** 8640

11 a 14 **b** 41 **c** 40 **d** 10 **e** 3

f 9 **g** 13 **h** 7 **i** 16

12 10 400 m **13** $18 000

Chapter 2

Learning task 2A

1 a 10, 11, 12, 13, 14 **b** 12, 14, 16, 18, 20

c 21, 28, 36, 45, 55 **d** 17, 21, 26, 31, 37

e 33, 45, 59, 75, 93 **f** 32, 64, 128, 256, 512

g 25, 19, 14, 10, 7 **h** 33, 65, 129, 257, 513

2 a 1, 121, 12 321, 1 234 321

b 6, 12, 18, 24

c 11, 101, 1001, 10 001

3 a 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765

b 4 **c** 7 **d** 12 **e** 20

f Twentieth term − 1 = 6765 − 1 = 6764

5 b 3, 8, 15, 24, 35, 48, 63, 80, 99, 120

c Differences = 5, 7, 9, 11 …

6 a **i** 6, 15 **ii** 10, 25

b **i** 9 **ii** 15

d **i** 6, 15, 28, 45, 66, 91, 120, 153, 190, 231

ii 10, 25, 40, 55, 70, 85, 100, 115, 130, 145

7 a 47, 95, 191 **b** 33, 65, 129

c 121, 249, 505 **d** 65, 129, 257

e 77, 157, 317 **f** 91, 187, 379

g 108, 220, 444 **h** 136, 280, 568

Exercise 2B

1 a 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96

b 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91, 98

c 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96

d 9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99

e 10, 20, 30, 40, 50, 60, 70, 80, 90

2 a 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48

b 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48

c 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48

d 5, 10, 15, 20, 25, 30, 35, 40, 45

3 44, 55, 66, 77

4 144, 156, 168, 180, 192

5 a 10 **b** 12 **c** 63 **d** 42 **e** 24 **f** 30

6 a 10 **b** 60 **c** 72

7 Lowest common multiple is 420.
10 circuits for Sarah = 42 × 10 = 420 seconds
7 circuits for Emily = 60 × 7 = 420 seconds
After 7 minutes they will be together again.

8 Lowest common multiple is 12. The machines produce soft drinks simultaneously every 12 seconds.

9 Lowest common multiple is 36. The company will change the vehicles' tyres simultaneously in 36 weeks. If they change their tyres on 1 January, they will change their tyres on the same day only once again that year.

10 38 mins 23 secs, Maneori 49 laps, Iroga 47 laps

Exercise 2C

1 a 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

b 1, 2, 3, 5, 6, 10, 15, 30 **c** 1, 2, 7, 14

d 1, 2, 4, 5, 8, 10, 20, 40

e 1, 2, 4, 13, 26, 52 **f** 1, 3, 5, 15

g 1, 2, 4, 8, 16, 32 **h** 1, 13

i 1, 2, 5, 10, 25, 50 **j** 1, 3, 9, 27

k 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

l 1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48, 72, 144

2 a 6 **b** 15 **c** 1 **d** 13 **e** 8

f 10 **g** 30 **h** 48 **i** 16

3 Highest common factor of 40 and 64 is 8, so the longest length which makes all the pieces the same size is 8 m.

4 The highest common factor of 150 and 180 is 30, so the longest length which uses all the wood is 30 cm.

5 a Highest common factor of 4, 6 and 10 is 2, so each piece of rope would be 2 m.

b Kekeni will thus have 10 pieces of 2 m each.

6 Factors of 24 are 1, 2, 3, 4, 6, 8, 12 and 24. Mr Lulumani could split the class exactly into groups of any of these

numbers. There would be 24, 12, 8, 6, 4, 3, 2 or 1 groups, respectively.

7 Highest common factor of 84, 126, 294 and 462 is 42. The maximum number will be 42 groups of scouts.

Exercise 2D

1 a 45, 55, 6210   **b** 6210

2 a 234, 6780   **b** 234, 6780   **c** 234

3 a 32, 540, 5672, 54 984, 346 884

  b 32, 540, 5672, 54 984, 346 884

  c 32, 5672, 54 984

4 a 2, 3, 4, 5, 8, 9   **b** 3, 5   **c** 2, 3, 9

  d 3   **e** 2, 4, 8   **f** 3, 9

  g 3   **h** 2, 4, 5, 8   **i** 3, 9

Learning task 2E

1 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

2 4, 6, 8, 9, 10, 12, 14, 15, 16, 18

3 $10 = 3 + 7$, $12 = 5 + 7$, $14 = 3 + 11$, $16 = 5 + 11$, $18 = 7 + 11$, $20 = 7 + 13$, $22 = 3 + 19$, $24 = 5 + 19$, $26 = 7 + 19$, $28 = 5 + 23$, $30 = 7 + 23$

Exercise 2F

1 a 2^7 **b** 6^3 **c** 17^3 **d** 5^{10}

  e 23^4 **f** 3^5 **g** 1^7 **h** 19^2

2 a $9^2 = 9 \times 9$ **b** $23^1 = 23$

  c $3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

  d $4^5 = 4 \times 4 \times 4 \times 4 \times 4$

  e $8^9 = 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8$

  f $19^3 = 19 \times 19 \times 19$

  g $6^{10} = 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6$

  h $2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

3 a 25   **b** 1000   **c** 0   **d** 256

  e 20   **f** 81   **g** 256   **h** 169

4 a 65   **b** 32   **c** 24   **d** 41

  e 89   **f** 500   **g** 180   **h** 27

  i 50   **j** 100   **k** 20   **l** 100

5 1^{10}, 2^5, 3^4, 5^3, 4^4, 25^2, 10^5

6 If each of the 4 breeders has 4 cats, then the total number of cats = $4 \times 4 = 16$.

  If each cat has 4 kittens, then the total number of kittens = $16 \times 4 = 64$.

  Therefore the total number of cages needed = $16 + 64 = 80$ cages.

7 Each tray can hold $6 \times 6 = 36$ cakes.

  Each shelf can hold 6 trays = $6 \times 36 = 216$ cakes.

  Each cupboard has 6 shelves = $6 \times 216 = 1296$ cakes.

  Therefore the three cupboards can hold a total of 3888 cakes between them.

Exercise 2G

1 a 25   **b** 4   **c** 100   **d** 81   **e** 64

  f 144   **g** 169   **h** 121   **i** 400   **j** 1600

2 a 6   **b** 3   **c** 5   **d** 11   **e** 7

  f 10   **g** 9   **h** 15   **i** 12   **j** 30

3 a 289   **b** 676   **c** 900   **d** 15 625

  e 10 000   **f** 2704   **g** 2209   **h** 1089

  i 6561   **j** 3969

4 a 18   **b** 54   **c** 26   **d** 101

  e 111   **f** 89   **g** 69   **h** 4·4

  i 1·2   **j** 1·5

Exercise 2H

1 a $105 = 3 \times 5 \times 7$ **b** $182 = 2 \times 7 \times 13$

  c $51 = 3 \times 17$ **d** $115 = 5 \times 23$

2 a $20 = 2 \times 2 \times 5$ **b** $49 = 7 \times 7$

  c $100 = 2 \times 2 \times 5 \times 5$ **d** $36 = 2 \times 2 \times 3 \times 3$

  e $16 = 2 \times 2 \times 2 \times 2$ **f** $48 = 2 \times 2 \times 2 \times 2 \times 3$

  g $30 = 2 \times 3 \times 5$ **h** $24 = 2 \times 2 \times 2 \times 3$

  i $70 = 2 \times 5 \times 7$ **j** $54 = 2 \times 3 \times 3 \times 3$

  k $84 = 2 \times 2 \times 3 \times 7$ **l** $63 = 3 \times 3 \times 7$

  m $81 = 3 \times 3 \times 3 \times 3$ **n** $66 = 2 \times 3 \times 11$

  o $120 = 2 \times 2 \times 2 \times 3 \times 5$

3 a $42 = 2 \times 3 \times 7$ **b** $65 = 5 \times 13$

  c $90 = 2 \times 3 \times 3 \times 5$ **d** $28 = 2 \times 2 \times 7$

  e $72 = 2 \times 2 \times 2 \times 3 \times 3$

  f $196 = 2 \times 2 \times 7 \times 7$

  g $400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5$

  h $224 = 2 \times 2 \times 2 \times 2 \times 2 \times 7$

  i $420 = 2 \times 2 \times 3 \times 5 \times 7$

  j $560 = 2 \times 2 \times 2 \times 2 \times 5 \times 7$

  k $1000 = 2 \times 2 \times 2 \times 5 \times 5 \times 5$

  l $603 = 3 \times 3 \times 67$

  m $110 = 2 \times 5 \times 11$

  n $525 = 3 \times 5 \times 5 \times 7$

  o $13 860 = 2 \times 2 \times 3 \times 3 \times 5 \times 7 \times 11$

Exercise 2I

1 a even   **b** odd   **c** even

  d even   **e** neither   **f** odd

  g odd   **h** even   **i** even

  j even   **k** odd   **l** odd

  m even   **n** odd   **o** even

2 50, 52, 54, 56, 58, 60

3 88, 90, 92, 94, 96, 98, 100, 102, 104, 106

4 29, 31, 33, 35, 37, 39   **5** 3, 7, 11, 15, 19

6 6, 8, 10   **7** 10, 12, 14, 16

8 9, 11, 13

9 3, 5, 7, 9

10 a $2 + 4 = 6$ **b** $6 + 10 = 16$
  c $12 + 4 = 16$ **d** $4 + 16 = 20$
  e even

11 a $3 + 5 = 8$ **b** $11 + 7 = 18$
  c $17 + 5 = 22$ **d** $5 + 19 = 24$
  e even

12 a $3 + 8 = 11$ **b** $4 + 11 = 15$
  c $10 + 7 = 17$ **d** $12 + 11 = 23$
  e odd

13 a even $(2 \times 4 = 8)$ **b** odd $(3 \times 5 = 15)$
  c even $(2 \times 5 = 10)$ **d** even $(9 - 3 = 6)$
  e even $(10 - 4 = 6)$ **f** odd $(11 - 4 = 7)$

Applications

Factor puzzle

a 1   **b** 2   **c** 4   **d** 6   **e** 16   **f** 12

Brick walls

a 5 patterns are possible for a wall four units wide.

b 8 patterns are possible for a wall five units long.

c Four units wide: Five units wide:
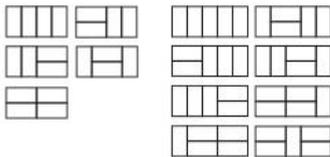
d There are 13 different patterns for a wall of length 6 units.

e Six-unit wall:
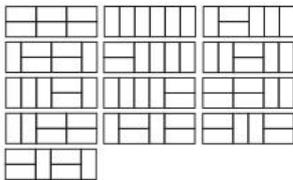
f **ii** This pattern is called a Fibonacci sequence as the two previous numbers add to give the next.

g **i** 1, 2, 3, 5, 8, 13, 21, 34

   This means 34 different brick walls could be made for an 8-unit wall.

  ii 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144

   This means 144 different brick walls could be made for an 11-unit wall.

  iii 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10 946, 17 711, 28 657, 46 368, 75 025, 121 393, 196 418, 317 811, 514 229, 832 040, 1 346 269

   This means 1 346 269 different brick walls could be made for a 30-unit wall.

Enrichment

1 a The red and blue lights flash together every 45 seconds.
  b The red and yellow lights flash together every 63 seconds.
  c The blue and yellow lights flash together every 105 seconds.

2 Odds: perfect squares 1, 4, 9, 16 …
Evens: all others 2, 3, 5, 6, 7, 8 …

3 a 32 matches are needed with 64 players
  b $32 = 2 \times 2 \times 2 \times 2 \times 2$ or 2^5
  c 16 matches will played in the third round
  d 8 matches will be played in the fourth round
  e Total number of matches would be
   $64 + 32 + 16 + 8 + 4 + 2 + 1 = 127$ matches.

4 11, 13, 17, 31, 37, 71, 73, 79, 97

5 a 28, 496, 8128
  b The sum of the squares of the digits eventually results in an answer of 1.
  c 1, 7, 10, 13, 19, 23

6 a $24 = 2^3 \times 3$
   $30 = 2 \times 3 \times 5$
   $40 = 2^3 \times 5$
   LCM $= 2^3 \times 3 \times 5 = 120$
  b $693 = 3 \times 3 \times 7 \times 11 = 3^2 \times 7 \times 11$
   $9317 = 7 \times 11 \times 11 \times 11 = 7 \times 11^3$
   LCM $= 3^2 \times 7 \times 11^3 = 83\,853$
  c $1178 = 2 \times 19 \times 31$
   $1444 = 2 \times 2 \times 19 \times 19$
   HCF $= 2 \times 19 = 38$
  d $204 = 2 \times 2 \times 3 \times 17$
   $1380 = 2 \times 2 \times 3 \times 5 \times 23$
   HCF $= 2 \times 2 \times 3 = 12$
  e Factors of 204: 1, 2, 3, 4, 6, 12, 17, 34, 51, 68, 102, 204
   Factors of 1380: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 23, 60, 69, 92, 115, 138, 230, 276, 345, 460, 690, 1380
  f 5280   **g** 961, factors are 1, 31, 961
  h 867, factors are 1, 3, 17, 51, 289, 867
  i HCF of 245 700, 132 300, 114 660, 207 900 is 1260

7 a 2, 2, 4, 6, 10, 16, 26, 42, 68, 110; Sum $= 286$
  b 1, 4, 5, 9, 14, 23, 37, 60, 97, 157; Sum $= 407$
  c Sum $= 143$

Revision

1 a 1, 3, 5, 7, 9, 11, 13, 15, 17, 19
  b 1, 3, 6, 10, 15, 21, 28, 36, 45, 55

2 a 3, 8, 15, 24, 35, 48, 63, 80, 99, 120
  b 12, 20, 28, 36, 44, 52, 60, 68, 76, 84

3 a 7, 14, 21, 28, 35
  b 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39
   5, 10, 15, 20, 25, 30, 35

c 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48
   6, 12, 18, 24, 30, 36, 42, 48
   Therefore common multiples are 12, 24, 36, 48.

d 36   e 42   f 105

4 6, 12, 18, 24. At least 6 steps.

5 396 seconds

6 a 15: 1, 3, 5, 15   20: 1, 2, 4, 5, 10, 20
   b HCF = 5
   c 14: 1, 2, 7, 14   21: 1, 3, 7, 21
      HCF = 7
   d 36: 1, 2, 3, 4, 6, 9, 12, 18, 36
      42: 1, 2, 3, 6, 7, 14, 21, 42
      54: 1, 2, 3, 6, 9, 18, 27, 54
      HCF = 6
   e 18: 1, 2, 3, 6 9, 18
      51: 1, 3, 17, 51
      63: 1, 3, 7, 9, 21, 63
      HCF = 3

7 HCF of 650 and 475 is 25
   25 cm × 25 cm, 26 tiles × 19 tiles

8 a Yes   b No   c Yes   d No

9 3696 divisible by: 2, 3, 4, 6, 8
   580 divisible by: 2, 4, 5, 10
   4752 divisible by: 2, 3, 4, 6, 8, 9
   4599 divisible by: 3, 9

10 a Prime   b Composite   c Composite
   d Composite   e Composite   f Prime

11 a 4^6 b 9^3 c 10^7 d 2^2

12 a 6×6 b $4 \times 4 \times 4 \times 4 \times 4$
   c $8 \times 8 \times 8$ d $10 \times 10 \times 10 \times 10$
   e $3 \times 3 \times 3 \times 3 \times 3 \times 3$

13 a 24   b 72   c 36   d 216   e 17

14 a 36   b 225   c 8   d 13

15 a 784   b 11 449   c 46   d 103

16 a $18 = 2 \times 3 \times 3$
   b $64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$
   c $26 = 2 \times 13$
   d $32 = 2 \times 2 \times 2 \times 2 \times 2$
   e $242 = 2 \times 11 \times 11$
   f $128 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

17 a 46, 48, 50, 52, 54, 56, 58
   b 19, 21, 23, 25, 27, 29, 31
   c 5, 9, 13, 17   d 4, 6, 8

Chapter 3

Exercise 3A

1

a 3·12			3	·	1	2		
b 12·890		1	2	·	8	9	0	

c 123·5	1	2	3	·	5			
d 8·5678			8	·	5	6	7	8
e 2·008			2	·	0	0	8	
f 56·7071		5	6	·	7	0	7	1
g 0·1004			0	·	1	0	0	4
h 440·6	4	4	0	·	6			
i 49·003		4	9	·	0	0	3	
j 943·761	9	4	3	·	7	6	1	
k 78·0002		7	8	·	0	0	0	2
l 0·0643			0	·	0	6	4	3

2 a Units   b Hundredths
   c Ten-thousandths   d Tenths
   e Hundreds   f Hundreds
   g Thousandths   h Hundredths
   i Thousandths   j Ten-thousandths
   k Hundred-thousandths   l Hundred-thousandths

3 a 5   b 2   c 3   d 6   e 3   f 9
   g 8   h 1   i 3   j 4   k 5   l 1

4 a 2·6   b 5·07   c 0·008
   d 90·024   e 0·0009   f 0·707

5 a 5·43   b 4·96   c 7·6
   d 0·14   e 126·986   f 10·47
   g 6 hundredths   h 7 tenths

6 a 2·345 2·435 2·453 2·543 3·245
   b 2·718 27·08 27·18 27·81
   c 19·115 19·151 19·5 19·511
   d 0·00004 0·0004 0·004 0·4
   e 0·907 0·909 0·997 1·003 1·909
   f 0·9199 0·989 0·9909 0·99989 0·9999

7 a 3 pm   b 33·5°
   c Thirty-one point three °C
   d 28·8 30·4 31·3 32·8 33·5 (all °C)

8 a 8 cents   b $28·00   c Martin's hat

9 a Amanda   b Sally's
   c Mary's   d Amanda, Mary, Deborah
   e 6·9 m   f 0·6 m

Exercise 3B

1

	Approximate question	Estimate answer	Calculator answer
	≈ 120 + 20	= 140	= 148·01
a	≈ 1 + 15	= 16	= 15·67
b	≈ 236 + 7	= 243	= 242·8987
c	≈ 2 + 9	= 11	= 11·23
d	≈ 15 − 4	= 11	= 10·83
e	≈ 14 − 1	= 13	= 12·80
f	≈ 57 − 1	= 56	= 56·133
g	≈ 25 × 10	= 250	= 320·8321
h	≈ 5 × 10	= 50	= 55·0095
i	≈ 14 × 3	= 42	= 41·9058
j	≈ 240 ÷ 4	= 60	= 58·9925
k	≈ 640 ÷ 8	= 80	= 79·73625
l	≈ 81 ÷ 9	= 9	= 8·954

2 $14   **3** $340

Exercise 3C

1 a 8   **b** 20   **c** 125   **d** 24
   e 47   **f** 983   **g** 1   **h** 0
2 a 2·3   **b** 0·2   **c** 4·6   **d** 99·9
   e 0·1   **f** 689·1   **g** 45·9   **h** 0·0
3 a 23·69   **b** 12·81   **c** 25·01   **d** 14·56
   e 56·22   **f** 12·10   **g** 15·00   **h** 88·10
4 a 45·254   **b** 97·025   **c** 19·658   **d** 14·235
   e 2·610   **f** 108·000   **g** 2·680   **h** 0·333
5 a 45·87612   **b** 0·0873462   **c** 21·4690
   d 0·005   **e** 35   **f** 17·0905
   g 0·700   **h** 0·1429   **i** 43·4678
   j 1·54   **k** 9·155   **l** 0·0047

Exercise 3D

1 a 36·75   **b** 172·9   **c** 7·76
   d 58·64   **e** 294·63   **f** 105·916
   g 41·81   **h** 10·34   **i** 93·50
2 a 9·75   **b** 58·364   **c** 127·97
   d 172·77   **e** 374·76   **f** 163·760
   g 126·16   **h** 280·8   **i** 3723·15
   j 1047·33
3 281·93   **4** 162·20 kg
5 7·27 km   **6** $9·80
7 a 6·35 kg   **b** 3·02 kg   **8** 7·2 m
9 a $26·45   **b** $29·20   **c** Tamana   **d** $55·65

10 a $16·10   **b** $18·00   **c** Yes, with $1·90 left over
11 $12·75   **12** $304·90   **13** 17·46 kg

Exercise 3E

1 a 15·22   **b** 172·3   **c** 3·33
   d 71·58   **e** 72·36   **f** 9·65
   g 57·2   **h** 0·78   **i** 83·1
2 a 75·86   **b** 127·35   **c** 117·19
   d 187·43   **e** 8·6   **f** 16·73
   g 1·85   **h** 10·68   **i** 450·14
   j 918·04   **k** 164·8   **l** 40·2
3 12·9   **4** 34·3   **5** 117·29 m
6 $56·65   **7** 2·6°C   **8** $21·77
9 a   **i** 446·1 km   **ii** 572·5 km   **iii** 509·2 km
   b Tuesday   **c** 1527·8 km
10 a $91·91   **b** $97·73   **c** $67·78   **d** $93·63

Exercise 3F

1 a 165·2   **b** 134·1   **c** 2·94
   d 499·00   **e** 7·062   **f** 341·34
   g 89·82   **h** 38·992   **i** 321·860
   j 78·456   **k** 119·5435   **l** 152·6996
   m 3·04   **n** 103·75   **o** 53·94
   p 30·36
2 a 177·8   **b** 802·7   **c** 25·46
   d 129·96   **e** 7164   **f** 271·66
   g 251·22   **h** 2832·27   **i** 86·24
   j 10 428·152   **k** 6867·258   **l** 34 206·48
   m 62·93   **n** 229·9779   **o** 4920·524
   p 6·0759
3 a 1·82   **b** 5·04   **c** 2·82
   d 2·36   **e** 3·28   **f** 20·52
   g 76·96   **h** 13·32   **i** 14·792
   j 0·6175   **k** 2·1624   **l** 47·5356
4 a 0·0276   **b** 0·00455   **c** 0·000018
   d 0·000264   **e** 0·00004   **f** 0·0486
   g 0·0000036   **h** 0·000603   **i** 0·00301
5 a 23·29   **b** 175·11   **c** 93·22
   d 121·929   **e** 373·221   **f** 82·705
   g 365·976   **h** 45·408   **i** 83·5125
   j 132·2411   **k** 353·2396   **l** 156·6661
6 a 10 768·146   **b** 1197·4843
   c 394·64384   **d** 872·2956816
7 $1181·97
8 a $173·25   **b** $28·88   **c** $202·13
9 $49·85   **10** $1753·13
11 $145·00   **12** $46·72

13 a   i $6·44   **ii** $15·71   **iii** $1·42

    iv $3·47   **v** $6·76   **vi** $1·78

    vii $3·07

  b $38·65   **14** $6847·50

Exercise 3G

1 a 3·9   **b** 29·1   **c** 32·4   **d** 3·12

  e 4·28   **f** 7·54   **g** 0·0579   **h** 29·27

  i 0·04   **j** 0·009   **k** 39·66   **l** 1·83

  m 23·4   **n** 0·7   **o** 0·41   **p** 3·51

2 a 4·00   **b** 1·97   **c** 0·52   **d** 2·44

  e 14·23   **f** 13·58   **g** 1·99   **h** 0·88

  i 4·04   **j** 19·71   **k** 11·97   **l** 120·29

3 $3·15 each   **4** $1·95

5 a $0·04   **b** 4 cents   **6** $0·29

7 a 518·5 km   **b** 129·625 km

Exercise 3H

1 a 13   **b** 7   **c** 1·2   **d** 12

  e 0·6   **f** 0·09   **g** 100   **h** 2100

  i 110   **j** 0·002   **k** 0·04   **l** 5

  m 90   **n** 15   **o** 1   **p** 0·5

  q 2·275   **r** 0·0016   **s** 0·6   **t** 1360

2 a 4·58   **b** 3·5   **c** 316

  d 6·4   **e** 0·258   **f** 45·6

  g 1·256   **h** 24·67   **i** 1·256

  j 0·146   **k** 911·5   **l** 0·45825

  m 60   **n** 120·46571   **o** 130

  p 1·55   **q** 765·5   **r** 16·18

  s 19·1325   **t** 49·9$\overline{27}$ **u** 3·768

3 a 4·56   **b** 1·569   **c** 0·045

  d 23   **e** 3·54   **f** 74·809

  g 0·018   **h** 0·9175   **i** 114·99

4 a 709·8775   **b** 971·21

5 245   **6** 18   **7** 18·5

Learning task 3I

1

Question	Answer
$1·8 \times 10$	18
$0·6 \times 10$	6
$7·3 \times 10$	73
$3·68 \times 100$	368
$5·008 \times 100$	500·8
$0·005 \times 1000$	5
$1·612 \times 1000$	1612
$1·75 \times 1000$	1750

2 a When a decimal is multiplied by 10 the decimal point moves one place to the right.

  b When a decimal number is multiplied by a power of 10, say 100 or 1000, the decimal point moves to the right by the number of places equal to the number of zeros in the multiplying power.

3

Question	Answer
$40·3 \div 10$	4·03
$50·4 \div 10$	5·04
$0·24 \div 10$	0·024
$650·48 \div 100$	6·5048
$346·24 \div 100$	3·4624
$19·36 \div 100$	0·1936
$1087·4 \div 1000$	1·0874
$471·28 \div 1000$	0·47128
$0·24 \div 100$	0·0024

4 a When a decimal is divided by 10 the decimal point moves one place to the left.

  b When a decimal number is divided by a power of 10, say 100 or 1000, the decimal point moves to the left by the number of places equal to the number of zeros in the dividing power.

5 a 127·4   **b** 765·4   **c** 14·56

  d 59·83   **e** 65   **f** 1587·39

  g 35·89   **h** 0·67   **i** 123 678

  j 8·76   **k** 2789·04   **l** 42 780

6 a 34 987   **b** 650 098   **c** 340·08

  d 877·6402   **e** 285·7162   **f** 567 901·1

  g 23 589·0   **h** 34 125·67

  i 4 569 998·7   **j** 345 000

  k 23 487 124·5   **l** 3 478 000

7 a 1737·5   **b** 10 235·85   **c** 767·35

8 a 0·3983   **b** 1·23876

  c 145·83245   **d** 34·598

  e 0·5699   **f** 0·087

  g 9·8054   **h** 0·234123

  i 56·7329   **j** 60·6098

  k 0·2359087   **l** 3·490

9 a 0·02387   **b** 0·0098

  c 0·0023498   **d** 0·000123

  e 6·7908   **f** 0·00876

  g 2·345679   **h** 0·0127654

  i 0·001245   **j** 0·034576

  k 0·03456   **l** 0·125745

  m 0·04789   **n** 0·00376

  o 1·9567   **p** 0·00098

  q 0·034567   **r** 0·0000876

s 23·45623	**t** 0·000987			
u 0·000 001 05				

10 a 497·2   **b** 62 325   **c** 962·5
d 2·2244   **e** 14·528   **f** 0·1659
g 17 172 750   **h** 13 873·6   **i** 473 917·5
j 21·40   **k** 45·80   **l** 71·9
m 3360   **n** 1475   **o** 4016

Exercise 3J

1 a $0·\dot{3}$ **b** $0·4$ **c** $0·25$
d $0·125$ **e** $0·875$ **f** $0·41\dot{6}$
g $0·8\dot{3}$ **h** $0·75$ **i** $0·8$
j $0·3$ **k** $0·\dot{5}$ **l** $0·\overline{27}$
m $0·625$ **n** $0·\dot{8}$ **o** $0·8\dot{3}$
p $0·\dot{6}$ **q** $0·\dot{2}$ **r** $0·2$
s $0·1\dot{6}$ **t** $0·\overline{45}$

2 a $1·\dot{7}$ **b** $3·\dot{3}$ **c** $1·8$
d $1·\overline{45}$ **e** $2·1\dot{6}$ **f** $1·7$
g $1·\overline{09}$ **h** $1·08\dot{3}$

3 a $0·57$ **b** $0·14$ **c** $4·67$
d $2·43$ **e** $0·44$ **f** $0·38$
g $0·29$ **h** $1·67$

Exercise 3K

1 a $\frac{1}{5}$ **b** $\frac{1}{25}$ **c** $\frac{9}{10}$ **d** $\frac{3}{1000}$

e $\frac{13}{100}$ **f** $\frac{9}{20}$ **g** $\frac{33}{500}$ **h** $\frac{11}{125}$

i $\frac{1}{4}$ **j** $\frac{3}{8}$ **k** $\frac{3}{4}$ **l** $\frac{1}{8}$

2 a $8\frac{1}{2}$ **b** $3\frac{3}{5}$ **c** $2\frac{7}{100}$ **d** $8\frac{1}{125}$

e $1\frac{3}{50}$ **f** $2\frac{7}{8}$ **g** $3\frac{5}{8}$ **h** $4\frac{7}{100}$

3 a $\frac{13}{125}$ **b** $\frac{909}{1000}$ **c** $\frac{141}{200}$ **d** $\frac{17}{50}$

e $\frac{27}{200}$ **f** $\frac{249}{250}$ **g** $\frac{137}{250}$ **h** $\frac{5}{8}$

i $1\frac{1}{4}$ **j** $2\frac{3}{4}$ **k** $1\frac{1}{50}$ **l** $3\frac{13}{20}$

m $5\frac{63}{200}$ **n** $7\frac{343}{1000}$ **o** $9\frac{48}{125}$ **p** $12\frac{81}{125}$

q $10\frac{21}{200}$ **r** $12\frac{9}{500}$ **s** $15\frac{9}{25}$ **t** $20\frac{9}{200}$

Exercise 3L

1 a $\frac{21}{100}$ **b** $\frac{97}{100}$ **c** $\frac{1}{2}$ **d** $\frac{1}{4}$

e $\frac{13}{20}$ **f** $1\frac{73}{100}$ **g** $1\frac{59}{100}$ **h** $3\frac{33}{100}$

2 a 3%   **b** 81%   **c** 70%   **d** 30%
e 46%   **f** 2%   **g** 4%   **h** 48%
i 50%   **j** 20%   **k** 25%   **l** 100%

3 a 0·16   **b** 0·47   **c** 0·07   **d** 0·88
e 0·50   **f** 0·90   **g** 0·35   **h** 0·05
i 1·14   **j** 4·25   **k** 2·50   **l** 3·15

4 a 33%   **b** 45%   **c** 13%   **d** 93%
e 19%   **f** 5%   **g** 1%   **h** 2%
i 163%   **j** 159%   **k** 100%   **l** 106%

5 a $0·8, 82\%, \frac{7}{8}, 0·8\dot{7}, \frac{8}{9}$

     $(0·8, 0·82, 0·875, 0·8\dot{7}, 0·8\dot{8})$

b $0·6, 65\%, \frac{2}{3}, 67\%, 0·6\dot{7}$

     $(0·6, 0·65, 0·6\dot{6}, 0·67, 0·6\dot{7})$

c $\frac{9}{10}, 0·923, 92·5\%, 0·96, 98\%$
     $(0·9, 0·923, 0·925, 0·96, 0·98)$

d $24\%, \frac{1}{4}, 0·26, \frac{7}{25}, 29\%$
     $(0·24, 0·25, 0·26, 0·28, 0·29)$

Exercise 3M

1 a 18   **b** 22   **c** 40   **d** 198
e 4   **f** 37·5   **g** 3   **h** 42
i 343   **j** 63   **k** 5·7   **l** 8

2 a 88   **b** 300   **c** 91   **d** 225
e 795   **f** 1260   **g** 116·25   **h** 42

3 a 13   **b** 51   **c** 363   **d** 162
e 2   **f** 8   **g** 343   **h** 255

4 $6000

5 a 202 800 ML   **b** 135 600 ML
c 2568 ML   **6** 57

Exercise 3N

1 a $10·80   **b** $85·00   **c** $159·20
d $28·50   **e** $15·00   **f** $874·13

2 a 7·5 km   **b** 170 m   **c** $87·50
d 19 litres   **e** $250   **f** 2·8 cm

3 a $49·50   **b** $165   **c** $132
d $825   **e** $27·50   **f** $40·15

Applications

The price is right?

1 $4·47   **2** $3·49   **3** $3·19

Magic squares

12·78	8·52	21·3	5·68
22·72	4·26	14·2	7·1
2·84	18·46	11·36	15·62
9·94	17·04	1·42	19·88

Magic number = 48·28

56·7	37·8	94·5	25·2
100·8	18·9	63	31·5
12·6	81·9	50·4	69·3
44·1	75·6	6·3	88·2

Magic number = 214·2

Currency

1 There are 13 ways of having 50 cents using Solomon Islands currency.

2 Using US currency there are 50 ways of having 50 cents.

5 There are 7 ways of having 50 agorots using Israel's currency of agorots.

Enrichment

1 a $\dfrac{7}{30}$ **b** $\dfrac{8}{9}$ **c** $\dfrac{13}{18}$ **d** $\dfrac{5}{9}$

e $\dfrac{19}{55}$ **f** $\dfrac{27}{110}$ **g** $\dfrac{17}{90}$ **h** $\dfrac{226}{495}$

i $\dfrac{1}{15}$ **j** $\dfrac{223}{90}$ **k** $\dfrac{139}{450}$ **l** $\dfrac{3637}{990}$

3 a 1750 **b** $52 500 **c** $87 500

d 57%; No, the statement was not correct.

e 3010 males attended; 3990 females attended

4 a $34·10 **b** 30 **c** 60

d $495 **e** $210 **f** $1233

g $1600 **h** $2833 **i** $3116·30

Revision

1 a Units **b** Thousandths

c Tenths **d** Tens

e Hundredths **f** Thousand-thousandths

g Tenths **h** Hundred-thousandths

2 a 34·8762 **b** 1·35 **c** 19·606

d 0·01 **e** 0·0 **f** 0·5000

3 a 69·01 **b** 1198·143 **c** 2·43

d 13·563 **e** 1002·434 **f** 51·84

4 a $50·06 **b** $254·84

c Michael **d** $184·78

5 a 100·24 **b** 0·81 **c** 10·57

d 802·7 **e** 64·432 **f** 684·35

6 a 108 **b** 2·04 **c** 2·25

d 9·8 **e** 145·992 **f** 821·1

7 a $1·79 per kilogram **b** $1·75 per kilogram

c $2·50 per kilogram

d The 10 kg bag when it is on special

8 a 12·52 **b** 2·1 **c** 102·87

d 25 **e** 57·6 **f** 705

9 a 378·9 **b** 1 234 500 **c** 402 240

d 239·4 **e** 23·4875 **f** 1·245 674 32

10 a $0·58\dot{3}$ **b** 0·375 **c** $0·0\overline{9}$

d $0·\dot{7}$ **e** 1·8 **f** 1·375

11 a $\dfrac{1}{2}$ **b** $\dfrac{7}{1000}$ **c** $\dfrac{67}{100}$

d $\dfrac{173}{500}$ **e** $5\dfrac{809}{1000}$ **f** $12\dfrac{29}{500}$

12 a $\dfrac{23}{100}$, 0·23 **b** $\dfrac{9}{10}$, 0·9

c $\dfrac{7}{20}$, 0·35 **d** 3

e $2\dfrac{1}{4}$, 2·25 **f** $\dfrac{1}{100}$, 0·01

13 a $8 **b** 6 cm **c** $25

d 1 cent **e** $12 **f** $125

14 a $366·31 **b** $42·53 **c** $408·84

d $367·95 **e** $132·05

Chapter 4

Exercise 4A

1 a Metres **b** Metres **c** Metres

d Metres **e** Metres **f** Metres

g Kilometres **h** Centimetres **i** Millimetres

j Metres

2 One example is given

a Distance of a marathon

b Height of Mount Everest

c Height of a chair **d** Width of a pencil

Exercise 4B

1 a 4 m **b** 3·5 m **c** 1·4 m

d 9·6 m **e** 4 m **f** 2·5 m

2 a 1 m **b** 6 m **c** 2·5 m

d 1·7 m **e** 3 m **f** 3 m

Exercise 4C

1 Both circles are 1·9 cm in diameter.

2 Both lines are 3·1 cm.

3 Squares are the same size.

4 Rectangles are the same size.

5 They are the same size.

6 A and C are the same size, B and D are the same size and bigger than A, C.

7 The top and bottom ones are the same height, the middle one is taller.

8 The two on the left are the same size and the two on the right are the same size and bigger than the others.

9 A = 5 cm   B = 6 cm   C = 11 cm   D = 8 cm
E = 5·5 cm   F = 4·5 cm   G = 4·5 cm

A, B and C are the easiest; the hardest are D and E. Horizontal and vertical are easier than diagonal

Exercise 4D

1 a 9·4 cm   **b** 6·7 cm   **c** 11·9 cm
   d 1·5 cm   **e** 8·1 cm   **f** 12·7 cm

2 a 4·1   **b** 4·1   **c** 2   **d** 3   **e** 3·4

3 A: $\dfrac{6}{16} = \dfrac{3}{8}$ inch B: 1 inch

   C: $1\dfrac{1}{2}$ inches D: $2\dfrac{2}{16} = 2\dfrac{1}{8}$ inches

   E: $2\dfrac{14}{16} = 2\dfrac{7}{8}$ inches F: $4\dfrac{7}{16}$ inches

   G: 5 inches

Exercise 4E

1 a Width: 34 mm, height: 23 mm, bottom span: 10 mm
   b Height: 9 mm, length: 33 mm
   c Front length: 10 mm, height of front tyre: 11 mm, length: 33 mm
   d Head height: 17 mm, height: 43 mm, shoe width: 11 mm
   e Length: 30 mm, height: 21 mm
   f Height: 40 mm, width: 31 mm

2 a 204 mm   **b** 165 mm   **c** 144 mm   **d** 122 mm

3 a 426 mm   **b** 480 mm

4 a Length: 29·0 cm, cost: $348
   b Length: 43 cm, cost $516

Exercise 4F

1 a Multiply by 100   **b** Divide by 10
   c Divide by 1000   **d** Divide by 1000
   e Divide by 100   **f** Multiply by 1000
   g Multiply by 100 000 **h** Multiply by 10

2 a 3·9 km = 3900 m = 390 000 cm
   b 0·0003 km = 0·3 m = 30 cm = 300 mm
   c 0·14 m = 14 cm = 140 mm
   d 0·57 m = 57 cm = 570 mm

3 a 1·2 m   **b** 1·5 km   **c** 20 cm
   d 0·12 km   **e** 4700 mm   **f** 20 mm
   g 12 cm   **h** 0·8 km   **i** 2 cm
   j 350 cm   **k** 4500 m   **l** 24 mm

4 21·11 m   **5** 60 480 m, 60·48 km

6 126 cm or 1·26 m

7 a 1 m   **b** 0·848 m   **c** 2·334 m

Exercise 4G

1 a 81 mm   **b** 31 m   **c** 80 mm
   d 610 km   **e** 340 mm   **f** 15 cm
   g 113 m   **h** 3 mm   **i** 293 m
   j 28 mm   **k** 72 km   **l** 187 cm

2 a 858 cm   **b** 8290 m   **c** 398 cm
   d 101 mm   **e** 670 mm   **f** 102 mm
   g 736 m   **h** 146 mm   **i** 56 789 m
   j 3280 cm   **k** 701 mm   **l** 1363 cm

3 a 7·124 km **b** 4·87 m   **c** 17·0 cm
   d 5·986 km **e** 75·3 m   **f** 1·4 cm
   g 0·502 km **h** 85·17 m   **i** 3·2 km
   j 81·7 cm   **k** 88·7 km   **l** 1·1 m

4

	Tenaru NSS	King George Sixth NSS	Selwyn NSS
Longest	4·5 m	4·5 m	6·98 m
Shortest	2·1 m	0·63 m	4·75 m
Difference	2·4 m	3·87 m	2·23 m

5 The 23·2 m kick was greater by 3·31 m.

6 Bill's worm was longer by 33 mm.

7 Jin walks 2·5 + 0·56 = 3·06 km.
Shan walks 2·5 km.

8 a 133·7 m   **b** 36·7 m

9 a 27·3 mm, 3 cm, 0·045 m
   b 43 mm, 8 cm, 153 mm, 0·0045 km
   c 1450 mm, 6·8 km, 7932 m
   d 180 cm, 3 m, 0·0045 km
   e 0·12 cm, 3·5 mm, 0·009 m, 0·0058 km
   f 0·2 cm, 15 mm, 0·04 m, 0·006 km

10 a i Length 0·8 m   **ii** Length 0·4 m
        Depth 0·15 m   Depth 0·9 m
        Height 0·4 m   Height 0·3 m

   b 500 m at Betikama girls' dormitory
       210 m at Don Bosco School
       4150 m at Tasahehoysins estate
       6525 m at PNG High Commission

Exercise 4H

1 Shape A is 14 cm. Shape B is 15 cm.
Shape C is 29 cm. Shape D is 20 cm.

2 a 180 cm **b** 70 cm **c** 84 cm
d 18 cm **e** 24 cm

3 a 42 cm **b** 48 cm **c** 85 cm **d** 54 mm

4 a 76 m **b** 169 cm

5 a 48 cm **b** 55 cm or 550 mm

6 Bed 1: 3580 cm or 38·5 m Bed 2: 2140 cm or 21·4 m
Bed 3: 4020 cm or 40·2 m Bed 4: 4100 cm or 41 m
Bed 5: 7900 cm or 79 m Bed 6: 1600 cm or 16 m

7 a 30·09 cm **b** 1030 cm **c** 540 000 cm
d 138·6 cm **e** 36 812 cm

8 a 685 cm or 6·85 m **b** 14·1 cm or 141 mm
c 15 900 cm or 159 m **d** 3450 cm or 34·5 m
e 3630 cm or 36·3 m or 36300 mm

Learning task 4I

1 c Differences could arise due to individual differences
in body size and shape. The amount of food eaten
and amount of hard manual labour could also lead
to different finger thickness.

2 a Royal cubit **b** Hand **c** Digit
d Palm **e** Digit

Enrichment

1 a Pipe A **b** 63 cm

2 a 370 cm **b** 340 cm

3 If there are 330 shapes required and twice as many
hexagons as octagons, 220 hexagons and 110 octagons
are required.

Each hexagon has a perimeter of 90 cm.

Each octagon has a perimeter of 120 cm.

The total length of wire required is 330 m.

The density of the wire is 200 g per metre so 66 kg
of wire is required.

4 a **i** 574 mm **ii** 308 m
b **i** 552 m **ii** 336 mm

5 a Black: 124 m Red: 100 m
Green: 78 m Blue: 56 m
b $89·50 **6** 482 tiles **7** 342 pages

Revision

1 a millimetres **b** metres
c kilometres **d** centimetres

2 1·6 m **3** Check with your ruler.

4
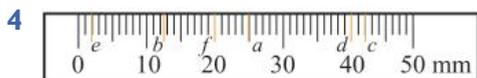
5 a 14 mm **b** 22 mm **c** 26 mm **d** 34 mm
e 56 mm **f** 150 mm **g** 200 mm

6 a 489 mm **b** 32 880 m **c** 21·4 cm
d 21 m **e** 0·0856 m **f** 0·514 km
g 45 mm **h** 1250 m **i** 20 cm

7 a 0·45 m **b** 0·75 m **c** 3 m
d 3·6 m **e** 5·7 m

8 a 41 mm **b** 2100 m **c** 1310 mm

9 a John 409 mm Manuel 0·33 m
Lulu 635 mm Valda 58 cm
b 6046 mm = 604·6 cm = 6·046 m

10 316·95 cm

11 a 10 cm **b** 11 cm **c** 8 cm **d** 184 cm

Chapter 5

Exercise 5A

1 a Shoe size, number of matches in a box, number of
cars in a parking lot
b Height, length, time

2 a Discrete **b** Continuous
c Discrete **d** Discrete
e Continuous **f** Discrete
g Discrete **h** Discrete
i Discrete **j** Continuous

3 Student's own answers

4 a

Transport	Tally	Frequency
Car	‖‖‖‖ ‖‖‖‖	9
Bus	‖‖‖‖ ‖‖‖‖	10
Walk	‖‖‖‖ ‖‖‖	8
Bike	‖‖‖	3

b 8 **c** Car and bus

5 a Pawpaw **b** Beans **c** 12
d 53 **e** 42

6 a

Qtr	Home team	Total	Visitors	Total
1	GS ‖	2	GS ‖‖‖‖ ‖	6
	GA ‖	2	GA ‖‖‖‖	4
2	GS ‖‖‖‖ ‖	6	GS ‖‖‖‖ ‖	6
	GA ‖	1	GA ‖‖‖	3
3	GS ‖‖‖	3	GS	0
	GA ‖‖‖	3	GA ‖	2
4	GS ‖‖‖‖ ‖	6	GS ‖	1
	GA ‖	2	GA ‖‖‖‖	5
	Final score	25	Final score	27

b 7 **c** The visitors won by 2 goals, 25 to 27.
d The home team GS scored the highest with 17 goals.

7 a 49   **b** 121   **c** 2009

   d Cars; cheaper, personal

8

Number of matchsticks	Frequency
31–40	6
41–50	6
51–60	9
61–70	2
71–80	1

9 a continuous   **b** 7   **c** 11   **d** 26

Exercise 5B

1 a 1   **b** 7

   c Thailand   **d** Iran and Thailand

   e Thailand   **f** Iraq

   g Iran   **h** Bahrain and Thailand

2

Name	F or M	Year level	Boarding or day	Favourite subject	Language	Siblings	Pets
Beth	F	7	Boarding	Maths	French	2	1
Kyle	M	8	Day	PE	Chinese	1	4
Sarah	F	8	Day	Music	Chinese	2	3
Leo	M	8	Boarding	Maths	Chinese	1	0
Henry	M	8	Day	Maths	Chinese	3	3
Laura	F	8	Day	Art	French	2	6

3 a 2   **b** 3

   c Leo   **d** 4

   e None

   f Kyle, Leo and Henry

Exercise 5C

1 a Asia   **b** Australia/Pacific   **c** 28

   d The Americas and Africa   **e** 100

2 a Catholic   **b** 3000

   c 500   **d** 12 500

   e Anglican, Catholic and Other Christian

3

Most popular colour
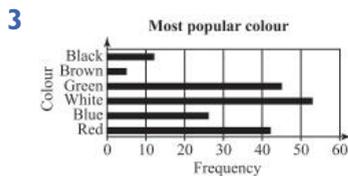
4 Student's own answer

5 a The washing   **b** Home maintenance

   c 42   **d** 39

6 a USA   **b** Russia   **c** USA   **d** USA

   e Cuba   **f** 9   **g** Germany

Exercise 5D

1 a The months

   b Australian cents per Solomon Island dollar

   c 13 Australian cents

   d 14·125 cents; 1 June 2010

   e 12·125 cents; 1 February 2011

   f Fall

2 a The time after Angela started exercising

   b Angela's pulse rate

   c 80 beats per minute

   d 430 beats

   e After 4 minutes

   f **i** Between minutes 1 and 4

      ii A steep positive slope

   g **i** Between minutes 4 and 5

      ii Slope is flat

   h **i** From the 5th minute

      ii A downwards slope to the line

   i 9 minutes

Exercise 5E

1 a Malaita   **b** 8%

   c Bellona   **d** Santa Cruz

2 a

Percentage of participants
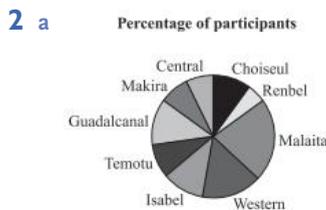
   b Malaita   **c** Renbel

3 a $3·50

   b **i** 40%   **ii** 25%   **iii** 35%

   c

Ben's pocket money
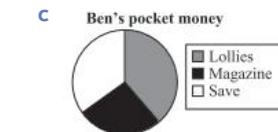
4 a Cucumber 20%   **b** Pineapple 16·66%

                                   Melon 52·22%

                                   Tomato 11·11%

   c

Vegetable weights
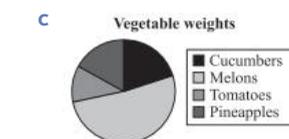
Exercise 5F

1 a 43 km/h   **b** 54 km/h

  c
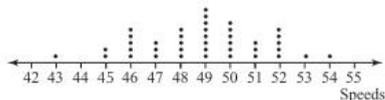
  d 49 km/h   **e** 10

2 a 51   **b** 45

  c
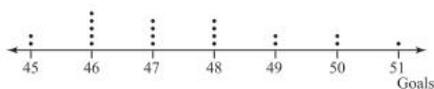
  d 46

3 a 45 words per minute   **b** 28 words per minute

  c
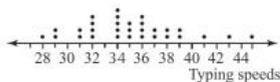
  d 34 words per minute

4 a The mode was 7   **b**
   hours of homework.
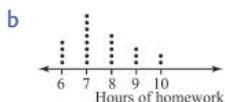
5 a

Goals kicked	Tally	Frequency
1	‖‖‖ ‖	6
2	‖‖‖ ‖‖‖ ‖‖‖	13
3	‖‖‖ ‖‖‖	8
4	‖‖‖‖	4
5	‖‖	2

  b The mode was 2 goals per game.

  c
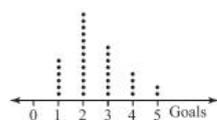
6 a
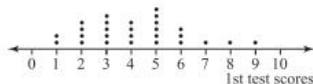
  b
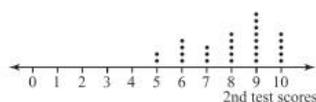
  c The test results were much higher for the second test.

7 a This is discrete data.   **b** 4

  c
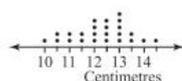
  d 11   **e** 13 cm

  f The data suggests that most students have a good perception of length.

8 Student's own answers

9 a This is discrete data as the data has definite values.

  b
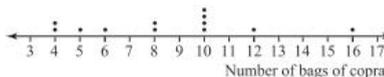
  c 6   **b** 4   **c** 10 bags of copra

10 a 4 kava bags
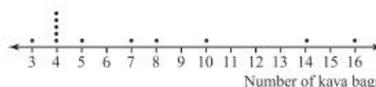
  b 3   **c** 2

Exercise 5G

1 48·9 km/h   **2** 12·3 cm

3 35 wpm   **4** 2·5 children

5 Student's own answer   **6** 161·6 cm

7 a $12   **b** 11

  c **i** $50   **ii** $10

     iii The second value is a better estimate of the real mean as the first was distorted by an outlier. This can be a problem when using the mean of data.

8 a **i** 4·2   **ii** 8·0

  b The difference in the means indicates that the scores were much higher across the board in the second test.

9 53·5 wpm   **10** 61

11 a Ward 1: 16, Ward 2: 18

  b On average, Ward 2 had more dogs in each council than Ward 1.

  c The last result for Ward 2 should be 10. This would give the same average.

Exercise 5H

1 The median of the results is 49.
   The range is 11.

2 a **i** The median is 265.
       The mean is 271.
       The range is 93.

    ii The median is 265.
       The mean is 249.
       The range is 223.

   iii The median is 265.
       The mean is 298.
       The range is 257.

    iv The median is 265.
       The mean is 277.
       The range is 387.

  b The mean of a set of data is much more affected by an unusually high amount (outlier). Here we saw that the median did not change, although the mean (and also range) changed significantly.

3 The median number of children in each family is 2.

5 a The median was 12·5 cm.

  b The range was 4·5 cm.

6 a $9·75, $46·50   **b** 12

  c **i** The mean is higher than the median.

    ii The median is more reliable as the mean is affected by the outlier of $50.

7 The median of the dot plot is 14.

8 a The mean height for squad A is 170 cm.
The mean height for squad B is 170·6 cm.

  b The median height for squad A is 169·5 cm.
The median height for squad B is 171·5 cm.

  c Squad A: 48 cm, Squad B: 21 cm

  d There is more variation in the heights of Squad A players, but the mean and medians are both around 170.

Exercise 5I

1 a Median is 46, range is 48

  b Median is 65, range is 48

  c Median is 120, range is 37

2 a

```
4 | 1 4 4 8 8 9      Life expectancies
5 | 0 8
6 | 1 4 5 6 8
7 | 1 2 2 3 4 4 5
8 |
```

  b Highest life expectancy is 75. Lowest life expectancy is 41.

  c Median life expectancy is 64·5.

3 a b

```
1 | 7                  Typing speeds
2 | 4 6 8 9 9
3 | 4 5 5 6 6 8 9
4 | 1 3 5 9
5 | 4 6 7 8
6 | 2 2 2 5
7 | 2 4 4
8 | 1 2
```

  c The median typing speed is 44.
The range is 65.

4 a

```
1 | 2 8                  Number of absentees
2 | 3 5 6 7 7 8 9
3 | 2 4 6 7 7 8 9
4 | 0 1 2 3 3 5 6 8 9
5 | 0 1 1 2 2 3 4 5 6 6 6 6 8
6 | 1 2 3 3 5 9
```

  b The median number of absentees was 45·5.
The range was 57.

Exercise 5J

1 a 50   **b** 3   **c** 20

2 a 180   **b** 24   **c** 64

  d Student's own answers   **e** 22%

3 a 100   **b** 47   **c** 5   **d** 3

4 a 48   **b** 28   **c** 7

5 a
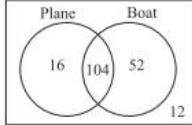
  b 184   **c** 16   **d** 172

6 Kelly was right.
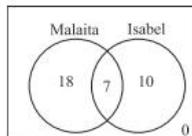
8 a
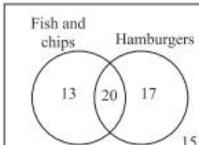
    b 20

Exercise 5K

1 a

	SIBC Local Music	Not SIBC Local Music	Total
Z-FM Island Music	12	10	22
Not Z-FM Island Music	35	23	58
Total	47	33	80

80   **b** 23   **c** 12

2 a

	Sedan	Not sedan	Total
Wagon	14	10	24
Not wagon	51	25	76
Total	65	35	100

100   **b** 14   **c** 10%

3

	Bike	Not bike	Total
Mobile phone	6	6	12
Not mobile phone	11	7	18
Total	17	13	30

Kathy was wrong.

Left column

4 a

	Cotton	Not cotton	Total
Long	23	48	71
Not long	12	37	49
Total	35	85	120

b 71

c The most popular pairs were non-cotton long jeans.

d 23 of the 120 pairs sold were long cotton, i.e. about 19%.

5 a

	Canoe	Not canoe	Total
Ship	34	31	65
Not ship	22	12	34
Total	56	43	99

b 99   **c** 31   **d** 87

6 a

	Indonesia	Not Indonesia	Total
Japan	24	6	30
Not Japan	12	8	20
Total	36	14	50

b Indonesia

c 36 out of the 50 passengers had visited Indonesia, i.e. 72%.

7 a

	Paris	Not Paris	Total
Moscow	21	30	51
Not Moscow	32	17	49
Total	53	47	100

b Paris

c 53 out of the 100 passengers visited Paris so 53%.

8 Student's own answers

Enrichment

1 a 56

b No—27 people used only prawns, 23 used prawns and mamu fish, 4 used prawns and octopus, and 3 used all three types. So 57 people used prawns altogether.

c 128

d 89

e 13 used only octopus, 56 used only whitebait, 27 used only prawns. The total is 96.

Right column

2
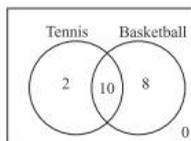
a 0·6   **b** 0·4   **c** 0·9   **d** 0·5

3 a
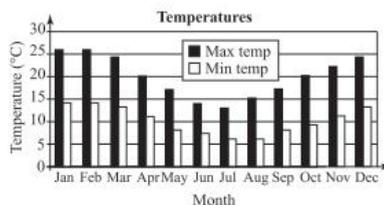
b January and February

c June and July

4 a

Height	Tally	Frequency
140–<150	|||	3
150–<160	⊦⊦⊦⊦ ||	7
160–<170	⊦⊦⊦⊦ ⊦⊦⊦⊦ ⊦⊦⊦⊦ |	16
170–<180	||||	4
	Total	30

c 14 | 4 8 9   Height in cm
15 | 3 3 4 6 6 7 8
16 | 0 1 1 2 2 2 3 3 4 5 6 6 7 7 8 9
17 | 0 1 4 8

If we turn the stem-and-leaf plot on its side, we can see it is the same shape as the histogram.

5 a   i

Salary male	Tally	Frequency
<$20 000		
$20 000–39 999	⊦⊦⊦⊦ ⊦⊦⊦⊦ ||	12
$40 000–59 999	⊦⊦⊦⊦ ⊦⊦⊦⊦ ⊦⊦⊦⊦ ⊦⊦⊦⊦ ||	22
>$60 000	⊦⊦⊦⊦ ⊦⊦⊦⊦ |	11
Salary female		
<$20 000	⊦⊦⊦⊦ ⊦⊦⊦⊦ ||||	14
$20 000–39 999	⊦⊦⊦⊦ ⊦⊦⊦⊦ ⊦⊦⊦⊦ ⊦⊦⊦⊦	20
$40 000–59 999	⊦⊦⊦⊦ ⊦⊦⊦⊦ ||||	14
>$60 000	⊦⊦⊦⊦ |	6

ii
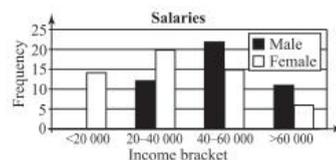
b Males tend to fall into the higher income brackets.

Revision

1 a Categorical

b

Favourite fast food	Tally	Frequency
Hamburgers	++++	5
Pizza	++++ |||	8
Pies	|||	3
Chips	||||	4
Chicken	++++	5
Total	25	25

c The favourite fast food was pizza.

2 a 4   **b** 5   **c** 3

3 a
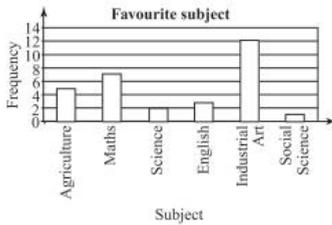
b Art

4 a 65%   **b** 55%

5 a The speed at which the Commodore is travelling

b The amount of petrol that is being consumed

c 8 L/100 km

d Travelling at 120 km/h uses up 2 more litres per 100 km than travelling at 90 km/h.

e 60 km/h   **f** 30 km/h

6
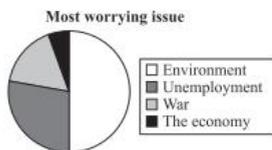
7 a 20   **b** 3

8 a
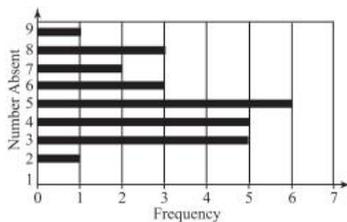
b 5

9 a 35·3   **b** 318   **c** 32

10 a
```
0 | 4
1 | 0 1 2 5 6 7
2 | 1 3 3 5 6 7
3 | 2 2 4 4 6 7
4 | 5 5 8
5 | 0 1 4 4 5 6 6 6 8 9
6 | 2 3 4 5 5 5 6 7 9
7 | 2 3 3 3 4 4 5 5
8 | 4 5 5 6 7
9 | 9
```

b His median score is 56.

c His range is 95.

d His mean score is 51·3.

11 a
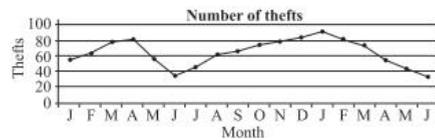
b The number of thefts peaked in March–April, then in the following January. In general, there seem to be more thefts in the summer months.

c May–July, the winter months

d 63·4

12 a
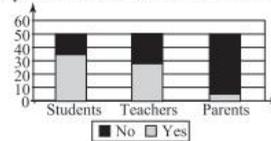
Most parents think that their children should have more homework, but students want less.

13 The median number of goals scored is 30.
The range is 54.

14 a 24   **b** 6   **c** 13   **d** 10

15 The two-way table shows the results of the survey on shirts.

a

	Hoods	No hoods	Total
Long-sleeved	15	18	33
Short-sleeved	17	50	67
Total	32	68	100

b 100

c short-sleeved one without a hood

d 32%

Chapter 6

Exercise 6A

1 a ☺ + 4   **b** ■ − 3

c) ÷ 4 = $\frac{1}{4}$)   **d** 5🕓

e $\frac{1}{5}\blacksquare$ **f** $5 \div \blacklozenge$

g $\oplus \mho$ **h** $5\blacklozenge - 3\blacksquare$

i $3\blacklozenge + 2$ **j** $\odot - 4\blacklozenge + 3$

2 a $5n + 4$ **b** $\frac{x}{3} - 2$ **c** $3y + 6$

d $\frac{p}{2} + 30$ **e** $\frac{q+2}{y}$ **f** $\frac{x+3}{4}$

g $4y - 10$ **h** $\frac{3x}{5}$ **i** $x^2 + 7$

3 a $4l$ **b** $3a$ **c** $2x + a + b$

4 a $\male + \female$ is the number of students

b $\male + 3$ is the number of boys

c $\female - 2$ is the number of girls

d $(\male + 3) + (\female - 2) = \male + \female + 1$
is the total number of students

5 a $5d$ **b** $\frac{d}{2}$ **c** $\frac{3d}{2}$

d $2d + p$ **e** $d + 2p$

6 a $2d + f$ **b** $10d + f$

c $nd + f$ **d** $\frac{nd + f}{4}$

7 a $4x + 3y$ **b** $3x + 4y$ **c** $mx + ny$

8 a $f + r + s$ **b** $2f$

c $r - 3$ **d** $\frac{s}{2}$

9 a Current number of dives $= n - m$

b Number of dives p ago $= n - m - p$

Exercise 6B

1 a 3 cats + 2 cows + 4 dogs

b 5 guavas + 2 bananas + 1 orange + 2 coconuts

c eraser + 5 pens + 4 pencils + scissors

d 1 bus + 6 cars + 3 trucks + 2 motor cycles

2 $3\square$ and $10\square$, $4\pentagon$ and $10\pentagon$, $2\gear$ and $3\gear$, $5\gear\square$ and $6\gear\square$

3 $8f$ and $2f$, $10ab$ and $3ba$, $8kz$ and $5kz$, $3pq$ and $12qp$, $9jg$ and $2gj$, $6b$ and b

4 a $\gear + \gear + \gear + \gear = 4\gear$

b $\square + \square = 2\square$

c $2\star + 3\star - 2\star = 3\star$

d $4\odot + 4\odot - 2\odot + \odot = 7\odot$

e $10\star + 10\star + 10\square = 20\star + 10\square$

f $3\gear + 4\odot + 2\gear = 5\gear + 4\odot$

g $4\triangle + 3\triangle - \triangle + \square = 6\triangle + \square$

h $6\square + 4\circ - 2\square = 4\square + 4\circ$

i $3\heartsuit + \heartsuit + \triangle + 2\triangle = 4\heartsuit + 3\triangle$

j $5\odot + 6\odot - \circ + \odot = 12\odot - \circ$

k $4\square - \triangle + 4\triangle = 4\square + 3\triangle$

l $6\heartsuit - 3\heartsuit + 2\circ = 3\heartsuit + 2\circ$

m $2\star + 5\star + 3\triangle + 2\triangle = 7\star + 5\triangle$

n $5\square - 2\square + 3\triangle - 2\triangle = 3\square + \triangle$

5 a $3m$ **b** $4x$ **c** $3x + 2y$ **d** $4a + 2b$

e $15x$ **f** $7a$ **g** $5x$ **h** $7y$

i $45t$ **j** $8p$ **k** x **l** 0

6 a $8xy$ **b** $16xy$ **c** $7ab$ **d** $12ab$

e $22pq$ **f** $13pq$ **g** $6mn$ **h** $27mn$

i $2xy$ **j** $3xy$ **k** wx **l** 0

7 a $9x + y$ **b** $3n + 3m$ **c** $8xy + zy$

d $8pq - 3q$ **e** $6x + 8y$ **f** $7x + 7$

g $3a + 3$ **h** $2x + 2$ **i** $10x + 8y + 3$

j $2x + 3y + 4$

8 a $4a + 3b + 2c$ **b** $3ab + 7bc$

c $11xy + 9zx$

9

5	$5y + 2$	$2x + 2$	$5xy + 2$
$3y + 3$	$8y$	$2x + 3y$	$5xy + 3y$
$4x + 3$	$4x + 5y$	$6x$	$5xy + 4x$
$2xy + 3$	$2xy + 5y$	$2xy + 2x$	$7xy$

10

2	$8a - 4$	$10b - 4$	$7ab - 4$
$6 - 3a$	$5a$	$10b - 3a$	$7ab - 3a$
$6 - 5b$	$8a - 5b$	$5b$	$7ab - 5b$
$6 - 2ab$	$8a - 2ab$	$10b - 2ab$	$5ab$

Exercise 6C

1 a $2P$ **b** $5P$ **c** $\frac{1}{2}P$ **d** $\frac{1}{3}P$

e $\frac{P}{6}$ **f** $2P - 4$ **g** $3P + 5$

2 a $4y$ **b** $5y$ **c** $10a$ **d** $6b$

e ab **f** mn **g** $12yz$ **h** $9mn$

i abc **j** $30y$ **k** $48y$ **l** $28p$

m $21ab$ **n** $24yz$ **o** ab^2 **p** $72z^2$

q $36y^2z$ **r** $3m^2n$

3 a $10x$ **b** $48y$ **c** $21a$ **d** $5xy$

e $6m^2n$ **f** $35bc$ **g** $30yz$ **h** $63pq$

i $36z^2$ **j** $20y^2$ **k** $56ab$ **l** $108mnp$

m $30pqr$ **n** $126abc$ **o** $60y^2z$

4 a $\frac{x}{3}$ **b** $\frac{m}{6}$ **c** $\frac{p}{10}$ **d** $\frac{5}{x}$

e $\frac{7}{2x}$ **f** $\frac{3x}{5y}$

5 a $\dfrac{a}{5}$ b $\dfrac{a}{2}$ c $\dfrac{y}{4}$ d $\dfrac{2}{x}$

  e $\dfrac{2}{y}$ f $\dfrac{3}{m}$ g $\dfrac{1}{3p}$ h $\dfrac{1}{4q}$

  i $\dfrac{1}{4xy}$ j $\dfrac{5x}{4}$ k $\dfrac{6x}{5}$ l $\dfrac{3y}{2}$

  m $\dfrac{8x}{3}$ n $\dfrac{2}{5b}$ o $\dfrac{3}{5w}$

6

6	$10y$	$4x$	$10xy$
$9y$	$15y^2$	$6xy$	$15xy^2$
$12x$	$20xy$	$8x^2$	$20x^2y$
$6xy$	$10xy^2$	$4x^2y$	$10x^2y^2$

7

8	$16a$	$24b$	$32ab$
$\dfrac{6}{a}$	12	$\dfrac{18b}{a}$	$24b$
$\dfrac{12}{b}$	$\dfrac{24a}{b}$	36	$48a$
$\dfrac{3}{ab}$	$\dfrac{6}{b}$	$\dfrac{9}{a}$	12

Exercise 6D

1 a 40   b 40   c 64   d 64
2 a $3x + 3y$ b $7a + 7b$ c $7m + 7n$
  d $9x + 36$ e $6y + 42$ f $10p + 80$
  g $8a + 32$ h $9c + 45$ i $5b + 45$
  j $36 + 6p$ k $84 + 7q$ l $40 + 8n$
  m $3x + 15$ n $7a + 7b$ o $10m + 10n$
  p $7r + 7s$
3 a $5x - 5y$ b $7a - 7b$ c $9m - 9n$
  d $8x - 56$ e $3x - 27$ f $9x - 108$
  g $26 - 2m$ h $56 - 8q$ i $36 - 4p$
  j $56 - 8x$ k $54 - 3b$ l $60 - 4m$
4 a $xy + xz$ b $mp + mq$ c $ab + ac$
  d $rs - rt$ e $pq - pr$ f $lm - ln$
  g $mn - 8m$ h $ab - 12a$ i $yz - 8z$
  j $9c - bc$ k $14p - pq$ l $9m - mn$
5 a $24x + 16$ b $20y + 30$ c $63b + 28$
  d $35q - 30$ e $54p - 108$ f $24s - 56$
  g $8x + 20y$ h $30m + 45n$ i $56a + 84b$
  j $18a - 42b$ k $88m - 66n$ l $18m - 27n$
6 a $6x + 27$ b $49y + 3$
  c $15m + 34$ d $9b + 12$
  e $8a + 17b + 16c$ f $12x^2 + 8x$
  g $6x^2 + 13x + 6$ h $30y^2 - 48y$
  i $18x^2 + 7x$ j $2mp$

7 a $6n + 18$ b $7n - 28$ c $8n + 12$
  d $12n - 18$ e $2n - 12$
8 a $a + c$ b $3a + 1·5c$
  c $5(3a + 1·5c)$ d $15a + 7·5c$

Exercise 6E

1 a 8   b 9   c 2   d 1
2 a 24   b 56   c 4   d 17
3 a 120   b 39   c 4   d 34
  e 13   f 31
4 a 10   b 5   c 2   d 3
  e 2   f 2   g 50   h 50
  i 66   j 45   k 30   l 100
  m 50   n 61   o 121   p 27
  q 9   r 729
5 a 3, 5, 7, 9, 11   b 3, 4, 5, 6, 7
  c 7, 6, 5, 4, 3   d 1, 4, 7, 10, 13
6 a $n = c + d$ b 40
7 a $h = m + b$ b 17
8 a $c = 15x + 20y$ b \$135
  c 8 CDs and no DVDs
     4 CDs and 3 DVDs
     No CDs and 6 DVDs
9 a $c = 5x + 3y$ b \$27
  c 12 ice creams and 0 coconuts
     9 ice creams and 5 coconuts
     6 ice creams and 10 coconuts
     3 ice creams and 15 coconuts
     0 ice creams and 20 coconuts
10 a $c = 12x + 8y$ b \$64
  c 0 hot dogs and 12 egg burgers
     2 hot dogs and 9 egg burgers
     4 hot dogs and 6 egg burgers
     6 hot dogs and 3 egg burgers
     8 hot dogs and 0 egg burgers

Learning task 6F

1 a The next two shapes have 15 and 21 dots.

  nth pattern has $\dfrac{n^2 + n}{2}$ dots

  b The first 10 triangular numbers have 1, 3, 6, 10, 15, 21, 28, 36, 45, and 55 dots.

  c The nth term is the sum of the numbers from 1 to n. e.g. 6th term is $1 + 2 + 3 + 4 + 5 + 6 = 21$

2 a The next two shapes have 25 and 36 dots.

  b The first 10 square numbers have 1, 4, 9, 16, 25, 36, 49, 64, 81 and 100 dots.

  c The nth square number is equal to n^2. In other words to find the number of dots in a number you multiply that number by itself.

3 a These numbers are called pentagonal as they can form patterns containing pentagons, which have five sides.

  b 13 and 17 dots

  c 1, 5, 9, 13, 17, 21, 25, 29, 33 and 37 dots

  d The nth pentagonal number is equal to the previous number plus 4. In other words to find the number of dots in a number you multiply the previous number (i.e. $n - 1$) by 4 and add 1.

4 a 9 and 25 **b** 36

Learning task 6G

1 a The next three shapes have 9, 11 and 13 matches.

  b 3, 5, 7, 9, 11, 13, 15, 17, 19

  c Add 2 to the previous number.

  d 31 matches

2 a 13 matches

  b The fourth term has 13 matches.

  c To find the fourth term you add 3 matches onto the third term.

  d We start with 4 matches, then add 3 matches each time.

3 a 24 matches

  b The fourth term has 24 matches.

  c To find the fourth term you add 3 matches onto each side of the third.

  d We start with 6 matches, then add 6 matches each time.

Exercise 6H

1 a 13 cm **b** 20 m

2 a 108 cm^2 **b** 42 m^2

3 24 cm^2

4 a **i** 22 points **ii** 22 points

  b It was a draw.

5 a 11 **b** 41 **c** 16

6 a **i** 13 **ii** 16

  b 4, 7, 10, 13, 16, 19, 21, 24, 24, 30

  c $N = 1 + 3R$

7 a **i** 18 **ii** 22

  b 6, 10, 14, 18, 22, 26, 30, 34, 38, 42

  c $N = 2 + 4A$

8 a **i** $55 **ii** $62·50 **iii** $75 **iv** $0·5n + 50$

  b $C = 0·5n + 50$

  c $C = 55 for 10 programs

  d $C = 125

9 a **i** $40 **ii** $55 **iii** $70 **iv** $5n + 30$

  b $A = 5n + 30$ **c** $A = 55

  d It will take 21 weeks.

Enrichment

1 a $Q = \dfrac{P}{2} + 1$ **b** $Q = 3P - 3$ **c** $Q = P^2 - P$

2

m	9	1	5	2	8	7	10	3	4
$m + 1$	10	2	6	3	9	8	11	4	5
$5m$	45	5	25	10	40	35	50	15	20
m^2	81	1	25	4	64	49	100	9	16
$\dfrac{m}{2}$	$4\frac{1}{2}$	$\frac{1}{2}$	$2\frac{1}{2}$	1	4	$3\frac{1}{2}$	5	$1\frac{1}{2}$	2
$3m + 1$	28	4	16	7	25	22	31	10	13
$2m^2$	162	2	50	8	128	98	200	18	32
$(2m)^2$	324	4	100	16	256	196	400	36	64
$17 - m$	8	16	12	15	9	10	7	14	13
m^3	729	1	125	8	512	343	1000	27	64

3 $\dfrac{5(2n + 3) - 15}{10}$

$= \dfrac{10n + 15 - 15}{10}$
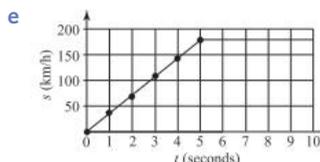
$= \dfrac{10n}{10}$

$= n$

4 a $4(2x + 3y)$ **b** $5(2m + 3n)$ **c** $3x(2x + 3)$

  d $x(x + 6y)$ **e** $3x(x - 2)$ **f** $x(x - 4y)$

  g $5(x^2 - 2)$ **h** $2x(x + 4)$

5 a $7(2x + 3y)$ **b** $4(4x + 5y)$ **c** $5(5a + 6b)$

  d $4(2a - 3b)$ **e** $x(x + 5)$ **f** $x(x - 7)$

  g $6x(x - 2)$ **h** $2x(2x - 3)$ **i** $2x(3x - 7y)$

6 a **i** $t = 1, s = 36 \times 1 = 36$ km/h

   ii $t = 2, s = 36 \times 2 = 72$ km/h

  b

t (seconds)	0	1	2	3	4	5
s (km/h)	0	36	72	108	144	180

  c

  e
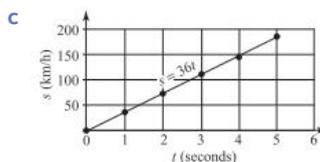
7 a

t (seconds)	0	1	2	3	4	5
p (metres)	0	5	20	45	80	125

d

t (seconds)	5	6	7	8	9	10
d (metres)	125	175	225	275	325	375

e
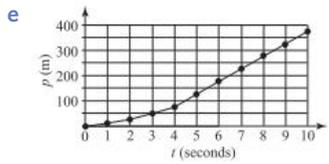
f   **i** 4 seconds   **ii** 10·5 seconds   **iii** 14·5 seconds

g 50 m/s

Revision

1   **a** ♣ $+ 9$ **b** ♡ $- 12$ **c** $\frac{1}{5}$ ♥

   d $3\ominus$ **e** $\frac{1}{7}$ ●   **f** ● $+$ ♡

2   **a** The sum of c and 10

   b Eight times the value of a

   c One-ninth of the value of y

   d The sum of x and 2 is divided by 3.

   e Four t multiplied by b and the product is divided by 3.

   f The sum of x and 6 is multiplied by 3.

3   **a** 8♡ $+ 9$♡ $= 17$♡   **b** 6♥ $+ 5$♥ $= 11$♥

   c 13▲ $- 5$▲ $= 8$▲   **d** $19\ominus - 4\ominus = 15\ominus$

   e 7☺ $+ 2$☺ $= 9$☺   **f** ▲ $+$ ▲ $+$ ▲ $= 3$▲

   g 7▲ $+ 3$▲ $+ 2$■ $+ 4$■ $= 10$▲ $+ 6$■

   h 4♡ $+ 3$♡ $+ 6$★ $+ 2$★ $= 7$♡ $+ 8$★

   i 5▲ $- 2$▲ $+ 8$■ $- 6$■ $= 3$▲ $+ 2$■

4   **a** $9a + 6b + 5c$ **b** $2x + y = 4$

   c $3ab + 9bc + ac$ **d** $3x + 5y = 4$

   e $12xy + 4zy + 8xz$ **f** $3a + b + c$

5   **a** $7a$ **b** $9y$ **c** $15a$ **d** $8b$

   e ac **f** mp **g** $16yz$ **h** $6mn$

   i apq **j** $72p$ **k** $8y$ **l** $56p$

6   **a** $\frac{x}{5}$ **b** $\frac{m}{9}$ **c** $\frac{p}{12}$ **d** $\frac{5y}{z}$ **e** $\frac{9y}{4x}$

   f $\frac{5x}{7y}$ **g** $\frac{x}{3}$ **h** $\frac{1}{2x}$ **i** $\frac{4}{5w}$

7   **a** $4x + 4y$ **b** $9a + 9b$ **c** $6m + 6n$

   d $xy + 4y$ **e** $y^2 + 7y$ **f** $p^2 + 8p$

   g $5a - 20$ **h** $4c + 20$ **i** $5b - 45$

   j $6p + p^2$ **k** $36q - 3q^2$ **l** $40n - 8n^2$

   m $x^2 + x$ **n** $x^2 - 3x$ **o** $2x^2 + 5x$

   p $30y^2 - 12y$ **q** $10q^2 - 20q$ **r** $3x^2 + 3x$

   s $4x^2 + x$ **t** $15x$ **u** $m^2p - mp^2$

8   **a** $P = 18$ cm   **b** $P = 11$ cm

   c The sides of the triangle are 5 cm and 4 cm.

9   **a** 384   **b** 239   **c** 10   **d** 52   **e** 4   **f** 48

   g 73   **h** 49   **i** 40   **j** 70   **k** 155   **l** 9

10   **a** $3x + 2y$ **b** $3(3) + 2(5)$
$$= 9 + 10$$
$$= \$19$$

   c $\$24 = 3x + 2y$

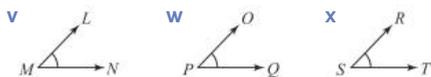| Popcorn	0	2	4	6	8
Mango	12	9	6	3	0

11   **a**
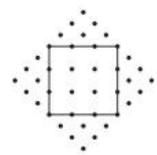
   b 1, 8, 21, 40, 65, 96, 133, 176, 225, 280

   c Start with 1, then add 7, then add 7 + 6. Increase the amount you add by 6 each time. $3n^2 - 2n$ works out nth term.

12   **a** 96 cm^2 **b** 64 cm^2 **c** 40 cm

   d 16 cm^2, a quarter of the previous area

Chapter 7

Exercise 7A

1   **a** $\angle O$, $\angle BOC$ or $\angle COB$

   b $\angle S$, $\angle MSK$ or $\angle KSM$

   c $\angle G$, $\angle MGF$ or $\angle FGM$

   d $\angle P$, $\angle KPL$ or $\angle LPK$

2 $\angle ABC$, $\angle CBA$, $\angle BCD$, $\angle DCB$, $\angle CDE$, $\angle EDC$, $\angle DEF$, $\angle FED$, $\angle EFG$, $\angle GFE$

3   **a**

v   **w**   **x**

Exercise 7B

1 **a** Acute angle   **b** Obtuse angle

    c Reflex angle   **d** Reflex angle

    e Right angle   **f** Obtuse angle

    g Full circle   **h** Straight angle

    i Acute angle   **j** Reflex angle

    k Right angle   **l** Reflex angle

    m Straight angle   **n** Reflex angle

    o Right angle

2 **a** Internal: acute   **b** Internal: right
     External: reflex   External: reflex

    c Internal: obtuse and acute   **d** Internal: obtuse
     External: reflex   External: reflex

    e Internal: obtuse
     External: reflex

3 **a** Acute angles: $\angle DOI$, $\angle IOD$, $\angle IOH$, $\angle HOI$,
     $\angle FOG$, $\angle GOF$, $\angle FOE$, $\angle EOF$

    b Right angles: $\angle DOH$, $\angle HOD$, $\angle HOG$,
     $\angle GOH$, $\angle GOE$, $\angle EOG$, $\angle DOE$, $\angle EOD$

    c Obtuse angles: $\angle IOG$, $\angle GOI$, $\angle HOF$, $\angle FOH$,
     $\angle DOF$, $\angle FOD$, $\angle EOI$, $\angle IOE$

    d Straight angles: $\angle DOG$, $\angle GOD$, $\angle IOF$, $\angle FOI$,
     $\angle HOE$, $\angle EOH$

    e $\angle EOI$, $\angle IOG$, $\angle FOD$, $\angle FOH$

    f $\angle EOH$, $\angle HOE$, $\angle DOG$, $\angle GOD$, $\angle FOI$, $\angle IOF$

4 **a** Acute angle   **b** Right angle

    c Acute angle   **d** Obtuse angle

    e Acute angle   **f** Acute angle

Exercise 7C

1 **a** 14°   **b** 28°   **c** 37°   **d** 48°

    e 57°   **f** 62°   **g** 109°   **h** 123°

    i 137°   **j** 143°   **k** 152°   **l** 167°

2 **a** between 0° and 90°   **b** between 270° and 360°

    c between 270° and 360°   **d** between 0° and 90°

    e between 270° and 360°   **f** between 0° and 90°

    g between 90° and 180°   **h** between 180° and 270°

    i between 270° and 360°   **j** between 270° and 360°

    k between 90° and 180°   **l** between 0° and 90°

    m between 90° and 180°   **n** between 0° and 90°

    o between 90° and 180°

3 **a** $Z = 58°$ $M = 50°$ **b** $Z = 35°$ $M = 25°$

    c $Z = 135°$ $M = 130°$ **d** $Z = 255°$ $M = 220°$

4 **a** 45°   **b** 10°   **c** 23°   **d** 145°

    e 115°   **f** 115°   **g** 145°   **h** 215°

i 240°   **j** 335°   **k** 320°   **l** 295°

m 144°   **n** 143°   **o** 216°

5 **a** 28°   **b** 104°   **c** 48°   **d** 40°

    e 72°   **f** 42°

6 **a** 60°   **b** 90°   **c** 150°   **d** 180°

    e 240°   **f** 330°

7 **a** 12:00   **b** 3:00   **c** 6:00   **d** 12:00

    e 1:00   **f** 4:00   **g** 7:00   **h** 9:00

Exercise 7D

1 **a**   **b**

    c   **d**

    e   **f**

    g   **h**

2 **a**   **b**

    c   **d**

    e   **f**

    g   **h**

3   **4**

Exercise 7E

1 **a** 20°   **b** 78°   **c** 65°   **d** 37°   **e** 55°

    f 43°   **g** 29°   **h** 22°   **i** 38°

2 **a** 37°   **b** 45°   **c** 31°   **d** 35°   **e** 45°

    f 56°

3 a 30° **b** 15° **c** 30° **d** 20°
e 10° **f** 20° **g** 10° **h** 15°

4 c and e are complementary

5 a 75° **b** 54° **c** 32° **d** 19° **e** 1°

6 Yes **7** 15° **8** They add to 90°.

9 a 5:00 **b** 150°
c 3 o'clock, 9 o'clock

Exercise 7F

1 a 55° **b** 37° **c** 45° **d** 56°
e 82° **f** 90°

2 a 19° **b** 105° **c** 100° **d** 33°

3 a 20° **b** 50° **c** 35° **d** 20°
e 37° **f** 35° **g** 45° **h** 30°

4 A, B, D

5 a 165° **b** 124° **c** 82° **d** 69° **e** 21°

6 Yes **7** 105°

8 The two angles add up to 180°.

9 The three angles add up to 180°.

10 a 120°, 60° **b** 60° + 120° = 180°

Exercise 7G

1 a 72° **b** 88° **c** 71° **d** 216°
e 109° **f** 268°

2 a 91° **b** 51° **c** 53° **d** 92° **e** 112° **f** 134°

3 a 60° **b** 40° **c** 20° **d** 54° **e** 50° **f** 120°

4 180° **5** 285°

6

7

Applications

Pizza angles

a 75°, 105°, 75°, 105°

b 360° **c** They are equal.

Angles on a compass

45°, 90°, 135°, 180°, 225°, 270°, 315°, 360°

Enrichment

1 a ∠AOB, ∠BOC, ∠COD, ∠DOE, ∠EOF, others
are possible

b ∠BOD

c ∠AOD, ∠BOE, ∠COF, ∠AOE, ∠BOF, others
are possible

d ∠AOF

2 a 40°, 40°, 140°, 140° **b** 40°, 140

3 a 2 **b** 24 **c** 1440

4 i Train tracks, ruler sides, boxes etc.

ii a

 b

c

 d

e
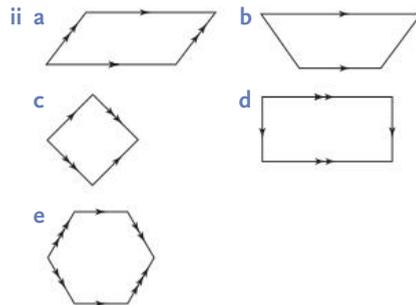
5 i a $C = 50°$ **b** $O = 50°$
c $A = 70°$ and 110° **d** $X = 70°$

ii Corresponding angles are equal; co-interior angles
add up to 180°; alternate angles are equal.

6 a 70° (*O*) **b** 105° (*C*) **c** 120° (*A*)
d 52° (*C*) **e** 58° (*X*) **f** 118° (*X*)

7 a 53° **b** 127° **c** 53°
d 53° **e** 127°

Revision

1 ∠XYZ, ∠ZYX

3 a Acute angle **b** Obtuse angle
c Reflex angle **d** Obtuse angle
e Right angle **f** Acute angle
g Straight angle **h** Full circle
i Right angle

4 a 28° **b** 135° **c** 325°

5 162°, 165°

6 a

 b

c

 d

e

 f

7 The angle sum of complementary angles is 90°.

8 a 21° **b** 34° **c** 84°
d 22·5° **e** 10° **f** 10°

9 The angle sum of supplementary angles is 180°.

10 a 41° **b** 143° **c** 134°
d 43° **e** 44° **f** 15°

11 One revolution is 360°.

12 a $p = 224°$ **b** $m = 33°, s = 180°$ **c** $n = 158°$

Solomon Islands
MATHEMATICS
Year 7 Learner's Book

Book 1

Mathematical knowledge is essential for full participation in Solomon Islands life, both at school as learners and in the future as adults.

Mathematics is the exploration and use of patterns, relationships and variations in quantity, space, and time, as well as the interpretation of statistical data. *Solomon Islands Mathematics Year 7 Learner's Book* integrates these aspects of mathematics into a wide range of social, cultural, scientific, technological, environmental, health and economic contexts, representing both real-life and hypothetical situations.

Learners in secondary schools will build on their existing knowledge and skills in five main strands:

• Number
• Measurement
• Algebra
• Geometry
• Probability and Statistics.

Learners will acquire effective strategies for investigating, interpreting, explaining and making sense of the world, using numbers, symbols and graphs. They will develop the ability to think creatively, critically, strategically and logically. These skills and approaches will have long-term applications throughout the learners' lives.