

Solomon Islands
MATHEMATICS
Year 7 Learner's Book

Book 2



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CONTENTS

How to use this book	iv
Introduction	vi
Suggested teaching plan for the Year 7 Learner's Book	viii

Chapter 8 **Directed Numbers** **2**

8A	Directed numbers	4
8B	Number patterns	6
8C	Comparing directed numbers	7
8D	Exploring addition	10
8E	Adding directed numbers	11
8F	Exploring subtraction	12
8G	Subtracting directed numbers	13
8H	Multiplying directed numbers	14
8I	Dividing directed numbers	15
8J	Order of operations	16
8K	Miscellaneous directed numbers	17
8L	The coordinate plane	18
8M	Exploring board games with directed numbers	20
	Puzzles	22
	Applications	24
	Enrichment	26
	Revision/Assessment	28

Chapter 9 **Coordinate Graphs and Location** **30**

9A	Directions in two dimensions	32
9B	The coordinate number plane	34
9C	Handy reflections	38
9D	Scale diagrams and maps	40
9E	Maps and bearings	42

	Puzzles	46
	Applications	48
	Enrichment	50
	Revision/Assessment	52

Chapter 10 **Fractions** **54**

10A	Shaded diagrams	56
10B	Mixed numbers and improper fractions	58
10C	Adding with the same denominator	60
10D	Adding with different denominators	62
10E	Subtracting with the same denominator	65
10F	Subtracting with different denominators	67
10G	Exploring multiplication of fractions	69
10H	Multiplying fractions	70
10I	Exploring division of fractions	72
10J	Dividing fractions	73
10K	Fractions of quantities	76
10L	Squares and square roots of fractions	78
10M	Order of operations	80
	Puzzles	82
	Applications	84
	Enrichment	86
	Revision/Assessment	88

Chapter 11 **Time and Mass**

90

11A	Timelines	92
11B	Time conversions	95
11C	Time differences and the calendar	97
11D	Time differences in hours and minutes	100
11E	Using timetables	102
11F	Time zones	104
11G	Ordering events and flow charts	106
11H	Mass and conversion of units of mass	112
	Puzzles	114
	Applications	116
	Enrichment	118
	Revision/Assessment	120

Chapter 12 **Probability**

122

12A	The language of chance	124
12B	Theoretical probability	126
12C	Exploring simple experiments	128
12D	Exploring spinners	130
12E	Exploring games of chance	131
12F	Exploring card games	132
12G	Spinners	134
12H	Using statistics to find probabilities	136
	Puzzles	138
	Applications	140
	Enrichment	142
	Revision/Assessment	144

Chapter 13 **Polygons**

146

13A	Triangles: Side properties	148
13B	Triangles: Angle properties	151
13C	Finding the third angle in a triangle	153
13D	Exterior angle properties of triangles	155
13E	Quadrilaterals	156
13F	Angle sum of a quadrilateral	158
13G	Polygons	161
13H	Angle sum of polygons	163
13I	Exploring polygon constructions	166
13J	Exploring geometric designs	168
	Puzzles	170
	Applications	172
	Enrichment	174
	Revision/Assessment	176

Chapter 14 **Area and Volume**

178

14A	Finding and comparing areas	180
14B	Using grids to find areas	182
14C	Exploring areas of faces	184
14D	Area of rectangles	185
14E	Area of parallelograms	188
14F	Area of triangles	190
14G	Volume as a measure of space	193
14H	Exploring volume	195
14I	Volume of rectangular prisms	196
14J	Volume of prisms	198
	Puzzles	200
	Applications	202
	Enrichment	204
	Revision/Assessment	206

Answers

210

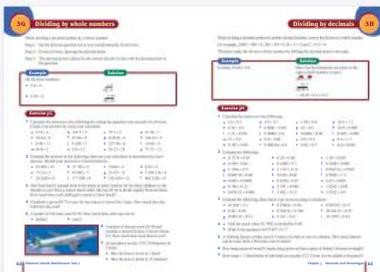
HOW TO USE THIS BOOK

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.



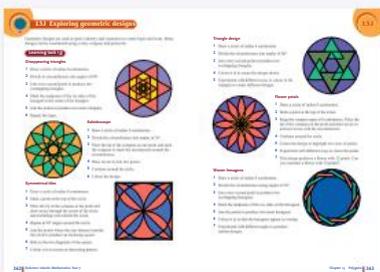
Chapter opening pages

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

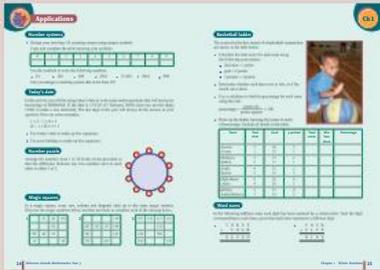
Theory and exercise sections contain explanations, examples and exercises designed to develop understanding of concepts and provide opportunities for students to practise new skills.



Explorations

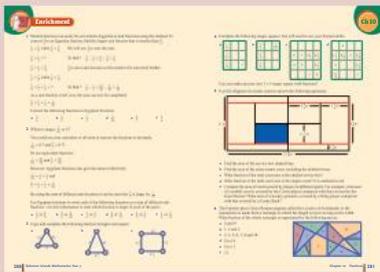
Explorations are scattered throughout the chapters, allowing students to work independently on non-standard problems and construct their own understandings.

These features are found at the end of each chapter



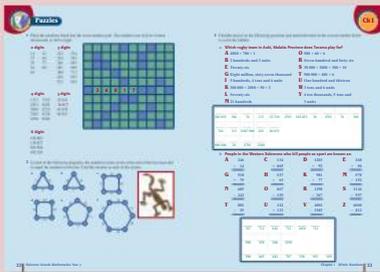
Puzzles

Puzzles are included for extra skills practice.



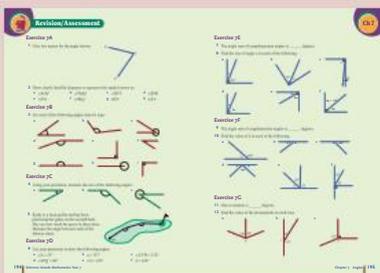
Application

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	<i>Mid-Year Examinations</i>	1 Week
Mid-year Holidays		

Semester 2

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

CHAPTER

8

Directed
Numbers



Directed Numbers

Directed numbers include the size and the direction of the number. For example, they are used to represent temperatures above and below zero.

The temperature in Solomon Islands is the same all the year around. There are no seasons, unlike other countries that have spring, summer, autumn and winter seasons. The temperature is normally between 26° and 33°C throughout the day, while at night it sometimes drops to 26°C . It has been recorded in Solomon Islands history that during one night the temperature went down to 19°C , which was the coldest night on record.

This chapter covers the following skills:

- Extending the number line to include negative numbers
- Comparing, ordering and completing patterns by using directed numbers
 - < is less than
 - > is greater than
- Applying directed numbers to real-life situations
- Practising addition, subtraction, multiplication and division of directed numbers
 - Like signs give a positive
 - Unlike signs give a negative
- Applying BODMAS to questions involving directed numbers
 - B Work out the calculations inside the brackets first. If the brackets contain more than one operation, they must also follow the rules of BODMAS
 - O If the question contains a fraction 'of' a number then this is 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
- Locating positive and negative numbers on a Cartesian plane

Specific Learning Outcome (SLO)

Learners should be able to:

- 7.8.1.1** Define and identify directed numbers.
- 7.8.1.2** Construct a number line with positive numbers.
- 7.8.1.3** Extend the number line to have both the negative and positive numbers.
- 7.8.2.1** Indicate and identify the positions of various objects and letters that are given on the number line.
- 7.8.3.1** Identify number patterns that are created using the positive and negative.

7.8.4.1

Create patterns using positive and negative numbers.

7.8.5.1

Use inequality signs, < and >, to compare numbers and place them on the number line.

7.8.6.1

Insert inequality signs, < and > to make statements either true or false.

7.8.7.1

Arrange numbers from small to big and vice versa.

7.8.8.1

Add and subtract directed numbers using number line: 'add on' or 'take away' for both positive and negative values.

7.8.8.2

Use the rules 'like signs give positive (+)' and 'unlike signs give negative (-)' to add and subtract directed numbers.

7.8.9.1

Multiply and divide directed numbers using the rules:
'Like signs give positive'
'Unlike signs give negative'.

7.8.10.1

Solve directed number problems applying the rule of BODMAS.

7.8.11.1

Evaluate and solve different directed number problems using number line, BODMAS and other approaches.

7.8.12.1

Identify two sides of the plane and name the axes.

7.8.13.1

Find the coordinates of objects on the coordinate plane using the x and y axes.

7.8.14.1

Plot coordinate pairs on a set of x and y axes.

8A

Directed numbers

Positive and negative numbers are called directed numbers.

Temperature and money transactions are just two examples where positive and negative numbers are used in the real world.

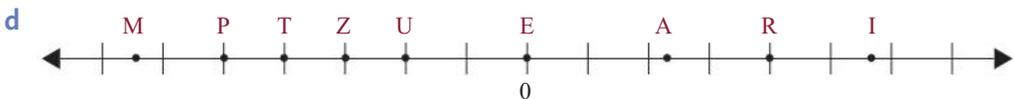
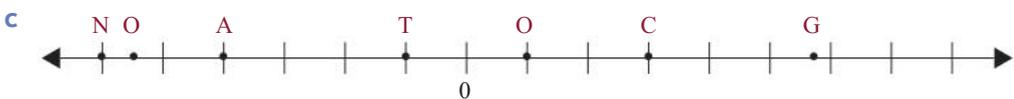
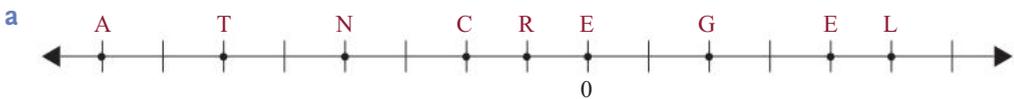
A number line can be used to display positive and negative numbers and zero. Positive numbers are placed to the right of zero and negative numbers are placed to the left of zero. The numbers increase to the right.

The points -6 , -2 , 3 and $4\frac{1}{2}$ are marked on the number line below.



Exercise 8A

- 1 Use a number line to best describe each of the following situations:
 - a A temperature of seven degrees below zero
 - b A plane one thousand metres above sea level
 - c Owing \$90 on a credit card
 - d A hammerhead shark that is two hundred and seventy-five metres below sea level
 - e A temperature of twenty-one degrees
 - f Depositing \$76 into your bank account
 - g The temperature dropping sixteen degrees from twenty-one degrees
 - h The temperature dropping ten degrees from eight degrees
 - i A boat at sea level
 - j The third level below ground in a multistorey car park
- 2 Identify the points on the number line for each letter. The letters spell the name of a shape when rearranged. Name the shape for each question.

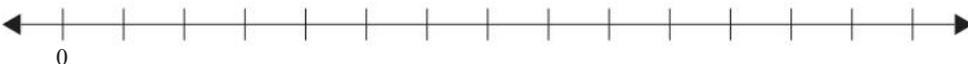


3 Copy the number lines below and complete the following questions.

a Write in the numbers from 0, counting up in twos. What is the last number on the right end?



b Write in the numbers from 0, counting up in fives. What is the last number on the right end?



c Write in the numbers from 7, counting down in ones. What is the last number on the left end?



d Write in the numbers from -5, counting up in ones. What is the last number on the right end?



e Write the number zero in the middle, number up and down by ones. What is the number on the left end?



f On the number line in part e, how far apart are the last numbers on the left and right ends?

4 Place the following symbols and letters on a number line. You will need to draw a new number line from -9 to 9 for each part:

a  at -3  at 2  at -7  at 0  at 6  at -1

b H at -6 O at 8 L at zero E at -2 L at 4

c H at -8 O at 5 Y at zero R at -3 W at -6 O at 1 Y at 8
 O at -7 A at -4 E at -2 U at 2 A at 7 T at 4 D at 6
 ? at 9

d D at -8 ? at 9 U at -3 A at zero E at 2 Y at -5 O at -7
 C at 6 A at 4 A at 7 O at -4 V at 1 T at 8 H at -1

e M at -5 N at 4 A at -6 H at -2 T at 1 R at 0 I at -8
 T at -3 I at -1 E at 2 E at 3

Number patterns can include negative and positive numbers. Find the difference between each pair of numbers given, then use this information to help you complete the patterns.

Example

Complete the following number patterns:

a 10, 7, 4, __, __, __, __, __

b -6, -8, -10, -12, __, __, __, __

Solution

10, 7, 4, 1, -2, -5, -8, -11

-6, -8, -10, -12, -14, -16, -18, -20

Exercise 8B

1 Complete the number patterns:

a 8, 7, 6, 5, 4, __, __, __, __, __

b 15, 10, 5, 0, -5, __, __, __, __, __

c -3, -5, -7, -9, -11, __, __, __, __, __

d -30, -27, -24, -21, -18, __, __, __, __, __

e -14, -10, -6, __, __, __, __, __

f -16, -13, -10, __, __, __, __, __

g $3\frac{1}{2}$, 3, $2\frac{1}{2}$, 2, $1\frac{1}{2}$, __, __, __, __, __

h $-2\cdot3$, $-2\cdot0$, $-1\cdot7$, $-1\cdot4$, $-1\cdot1$, __, __, __, __, __

2 Jemila buys some shares in National Fisheries Development Ltd (NFD) for \$5.36 each. She watches her shares rise and fall over the next two weeks. One day the price rises 14 cents, the next day it falls 8 cents.

a Show the rise and fall of her shares as a number pattern.

b If the pattern above continues, how much will her shares be worth on day 14?

3 Marau is paid \$20 each week for doing a paper round. He spends \$8 of this and has \$12 left over each week. He begins by giving his Mum the \$12 towards the \$73 he owes her. Once he has paid his Mum, Marau will start putting his savings into a bank account.

a Show his debt to his Mum as a number pattern.

b How many weeks will it take Marau to pay his Mum?

c How much money will he have to open his bank account?

d Show the balance of his bank account for the first 8 weeks.

4 A coconut was washed ashore at Bonege Beach. A second wave moved it 1 metre further up the beach. A third wave dragged it back 5 metres. A fourth wave pushed it 7.8 metres up the beach. If the position of the coconut when it is first washed ashore is zero:

a what number might represent the position of the coconut in metres after the second wave?

b what number might represent the position of the coconut after the third wave?

c what number might represent the position of the coconut after the fourth wave?

d calculate the total distance the coconut moved between the first wave and after the fourth wave.



Comparing directed numbers

8C

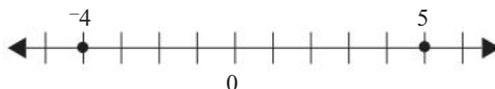
The inequality signs $<$ and $>$ are used to represent less than or greater than when comparing numbers.

$<$ is less than $>$ is greater than

Example

1 Insert $<$ or $>$ signs to make the following statements true:

a $-4 \square 5$



$-4 < 5$

-4 is further to the left, so it is less than 5

b $6 \square -3$



$6 > -3$

6 is further to the right, so it is greater than -3

c $-7 \square -1$



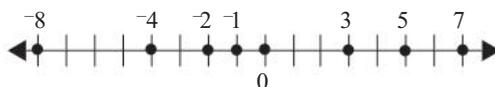
$-7 < -1$

-7 is further to the left, so it is less than -1

2 Arrange the following list of numbers in order from smallest to largest:

7, -2, 5, -8, -1, 3, 0, -4

Consider the number's position on a number line.



Moving from the left to the right you obtain the solution -8, -4, -2, -1, 0, 3, 5, 7.

Exercise 8C

1 Give the following amounts as positive or negative numbers:

- a Melanie has \$83 in the bank.
- b The temperature in the Sahara Desert is 48°C .
- c The bottom of a ship is 12 metres below sea level.
- d The Nimele's family has borrowed \$150 000 from the bank.
- e The temperature at the South Pole is 58°C below zero.
- f Mrs Tango has her office on the fourth storey of the Anthony Saru Building.
- g Mt Popomaneseu is 2330 metres above sea level.
- h Romano had \$67.50 in the bank and received interest of \$1.35; what is his new bank balance?

2 Write a real-life example to represent each of the following numbers:

- a 23
- b -10
- c -50
- d 89

3 Arrange the following numbers in order from smallest to largest:

a $-6, -10, 8, -2, 5, 9, 7, -11$

b $7, -1, 5, 6, -3, -8, 3, -7$

c $-12, 20, -52, 14, 28, -31, -13, 46, -6$

d $12, -22, -14, 8, -13, -33, -8, 5, 21, 17$

e $-5\frac{1}{2}, 3\frac{1}{2}, -1\frac{1}{4}, -6\frac{3}{4}, 4, 3, -2\frac{3}{4}, -6, 4\frac{1}{2}, 0$

f $10, -2\frac{1}{4}, 5\frac{1}{2}, 4, -3, -1\frac{1}{2}, -4, 8, 6\frac{3}{4}, -3\frac{1}{2}$

g $2 \cdot 2, 3 \cdot 1, -4 \cdot 5, -6, -1 \cdot 5, 0, 4 \cdot 6, -4 \cdot 1, 7 \cdot 2, 3$

h $-4 \cdot 1, -5 \cdot 2, 6, -4 \cdot 9, 8, 7 \cdot 2, 6 \cdot 5, -4 \cdot 8, -6 \cdot 9, 2 \cdot 8$

i $-8, -2\frac{1}{2}, -5 \cdot 5, 0, 2, -3 \cdot 1, 4\frac{1}{2}, 2 \cdot 9, -1 \cdot 8, 7$

j $14, 3, 12\frac{1}{2}, 5, 8 \cdot 1, -3\frac{1}{2}, -2 \cdot 2, -5, 9, -7 \cdot 1$

4 Label the following expressions as true or false:

a $-3 > -5$

b $-4 < 3$

c $-2 \cdot 5 > -2\frac{1}{2}$

d $-5 = 5$

e $-8\frac{1}{2} > -2$

f $4 < -1$

g $6 > \frac{1}{2}$

h $-6 > 3$

i $-2 > -10$

j $-5\frac{1}{2} < -4$

k $7 < -8$

l $-6 < -2$

5 Is zero a positive or a negative number? Explain why.

6 Using a number line to help you, find the number that is:

a 4 more than 5

b 6 less than 6

c 9 less than 7

d 3 less than 0

e 5 more than -3

f 8 less than 5

g 3 less than -2

h 4 less than -7

i 4 more than -9

7 Determine whether each of the following statements is true or false:

a $7 < 12$

b $3 > 6$

c $0 < 2$

d $0 > -5$

e $-4 > 1$

f $2 < -6$

g $-1 < -5$

h $-7 > -12$

i $-16 > -23$

8 Insert $>$ or $<$ to make the following statements true:

a $2 \square 8$

b $-3 \square 5$

c $0 \square -6$

d $-4 \square -9$

e $-3 \square 1$

f $-11 \square -20$

g $-4 \square 0$

h $4 \square -6$

i $-5 \square -1$

j $6 \square -4$

9 The temperature at Mt Tatuve was 27°C , but dropped 8 degrees overnight. What was the minimum temperature reached during the night?

10 John owed $\$127.50$ on his credit card.

a He paid $\$100$ off. How much did he still owe?

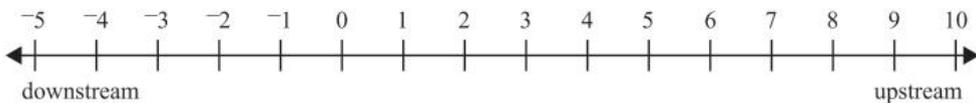
b Write this amount as a directed number.

c John purchased goods to the value of $\$26.50$. What is the balance on his credit card now?

d How much does John need to pay to have a balance of zero?

11 Divers are 2 metres above sea level preparing to dive to a shipwreck $12\frac{1}{2}$ metres below. What is the total distance between the divers and the wreck?

- 12** The Tuvaruhu Community High School Year 9 class went camping up the Mataniko River. They walked 8 kilometres upstream to the campsite. After camping for 3 days, they paddled down 11 km, left their canoes and walked back to school.
- Copy the number line below into your workbooks.
 - Mark the position of the school at 0 on the number line.
 - What was the initial position of the canoes? Mark it on the diagram.
 - What was the students' position when they got out of the canoes and started walking?
 - How far did the students have to walk back to the school after canoeing, and in what direction relative to the flow of the river?



- 13** A dolphin at Gavutu, Gela Islands comes into shallow 2-metre deep water during summer. An aeroplane 300 metres above sea level sees the dolphin in 40-metre deep water.
- If sea level represents zero, what is the dolphin's position in the shallow water as a directed number?
 - What is the aeroplane's position?
 - What is the new position of the dolphin in the deep water?
 - What is the distance between the plane and the dolphin?





8D Exploring addition

Adding directed numbers can be shown on a number line. Face right when adding a number. Move forwards when the number is positive. Move backwards when the number is negative.

Example

- 1 On a number line we can show that $4 + 3 = 7$ like this.

First step: Start at zero and move to positive 4 (+4).

Second step: Facing right (because we are adding) go forward (because the number is positive) 3.

- 2 $8 + -5 = 3$

First step: Start at zero and move to positive 8.

Second step: Facing right (because we are adding) go backwards (because the number is negative) 5.

- 3 $4 + -7 = -3$

First step: Start at zero and move to positive 4 (+4).

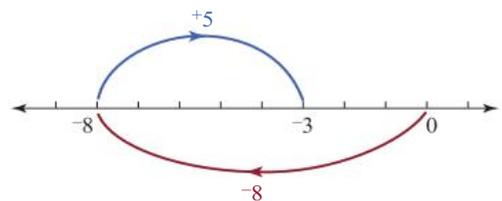
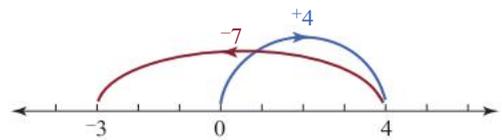
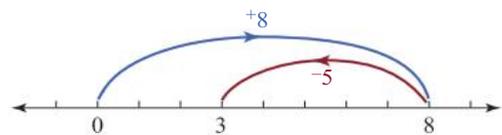
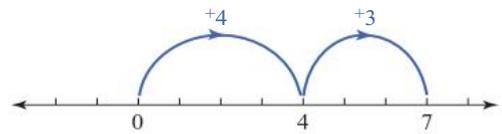
Second step: Facing right (because we are adding) go backwards (because the number is negative) 7.

- 4 $-8 + 5 = -3$

First step: Start at zero and move to negative 8 (-8).

Second step: Facing right (because we are adding) go forward (because the number is positive) 5.

Solution



Learning task 8D

- 1 Complete the following questions using a number line:

a $4 + 5 =$

b $3 + 9 =$

c $12 - 4 =$

d $9 - 5 =$

e $3 + -2 =$

f $7 + -5 =$

g $2 + -5 =$

h $4 + -9 =$

i $-7 + 4 =$

- 2 Find the answers to the following questions:

a $7 + 15 =$

b $22 - 17 =$

c $13 - 8 =$

d $6 + -4 =$

e $7 + -6 =$

f $13 + -8 =$

g $-10 + 9 =$

h $-6 + 10 =$

i $-1 + 3 =$

j $-3 - 5 =$

k $-15 - 4 =$

l $-18 - 9 =$

m $-25 + 12 =$

n $-39 + 19 =$

o $-27 + 14 =$

p $-23 - 4 =$

q $-35 - 14 =$

r $-51 - 11 =$

s $-5 + 4 =$

t $6 - 8 =$

u $-12 - 13 =$



8F Exploring subtraction

Learning task 8F

Number lines can be used to add and subtract negative numbers. Face right when adding and face left when subtracting. Move forward when the number is positive. Move backwards when the number is negative.

1 Determine the answers to the following examples:

a $7 - -5$

b $4 - -7$

c $2 - -3$

d $10 - -4$

e $13 - -6$

2 Write down any patterns you see in Question 1.

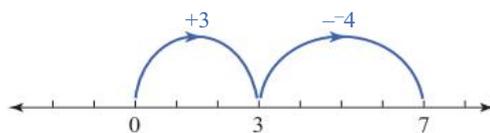
Example

$$3 - -4 = 7$$

First step: Start at zero and move forward to positive 3.

Second step: Facing left (because we are subtracting) go backwards (because the number is negative) 4.

Solution



3 Determine the answers to the following:

a $-3 - -3$

b $-7 - -4$

c $-16 - -12$

d $-13 - -5$

e $-10 - -2$

4 Write a sentence or two to describe what you have noticed about your answers to Question 3.

5 Use a number line to find the answers to the following:

a $10 - -3 =$

b $14 - -7 =$

c $24 - -6 =$

d $16 - -10 =$

e $-13 - -3 =$

f $-4 - -2 =$

g $10 - -7 =$

h $-5 - -9 =$

i $-1 - -6 =$

j $9 - -1 =$

k $-6 - -2 =$

l $-14 - -16 =$

m $5 - -7 =$

n $-7 - -2 =$

o $-10 - -8 =$

6 Draw a stick figure character moving along a number line to illustrate the following problems. Show in which direction your character is facing and moving, and state the final position:

a $3 + 4$

b $-3 + 4$

c $-3 - 4$

d $3 - 4$

e $-3 - -4$

f $3 - -4$

7 Copy and complete the following:

a $3 + +4$ can be written as $3 \underline{\quad} 4 = \underline{\quad}$.

b $3 - +4$ can be written as $3 \underline{\quad} 4 = \underline{\quad}$.

c $3 + -4$ can be written as $3 \underline{\quad} 4 = \underline{\quad}$.

d $3 - -4$ can be written as $3 \underline{\quad} 4 = \underline{\quad}$.

8 Copy and complete these rules:

a When two signs are together and different, change to _____.

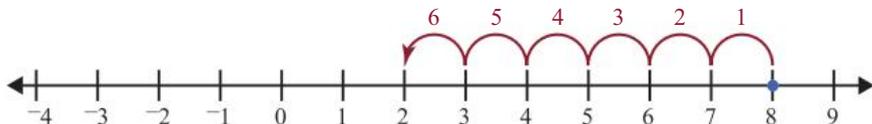
b When two signs are together and the same, change to _____.

Example

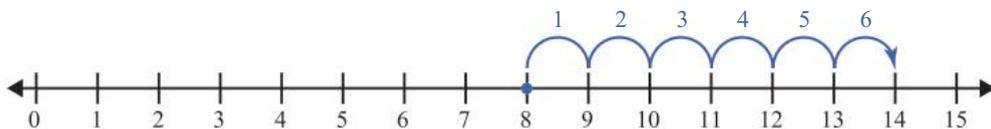
- 1 John has \$8. He then pays for a lunch order totalling \$6, which leaves him with only \$2. Show this on a number line.
- 2 Marion has \$8 left after taking \$6 to pay for her library fines. When she arrives at the library, she discovers that they are having an amnesty on library fines and she does not have to pay her fine. Marion therefore has \$14. Show this on a number line.
- 3 Use a number line to evaluate:
 - a $-2 - 4$
 - b $-2 - -4$

Solution

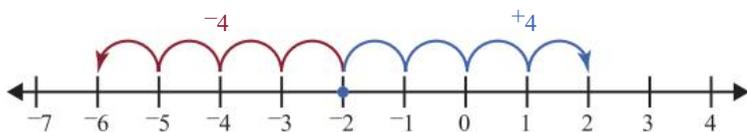
- 1 $8 - 6 = 2$
A number line shows the process. Start at 8 and move 6 positions to the left to reach 2.



- 2 $8 - -6 = 8 + 6 = 14$
A number line shows the process. Start at 8 and move to the right 6 positions to reach 14.



- 3 a $-2 - 4 = -6$
- b $-2 - -4 = -2 + 4 = 2$



Exercise 8G

- 1 Find the answers to the following, using a number line if needed:

- | | | | |
|------------|------------|-------------|-------------|
| a $4 - 1$ | b $4 - -1$ | c $8 - 4$ | d $8 - -4$ |
| e $3 - 5$ | f $3 - -5$ | g $2 - 5$ | h $2 - -5$ |
| i $4 - 7$ | j $5 - -2$ | k $9 - -11$ | l $3 - 6$ |
| m $7 - -8$ | n $4 - -4$ | o $7 - -3$ | p $8 - -18$ |

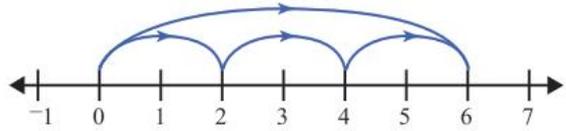
- 2 Evaluate these mixed addition and subtraction questions:

- | | | | |
|--------------|-------------|--------------|-------------|
| a $6 - 3$ | b $-14 + 5$ | c $-11 - -9$ | d $8 + -2$ |
| e $-10 + -2$ | f $4 + 10$ | g $3 - -3$ | h $-2 - 4$ |
| i $-7 - 4$ | j $-4 + 4$ | k $4 + 3$ | l $-1 - -8$ |
| m $-6 + -5$ | n $5 - 7$ | o $8 - -2$ | p $6 + -8$ |
| q $4 - 10$ | r $-10 - 8$ | s $-8 + 2$ | t $2 + -4$ |

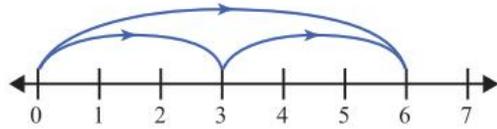
8H

Multiplying directed numbers

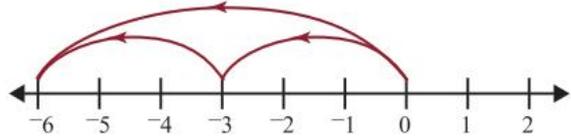
One meaning for $3 \times 2 = 6$ is 3 lots of 2 = 6.



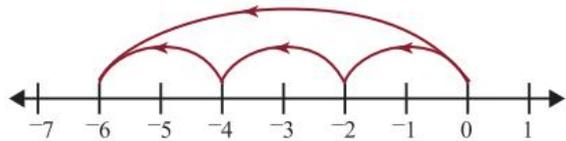
Of course this is the same as $2 \times 3 = 6$ or 2 lots of 3.



One meaning for 2×-3 is 2 lots of -3 . The number shows $2 \times -3 = -6$.



And if 2×-3 is the same as -3×2 then $3 \times -2 = -6$ also. On the number line:



Some real-life examples for multiplying directed numbers are given below:

- $2 \times 5 = 10$ You are given 2 lots of \$5, which means you have \$10.
- $2 \times -5 = -10$ You are given 2 bills for \$5 each, which means you have to pay \$10.
- $-2 \times 5 = -10$ You give away 2 lots of \$5, which means you have \$10 less than before.
- $-2 \times -5 = 10$ You give away 2 bills for \$5 each, which means you no longer have to pay the \$10 so you have \$10 more than if you had not given the bills away.

- Positive \times Positive gives a Positive $3 \times 4 = 12$
- Negative \times Negative gives a Positive $-3 \times -4 = 12$
- Positive \times Negative gives a Negative $3 \times -4 = -12$
- Negative \times Positive gives a Negative $-3 \times 4 = -12$

• Like signs give a Positive.

• Unlike signs give a Negative.

Exercise 8H

- 1 Draw the number lines to show meanings for the following multiplications:
 - a $-4 \times 3 = -12$ b $4 \times -3 = -12$ c $-5 \times 2 = -10$ d $-1 \times 6 = -6$
- 2 Write real-life examples for the following multiplications using the sentence structures referring to money and bills as above. The first one is:
 - $4 \times 3 = 12$ You are given 4 lots of \$3, which means you have \$12.
 - a $4 \times 3 = 12$ b $-4 \times 3 = -12$ c $-5 \times 2 = -10$ d $1 \times -6 = -6$
- 3 Evaluate:
 - a -2×-6 b -5×-11 c -7×-10 d -6×-5
 - e -3×-8 f -9×-7 g -2×-5 h -11×-12
- 4 a If three people each owe \$24, how much is the total debt?
 b Write a number sentence to represent this situation.

A set of rules similar to those used for multiplication also applies for division.

Positive \div Positive gives a Positive $12 \div 3 = 4$
 Negative \div Negative gives a Positive $-12 \div -3 = 4$

• Like signs give a Positive.

Positive \div Negative gives a Negative $12 \div -3 = -4$
 Negative \div Positive gives a Negative $-12 \div 3 = -4$

• Unlike signs give a Negative.

One real-life example of $-20 \div 4$ is how four friends can share their bill of \$20 for ice creams. They would each have to pay \$5. Using directed numbers, this is $-20 \div 4 = -5$.

A real-life example of $-36 \div -9 = 4$ could be if you were finding how many temperature drops of 9 degrees (-9°) it would take for the temperature to drop 36 degrees (-36°) in total: it would take 4 changes of -9 degrees.

Exercise 81

1 Evaluate:

a $16 \div 2$

b $20 \div 5$

c $40 \div 8$

d $35 \div 7$

e $18 \div 9$

f $72 \div 8$

g $84 \div 12$

h $100 \div 10$

2 Evaluate:

a $-12 \div -3$

b $-15 \div -3$

c $-4 \div -2$

d $-25 \div -5$

e $-30 \div -6$

f $-110 \div -10$

g $-99 \div -9$

h $-84 \div -7$

3 Evaluate:

a $48 \div -8$

b $42 \div -6$

c $32 \div -4$

d $40 \div -5$

e $10 \div -5$

f $45 \div -9$

g $70 \div -7$

h $96 \div -12$

4 Evaluate:

a $-20 \div 5$

b $-42 \div 7$

c $-44 \div 4$

d $-8 \div 2$

e $-28 \div 7$

f $-64 \div 8$

g $-90 \div 9$

h $-18 \div 6$

5 Find the answers to the following:

a $-48 \div -8$

b $-16 \div 4$

c $12 \div 2$

d $36 \div -12$

e $96 \div -8$

f $-30 \div -15$

g $-20 \div 5$

h $14 \div 7$

i $28 \div 4$

j $-88 \div 11$

k $84 \div -12$

l $-80 \div -10$

m $-15 \div 5$

n $-42 \div -6$

o $-12 \div 3$

p $64 \div 8$

6 Simplify the following:

a $16 \div -8$

b $-12 \div -3$

c $-30 \div 5$

d $-24 \div -6$

e $12 \div -3$

f $-18 \div -3$

g $-36 \div -6$

h $8 \div -2$

i $-8 \div 4$

j $-6 \div 2$

k $14 \div -7$

l $-15 \div -3$

m $-3 \div -1$

n $-6 \div -2$

o $-20 \div -5$

p $-20 \div -10$

7 a If three people owed a total of \$15, how much debt would each have if the debt is shared equally between them?

b Write a number sentence to express this situation.

8 The temperature fell from 5°C by a total of 20°C over 5 hours.

a What was the final temperature?

b How many degrees did the temperature fall each hour, if it fell at a constant rate?

c Write a number sentence to represent this situation.

BODMAS or BOMDAS allows you to correctly calculate questions containing more than one operation, and applies to directed numbers.

- Work out the calculations inside the brackets first. If the brackets contain
- **B** more than one operation, they must also follow the rules of BODMAS. **B**
- **O** If the question contains a fraction 'of' a number then this is calculated next. **O**
- **D** Work out the **d**ivision and **m**ultiplication calculations working across the **M**
- **M** page from left to right. **D**
- **A** Work out the **a**ddition and **s**ubtraction calculations working across the page **A**
- **S** from left to right. **S**

Directed numbers can be written in two different ways to distinguish between a subtraction sign and a negative sign. For example, 5 minus negative 2, can be written as:

$$5 - (-2) \text{ or } 5 - ^{-}2.$$

Example

Evaluate the following:

a $-4 + 8 \times (-3 + 2)$

$$\begin{aligned} & -4 + 8 \times (-3 + 2) \\ & = -4 + 8 \times ^{-}1 \\ & = -4 + ^{-}8 \\ & = -4 - 8 \\ & = ^{-}12 \end{aligned}$$

b $16 \div ^{-}4 \times ^{-}3 + 5$

$$\begin{aligned} & 16 \div ^{-}4 \times ^{-}3 + 5 \\ & = ^{-}4 \times ^{-}3 + 5 \\ & = 12 + 5 \\ & = 17 \end{aligned}$$

Solution

Exercise 8J

1 Use the BODMAS rules to evaluate the following:

a $16 \div ^{-}8 + (^{-}5)$

b $2 \times ^{-}3 + 5$

c $3 - 5 \times ^{-}4$

d $^{-}24 \div ^{-}6 - 11$

e $12 \div ^{-}3 - 1$

f $(14 - 5) \div ^{-}3$

g $^{-}36 \div ^{-}6 \div ^{-}2 + 5$

h $^{-}12 + 8 \div ^{-}2 + 7$

i $8 + 4 \times ^{-}3 - 9$

j $(^{-}4 + 5) \times ^{-}6 \div 2$

k $14 \div ^{-}7 + 2 \times ^{-}3$

l $^{-}15 \div ^{-}3 + 6 \times ^{-}2$

m $(^{-}4 + ^{-}2) \times ^{-}3 \div ^{-}9$

n $(9 \div ^{-}3 + 1) \times ^{-}6 \div ^{-}2$

o $(16 + 4) \div ^{-}5 + 7$

p $(^{-}19 \times ^{-}1 + 1) \div ^{-}10$

q $96 \div 8 \div ^{-}2 + 3$

r $(^{-}132 \div ^{-}11 + 2) \div ^{-}7$

s $\frac{1}{2}$ of $^{-}48 + ^{-}5 \times ^{-}3$

t $6 + \frac{1}{4}$ of $^{-}24 - 4 \times ^{-}3$

u $\frac{1}{3}$ of $27 + 3 \times ^{-}2$

2 Insert one of the symbols $+$, $-$, \times , \div into the boxes below to make the number equations true:

a $(16 \square 8) \square ^{-}2 = ^{-}4$

b $2 \square ^{-}3 \square 5 = ^{-}1$

c $3 \square 7 \square ^{-}4 = 14$

d $4 \square ^{-}6 \square 8 = ^{-}3$

e $(12 \square ^{-}3) \square 4 = 0$

f $(14 \square 5) \square 3 = 12$

g $(^{-}36 \square ^{-}6) \square ^{-}7 = 6$

h $(^{-}12 \square 8) \square ^{-}2 = 2$

i $\frac{1}{2} \square ^{-}72 \square ^{-}6 = 6$

j $\frac{1}{4} \square ^{-}48 \square ^{-}3 = 36$

k $\frac{1}{4} \square ^{-}8 \square 5 = 3$

l $\frac{2}{3} \square 15 \square ^{-}1 = 11$

Exercise 8K

1 Find the answers to the following:

a $-3 + 6$

b $-3 + -6$

c $-4 + 8$

d $-4 + -8$

e $-10 + 3$

f $-10 + -3$

g $-7 + 5$

h $-7 + -5$

i $-4 + -5$

j $-9 + -2$

k $-9 + -8$

l $-7 + -4$

2 Label the following as True or False:

a $-6 + 4 = 2$

b $-3 + 4 = 1$

c $-5 + -2 = -7$

d $-4 + -2 = -2$

e $-1 + -4 = -5$

f $-2 + -6 = 8$

g $-6 + 8 = -2$

h $-5 + -6 = 1$

i $-6 + -2 = -8$

j $-1 + -5 = 4$

k $-1 + 9 = 8$

l $-8 + -2 = -10$

3 Evaluate:

a $-6 - 2$

b $-6 - -2$

c $-4 - 2$

d $-4 - -2$

e $-2 - 4$

f $-2 - -4$

g $-1 - 5$

h $-1 - -5$

i $-4 - 2$

j $-3 - 8$

k $-7 - -4$

l $-6 - -7$

m $-9 - -4$

n $-8 - -10$

o $-12 - -3$

p $-11 - 4$

4 Label the following expressions as True or False:

a $2 + -2 = 0$

b $-4 - -5 = 1$

c $-14 + 8 = 6$

d $-12 + -6 = -6$

e $4 - 11 = -15$

f $-6 + -2 = -8$

g $6 - -6 = 0$

h $5 - -2 = -7$

i $-2 - -4 = 2$

j $16 - 8 = -8$

k $-5 + 6 = 1$

l $-8 - -4 = -4$

5 Evaluate:

a $5 \times -5 \times 6$

b $16 \times -2 \times -3$

c $-4 \times -5 \times -2$

d $-3 \times -6 \times 2$

e $7 \times -1 \times -2$

f $-3 \times 7 \times 2$

g $-9 \times -1 \times 5$

h $-8 \times -2 \times 6 \times -1$

i $-2 \times -4 \times -6$

j $-5 \times 2 \times 3$

k $-1 \times -2 \times -3 \times -4$

l $-6 \times -2 \times 3 \times 3$

6 Evaluate:

a $42 \div -6 \div -1$

b $-84 \div -4 \div 3$

c $-36 \div 2 \div -9$

d $-100 \div 20 \div 2$

e $121 \div -11 \div -1$

f $-65 \div -5 \div -2$

g $-80 \div 4 \div -10$

h $96 \div -8 \div 6$

i $36 \div 6 \div -6$

j $-120 \div 10 \div 2 \div -3$

k $-65 \div -5 \div 13$

l $-84 \div -2 \div -2 \div -7$

7 Find the answers to the following:

a $\frac{1}{2}$ of $-12 + -2 \times -4$

b $5 + \frac{1}{4}$ of $-48 - 2 \times -5$

c $-14 \times -2 \div 4 + 3 \times -5$

d $-36 \div 12 \times -2 - 5 - -4$

e $\frac{1}{3}$ of $-54 + (-16 + 4 \div -2)$

f $(144 \div -4 \div 8) + 10 \div -2$

g $(-16 \times -1 + 4) \div 10$

h $25 \div -5 + 3 \times -7$

i $9 + 3 \times -5 - 2$

j $(5 - 7) \times -6 + -3$

k $-16 + 12 \div -3 + 5$

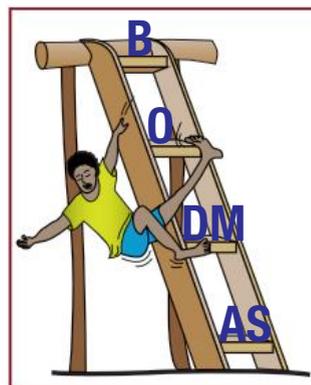
l $(-7 + -2) \times -4 \div -12$

m $45 \div 5 + -9 \div 3$

n $2 + 49 \div -7 \times -2$

o $(6 - 3) \times -7 + -2 \times -6$

p $5 \times -3 - (5 - 8) + (64 \div -8)$

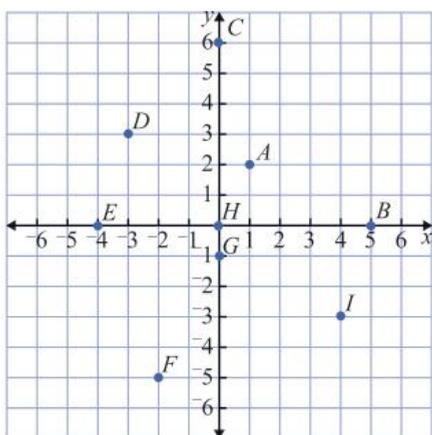


In Exercise 8A you worked with a number line that extended in two directions. A second number line can be included to give two dimensions. This is called a coordinate number plane. It may also be called a Cartesian number plane.

The horizontal axis is labelled the x -axis and the vertical axis is labelled the y -axis. Any position on the number plane can be represented by an ordered pair called a coordinate pair (or coordinates) (x, y) . The x -axis position is always written first, then the y -axis position. The centre is called the origin and has coordinates $(0, 0)$.

Example

Give the coordinates of the points labelled with letters in the diagram below:

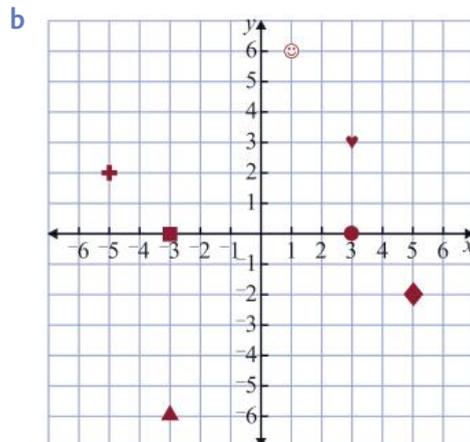
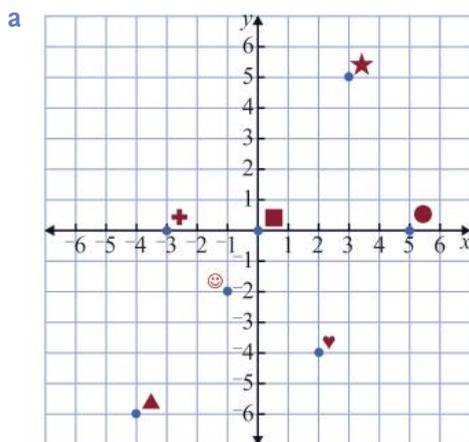


Solution

A (1, 2) B (5, 0) C (0, 6)
 D (-2, 3) E (-4, 0) F (-2, -5)
 G (0, -1) H (0, 0) I (4, -3)

Exercise 8L

1 Give the coordinates of the shapes positioned on the coordinate plane below:



2 Mark the following letters on a coordinate plane that has axes from -8 to 8 :

A (-3, 4) B (4, -6) C (0, 1) D (-2, 0) E (-4, -5) F (0, 0)
 G (4, 2) H (-6, 0) I (0, 8) J (1, 8) K (-7, -3) L (2, -6)

- 3** Plot the following points on a coordinate plane that has axes from -5 to 5 . Connect the points as you go to reveal the hidden picture:

START $(0, 0), (4, 2), (4, -2), (0, 0), (-4, -2), (-4, 2), (0, 0), (2, 4), (0, 5), (-2, 4), (0, 0), (-2, -4), (0, -5), (2, -4), (0, 0)$ STOP

- 4** Plot the following points on a coordinate plane that has axes from -6 to 6 . Connect the points as you go to reveal the hidden picture:

START $(0, -6), (0, -2), (-2, 0), (-1, 2), (1, 2), (2, 0), (0, -2)$ STOP

START $(0, -6), (6, -2), (4, 5), (1, 2)$ STOP

START $(-1, 2), (-4, 5), (-6, -2), (-2, 0)$ STOP

START $(-4, 5), (4, 5)$ STOP

START $(2, 0), (6, -2)$ STOP

START $(-6, -2), (0, -6)$ STOP

- 5** Plot the following points on a coordinate plane that has axes from -6 to 6 . Connect the points as you go to reveal the hidden picture:

a START $(1, 0), (1, -1), (0, -1\frac{1}{2}), (-1, -1), (-1, 0), (0, \frac{1}{2}), (1, 0)$ STOP, START $(1, 0), (2, 1), (3, 1), (4, 0), (4, -1), (3, -2), (1, -1)$ STOP, START $(3, -2), (3, -3), (2, -4), (0, -3), (0, -1\frac{1}{2})$ STOP, START $(0, -3), (-2, -4), (-3, -3), (-3, -2), (-1, -1)$ STOP, START $(-3, -2), (-4, -1), (-4, 0), (-3, 1), (-2, 1), (-1, 0)$ STOP, START $(-2, 1), (-1, 2\frac{1}{2}), (1, 2\frac{1}{2}), (2, 1)$ STOP

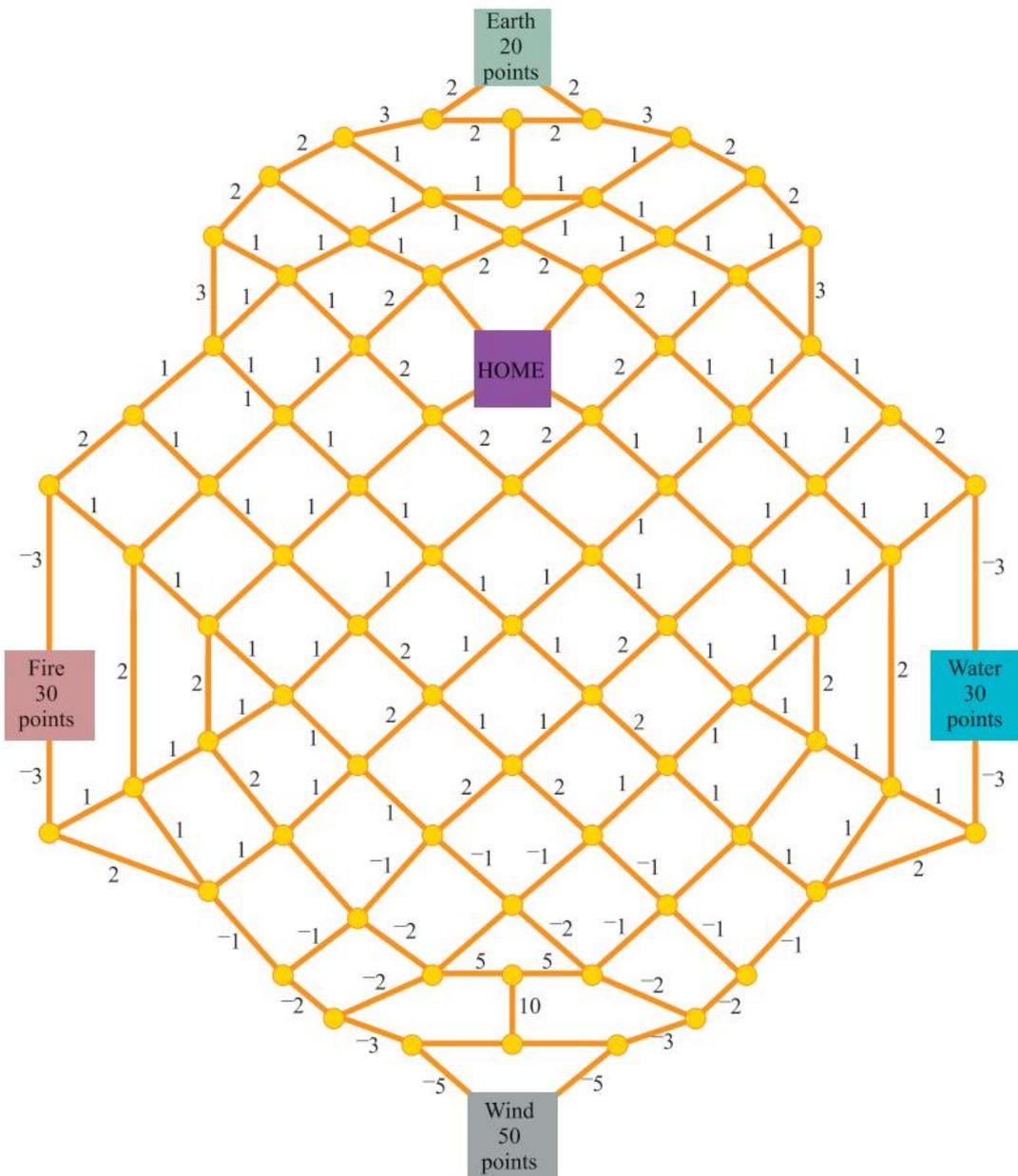
b START $(-\frac{1}{2}, -2), (0, -3), (\frac{1}{2}, -2), (3, -6), (4, -5), (5, -2), (4, -1), (\frac{1}{2}, -2), (1, 1), (\frac{1}{2}, 2), (4, 5), (5, 0), (4, -1)$ STOP, START $(\frac{1}{2}, 2), (0, 3), (1, 4)$ STOP, START $(-1, 4), (0, 3), (-\frac{1}{2}, 2), (-4, 5), (-5, 0), (-4, -1), (-\frac{1}{2}, -2), (-1, 1), (-\frac{1}{2}, 2)$ STOP, START $(-\frac{1}{2}, -2), (-3, -6), (-4, -5), (-5, -2), (-4, -1)$ STOP

c START $(2\frac{1}{2}, 1), (3, 3), (2\frac{1}{2}, 3\frac{1}{2}), (4, 4), (4, 5), (3, 5\frac{1}{2}), (2, 5), (0, 5\frac{1}{2}), (-2, 5), (-3, 5\frac{1}{2}), (-4, 5), (-4, 4), (-2\frac{1}{2}, 3\frac{1}{2}), (-3, 3), (-2\frac{1}{2}, 1), (-1, \frac{1}{2}), (1, \frac{1}{2}), (2\frac{1}{2}, 1), (3\frac{1}{2}, 0), (4, -1), (4, -2), (3, -2\frac{1}{2}), (2\frac{1}{2}, -4), (0, -5), (-2, -4), (-2\frac{1}{2}, -2\frac{1}{2}), (-3\frac{1}{2}, -3), (-4\frac{1}{2}, -2\frac{1}{2}), (-4\frac{1}{2}, -2), (-4, -\frac{1}{2}), (-2\frac{1}{2}, 1)$ STOP, START $(4, -2), (5, -2\frac{1}{2}), (5\frac{1}{2}, -4), (5, -5), (4, -5\frac{1}{2}), (3, -5), (2\frac{1}{2}, -4)$ STOP, START $(-2, -4), (-2\frac{1}{2}, -5), (-3\frac{1}{2}, -5\frac{1}{2}), (-4\frac{1}{2}, -5), (-5, -4), (-4\frac{1}{2}, -2\frac{1}{2})$ STOP, START $(-1, -1\frac{1}{2}), (0, -1), (1, -1\frac{1}{2})$ STOP, START $(-1, 1\frac{1}{2}), (-\frac{1}{2}, 1), (\frac{1}{2}, 1), (1, 1\frac{1}{2})$ STOP, START $(0, 1\frac{1}{2}), (\frac{1}{2}, 2\frac{1}{2}), (-\frac{1}{2}, 2\frac{1}{2}), (0, 1\frac{1}{2})$ JOIN $(-2\frac{1}{2}, -2\frac{1}{2})$ TO $(-2\frac{1}{2}, -1\frac{1}{2})$ JOIN $(3, -2\frac{1}{2})$ TO $(2\frac{1}{2}, -1\frac{1}{2})$ JOIN $(2, 5)$ TO $(2\frac{1}{2}, 3\frac{1}{2})$ JOIN $(-2, 5)$ TO $(-2\frac{1}{2}, 3\frac{1}{2})$ PUT A DOT AT $(-1, 3)$ AND $(1, 3)$ STOP

d START $(-3, 2\frac{1}{2}), (-4, 3), (-3, 3\frac{1}{2}), (-2\frac{1}{2}, 3), (-3, 2\frac{1}{2}), (1, 2), (3, 1\frac{1}{2}), (4, 1), (4\frac{1}{2}, 0), (4\frac{1}{2}, -1), (4, -2), (3, -2\frac{1}{2}), (1, -2\frac{1}{2}), (0, -2), (\frac{1}{2}, -1), (-1\frac{1}{2}, 0), (-2\frac{1}{2}, -1), (-5, 1), (-4\frac{1}{2}, 1\frac{1}{2})$ STOP, START $(-5, 1), (-5\frac{1}{2}, \frac{1}{2}), (-6, 1), (-5\frac{1}{2}, 1\frac{1}{2}), (-5, 2)$ STOP, START $(-5\frac{1}{2}, 1\frac{1}{2}), (-6, 2), (-6, 4), (-5, 4\frac{1}{2}), (-4, 4), (-4, 3)$ STOP, START $(-6, 3), (-5, 3), (-5, 4\frac{1}{2})$ STOP, START $(1, 2), (2, 3), (3, 3), (3\frac{1}{2}, 2), (3, 1\frac{1}{2})$ STOP, START $(4, 1), (2\frac{1}{2}, \frac{1}{2}), (2\frac{1}{2}, -\frac{1}{2}), (4\frac{1}{2}, 0)$ STOP, START $(0, -2), (-1, -3), (-2, -3\frac{1}{2}), (-3, -3), (-3\frac{1}{2}, -2), (-2\frac{1}{2}, -1)$ STOP, START $(0, 0), (0, \frac{1}{2}), (\frac{1}{2}, \frac{1}{2}), (\frac{1}{2}, 0)$ STOP, START $(-1\frac{1}{2}, \frac{1}{2}), (-1\frac{1}{2}, 1), (-1, 1), (-1, \frac{1}{2})$ STOP, START $(-3, 1), (-3, 1\frac{1}{2}), (-2\frac{1}{2}, 1\frac{1}{2}), (-2\frac{1}{2}, 1)$ STOP

This is a game for two or more players, using a die and counters. Start at HOME on the board below.

- Each player rolls the die, moves their counter the number of edges shown on the die, and scores points as they move.
- Players add up the points shown on the edges they move along.
- Edges may be used as many times as possible.
- The game finishes when one player has passed through each of the elements—earth, water, air and fire—once and has returned to the HOME square.
- The winner is the person with the highest score at that point.





Puzzles

- 1 Multiply the four numbers surrounding a letter in the square below, then locate the product in the coded answer below the square and write the appropriate letter above each answer to solve the riddle:

What makes Mathematics an enjoyable subject?

-1	6	-4	7	2
R	T	Y	E	
9	-2	-10	-5	11
N	A	G	L	
3	1	-9	-3	4
O	H	B	U	
-6	-12	5	-7	12
I	D	S	C	
-8	10	-11	8	0

-945	-770	0	-180	1008	3080	-770	-5760	-480	540	-180	3080
660	216	1350	-5760	0	-180	660	-5760	6600	-770	-180	3080

- 2 See if you can complete the cross-number puzzle below by placing an integer in each blank space to get the correct answers for both the rows and columns (remember the BODMAS rules!).

8	+		+	2	=	7
-		+		+		+
	-	6	×		=	-5
×		÷		×		
	-		+	4	=	
=		=		=		=
		3		10	=	7

- 3 Work out the answer to each expression below. Place the representing letter above its correct answer in the coded line provided to solve the riddle:

Why did the orange stop in the middle of the road?

A $9 - -4 + 5$

W $9 \div (3 \times -3)$

Y $-2 - 7 - -6$

P $15 - 4 \times 7$

E $8 - (-1 - 4)$

H $11 - 15 + 8$

O $10 - 12 \div 4 - 7$

A $6 - 3 \times 4 - 3$

N $(-3 - 5) - -2$

U $-50 \div 10 \times 2$

D $(-9 - 6) \div (-7 + 2)$

E $3 \div (-3 + 6)$

T $-4 + 7 \times 3$

S $7 - 5 + 8 \div 2$

L $-20 \div 5 \times 2$

A $8 + 3 \times -4$

H $(4 - -2) \div -3$

Q $9 - 3 \times -4 - 6$

S $5 \times (-4 - -1)$

T $((-9 \times 3) - 9) \div (6 \times -3)$

U $6 + -4 \times 3 - 2$

4	13	-1	18	-6	2	1	3
17	0	-13	-8	-9	-3		
-15	15	-8	-4	6	-2		

- 4 An opossum (kadora) climbs up a 24-metre high greased pole. The kadora takes 5 minutes to climb 4 metres and then slips back 2 metres while it takes a one-minute rest. How long will it take the kadora to reach the top?
- 5 Find the numbers:
- Twice a number is 6 more than -10 .
 - Four more than half a number is -1 .
 - Three times a number is 6 less than itself.
 - A number divided by 5 is 2 more than itself.
- 6 If $a \blacktriangle b = a + 2b$, find:
- $3 \blacktriangle -1$
 - $-4 \blacktriangle -2$
- 7 If $a \star b = a(b - 1)$, find:
- $3 \star -1$
 - $4 \star -3$
- 8 If $a \blacklozenge b = \frac{a}{2b}$, find:
- $4 \blacklozenge -2$
 - $-1 \blacklozenge 3$





Applications

A card game



You will need a pack of cards and a partner for this game. The black cards represent the positive numbers and the red cards represent the negative numbers. The value of the number cards will be as indicated on the card. An ace is worth 11 and a picture card (jack, queen and king) is worth 12. Each player is dealt two cards from the pack. The players look at their cards and calculate the total value of their cards, e.g. red 6 and a black queen = $-6 + 12 = 6$.

The player with the highest total receives one point for that round. The winner is the first person to gain 10 points.

Directed numbers board game

You are to work individually or in pairs to devise a board game. The board game must help students learn some or all of the rules required for directed numbers. The board game must be designed for Year 7 students and contain all the requirements needed in the game, such as the board, instructions, markers, question cards and answers if applicable. You can base your board game on one you are familiar with or, alternatively, use your imagination to devise your own board game.

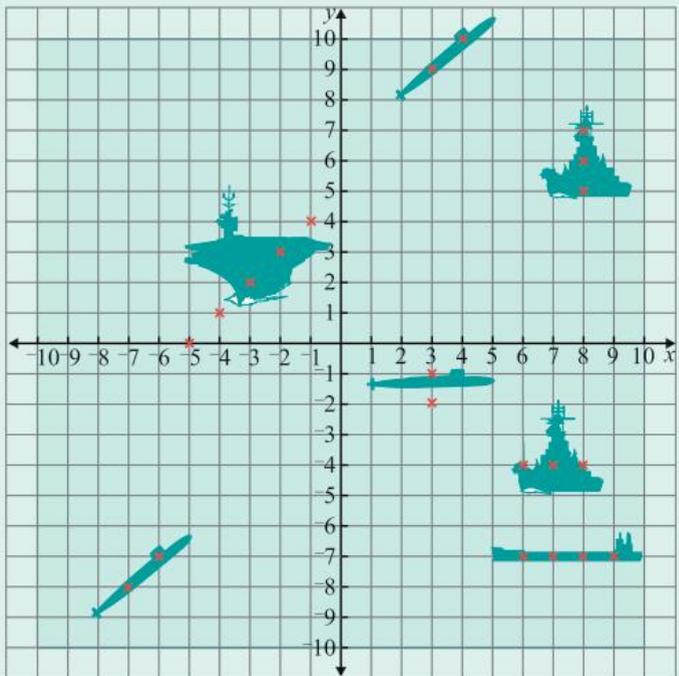
Battleships

The game of battleships can easily be adapted to pen and paper with the use of the Cartesian plane and a partner. Each player needs to draw up two grids from -10 to 10 . One grid is used to place your ships and the other grid is used to trace your partner's ships. Make sure the ships don't crash—leave at least one coordinate point between each ship.

Place the following on the grid:

- 1 aircraft carrier (five targets)
- 1 tanker (four targets)
- 2 destroyers (3 targets)
- 3 submarines (two targets)

You and your partner take it in turns to call out coordinates until all of one player's ships have been destroyed.



A game of golf

In the game of golf there are many terms used to identify whether the golfer took more than, less than or the expected number of shots to get the ball from the start to the hole.

Par	is used to indicate that the golfer took the expected number of shots
Birdie	one shot less than expected
Eagle	two shots less than expected
Albatross	three shots less than expected
Bogey	one shot more than expected
Double bogey	two shots more than expected
Triple bogey	three shots more than expected

Express each of the golf terms as a directed number.

Graham completed a round of golf, which was 18 holes. His results for the round were as follows:

Par, birdie, par, par, bogey, double bogey, eagle, birdie, par, bogey, par, par, par, bogey, par, double bogey, eagle.

If Graham's card started at zero, how far above or below the card was he at the end of the round?

His friend Roger also played 18 holes and his results were:

Birdie, birdie, eagle, birdie, par, par, par, bogey, eagle, birdie, par, par, bogey, birdie, par, par, bogey, triple bogey.

How far above or below the card is Roger at the end of the round? Who wins?

Make a die out of paper and label the sides as albatross, eagle, birdie, par, bogey and double bogey. With a partner take turns to throw the die 18 times, each time recording the result. Keep a running total of your score. The winner is the player with the lowest score.





Enrichment

- 1 Copy the bank statements below and complete them by filling in the correct entries in the green boxes.

a

Date	Deposit	Withdrawal	Balance
1 January			\$40
3 January	\$160		
8 January		\$50	
9 January			\$120
11 January			\$130
15 January		\$250	
23 January	\$40		
25 January		\$10	
29 January			-\$95
31 January			\$5

b

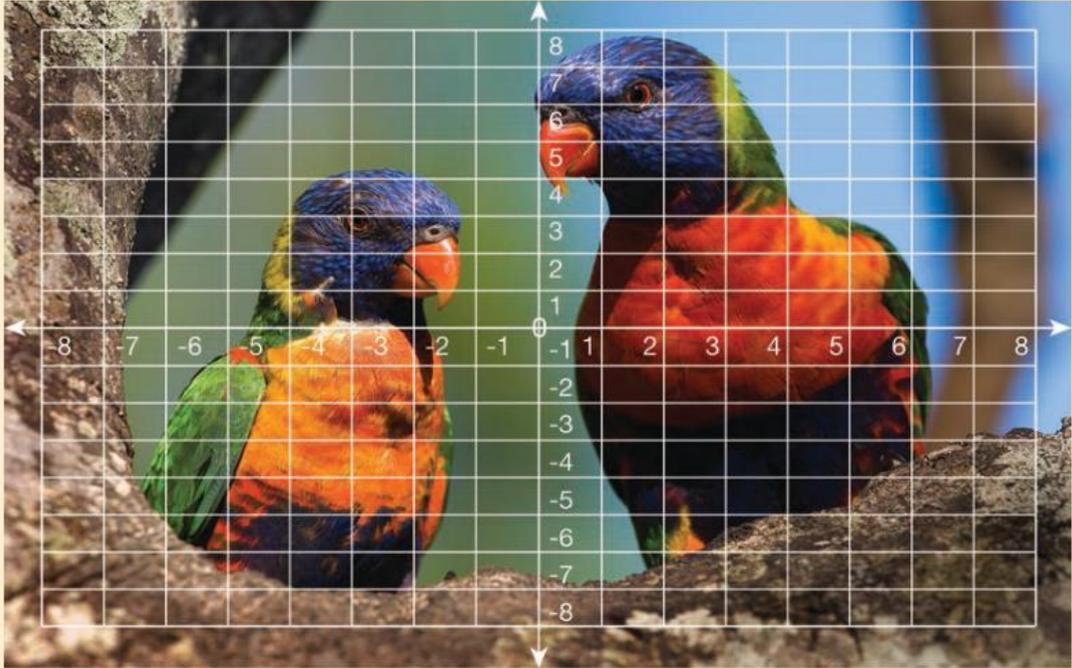
Date	Deposit	Withdrawal	Balance
1 February			\$5
9 February	\$16.50		
12 February			\$17.20
19 February		\$20	
21 February		\$55.30	
22 February	\$12.50		
23 February			-\$55.20
26 February			\$24.80
27 February		\$4.60	
28 February			\$62.50

- 2 The average temperature in Honiara for each month is listed below:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp. (°C)	31	30	29	27	29	27	26	28	32	34	35	35
Difference												

- a Calculate the average temperature for the year.
 b Find the difference between each monthly average temperature and the yearly average, then record it in the row labelled 'Difference'.
 c What is the sum of all the temperature differences?

- 3 Using a coordinate plane with axes from -8 to 8 , plot a design or picture on the grid using mostly whole numbers. List, in order, the coordinates that are required to reproduce the picture. Swap coordinates with a friend and recreate their design.



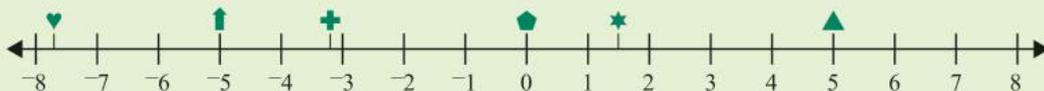
- 4 a Make two different-coloured dice and label the sides $-3, -2, -1, 0, 1, 2$. Toss the dice 100 times and record the sum of the two dice. What is the most common result?
- b List all the sums that are possible from a throw of the two dice.
- c Make a third die which is different in colour and label it with $-3, -2, -1, 0, 1, 2$. What sums are not possible? Which sum is likely to be the most common? Toss the three dice and record the sum. Was your prediction correct?



Revision/Assessment

Exercise 8A

- Give the following quantities as directed numbers:
 - Candice took \$30 out of her bank.
 - Solly parks his car on the sixth level of a car park.
 - The temperature in the state of Yukon, Canada, fell to 63°C below zero.
- Give the position on the number line for each of the symbols below:



Exercise 8B

- Complete the number patterns:
 - $-17, -14, -11, \underline{\quad}, \underline{\quad}, \underline{\quad}, \underline{\quad}, \underline{\quad}$
 - $44, 33, 22, \underline{\quad}, \underline{\quad}, \underline{\quad}, \underline{\quad}, \underline{\quad}$
 - $14\frac{1}{2}, -13, 11\frac{1}{2}, -10, 8\frac{1}{2}, \underline{\quad}, \underline{\quad}, \underline{\quad}, \underline{\quad}, \underline{\quad}$

Exercise 8C

- Insert $<$ or $>$ to make the following true:
 - $0 \square -5$
 - $-2 \square 9$
 - $4 \square 7$
 - $-3 \square -10$
 - $-6 \square 3$
 - $-8 \square -10$
 - $-4 \square 3$
 - $0 \square 5$
- Arrange the following in order from lowest to highest:
 - $-6, 10, 3, -8, 0, -1, 5, -3, -4, 2$
 - $6\frac{1}{2}, -3\frac{1}{4}, 5, 7, 10\frac{3}{4}, -3\frac{3}{4}, -2\frac{1}{2}, -3\cdot 8, -1\cdot 4, 0\cdot 3$

Exercise 8E

- Find the answers to the following using a number line if necessary:
 - $6 + 4$
 - $-5 + -6$
 - $-3 + 8$
 - $9 + -10$
 - $7 + -2$
 - $-9 + 2$
 - $-8 + -1$
 - $3 + 1$
 - $-1 + 7$
 - $4 + -7$
 - $-14 + 8$
 - $6 + -2$

Exercise 8G

- Evaluate the following, using a number line if necessary:
 - $10 - 4$
 - $-4 - 5$
 - $8 - -3$
 - $-7 - -2$
 - $-9 - -12$
 - $9 - 15$
 - $-4 - 7$
 - $3 - -1$
 - $7 - 10$
 - $-20 - -12$
 - $-15 - -40$
 - $2 - 5$

Exercise 8H

8 Evaluate:

a 6×3

b -2×-7

c -6×9

d 4×-3

e -8×-7

f -12×11

g 14×2

h 3×-9

i -6×8

j -2×-13

k 11×-6

l 5×4

Exercise 8I

9 Evaluate:

a $12 \div 3$

b $48 \div -6$

c $-54 \div 9$

d $-15 \div -5$

e $-8 \div 2$

f $-20 \div -5$

g $144 \div 12$

h $49 \div -7$

i $19 \div -1$

j $26 \div 13$

k $-32 \div -8$

l $96 \div -12$

Exercise 8J

10 Find the answers to the following:

a $42 \div -7 \times -2$

b $-4 + 3 \times 3 + 2$

c $-14 \div 7 + 5$

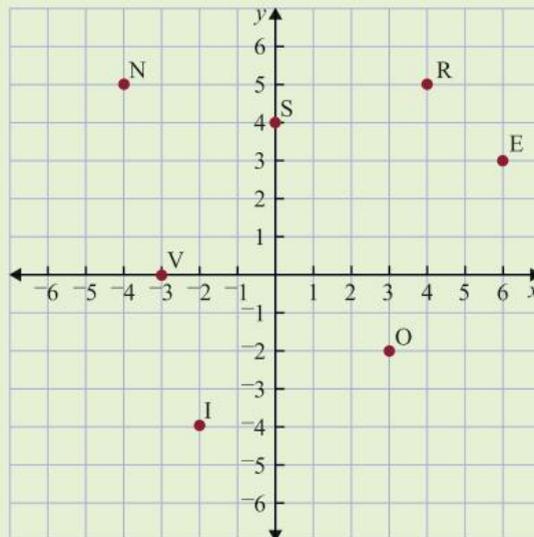
d $(12 \times 8 + 4) \div -10$

e $(-20 \times 2 - 4) \div -11$

f $(18 - 3) \div 5 + 16 \div -4$

Exercise 8L

11 Give the coordinates of the points on the Cartesian plane below:



12 Plot the following points on a Cartesian plane with axes from -5 to 5 and join the points in the order given to form a picture:

START $(1, -2), (4, -2), (3, -3), (-2, -3), (-3, -2), (1, -2), (1, 3), (3, -1), (-1, -1), (1, 2)$ STOP

CHAPTER

9

Coordinate Graphs and Location



Coordinate Graphs and Location

Solomon Islands covers over 1.35 million square kilometres of the Pacific Ocean, with a total land area of 27 556 square kilometres. The 992 islands are populated by people from many different tribes. In ancient times, people travelled from island to island by canoe, and navigated by the sun, stars, wind and currents. They followed *kavenga* or 'star paths' to locate particular islands, as well as foraging birds and *te lapa* or 'underwater lightning' (natural flashes of underwater light), both of which indicate the presence of a nearby island.

In more modern times, René Descartes, a 17th-century French mathematician, devised a grid system known as the Cartesian plane, which today forms the basis of the grid used in maps and street directories. Satellite navigation, where satellite signals received electronically are used to determine location, is now commonly used.

This chapter covers the following skills:

- Drawing and interpreting diagrams in two dimensions
- Using directions in two dimensions
- Locating points on a map
- Using the Cartesian Plane
- Using true bearings
A true bearing is represented by an angle measured clockwise from north
- Using compass bearings
A compass bearing gives the amount of turn east or west from the direction north or south, whichever is closer
- Applying true and compass bearings
- Using scales on maps

Specific Learning Outcome (SLO)

Learners should be able to:

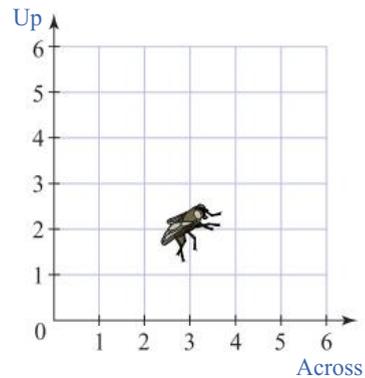
- 7.9.1.1** Identify and label parts of the coordinate plane: *x* and *y* axes, *origin*, *across* and *up*.
- 7.9.1.2** Draw and construct the coordinate planes and axes.
- 7.9.2.1** Describe and identify the positions of objects using 'across' and 'up'.
- 7.9.3.1** Name the positions of objects on the coordinate plane using 'across' and 'up.'
- 7.9.4.1** Locate the position of points on the grid by giving the coordinates using *x* and *y* axis values.
- 7.9.4.2** Plot and name coordinate pairs on the coordinate plane, using the *x* and *y* axis values.
- 7.9.5.1** Identify some of the things in life that can be represented using maps: *buildings, land, area etc.*

- 7.9.6.1** Identify the direction of the map, normally given as North, and its scales, which are normally expressed as ratio.
- 7.9.7.1** Calculate the distances on the map and the ground using given scales that are expressed as ratios.
- 7.9.8.1** Identify the purpose of bearings.
- 7.9.8.2** Identify areas where bearings are used widely by people.
- 7.9.8.3** Identify the two bearings that are used to give directions:
–*true bearings* and
–*compass bearings*.
- 7.9.8.4** Define the two bearings: ***true bearings*** and ***compass bearings***.
True bearings: angle of a turn, starting from north in a clockwise direction.
Compass bearings: angle of turn, up to 90° and referring to east or west. e.g. S40°E
- 7.9.9.1** Find bearings of given points using a protractor, starting from north.
- 7.9.9.2** Draw diagrams of given angles using protractors.
- 7.9.10.1** Calculate the actual distance on the ground by using the given scales on the map.

In 1619 René Descartes, a French mathematician, invented the grid system that we use in mathematics today.

He was lying in bed watching a fly crawl across the ceiling of his bedroom and he wanted to devise a way of describing the exact position of the fly on the ceiling. He began by picturing the ceiling covered with grid lines about 1 metre apart.

If he started in the bottom left-hand corner, he could describe the position of the fly as **‘three across and two up’**.

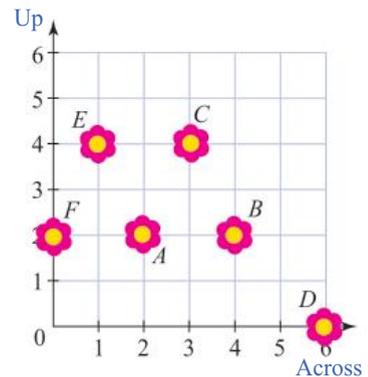


The starting point on the grid is known as the **origin**. It is from the origin that we start to count across (run) and then up (rise). To make the counting easier, the edges of the grid, known as axes, are numbered. The unit chosen for each axis depends on the information shown on the grid.

Exercise 9A

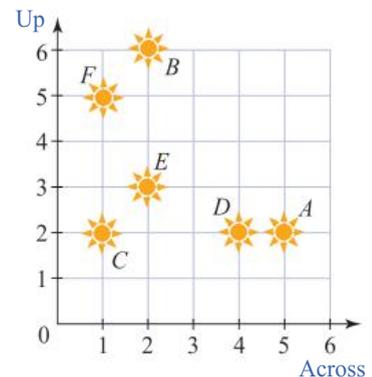
- 1 For each of the following, describe the position of the centre of the flower  from the origin:

a A b B
c C d D
e E f F



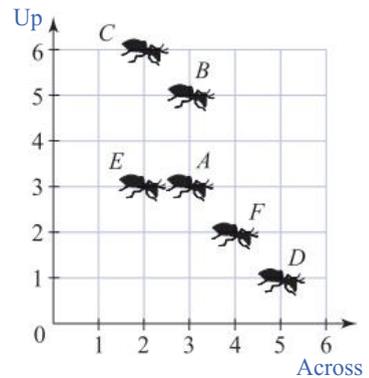
- 2 For each of the following, describe the position of the centre of the sun  from the origin:

a A b B
c C d D
e E f F



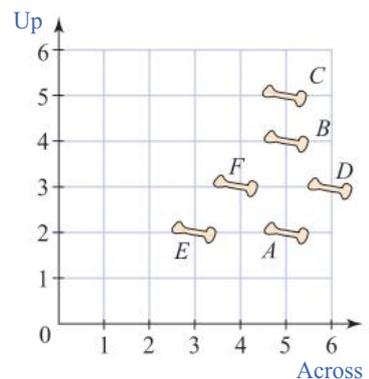
3 For each of the following, describe the position of the centre of the ant  from the origin:

- a *A* b *B*
 c *C* d *D*
 e *E* f *F*



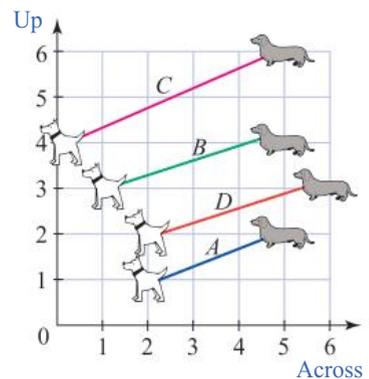
4 For each of the following, describe the position of the centre of the bone  from the origin:

- a *A* b *B*
 c *C* d *D*
 e *E* f *F*



5 For each of the following, describe the position of Chloe  from Sam :

- a *A* b *B*
 c *C* d *D*

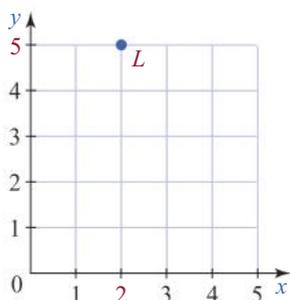


6 Using the grid in Question 5, describe the position of Sam from Chloe.

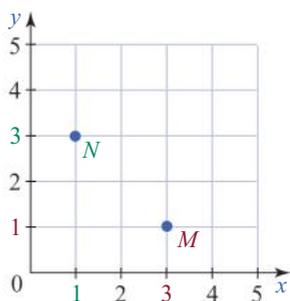
7 In your workbook draw a grid 6 up and 6 across and on it mark the following:

- a a sun at 3 across and 1 up b an ant at 5 across and 5 up
 c a flower at 2 across and 3 up d a dog at 1 across and 1 up
 e a bone at 1 across and 6 up f a moon at 6 across and 1 up

Maps are used to give accurate information as to where places are located. The horizontal axis is often called the x -axis and the vertical axis is known as the y -axis. To locate a point on a map we use coordinate points, written as two numbers in brackets e.g. $(3, 5)$. This coordinate point means 3 units across then 5 units up and is called an ordered pair because the x -coordinate is written before the y -coordinate.

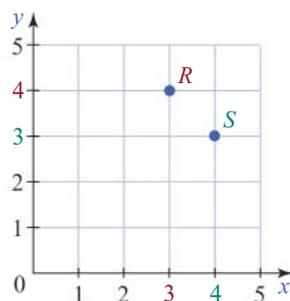


L is 2 units across and 5 units up.
We can write this as $L(2, 5)$.



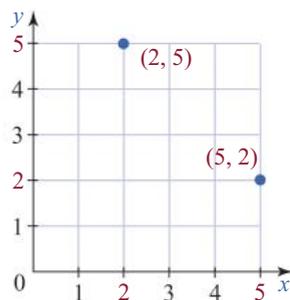
M is 3 units across and 1 unit up.
We can write this as $M(3, 1)$.

N is 1 unit across and 3 units up.
We can write this as $N(1, 3)$.



R is 3 units across and 4 units up.
We can write this as $R(3, 4)$.

S is 4 units across and 3 units up.
We can write this as $S(4, 3)$.

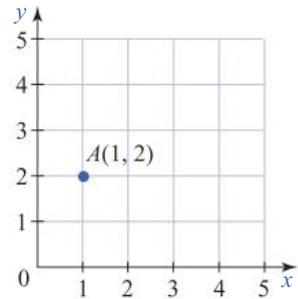


The ordered pair $(2, 5)$ is not the same as the ordered pair $(5, 2)$ because the order of the coordinates is different.

Remember, for coordinate pairs (x, y) , x comes before y , as in the alphabet.

Exercise 9B

- 1 Copy the set of axes shown onto grid paper.
On your set of axes mark the point $A(1, 2)$ as shown.
Now mark the following points on the same set of axes:
- | | | |
|-------------|-------------|-------------|
| a $B(4, 2)$ | b $C(4, 5)$ | c $D(2, 3)$ |
| d $E(4, 1)$ | e $F(5, 3)$ | f $G(5, 0)$ |
| g $H(0, 4)$ | h $I(3, 5)$ | |

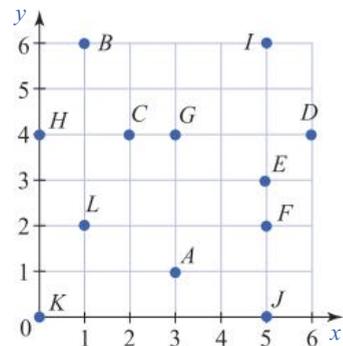


- 2 On a sheet of graph paper draw a set of axes, with the x -axis and y -axis each marked from 0 to 6. On your axes mark the following points:

- | | | | |
|-------------|-------------|-------------|-------------|
| a $B(3, 2)$ | b $C(1, 5)$ | c $D(2, 5)$ | d $E(4, 4)$ |
| e $F(5, 1)$ | f $G(6, 2)$ | g $H(3, 0)$ | h $I(0, 6)$ |

- 3 Which letter corresponds to each of the following points on the axes shown?

- | | | |
|------------|------------|------------|
| a $(2, 4)$ | b $(1, 6)$ | c $(0, 4)$ |
| d $(3, 1)$ | e $(5, 3)$ | f $(3, 4)$ |
| g $(6, 4)$ | h $(5, 2)$ | i $(0, 0)$ |
| j $(5, 6)$ | k $(1, 2)$ | l $(5, 0)$ |



- 4 On a sheet of graph paper draw a set of axes, with the x -axis and y -axis each marked from 0 to 6. On your axes mark the following points:

- | | | | |
|-------------|-------------|-------------|-------------|
| a $A(0, 4)$ | b $B(2, 4)$ | c $C(4, 4)$ | d $D(6, 4)$ |
| e $E(6, 0)$ | f $F(4, 0)$ | g $G(2, 0)$ | h $H(0, 0)$ |

Join the letters in alphabetical order (A to B to C etc. and then back to A). What shape do you see?

- 5 On a sheet of graph paper draw a set of axes, with the x -axis and y -axis each marked from 0 to 6. On your axes mark the following points:

- | | | | |
|-------------|-------------|-------------|-------------|
| a $A(0, 3)$ | b $B(1, 4)$ | c $C(3, 6)$ | d $D(3, 4)$ |
| e $E(6, 4)$ | f $F(6, 2)$ | g $G(3, 2)$ | h $H(3, 0)$ |

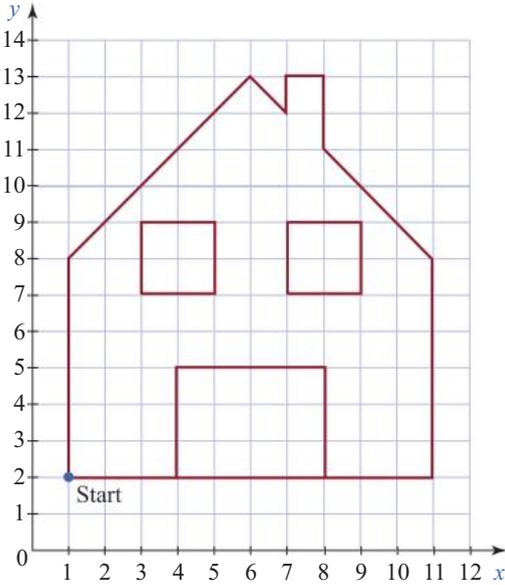
Join the letters in alphabetical order (A to B to C etc. and then back to A). What shape do you see?

- 6 On a sheet of graph paper draw a set of axes, with the x -axis and y -axis each marked from 0 to 6. On your axes mark the following points:

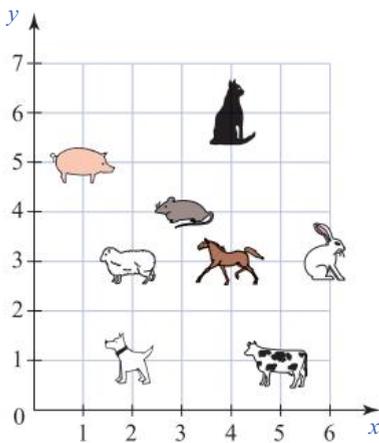
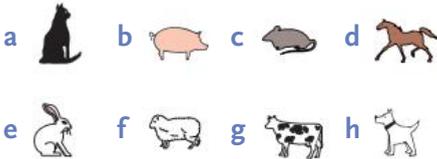
- | | | | |
|-------------|-------------|-------------|-------------|
| a $A(0, 3)$ | b $B(2, 4)$ | c $C(3, 6)$ | d $D(4, 4)$ |
| e $E(6, 3)$ | f $F(4, 2)$ | g $G(3, 0)$ | h $H(2, 2)$ |

Join the letters in alphabetical order (A to B to C etc. and then back to A). What shape do you see?

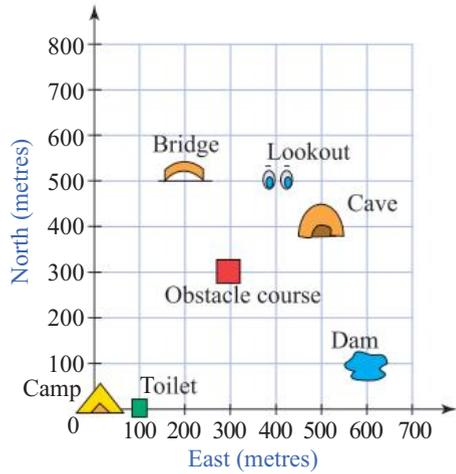
- 7 Write down the coordinates of the main parts of the picture and write instructions for a friend to follow.



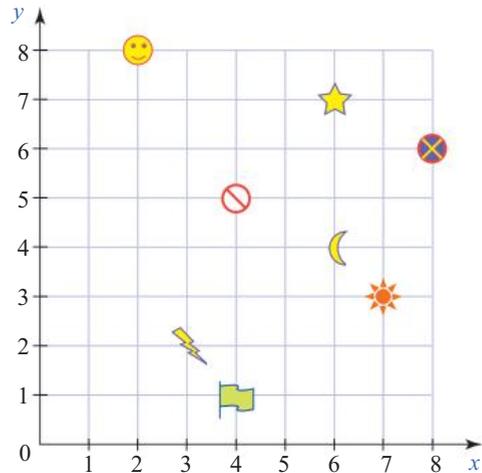
- 9 Write the coordinates of each of the following animals in the form (x, y) :



- 8 Write down the coordinates of the features of the campsite and write instructions for a friend to follow. Use the coordinates of the centre of each feature.



- 10 Write down the coordinates of the centre of pictures shown on the grid below:



- 11 a** Copy this grid in your workbook.
Use the coordinates to plot and label the following points onto the graph:

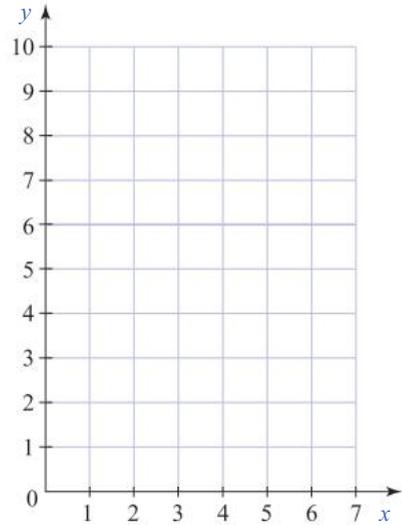
$$A(1, 7) \qquad B(5, 10)$$

$$C(2, 1) \qquad D(4, 5)$$

$$E(3, 2) \qquad F(5, 3)$$

$$G(1, 6) \qquad H(7, 2)$$

- b** Use a similar grid to plot these points.
Join the points to form a picture:
START (1, 2), (1, 8), (2, 8), (2, 6), (3, 6),
(3, 8), (4, 8), (4, 2), (3, 2), (3, 4), (2, 4),
(2, 2), (1, 2), STOP
START (5, 2), (5, 8), (6, 8), (6, 2), (5, 2), STOP



- 12 a** Copy this grid in your workbook.
Join these coordinates on the grid to draw a picture:

$$(1, 3), (2, 2), (3, 4), (4, 3), (3, 2),$$

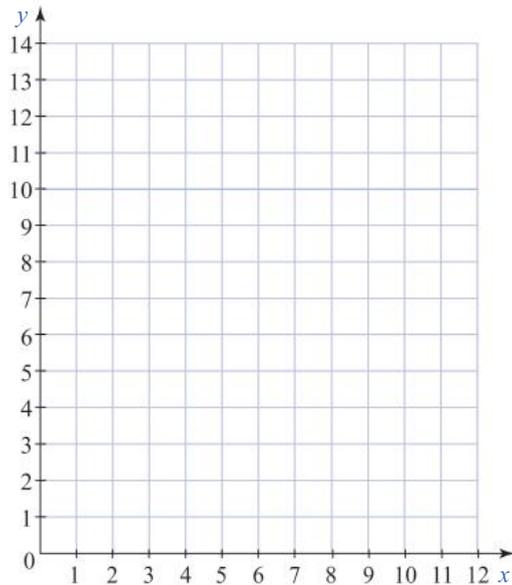
$$(7, 2), (8, 3), (4, 3), (8, 3), (10, 5),$$

$$(8, 5), (10, 5), (8, 8), (4, 8), (3, 9),$$

$$(7, 9), (8, 8), (4, 8), (3, 5), (2, 8),$$

$$(1, 6), (2, 5), (1, 5), (2, 4), (1, 3)$$

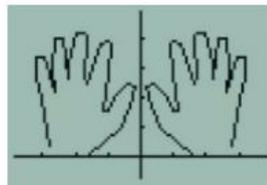
- b** Join these coordinates on a similar grid to draw a picture:
- $$(0, 6), (2, 6), (6, 6), (4, 1), (6, 2),$$
- $$(8, 6), (11, 6), (12, 5), (11, 7),$$
- $$(8, 8), (6, 10), (4, 10), (6, 8),$$
- $$(2, 8), (0, 10), (0, 6)$$



- 13** Draw a set of axes on graph paper and draw a picture using straight lines. Write down the coordinates for your picture, with instructions for another student to follow.
- 14** Draw a set of axes on graph paper and create your own geometric design using straight lines. Write down the coordinates for your picture, with instructions for another student to follow.

Reflecting your hand—The y -axis

- Suppose you wanted to draw a graph of your left hand. You could trace your hand and repeat all the measurements. A quicker solution is to imagine the y -axis as a mirror.
- The left hand could be drawn by making a reflection of the right hand in the y -axis.
- What would happen to your coordinates?
- Write down some of the coordinates for your right hand and explain how the coordinates for your left hand were obtained.
- Enter the new coordinates for your left hand into the calculator.



Note: This can be done by using a formula. Formulas can be entered at the top of a list.

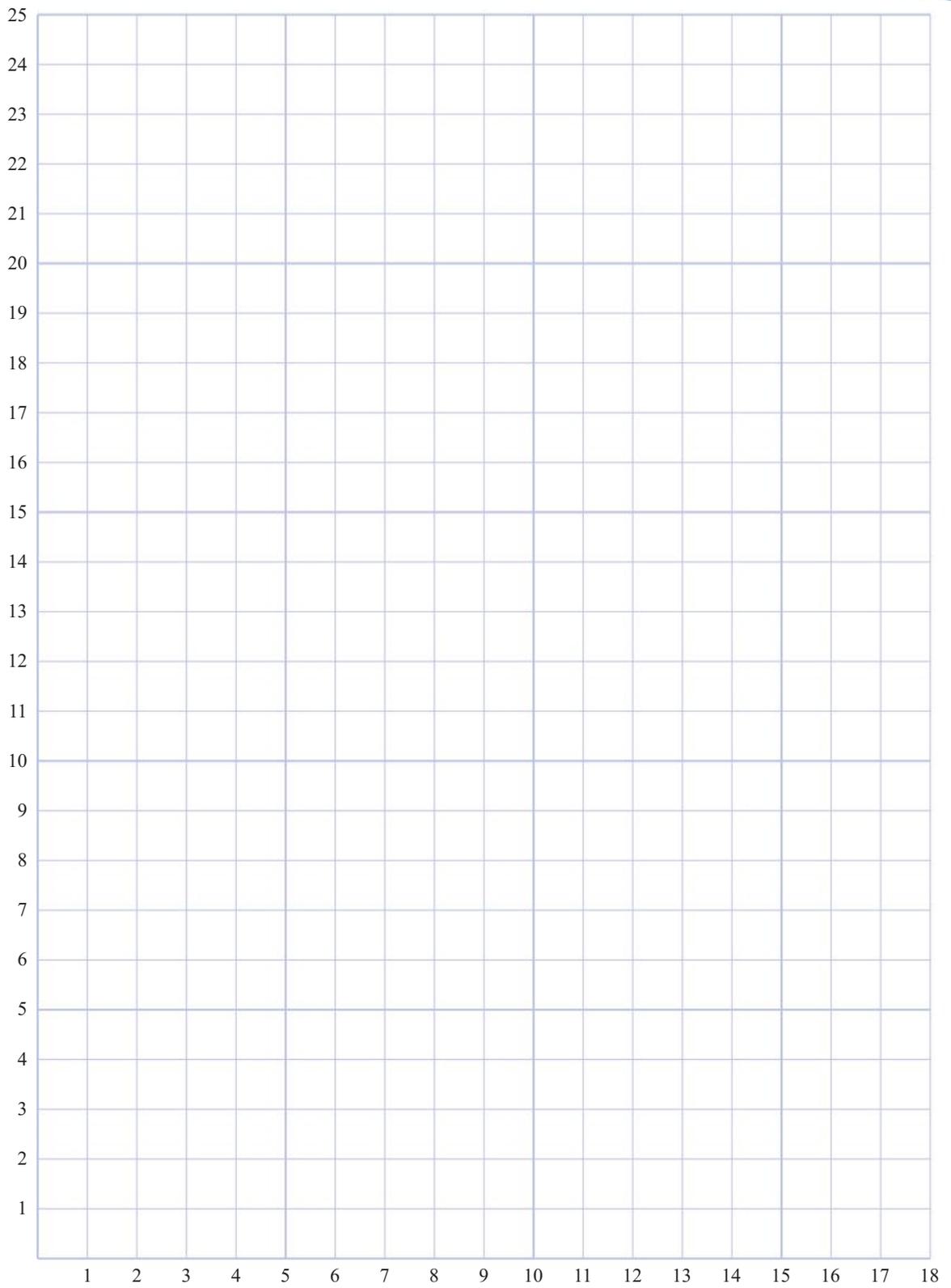
Reflecting your hand—The x -axis

- Suppose you wanted to draw an identical hand but upside down. Once again you could trace your hand and repeat all the measurements. A quicker solution is to imagine the x -axis as a mirror.
- What would happen to your coordinates if you wanted to reflect your hand in the x -axis?
- Write down some of your original right-hand coordinates and explain how the new coordinates were obtained.
- Enter the new coordinates for your right hand into the calculator using a formula.

Double reflections—The x - and y -axis

- By now you should already know how to create reflections by changing your coordinates. How could you change your coordinates if you wanted to reflect your hand in the x -axis then in the y -axis?
- Write down a selection of your coordinates and explain how the new coordinates were obtained.
- Draw a graph of your right hand after it has been reflected in the x -axis and the y -axis. Include the original image in your graph.



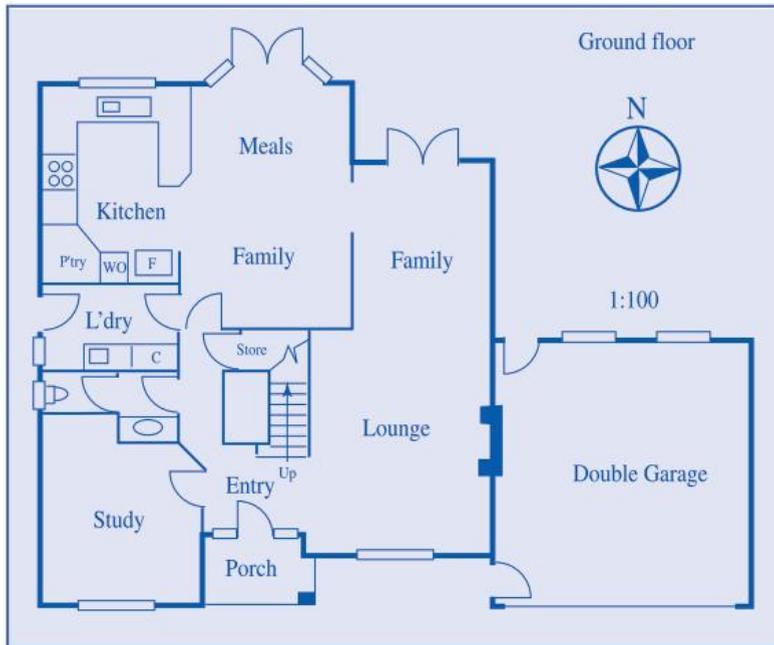


9D

Scale diagrams and maps

Maps are useful ways in which to record information about an area and to share that information with others. This can be useful when giving someone directions, or as a form of catalogue to observe the changes in marine life on a reef or wildlife in a park.

A house plan used by architects, builders and real estate agents in some countries is shown below.



Included on the plan is the direction of north. From this we are able to work out the compass directions of east, west and south. The map also includes a scale of 1 centimetre for approximately every 1 metre. This means that every centimetre on the map represents 1 metre in the actual house. (Note: This picture has been reduced to fit on this page.)

Example

If 1 cm represents 1 m, write the scale as a ratio.

Solution

1 cm represents 1 m
 1 cm represents 100 cm
 1:100

Exercise 9D

1 Write the following scales as ratios:

- | | |
|-------------------------|---------------------------|
| a 1 cm represents 5 m | b 2 cm represents 5 m |
| c 5 mm represents 1 m | d 2.5 cm represents 7.5 m |
| e 1 mm represents 1 m | f 1 cm represents 4000 km |
| g 2 cm represents 550 m | h 1 cm represents 1000 km |

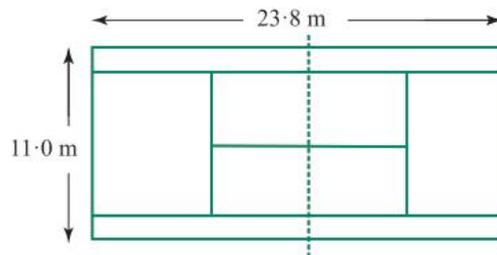
2 Find the distance represented by 1 centimetre on a map if the scale is written as:

- | | | | |
|---------|---------|------------|-------------|
| a 1:10 | b 1:50 | c 1:250 | d 1:100 |
| e 1:150 | f 1:500 | g 1:25 000 | h 1:100 000 |

- 3** A map is drawn with a scale showing that 1 cm represents 10 km. If the actual distance from Kaoka to Avu-Avu is 110 km, how far will it be on the map?
- 4** The map of Guadalcanal shown below has a scale of 1:500 000.
- a** Calculate the real distance represented by these distances on the map:
- i 1 mm ii 1 cm iii 8 cm iv 2.65 cm
- b** Calculate the distance represented on the map by these real distances:
- i 90 km ii 9 km iii 27 km iv 40.5 km
- c** Use the map to estimate the actual distance (as the kuru kuru flies) between the following pairs of villages:
- i Tulaghi and Kaoka ii Lambi and Avu Avu
iii Kologhona and Koimarama iv Lambi and Aola
- d** Use the scale on this map to estimate the perimeter of Guadalcanal Island.
- e** Estimate the area in square kilometres of Guadalcanal Island from the map shown here. (Hint: 1 sq km = $1000 \times 1000 = 1\,000\,000$ square metres)



- 5 a** Karen and Stephen want to lay concrete on their tennis court. Choose a suitable scale and make a scale drawing of their tennis court, given the information on their rough sketch.
- b** Find out the exact measurements of the singles and doubles court to complete the drawing.



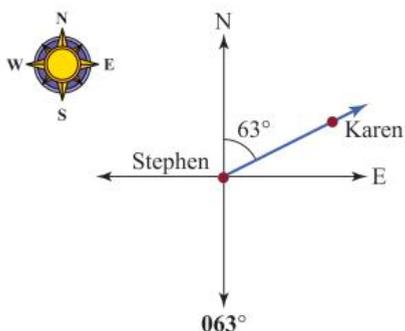
Bearings are used in navigation to identify the direction of one object from another object, usually the direction of an object from one's own ship or aircraft. While early Pacific Navigators used the stars, moon, sun and currents to navigate across the ocean, today's navigators on sea and land rely on bearings from maps to guide their way.

There are two possible ways of giving directions: true bearings and compass bearings.

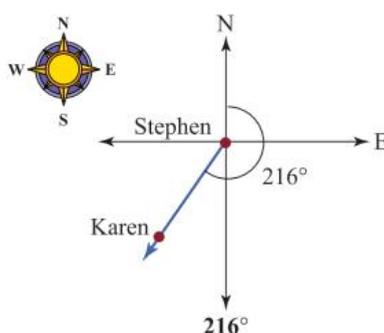
True bearings

True bearings are equivalent to the angle measured **clockwise from north**.

The bearing of Karen from Stephen can be described as 063° in the first diagram. This is the angle measured clockwise from north. Three digits are used to describe a bearing. For example 5° is written as 005° .



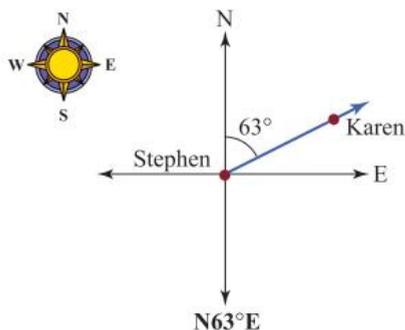
In the second diagram, the bearing of Karen from Stephen can be described as 216° , which is the size of the angle measured clockwise from north.



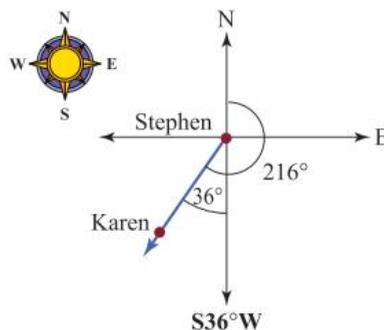
Compass bearings

Compass bearings always begin with north (N) or south (S), whichever is closest to the angle.

The bearing of Karen from Stephen can be described as $N63^\circ E$ in the first diagram.



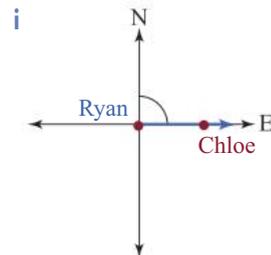
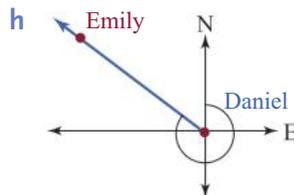
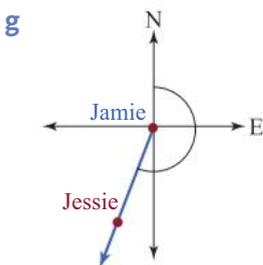
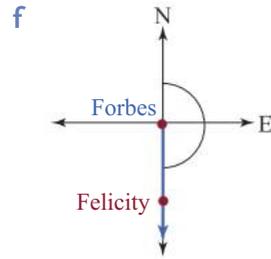
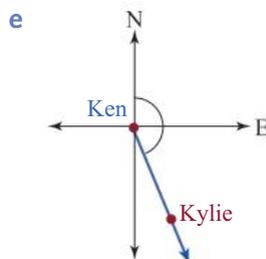
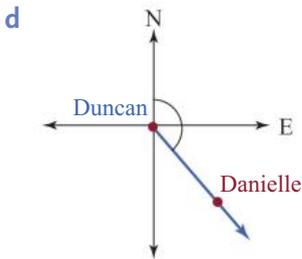
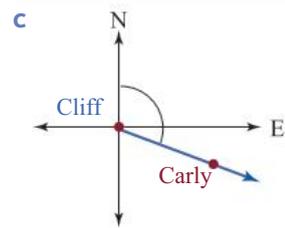
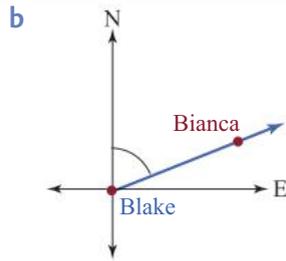
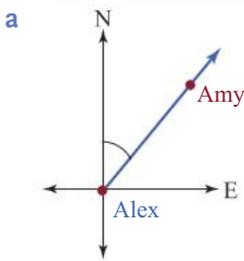
In the second diagram, the bearing of Karen from Stephen can be described as $S36^\circ W$. Notice that Karen is 36° towards the west from south. 216° is 36° more than 180° .

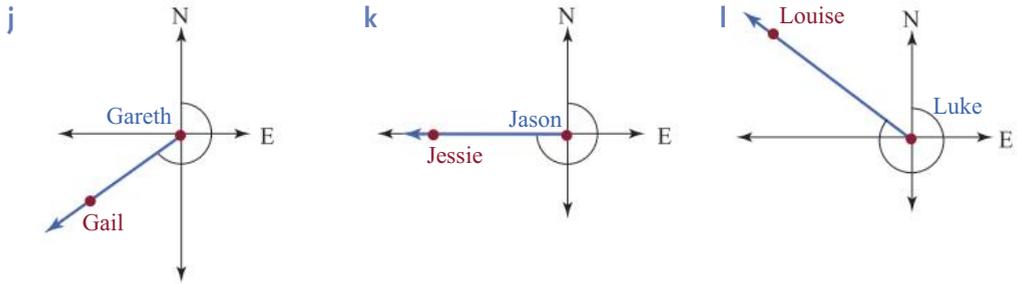


Exercise 9E

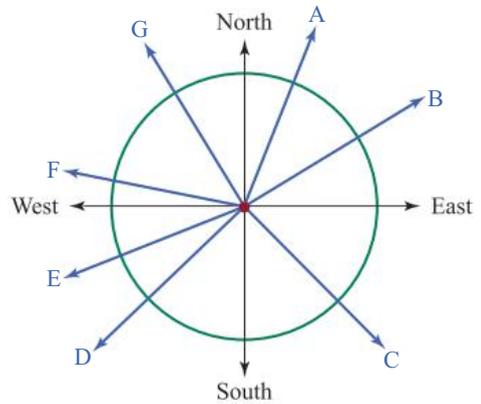
1 Copy the table into your workbook and complete it by measuring angles in the sketches below with your protractor to find the bearing from the boy to the girl.

	Angle, as shown, from the boy to the girl	True bearing	Compass bearing
a			
b			
c			
d			
e			
f			
g			
h			
i			
j			
k			
l			





2 Using your protractor to help you measure the angles clockwise from north, give the directions of each letter on the diagram, both as a true bearing and as a compass bearing.



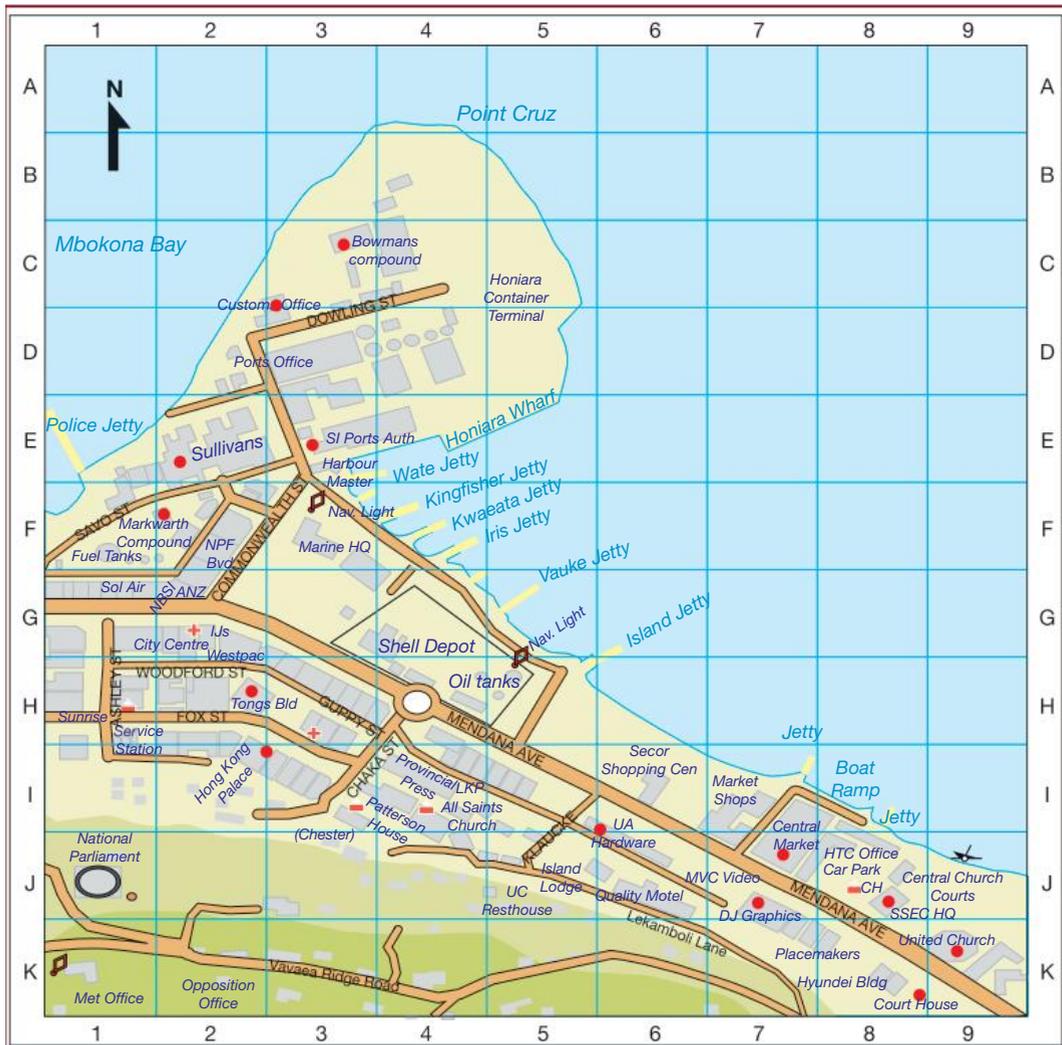
3 Use your protractor to draw diagrams to illustrate the following true bearings and compass bearings:

- | | | | |
|-----------------|-----------------|-----------------|---------------|
| a 025° | b $S15^\circ W$ | c $N35^\circ E$ | d 166° |
| e $S78^\circ E$ | f 235° | g $N85^\circ W$ | h 315° |

4 What are the true bearings of the points on the compass that are known as due north, due south, due west and due east?



5 The photograph above shows a part of the Point Cruz area in Honiara. A street directory map of the area is shown on the next page.



Assume the scale of this map is 1 : 10 000.

Use this map to answer the following questions:

- a Calculate the distance between:
 - i Tongs Building and DJ Graphics
 - ii SSEC Headquarters and Sullivans.
- b Find the real dimensions of:
 - i Custom Office in Dowling Street
 - ii Hong Kong Palace in Fox Street.
- c Find the bearing from the Central Market to:
 - i Markwarth Compound in Savo Street
 - ii Court House
 - iii All Saints Church.

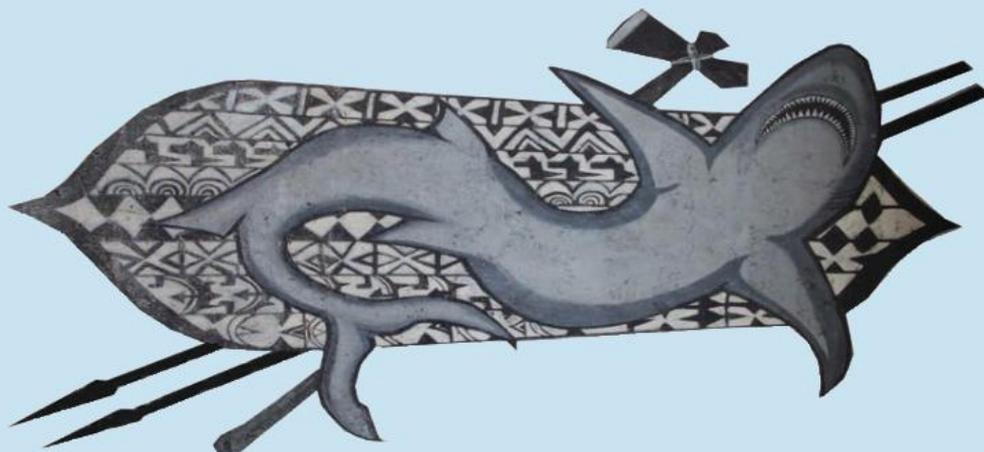
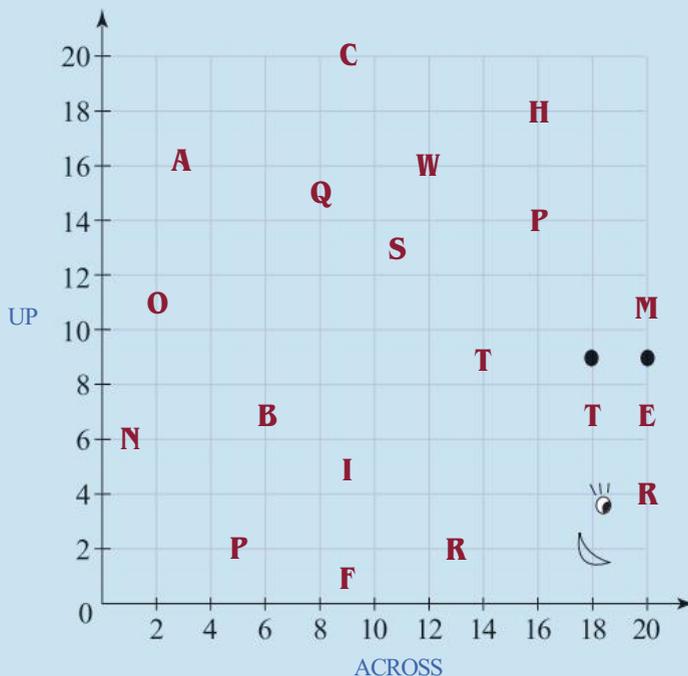


Puzzles

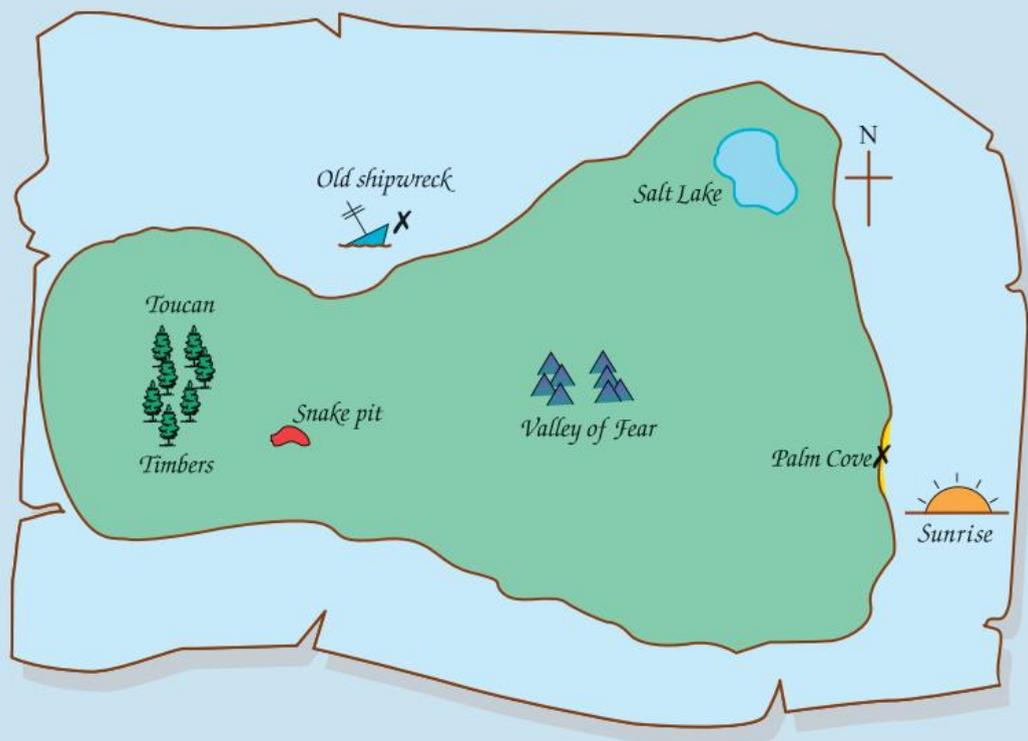
I Join the coordinates to form a picture. If you pass through any letters on the way, write them down in order below. You will find the answer to the riddle:

What do you get when you cross a vampire with a snowman?

(2, 3), (0, 3), (0, 1), (20, 1), (20, 5), (16, 5), (16, 3), (2, 3), (2, 13), (16, 13), (16, 3),
 (15, 3), (15, 12), (3, 12), (3, 3), (4, 3), (4, 11), (14, 11), (14, 3), (13, 3), (13, 10),
 (5, 10), (5, 3), (6, 3), (6, 9), (12, 9), (12, 3), (11, 3), (11, 8), (7, 8), (7, 3), (8, 3),
 (8, 7), (10, 7), (10, 3), (9, 3), (9, 6), (9, 3), (16, 3), (16, 5), (18, 5), (18, 9), (18, 5),
 (20, 5), (20, 9), (20, 5).



- 2 Follow Old Tom's instructions to the treasure.



Old Tom covers 100 cm in each pace.

Scale map: 1 cm = 100 m

- 1 Start at Palm Cove.
- 2 At daybreak walk 450 paces towards old shipwreck.
- 3 Turn and walk due south for 200 paces through the Valley of Fear.
- 4 At dusk walk approximately 700 paces towards the setting sun and camp for the night on the water's edge.
- 5 At daybreak walk 300 paces on bearing of 045°T and collect eggs for breakfast.
- 6 Walk 250 paces on a bearing $\text{S}20^{\circ}\text{E}$. Mind your step.
- 7 Walk due east and camp for the night at Palm Cove.
- 8 On a bearing of $\text{N}35^{\circ}\text{W}$ walk 400 paces keeping your feet dry and the bacon salty.
- 9 Turn and walk 650 paces on a bearing $\text{S}55^{\circ}\text{W}$ to where the treasure is buried.
- 10 Describe the location of the treasure.



Applications

Classroom plan

Draw a seating plan for your classroom. Clearly label each desk with the person who sits there. Using the bottom left-hand corner of your page as the starting point, describe the position of your desk (e.g. three desks across and two desks up). Repeat this exercise for the desks of two friends.

Where do you relax?

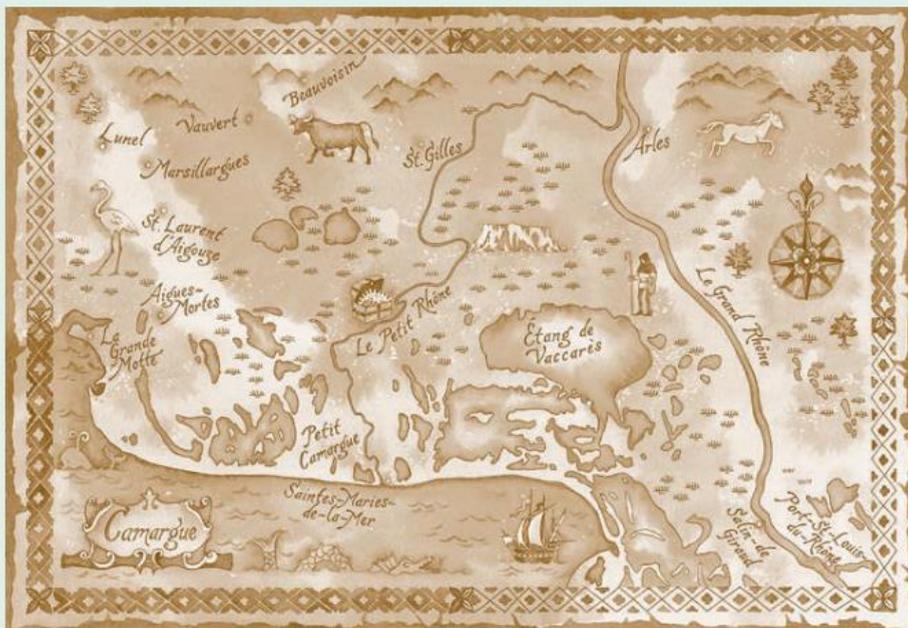
Draw a seating plan for your TV room at home. Clearly identify and label the seats for each member of your family. Your seating plan should include an accurate scale diagram.

Dream home

- Design a floor plan of your dream home. Your home must include a kitchen, bathroom and toilet, sleeping area, living area and a laundry. It could be one or two storeys, but you must show the floor plan for each storey. Include an appropriate scale.
- Draw an artistic impression of the front of your house.

Treasure map

Construct a maths trail in your school grounds. Record it on an A4 piece of paper. Your map must have a start, a compass point showing the direction of north, a scale, a legend, and at least five steps or clues giving both a distance and a compass bearing leading to the 'treasure'. Swap your trail with a friend and see if you can find each other's treasure.



Orienteering

On an orienteering camp, students were asked to use their compass, a map and a trundle wheel in order to navigate their way from place to place. The grid for the map the students were given is seen below.



The toilet block of the campsite is located at the origin $(0, 0)$.

The obstacle course is 200 m east and 300 m north of the campsite $(200, 300)$.

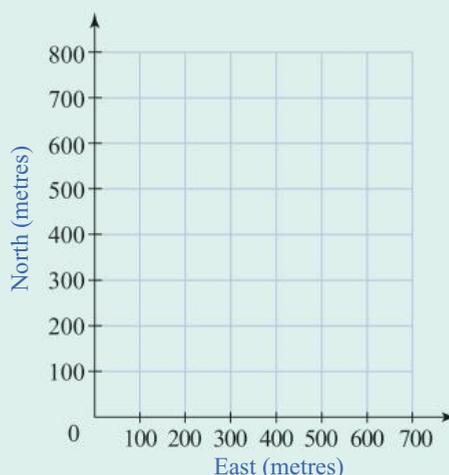
The cave is 700 m east and 400 m north of the campsite $(700, 400)$.

The lookout is 400 m east and 800 m north of the campsite $(400, 800)$.

The dam is 600 m east and 200 m north of the campsite $(600, 200)$.

The bridge is 100 m east and 500 m north of the campsite $(100, 500)$.

- Copy and complete the set of axes and mark all features on the map.
- Use the scale to calculate the distance of the toilet block from:
 - the bridge
 - the cave
 - the lookout
- Calculate the distance between the Dam and the bridge.



Schoolyard orienteering

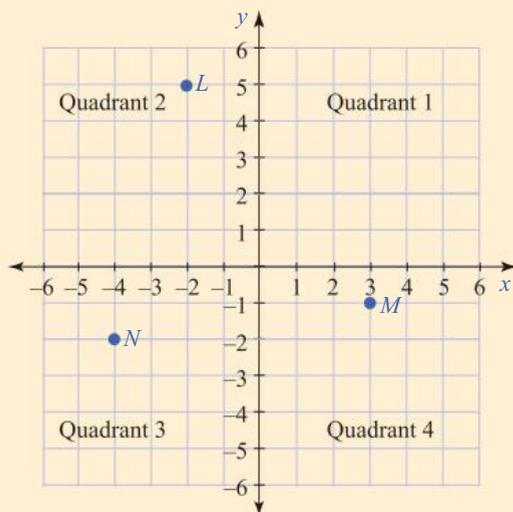
- Using a map of your school create your orienteering course. It must have a north point, a key and up to 10 stations.
- Swap maps with another student in your class and complete their course.
- You could even ask class mates to collect information as they complete your orienteering course.



Enrichment

Points on the Cartesian plane need not necessarily be confined to the first quadrant. They may comprise points from all four quadrants by using negative numbers.

Remember, the first coordinate means across and the second means up. The coordinates for $L(-2, 5)$ are the ordered pair of numbers that describe its position on the Cartesian plane. For the point L , -2 is the x -coordinate, meaning move 2 units in the negative direction of the x -axis, and 5 is the y -coordinate, meaning 5 units in the direction of the y -axis.



The coordinates for M and N are:

$$M(3, -1)$$

$$N(-4, -2)$$

- 1** On a sheet of graph paper draw a set of axes, with the x -axis and y -axis each marked in order from -6 to 6 .
 - a** On your axes mark the following points:

i $A(1, 2)$	ii $B(3, 4)$	iii $C(2, 3)$	iv $D(4, 5)$
v $E(0, 1)$	vi $F(2, 6)$	vii $G(4, 2)$	viii $H(6, 1)$
 - b** Join point A to B , then use your protractor to find the bearing of B from A .
 - c** Repeat part b for the points below:

i C to D	ii E to F	iii G to H
---------------------	----------------------	-----------------------
- 2** On a sheet of graph paper draw a set of axes, with the x -axis and y -axis each marked in order from -6 to 6 .
 - a** On your axes mark the following points:

i $A(2, 4)$	ii $B(-2, 5)$	iii $C(4, -4)$	iv $D(-6, 4)$
v $E(0, -1)$	vi $F(2, -3)$	vii $G(-4, 2)$	viii $H(-6, 1)$
 - b** Join point A to B then use your protractor to find the bearing of B from A .
 - c** Repeat part b for the points below:

i C to D	ii E to F	iii G to H
---------------------	----------------------	-----------------------

- 3 Draw a map of the world and mark on it the major capital cities. Place a grid over your map so that the origin $(0, 0)$ is located at Honiara. Identify and record in your workbook as many capital cities and their coordinates as you can.



- 4 Locate your house in the local street directory. Imagine that your house is situated at the origin $(0, 0)$. Give the coordinates of ten features in your neighbourhood, using all four quadrants. A good example would be a school, shops or your local park.
- 5 The following activity involves creating a Cartesian plane.
Each group of students will need:
- 2 pieces of string approximately 5 metres in length
 - a permanent marker
 - 50 pieces of card approximately 5 cm square.
- a Hand out a piece of card to each member of the group.
 - b Mark X, Y, $(0, 0)$ and two sets of the numbers 1 to 10 on the cards.
 - c Use the cards and string to lay out the first quadrant of a Cartesian plane on a large flat space such as a basketball court or asphalt playground. Place $(0, 0)$ at the origin, and label the axes from 1 to 10 with the remaining cards.
 - d Write a coordinate point on one of the remaining cards and take turns to stand at that point.
 - e Extend the axes to include all four quadrants, so the x -axis and the y -axis extend from -10 to 10.
 - f Write a new coordinate point from quadrants 2 to 4 and take turns to stand at that point.
 - g Prepare a group presentation of your Cartesian plane to the rest of the class.
 - h Give each student a card with a coordinate point from one of the four quadrants and ask them to place it in the correct position on the Cartesian plane.
 - i Evaluate your presentation based on how well the students carry out their tasks.

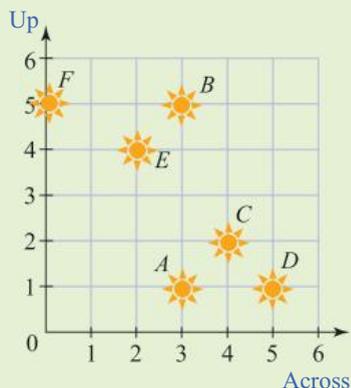


Revision/Assessment

Exercise 9A

1 In each of the following describe the position of the centre of the sun from the origin:

- | | | | | | |
|---|---|---|---|---|---|
| a | A | b | B | c | C |
| d | D | e | E | f | F |



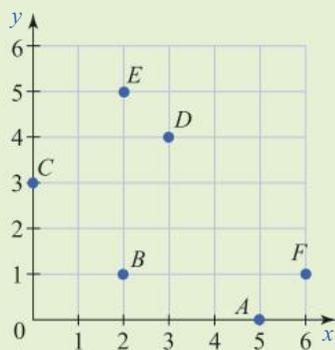
Exercise 9B

2 On a sheet of graph paper draw a set of axes with the x - and y -axes each marked from 0 to 6. On your axes mark the following points:

- | | | | | | | | |
|---|-----------|---|-----------|---|-----------|---|-----------|
| a | $B(3, 2)$ | b | $C(1, 5)$ | c | $D(2, 5)$ | d | $E(4, 4)$ |
| e | $F(5, 1)$ | f | $G(6, 2)$ | g | $H(3, 0)$ | h | $I(0, 6)$ |

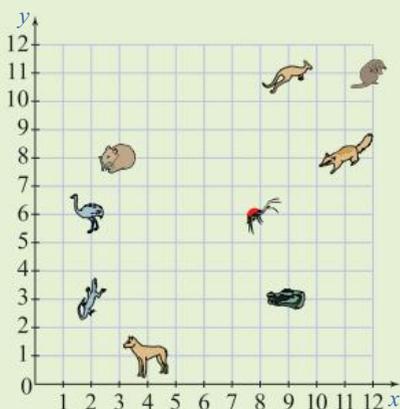
3 Give the coordinates of the points marked on the Cartesian plane:

- | | | | | | |
|---|---|---|---|---|---|
| a | A | b | B | c | C |
| d | D | e | E | f | F |



4 Determine the coordinates of the centre of each animal shown:

- a kangaroo
- b platypus
- c crocodile
- d goanna
- e numbat
- f dingo
- g redback spider
- h emu
- i wombat



Exercise 9D

5 Write these scales as ratios:

a 1 cm represents 5 m

b 1 cm represents 5 km

c 10 mm represents 2.5 m

d 0.5 cm represents 2 km

6 What would 1 cm on a map represent if the scale were:

a 1:1000?

b 1:500?

c 1:80?

d 1:10 000?

Exercise 9E

7 Using your protractor to help you, draw diagrams to illustrate the following true bearings or compass bearings:

a 075°

b 205°

c 345°

d 126°

e $S71^\circ E$

f $S35^\circ W$

g $N63^\circ W$

h $N39^\circ E$



CHAPTER

10

Fractions



Fractions

International Children's Day is celebrated annually in Solomon Islands. In the capital, Honiara, the day usually starts off with a parade of students from different schools in the capital. Not all students from all schools in the capital participate in these parades. A few of the students are chosen from each school around the capital to represent them in the parade. It is a time of fun and also an opportunity for students from different schools to share ideas and interact with each other. More importantly, it is a time to reflect on the issues that affect our children.

This chapter covers the following skills:

- Using the language of fractions
- Simplifying and finding equivalent fractions
- Converting improper fractions to mixed numbers and vice versa
- Adding and subtracting with like and unlike denominators
- Investigating multiplication of fractions
- Finding fractions of whole quantities
- Dividing fractions
- Finding squares and square roots of fractions
- Simplifying 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:

- 7.10.1.1** Define fraction: 'part of a whole' which is expressed as fraction with a top number divided by a bottom number.
- 7.10.1.2** Name parts of a fraction:
 - Numerator (top number) and denominator (bottom number)
- 7.10.2.1** Name and identify 3 different types of fractions:
 - Proper fraction, improper fraction and mixed number.
- 7.10.3.1** Find the fractions of shapes that have parts shaded.
- 7.10.4.1** Simplify fractions to find their simplest form.
- 7.10.5.1** Change mixed numbers to improper fractions.

7.10.6.1

Change improper fractions to mixed numbers by dividing the numerator by the denominator.

7.10.7.1

Find and calculate equivalent fractions.

7.10.8.1

Add and subtract fractions with the 'same' denominators.

7.10.8.2

Add and subtract mixed numbers with the same denominators.

7.10.9.1

Add and subtract fractions with 'different' denominators.

7.10.9.2

Add and subtract mixed numbers with different denominators.

7.10.10.1

Multiply fractions: *cancel common factors then evaluate top and bottom numbers.*

7.10.10.2

Divide fractions: *change + sign to × sign then reciprocate next fraction, then cancel and evaluate top and bottom numbers.*

7.10.11.1

Solve practical questions of fractions using division and multiplication.

7.10.12.1

Evaluate fractions that have the word 'of' in them.

7.10.13.1

Evaluate practical questions by taking fractions of quantities.

7.10.14.1

Square fractions: *square numerator then square denominator.*

7.10.14.2

Square mixed numbers by changing them to improper fractions.

7.10.15.1

Take the square root of fractions.

7.10.15.2

Take the square root of mixed numbers by changing them to improper fractions.

7.10.16.1

Evaluate and simplify fractions that involve a mixture of operations using the BODMAS Rule.

A fraction involves a part of a whole. The top number is called the **numerator** and tells you how many pieces you have of the whole. The bottom number is called the **denominator** and tells you into how many pieces the whole was divided.

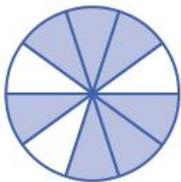
Example

1 What fraction of the diagram is shaded?

a



b



Solution

The number of parts in the diagram
= denominator

The number of parts shaded = numerator

$$\frac{\text{numerator}}{\text{denominator}} = \frac{3}{8}$$

$$\frac{\text{numerator}}{\text{denominator}} = \frac{7}{10}$$

A **proper fraction** has a numerator that is smaller than the denominator.

Examples: $\frac{2}{3}$, $\frac{3}{10}$, $\frac{19}{20}$

An **improper fraction** has a numerator that is larger than the denominator.

Examples: $\frac{10}{9}$, $\frac{5}{3}$, $\frac{58}{23}$

A **mixed number** has a whole number and a proper fraction part.

Examples: $2\frac{1}{2}$, $10\frac{4}{7}$, $100\frac{9}{20}$

A fraction can be simplified if the numerator and denominator can be divided exactly by the same number. All fractions should be given in their simplest form.

Example

2 Simplify these fractions:

a $\frac{8}{10}$

$$\begin{aligned} \frac{8}{10} &= \frac{8 \div 2}{10 \div 2} \\ &= \frac{4}{5} \end{aligned}$$

b $\frac{10}{25}$

$$\begin{aligned} \frac{10}{25} &= \frac{10 \div 5}{25 \div 5} \\ &= \frac{2}{5} \end{aligned}$$

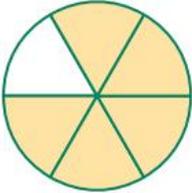
c $\frac{12}{36}$

$$\begin{aligned} \frac{12}{36} &= \frac{12 \div 12}{36 \div 12} \\ &= \frac{1}{3} \end{aligned}$$

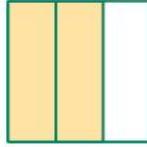
Exercise 10A

1 What fraction of each diagram is shaded?

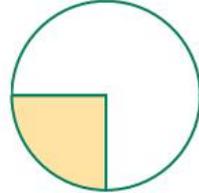
a



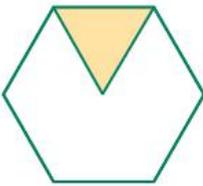
b



c



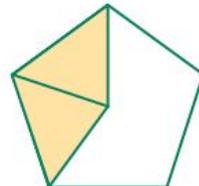
d



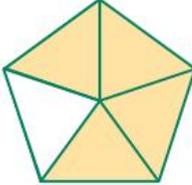
e



f



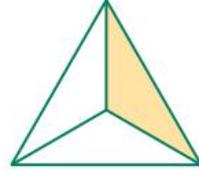
g



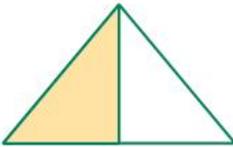
h



i



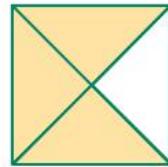
j



k



l



2 Label each of the following as proper (P), improper (I) or mixed number (M):

a $\frac{2}{3}$

b $2\frac{2}{5}$

c $\frac{7}{9}$

d $\frac{9}{5}$

e $1\frac{4}{5}$

f $\frac{1}{11}$

g $6\frac{1}{2}$

h $\frac{5}{2}$

i $\frac{3}{4}$

j $4\frac{1}{3}$

k $\frac{7}{3}$

l $\frac{25}{7}$

m $2\frac{1}{4}$

n $\frac{3}{5}$

o $\frac{15}{4}$

3 Simplify the following fractions:

a $\frac{6}{8}$

b $\frac{5}{20}$

c $\frac{8}{16}$

d $\frac{6}{9}$

e $\frac{10}{40}$

f $\frac{14}{21}$

g $\frac{35}{42}$

h $\frac{12}{30}$

i $\frac{13}{26}$

j $\frac{56}{64}$

k $\frac{12}{60}$

l $\frac{6}{18}$

m $\frac{99}{108}$

n $\frac{12}{40}$

o $\frac{35}{56}$

p $\frac{16}{28}$

q $\frac{56}{96}$

r $\frac{45}{72}$

s $\frac{33}{121}$

t $\frac{78}{169}$

u $\frac{8}{10}$

v $\frac{12}{14}$

w $\frac{21}{36}$

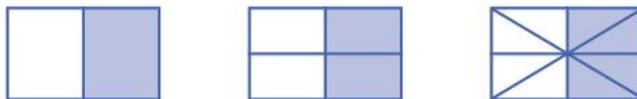
x $\frac{15}{25}$

y $\frac{96}{120}$

To change a mixed number to an improper fraction, multiply the whole number by the denominator and add the numerator. This answer becomes the new numerator. The denominator stays the same. (Remember BODMAS for the numerator—multiplication comes before the addition.)

To change improper fractions to mixed numbers, divide the denominator into the numerator. This answer becomes the whole number. Place the remainder in the numerator and the denominator remains the same.

Equivalent fractions can be determined by either simplifying or enlarging fractions. When these processes occur fractions have different denominators but they represent the same fraction in a different form. For example: $\frac{1}{2}, \frac{2}{4}, \frac{4}{8}$ are **Equivalent Fractions** with different denominators as shown in the diagram.



To find an equivalent fraction the numerator and denominator are both multiplied by the same number.

Example

- 1 Change the mixed numbers to improper fractions:

a $2\frac{4}{5}$

$$2\frac{4}{5} = \frac{2 \times 5 + 4}{5} \\ = \frac{14}{5}$$

b $3\frac{7}{9}$

$$3\frac{7}{9} = \frac{3 \times 9 + 7}{9} \\ = \frac{34}{9}$$

c $2\frac{1}{2}$

$$2\frac{1}{2} = \frac{2 \times 2 + 1}{2} \\ = \frac{5}{2}$$

Solution

Example

- 2 Change the improper fractions to mixed numbers:

a $\frac{34}{5}$

$$\frac{34}{5} = 6\frac{4}{5}$$

b $\frac{24}{7}$

$$\frac{24}{7} = 3\frac{3}{7}$$

Solution

Example

- 3 Find the equivalent fractions:

a $\frac{1}{3} = \frac{1}{6} = \frac{3}{21}$

$$\frac{1}{3} \times \frac{2}{2} = \frac{2}{6}$$

$$\frac{1}{3} \times \frac{3}{3} = \frac{3}{9}$$

$$\frac{1}{3} \times \frac{7}{7} = \frac{7}{21}$$

b $\frac{2}{5} = \frac{2}{25} = \frac{6}{15}$

$$\frac{2}{5} \times \frac{5}{5} = \frac{10}{25}$$

$$\frac{2}{5} \times \frac{3}{3} = \frac{6}{15}$$

Solution

To compare two or more fractions, change the fractions to equivalent fractions with the same denominator.

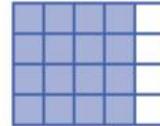
Example

4 Which is larger $\frac{3}{4}$ or $\frac{4}{5}$?

Solution

$$\frac{3}{4} \times \frac{5}{5} = \frac{15}{20}$$

$$\frac{4}{5} \times \frac{4}{4} = \frac{16}{20}$$



So $\frac{4}{5}$ is bigger than $\frac{3}{4}$.

Exercise 10B

1 Convert the following mixed numbers to improper fractions:

a $2\frac{1}{2}$

b $3\frac{2}{5}$

c $1\frac{1}{4}$

d $4\frac{1}{3}$

e $1\frac{3}{5}$

f $2\frac{5}{6}$

g $10\frac{1}{5}$

h $3\frac{4}{7}$

i $1\frac{5}{12}$

j $2\frac{7}{9}$

k $3\frac{1}{6}$

l $5\frac{3}{4}$

m $4\frac{3}{8}$

n $1\frac{11}{12}$

o $10\frac{4}{9}$

p $9\frac{3}{11}$

q $3\frac{2}{3}$

r $7\frac{4}{5}$

s $4\frac{3}{7}$

t $12\frac{5}{8}$

2 Change the following improper fractions to mixed numbers:

a $\frac{8}{3}$

b $\frac{7}{2}$

c $\frac{9}{5}$

d $\frac{29}{6}$

e $\frac{19}{8}$

f $\frac{9}{4}$

g $\frac{27}{8}$

h $\frac{16}{7}$

i $\frac{31}{7}$

j $\frac{21}{5}$

k $\frac{41}{9}$

l $\frac{22}{3}$

m $\frac{83}{10}$

n $\frac{85}{11}$

o $\frac{13}{6}$

p $\frac{19}{4}$

q $\frac{33}{8}$

r $\frac{46}{7}$

s $\frac{49}{5}$

t $\frac{77}{10}$

3 Fill in the gaps below:

a $\frac{1}{2} = \frac{\quad}{12} = \frac{4}{\quad}$

b $\frac{2}{3} = \frac{10}{\quad} = \frac{\quad}{21}$

c $\frac{3}{5} = \frac{\quad}{20} = \frac{18}{\quad}$

d $\frac{3}{4} = \frac{12}{\quad} = \frac{\quad}{28}$

e $\frac{5}{6} = \frac{\quad}{12} = \frac{25}{\quad}$

f $\frac{2}{7} = \frac{18}{\quad} = \frac{\quad}{77}$

g $\frac{4}{5} = \frac{\quad}{15} = \frac{36}{\quad}$

h $\frac{1}{4} = \frac{8}{\quad} = \frac{\quad}{20}$

i $\frac{4}{9} = \frac{\quad}{18} = \frac{20}{\quad}$

j $\frac{3}{10} = \frac{18}{\quad} = \frac{\quad}{110}$

k $\frac{1}{8} = \frac{2}{\quad} = \frac{\quad}{32}$

l $\frac{5}{9} = \frac{20}{\quad} = \frac{\quad}{63}$

4 Change each of the fractions in the following pairs to equivalent fractions and state which is larger:

a $\frac{5}{7}$ or $\frac{6}{7}$

b $\frac{10}{11}$ or $\frac{8}{11}$

c $\frac{2}{3}$ or $\frac{3}{5}$

d $\frac{5}{6}$ or $\frac{8}{11}$

e $\frac{4}{9}$ or $\frac{2}{5}$

f $\frac{2}{7}$ or $\frac{3}{10}$

Only fractions with the same denominator can be added. Always check the solution and simplify the fraction if required. Improper fractions need to be converted to mixed numbers.

Example

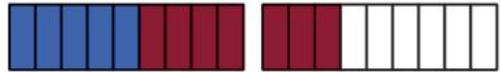
1 Add these fractions:

a $\frac{1}{7} + \frac{3}{7}$



$$\frac{1}{7} + \frac{3}{7} = \frac{4}{7}$$

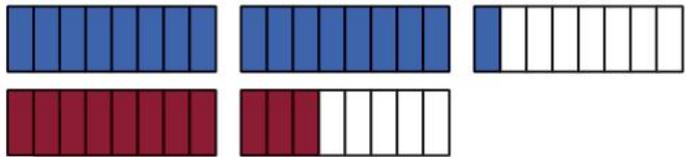
b $\frac{5}{9} + \frac{7}{9}$



$$\begin{aligned} \frac{5}{9} + \frac{7}{9} &= \frac{12}{9} \\ &= 1\frac{3}{9} \\ &= 1\frac{1}{3} \end{aligned}$$

When adding mixed numbers, add the whole number parts and add the fraction parts.

2 $2\frac{1}{8} + 1\frac{3}{8}$



$$\begin{aligned} 2\frac{1}{8} + 1\frac{3}{8} &= 3\frac{4}{8} \\ &= 3\frac{1}{2} \end{aligned}$$

Exercise 10C

1 Add these fractions (draw diagrams if necessary). Remember to fully simplify the answers:

a $\frac{1}{5} + \frac{2}{5}$

b $\frac{4}{7} + \frac{2}{7}$

c $\frac{6}{13} + \frac{5}{13}$

d $\frac{1}{9} + \frac{5}{9}$

e $\frac{4}{17} + \frac{9}{17}$

f $\frac{3}{10} + \frac{5}{10}$

g $\frac{9}{16} + \frac{3}{16}$

h $\frac{5}{14} + \frac{3}{14}$

i $\frac{5}{6} + \frac{5}{6}$

j $\frac{4}{5} + \frac{3}{5}$

k $\frac{3}{8} + \frac{5}{8}$

l $\frac{3}{10} + \frac{9}{10}$

m $\frac{17}{21} + \frac{11}{21}$

n $\frac{19}{24} + \frac{11}{24}$

o $\frac{20}{31} + \frac{5}{31}$

p $\frac{7}{12} + \frac{11}{12}$

q $\frac{6}{13} + \frac{7}{13}$

r $\frac{14}{15} + \frac{16}{15}$

s $\frac{14}{17} + \frac{20}{17}$

t $\frac{23}{25} + \frac{27}{25}$

2 Find the answers to the following additions:

a $\frac{2}{3} + \frac{1}{3} + \frac{2}{3}$

b $\frac{2}{9} + \frac{7}{9} + \frac{5}{9}$

c $\frac{1}{8} + \frac{5}{8} + \frac{3}{8}$

d $\frac{4}{17} + \frac{11}{17} + \frac{16}{17}$

e $\frac{9}{22} + \frac{11}{22} + \frac{19}{22}$

f $\frac{21}{40} + \frac{37}{40} + \frac{39}{40}$

3 Add these fractions:

a $1\frac{1}{5} + 3\frac{3}{5}$

b $4\frac{3}{8} + 2\frac{1}{8}$

c $6\frac{3}{7} + 3\frac{2}{7}$

d $5\frac{1}{10} + 2\frac{3}{10}$

e $1\frac{1}{6} + 4\frac{5}{6}$

f $4\frac{5}{11} + 3\frac{4}{11}$

g $2\frac{5}{12} + 1\frac{1}{12}$

h $2\frac{5}{14} + \frac{3}{14}$

i $5\frac{3}{4} + 6\frac{1}{4}$

j $4\frac{5}{9} + 2\frac{7}{9}$

k $3\frac{8}{15} + 2\frac{7}{15}$

l $1\frac{13}{20} + 2\frac{11}{20}$

m $8\frac{2}{3} + 6\frac{2}{3}$

n $5\frac{13}{18} + 4\frac{17}{18}$

o $1\frac{7}{13} + 3\frac{11}{13}$

p $2\frac{8}{11} + 3\frac{7}{11}$

4 Add these fractions:

a $2\frac{2}{7} + 3\frac{1}{7} + 1\frac{4}{7}$

b $5\frac{1}{5} + 2\frac{4}{5} + 1\frac{3}{5}$

c $6\frac{7}{8} + 5\frac{3}{8} + 1\frac{5}{8}$

d $14\frac{2}{15} + 3\frac{7}{15} + 2\frac{11}{15}$

e $4\frac{7}{20} + 5\frac{11}{20} + 8\frac{13}{20}$

f $13\frac{9}{11} + 11\frac{8}{11} + 5\frac{9}{11}$

5 A cassava pudding is cut into eighths. One child eats one piece while another eats three pieces.

a What fraction of the pudding is eaten by the first child?

b What fraction of the pudding is eaten by the second child?

c What fraction of the pudding has been eaten?

6 A shopkeeper has a new roll of fabric. During the day $1\frac{3}{4}$ metres and $4\frac{1}{4}$ metres of material are sold from the roll. How much material in total has been sold from the roll?

7 One week the Ramo family buys $3\frac{2}{5}$ kilograms of fish. The next week they buy $2\frac{4}{5}$ kilograms of fish. How many kilograms of fish has the Ramo family bought?

8 A hardware store sold $3\frac{1}{10}$ metres of shadecloth on Monday, $5\frac{7}{10}$ metres on Tuesday and $10\frac{9}{10}$ metres on Friday. How much shadecloth was sold during the week?

9 A pot of rice takes $\frac{3}{4}$ of an hour to cook. A pot of corn takes $\frac{7}{12}$ of an hour. What is the total length of cooking time for both pots?

10 Timo earns his pocket money. He spends $\frac{2}{7}$ of an hour cutting firewood, $\frac{5}{7}$ of an hour cleaning inside the house and $\frac{4}{7}$ of an hour cutting grass. How long does Timo spend working?

11 Mark bought a large pizza cut into 12 slices. He ate $\frac{1}{3}$, Sue ate $\frac{1}{6}$ and Dale ate $\frac{1}{12}$ of the pizza.

a How many slices did each person eat?

b How many slices were left?

12 Sandra bought 2 pizzas and cut each into 8 slices. Sandra ate $\frac{1}{4}$, Jemila Matangi ate $\frac{3}{8}$ and Julia ate $\frac{1}{8}$ of the slices.

a How many slices did each person eat?

b How many slices were left?

c What fraction of the pizzas remained?



Fractions with different denominators must be changed so that they have a common denominator before the numerators of the equivalent fractions can be added.

Example

1 Add these fractions:

a $\frac{1}{4} + \frac{2}{3}$

b $2\frac{4}{5} + 3\frac{5}{7}$

2 Add these fractions:

a $\frac{3}{4} + \frac{1}{5} + \frac{2}{3}$

b $1\frac{1}{4} + 5 + 6\frac{3}{4}$

Solution

The common denominator is 12.

$$\begin{aligned}\frac{1}{4} + \frac{2}{3} &= \frac{1}{4} \times \frac{3}{3} + \frac{2}{3} \times \frac{4}{4} \\ &= \frac{3}{12} + \frac{8}{12} \\ &= \frac{11}{12}\end{aligned}$$

The common denominator is 35.

$$\begin{aligned}2\frac{4}{5} + 3\frac{5}{7} &= 2 + 3 + \left(\frac{4}{5} \times \frac{7}{7} + \frac{5}{7} \times \frac{5}{5}\right) \\ &= 5 + \left(\frac{28}{35} + \frac{25}{35}\right) \\ &= 5\frac{53}{35} \\ &= 5 + 1\frac{18}{35} \\ &= 6\frac{18}{35}\end{aligned}$$

The common denominator is 60

$$\frac{3}{4} + \frac{1}{5} + \frac{2}{3} = \frac{45}{60} + \frac{12}{60} + \frac{40}{60} = \frac{97}{60} = 1\frac{37}{60}$$

Sometimes it is quicker to add the whole numbers and fractions separately

$$\begin{aligned}1\frac{1}{4} + 5 + 6\frac{3}{4} &= 1 + 5 + 6 + \left(\frac{1}{4} + \frac{3}{4}\right) \\ &= 12 + 1 \\ &= 13\end{aligned}$$

Exercise 10D

1 Add the following. Remember to find the common denominators first:

a $\frac{1}{4} + \frac{2}{5}$

b $\frac{1}{6} + \frac{4}{7}$

c $\frac{2}{3} + \frac{1}{5}$

d $\frac{2}{3} + \frac{7}{8}$

e $\frac{2}{5} + \frac{3}{10}$

f $\frac{3}{4} + \frac{1}{8}$

g $\frac{2}{9} + \frac{1}{6}$

h $\frac{3}{5} + \frac{2}{7}$

i $\frac{2}{3} + \frac{4}{15}$

j $\frac{9}{10} + \frac{19}{20}$

k $\frac{8}{15} + \frac{3}{5}$

l $\frac{5}{18} + \frac{7}{9}$

2 Add the following fractions:

a $2\frac{1}{2} + 4\frac{1}{5}$

b $2\frac{2}{5} + 4\frac{1}{7}$

c $1\frac{2}{7} + 3\frac{4}{9}$

d $8\frac{3}{8} + 4\frac{1}{9}$

e $2\frac{1}{4} + 3\frac{1}{2}$

f $4\frac{3}{7} + 2\frac{2}{9}$

g $5\frac{1}{6} + 4\frac{1}{2}$

h $1\frac{3}{5} + 2\frac{1}{8}$

i $16\frac{2}{3} + 4\frac{8}{9}$

j $14 + 10\frac{8}{25}$

k $9\frac{3}{10} + 6\frac{2}{5}$

l $2\frac{3}{4} + 4\frac{1}{2}$

3 Find the answers to the following. Remember to write your answers in the correct form:

a $\frac{1}{6} + \frac{11}{12}$

b $\frac{2}{5} + \frac{7}{10}$

c $\frac{6}{7} + \frac{3}{4}$

d $\frac{7}{9} + \frac{5}{6}$

e $\frac{3}{11} + \frac{7}{10}$

f $\frac{5}{8} + \frac{9}{11}$

g $\frac{12}{13} + \frac{1}{2}$

h $\frac{7}{8} + \frac{4}{5}$

i $9\frac{1}{2} + 3$

j $4\frac{5}{6} + 2\frac{2}{3}$

k $12\frac{7}{8} + 5$

l $1\frac{1}{2} + 2\frac{3}{4}$

m $4\frac{7}{10} + 3\frac{4}{5}$

n $6\frac{5}{8} + 1\frac{5}{6}$

o $4\frac{3}{4} + 4\frac{4}{7}$

p $7\frac{9}{10} + 3\frac{3}{8}$

q $3 + 4\frac{2}{5}$

r $5\frac{8}{15} + 2\frac{8}{9}$

s $2\frac{13}{20} + 3\frac{11}{25}$

t $6\frac{9}{10} + 4\frac{11}{15}$

u $\frac{7}{18} + \frac{11}{21}$

v $1\frac{5}{6} + 2\frac{1}{2} + 4\frac{2}{5}$

w $4\frac{11}{25} + 6\frac{7}{20}$

x $5\frac{7}{10} + 2\frac{11}{25}$

4 Calculate the following:

a $\frac{3}{4} + \frac{7}{8} + \frac{3}{5}$

b $\frac{2}{5} + \frac{5}{6} + \frac{3}{10}$

c $\frac{7}{10} + \frac{3}{4} + \frac{1}{6}$

d $\frac{11}{12} + \frac{3}{5} + \frac{5}{6}$

e $\frac{1}{7} + \frac{4}{5} + \frac{23}{35}$

f $\frac{1}{4} + \frac{5}{6} + \frac{11}{12}$

g $3\frac{1}{2} + 1\frac{5}{6} + 2\frac{3}{4}$

h $2\frac{3}{5} + 5\frac{7}{10} + 1\frac{7}{8}$

i $2\frac{10}{11} + 3\frac{3}{4} + 1\frac{1}{2}$

j $5\frac{2}{13} + 3\frac{1}{2} + 4\frac{3}{4}$

k $4\frac{5}{8} + 1\frac{9}{11} + 8\frac{1}{2}$

l $4\frac{7}{8} + 2\frac{4}{5} + 7\frac{2}{9}$

5 A caramel chocolate block is split into fifths, while a peppermint chocolate block is split into sevenths.

a What is the common denominator for $\frac{1}{5}$ and $\frac{1}{7}$?

b If Tony eats $\frac{1}{5}$ of caramel and $\frac{2}{7}$ of peppermint, what is the total amount of chocolate eaten by Tony?

c If Michelle eats $\frac{2}{5}$ of caramel and $\frac{3}{7}$ of peppermint, what is the total amount of chocolate eaten by Michelle?



- 6 Michael spends time each night doing homework.
- a On Monday night, he spent $\frac{3}{4}$ of an hour on English and $\frac{2}{5}$ of an hour on Agriculture. How much time is spent on homework on Monday night?
 - b Michael spends $\frac{2}{7}$ of an hour on Maths and $\frac{8}{9}$ of an hour on a Social Studies assignment. What is the total amount of time spent on homework on Tuesday night?
 - c On Wednesday night, Michael does Maths for $\frac{1}{4}$ of an hour and $\frac{3}{8}$ of an hour of Science. What total time is spent on homework?
 - d Thursday night requires Michael to spend $\frac{4}{5}$ of an hour on English and $\frac{2}{3}$ of an hour on Agriculture. What amount of time is spent on homework?
 - e On Friday, Michael spends $\frac{1}{3}$ of an hour on Maths, $\frac{2}{5}$ of an hour on Social Studies and $\frac{1}{2}$ of an hour on Science. What is the total time spent on homework on Friday?
- 7 Donald buys $12\frac{1}{2}$ metres of 25 mm pipe and $10\frac{2}{3}$ metres of 19 mm pipe to use in his garden. What is the total length of pipe purchased by Donald?
- 8 Mr Bebeu purchases $2\frac{2}{5}$ kilograms of oranges, 4 kilograms of potatoes and $1\frac{3}{4}$ kilograms of apples. What is the total weight in Mr Bebeu's carry bag?
- 9 Matthew ate $\frac{1}{4}$ of a cheese pizza and $\frac{2}{7}$ of a sausage pizza. What was the total fraction of pizza eaten by Matthew?
- 10 Saeni has three DVDs. One plays for $1\frac{3}{4}$ hours, the compilation DVD plays for $3\frac{2}{5}$ hours and the single plays for 15 minutes. What is the total length of time for the three DVDs to be played back to back? Give your answer in hours.
- 11 Erica works in a video shop at Ranadi. She has a collection of 14 movie DVDs. Eight play for $1\frac{1}{4}$ hours each, four play for 35 minutes each and two movie series DVDs play for 2 hours each. How many hours would it take to play all the DVDs back to back?



Subtracting with the same denominator

10E

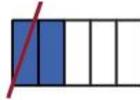
Only fractions with the same denominator can be subtracted. Always simplify the fraction if required. Improper fractions should first be converted to mixed numbers.

Example

Subtract these fractions:

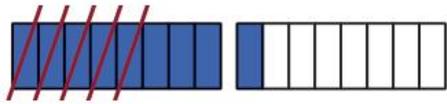
a $\frac{2}{5} - \frac{1}{5}$

$$\frac{2}{5} - \frac{1}{5} = \frac{1}{5}$$



b $\frac{9}{8} - \frac{5}{8}$

$$\begin{aligned} \frac{9}{8} - \frac{5}{8} &= \frac{4}{8} \\ &= \frac{1}{2} \end{aligned}$$



c $4\frac{5}{7} - 1\frac{1}{7}$

When subtracting mixed numbers, subtract the whole number parts and subtract the fraction parts.

$$\begin{aligned} 4\frac{5}{7} - 1\frac{1}{7} &= (4 - 1) + \left(\frac{5}{7} - \frac{1}{7}\right) \\ &= 3\frac{4}{7} \end{aligned}$$

d $4\frac{1}{8} - 1\frac{7}{8}$

If the first fraction is too small, take a whole number off and add it to the fraction part.

$$\begin{aligned} 4\frac{1}{8} - 1\frac{7}{8} &= 3\frac{9}{8} - 1\frac{7}{8} \\ &= 2\frac{2}{8} \\ &= 2\frac{1}{4} \end{aligned}$$

Exercise 10E

1 Find the answers to the following:

a $\frac{5}{8} - \frac{1}{8}$

b $\frac{7}{9} - \frac{1}{9}$

c $\frac{5}{11} - \frac{2}{11}$

d $\frac{11}{12} - \frac{5}{12}$

e $\frac{5}{13} - \frac{2}{13}$

f $\frac{30}{31} - \frac{15}{31}$

g $\frac{17}{19} - \frac{12}{19}$

h $\frac{97}{100} - \frac{37}{100}$

i $\frac{8}{7} - \frac{1}{7}$

j $\frac{12}{8} - \frac{3}{8}$

k $\frac{20}{13} - \frac{5}{13}$

l $\frac{16}{11} - \frac{10}{11}$

m $\frac{30}{25} - \frac{3}{25}$

n $\frac{42}{9} - \frac{21}{9}$

o $\frac{33}{10} - \frac{13}{10}$

p $\frac{18}{5} - \frac{6}{5}$

2 Find the answers to the following:

a $4\frac{7}{8} - 1\frac{3}{8}$

b $10\frac{9}{10} - 3\frac{3}{10}$

c $6\frac{10}{13} - 3\frac{4}{13}$

d $9\frac{8}{11} - 3\frac{4}{11}$

e $3\frac{1}{8} - 2$

f $14\frac{6}{15} - 8$

g $4 - \frac{3}{7}$

h $8 - \frac{5}{9}$

i $12 - 2\frac{3}{5}$

j $16 - 8\frac{7}{10}$

k $12\frac{10}{21} - 6\frac{4}{21}$

l $8\frac{19}{20} - 1\frac{7}{20}$

m $14\frac{16}{19} - 8\frac{11}{19}$

n $4\frac{2}{7} - 1\frac{5}{7}$

o $8\frac{1}{5} - 2\frac{4}{5}$

p $12\frac{3}{8} - 2\frac{7}{8}$

q $13\frac{2}{9} - 5\frac{7}{9}$

r $11\frac{5}{11} - 6\frac{8}{11}$

s $7\frac{5}{12} - 4\frac{11}{12}$

t $5\frac{1}{10} - 4\frac{7}{10}$

3 Find the answers to the following:

a $\frac{9}{11} - \frac{2}{11} - \frac{5}{11}$

b $\frac{10}{13} - \frac{7}{13} - \frac{2}{13}$

c $\frac{22}{25} - \frac{7}{25} - \frac{2}{25}$

d $\frac{42}{15} - \frac{21}{15} - \frac{8}{15}$

e $\frac{37}{24} - \frac{13}{24} - \frac{7}{24}$

f $\frac{31}{36} - \frac{17}{36} - \frac{11}{36}$

g $14 - 2\frac{4}{11} - 5\frac{10}{11}$

h $8 - 2\frac{1}{9} - 3\frac{7}{9}$

i $14\frac{11}{15} - 4\frac{1}{15} - 3\frac{7}{15}$

j $12\frac{5}{18} - 8\frac{11}{18} - 2\frac{17}{18}$

k $8\frac{11}{20} - 3\frac{7}{20} - 2\frac{13}{20}$

l $5\frac{11}{24} - 2\frac{1}{24} - 1\frac{17}{24}$

- 4 A cake is cut into eight pieces. Three pieces are eaten. What fraction of the cake is left?
- 5 Samani has $2\frac{3}{4}$ bags of lollies. If $1\frac{1}{4}$ bags are eaten, how many bags of lollies are left?
- 6 A roll of carpet contains $16\frac{7}{8}$ metres of carpet. If a family buys $10\frac{3}{8}$ metres of carpet for their lounge room, how much carpet will be left on the roll?
- 7 A shop owner orders a new tin of ice-cream when the tin is only $\frac{3}{10}$ full. If the tin is currently $\frac{8}{10}$ full, how much more ice-cream needs to be sold before a new tin is ordered?
- 8 A warehouse has $16\frac{7}{8}$ boxes of soft drink, $10\frac{3}{4}$ boxes of chips and 38 boxes of cups. A trade store purchases $3\frac{5}{8}$ boxes of soft drink, $2\frac{1}{4}$ boxes of chips and $10\frac{16}{25}$ boxes of cups.
- How many boxes of soft drink are left at the warehouse?
 - How many boxes of chips are left at the warehouse?
 - How many boxes of cups are left at the warehouse?



- 9 A taxi driver has $8\frac{4}{5}$ litres of fuel in his tank at the beginning of his day. If he uses $7\frac{1}{5}$ litres of fuel, how much fuel will remain in his tank?
- 10 Frank Honimae was employed as an accountant by the Public Service Commission of Solomon Islands. He had spent the last 6 years working in different parts of the country. He spent 37 months working in Buala, Isabel Province, 5 months in Taro, Choiseul Province, 23 months in Lata and the remaining months on holiday.
- Convert each time period to a fraction of a year.
 - What fraction of the time was spent on holiday?
 - What fraction of the 6 years was he working in Lata?

As for addition, fractions with different denominators must be changed to a common denominator before the numerators of the equivalent fractions are subtracted.

Example

Subtract these fractions:

a $\frac{7}{8} - \frac{2}{5}$

The common denominator is 40.

$$\begin{aligned}\frac{7}{8} - \frac{2}{5} &= \frac{7}{8} \times \frac{5}{5} - \frac{2}{5} \times \frac{8}{8} \\ &= \frac{35}{40} - \frac{16}{40} \\ &= \frac{19}{40}\end{aligned}$$

b $4\frac{1}{4} - 1\frac{5}{8}$

$$\begin{aligned}4\frac{1}{4} - 1\frac{5}{8} &= 4\frac{2}{8} - 1\frac{5}{8} \\ &= 3\frac{10}{8} - 1\frac{5}{8} \\ &= 2\frac{5}{8}\end{aligned}$$

c $8 - 6\frac{10}{17}$

$$\begin{aligned}8 - 6\frac{10}{17} &= 7\frac{17}{17} - 6\frac{10}{17} \\ &= 1\frac{7}{17}\end{aligned}$$

Exercise 10F

1 Find common denominators before subtracting:

a $\frac{2}{5} - \frac{3}{10}$

b $\frac{7}{10} - \frac{3}{5}$

c $\frac{11}{12} - \frac{1}{6}$

d $\frac{2}{3} - \frac{1}{5}$

e $\frac{2}{5} - \frac{1}{4}$

f $\frac{3}{4} - \frac{1}{6}$

g $\frac{3}{5} - \frac{1}{6}$

h $\frac{6}{7} - \frac{2}{3}$

i $\frac{2}{7} - \frac{1}{9}$

j $\frac{5}{6} - \frac{2}{5}$

k $\frac{9}{11} - \frac{2}{5}$

l $\frac{12}{13} - \frac{1}{2}$

2 Find the answers to the following:

a $3\frac{1}{2} - 1\frac{1}{4}$

b $6\frac{1}{2} - 2\frac{1}{5}$

c $10\frac{1}{2} - 4\frac{1}{6}$

d $6\frac{7}{8} - 1\frac{3}{4}$

e $9\frac{2}{5} - 4\frac{1}{7}$

f $3\frac{3}{5} - 1\frac{1}{4}$

g $6\frac{1}{2} - 4$

h $8 - 2\frac{7}{10}$

i $9 - \frac{14}{19}$

j $7\frac{1}{8} - \frac{3}{4}$

k $7\frac{3}{5} - 3\frac{9}{10}$

l $10\frac{7}{10} - 3\frac{4}{5}$

3 Find the answers to these:

a $\frac{7}{8} - \frac{2}{11}$

b $\frac{4}{7} - \frac{1}{8}$

c $\frac{2}{7} - \frac{2}{9}$

d $\frac{7}{9} - \frac{3}{4}$

e $\frac{5}{6} - \frac{3}{11}$

f $\frac{7}{10} - \frac{5}{8}$

g $\frac{9}{11} - \frac{1}{2}$

h $\frac{12}{13} - \frac{4}{5}$

i $9\frac{2}{5} - 3\frac{1}{6}$

j $3\frac{5}{7} - 1\frac{3}{8}$

k $3\frac{4}{9} - 1\frac{2}{7}$

l $2\frac{3}{5} - 1\frac{1}{8}$

m $6\frac{1}{2} - 4\frac{2}{5}$

n $7\frac{5}{8} - \frac{1}{3}$

o $18 - 3\frac{7}{10}$

p $8 - \frac{14}{17}$

q $10\frac{7}{10} - 3\frac{4}{5}$

r $10\frac{5}{8} - 2\frac{1}{9}$

s $4\frac{4}{7} - 2\frac{3}{4}$

t $7\frac{3}{8} - 3\frac{9}{10}$

u $4\frac{2}{5} - 1\frac{5}{6}$

v $2\frac{1}{4} - 1\frac{1}{3}$

w $3\frac{11}{25} - 1\frac{13}{20}$

x $10\frac{11}{15} - 6\frac{9}{10}$

4 Find the answer to the following:

a $\frac{11}{18} - \frac{1}{6} - \frac{1}{3}$

b $\frac{14}{15} - \frac{2}{5} - \frac{3}{8}$

c $\frac{19}{20} - \frac{1}{4} - \frac{2}{5}$

d $\frac{35}{36} - \frac{4}{9} - \frac{1}{4}$

e $\frac{21}{22} - \frac{5}{11} - \frac{1}{4}$

f $\frac{41}{48} - \frac{3}{4} - \frac{1}{12}$

g $10 - \frac{2}{5} - 4\frac{3}{4}$

h $19 - 4\frac{1}{2} - 6\frac{2}{7}$

i $12\frac{1}{4} - 2\frac{2}{5} - 5\frac{1}{6}$

j $14\frac{5}{6} - 4\frac{1}{8} - 2\frac{2}{3}$

k $8\frac{11}{12} - 5\frac{4}{7} - 1\frac{3}{4}$

l $9\frac{2}{5} - 3\frac{5}{6} - 1\frac{3}{8}$

- 5 The Harris family purchases $\frac{3}{4}$ hectare of land on which to build their house. If the house occupies $\frac{1}{12}$ hectare, how much land is left for garden?
- 6 A chocolate cake takes $\frac{2}{3}$ hour to bake. Fairy cakes take $\frac{1}{4}$ hour to bake. How much longer does the chocolate cake take to cook?
- 7 A roll of wire has $1082\frac{9}{10}$ metres left on it. If a fencing contractor uses $842\frac{1}{4}$ metres in a fence, how much wire will be left on the roll?
- 8 Ramon has $8\frac{2}{7}$ metres of material. He uses $5\frac{1}{2}$ metres to make a flag and $\frac{5}{14}$ metre for a banner. How much material is left?
- 9 Jess spent $\frac{1}{8}$ of her pocket money on stationery, and used $\frac{1}{5}$ of her pocket money to buy a book. She put the rest of her pocket money in the bank.
- a What fraction of her pocket money did Jess put in the bank?
- b If Jess had \$160 in pocket money, how much did she spend on each item?

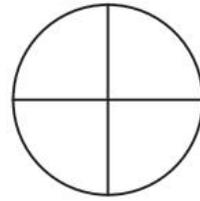


- 10 Miriam spent $\frac{5}{8}$ of her pocket money on shoes and $\frac{1}{4}$ of her pocket money on snacks from a supermarket.
- a What fraction of her pocket money did she spend in total?
- b What fraction of her pocket money did she have left?
- c If Miriam had \$200 in pocket money, how much did she spend on each item?



Learning task 10G

Kylie had to find the answer to $\frac{1}{2} \times \frac{1}{4}$.
She was having difficulty but managed this diagram.

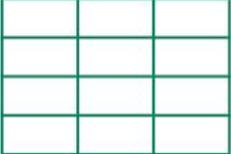
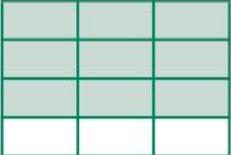
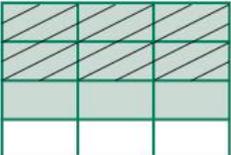


- 1 In your own words explain to Kylie what $\frac{1}{2} \times \frac{1}{4}$ means.
How would you complete the diagram?

Kylie was asked to describe a real life situation that would involve finding $\frac{1}{2} \times \frac{1}{4}$.

- 2 Demonstrate your understanding of $\frac{1}{2} \times \frac{1}{4}$ by writing about a real life example.
- 3 Is $\frac{1}{2} \times \frac{1}{4}$ (or half of a quarter) the same as $\frac{1}{4} \times \frac{1}{2}$ (or a quarter of a half)? Explain your answer using diagrams.

Kim drew the following diagrams to explain how to multiply $\frac{3}{4} \times \frac{2}{3}$.

$\frac{3}{4} \times \frac{2}{3}$	<p>a Draw a rectangle 4 units tall, because the denominator of $\frac{3}{4}$ is 4, and 3 units wide, because the denominator of $\frac{2}{3}$ is 3.</p>	<p>a </p>
	<p>b Colour in $\frac{3}{4}$ or 9 parts of the rectangle.</p> $\frac{3}{4} = \frac{9}{12}$	<p>b </p>
$= \frac{6}{12}$ $= \frac{1}{2}$	<p>c Shade in $\frac{2}{3}$ or 6 parts of the coloured area of the rectangle.</p> $\frac{2}{3} = \frac{6}{9}$ <p>d The amount that is coloured <i>and</i> shaded is the result when the two fractions are multiplied, and is smaller than both $\frac{3}{4}$ and $\frac{2}{3}$.</p>	<p>c </p>

- 4 Draw similar diagrams to find the answers to the following:

a $\frac{3}{4} \times \frac{6}{9}$

b $\frac{5}{6} \times \frac{2}{5}$

c $\frac{2}{3} \times \frac{3}{5}$

d $\frac{4}{5} \times \frac{1}{2}$

e $\frac{1}{4} \times \frac{5}{7}$

f $\frac{3}{10} \times \frac{3}{7}$

g $\frac{1}{5} \times \frac{2}{3}$

h $\frac{3}{4} \times \frac{1}{4}$

i $\frac{1}{3} \times \frac{3}{4}$

j $\frac{1}{2} \times \frac{2}{7}$

k $\frac{1}{3} \times \frac{2}{5}$

l $\frac{1}{2} \times \frac{2}{5}$

m $\frac{3}{4} \times \frac{3}{5}$

n $\frac{2}{3} \times \frac{1}{4}$

o $\frac{1}{6} \times \frac{2}{3}$

To multiply fractions, cancel common factors, multiply the numerators, then multiply the denominators.

Example

I Multiply these fractions:

a $\frac{3}{4} \times \frac{8}{9}$

$$\frac{\cancel{2}^1}{\cancel{4}_1} \times \frac{\cancel{8}^2}{\cancel{9}_3} = \frac{1}{1} \times \frac{2}{3}$$

$$= \frac{2}{3}$$

b $\frac{5}{6} \times \frac{11}{25}$

$$\frac{\cancel{5}^1}{6} \times \frac{11}{\cancel{25}_5} = \frac{1}{6} \times \frac{11}{5}$$

$$= \frac{11}{30}$$

c $4 \times \frac{3}{8} \times \frac{5}{6}$

$$4 \times \frac{3}{8} \times \frac{5}{6} = \frac{\cancel{4}^1}{1} \times \frac{\cancel{3}^1}{\cancel{8}_2} \times \frac{5}{\cancel{6}_2}$$

$$= \frac{5}{4}$$

$$= 1\frac{1}{4}$$

Solution

Exercise 10H

I a Copy and complete the table below.

Question	Answer
$\frac{1}{5} \times \frac{1}{2}$	
$\frac{1}{5} \times \frac{7}{10}$	
$\frac{3}{4} \times \frac{3}{7}$	
$\frac{5}{6} \times \frac{5}{7}$	

b Write a sentence or two to explain any patterns or strategies you can see between the question and the answer. Discuss your ideas with your group members or others in the class.

2 Find the answers to the following (remember to simplify your answer fully):

a $\frac{3}{4} \times \frac{8}{9}$

b $\frac{1}{3} \times \frac{9}{10}$

c $\frac{2}{5} \times \frac{10}{11}$

d $\frac{5}{8} \times \frac{3}{5}$

e $\frac{2}{7} \times \frac{1}{2}$

f $\frac{4}{5} \times \frac{10}{13}$

g $\frac{5}{6} \times \frac{7}{10}$

h $\frac{2}{3} \times \frac{4}{5}$

i $\frac{7}{12} \times \frac{4}{5}$

j $\frac{2}{9} \times \frac{6}{7}$

k $\frac{1}{2} \times \frac{4}{9} \times \frac{1}{6}$

l $\frac{2}{5} \times \frac{2}{3} \times \frac{1}{4}$

3 Calculate the answers to the following (remember to simplify your answer fully):

a $4 \times \frac{3}{8}$

b $6 \times \frac{1}{9}$

c $\frac{2}{3} \times 0$

d $\frac{8}{9} \times 1$

e $2\frac{1}{2} \times 4$

f $1\frac{1}{3} \times 9$

g $5 \times 1\frac{1}{4}$

h $3 \times 2\frac{2}{5}$

i $\frac{2}{3} \times 4\frac{1}{2}$

j $2\frac{1}{3} \times 2\frac{2}{7}$

k $1\frac{4}{5} \times \frac{2}{3}$

l $\frac{7}{9} \times 3\frac{2}{7}$

4 Evaluate the following:

a $2\frac{1}{6} \times 1\frac{1}{2} \times \frac{3}{4}$

b $4\frac{3}{4} \times 2\frac{2}{3} \times 2\frac{6}{7}$

c $2\frac{1}{4} \times 1\frac{3}{5} \times \frac{5}{6}$

d $1\frac{3}{4} \times 1\frac{7}{9} \times 3$

e $2\frac{4}{5} \times 3\frac{4}{7} \times 1\frac{13}{20}$

f $1\frac{1}{6} \times 2\frac{1}{4} \times 1\frac{11}{14}$

g $4\frac{1}{2} \times 1\frac{3}{5} \times \frac{1}{3}$

h $\frac{2}{5} \times 3\frac{1}{2} \times 1\frac{1}{4}$

i $6 \times \frac{3}{4} \times 2\frac{1}{3}$

j $\frac{5}{6} \times 10 \times 1\frac{4}{5}$

k $2\frac{2}{3} \times 4\frac{1}{2} \times 1\frac{4}{5}$

l $4\frac{1}{8} \times 5\frac{1}{3} \times 1\frac{1}{6}$

- 5** Kelvin wants to buy a jacket with a price tag of \$78. The shop has a sale with $\frac{1}{3}$ off the tag price. How much will Kelvin have to pay for the jacket?
- 6** Margaret takes $\frac{3}{4}$ of an hour to do her Maths project. It takes Carmel $2\frac{1}{4}$ times longer than Margaret to do the project. How long does it take Carmel?
- 7** A family in a car travels at 85 kilometres per hour. How far will they go in $2\frac{5}{6}$ hours?
- 8** Workers pay $\frac{8}{25}$ of their wages in tax:
- If a worker's wage is \$520, how much money is paid as tax?
 - How much money would the worker take home?
- 9** The ingredients needed to make fairy cakes are listed below:
- | | |
|-------------------------------|-------------------------------|
| $1\frac{1}{2}$ cups of flour | 1 teaspoon of vanilla essence |
| $\frac{1}{2}$ cup of jam | $\frac{1}{8}$ kg of butter |
| $\frac{2}{3}$ cup of sugar | 3 eggs |
| $\frac{3}{10}$ litre of cream | $\frac{1}{4}$ cup of milk |
- How much of each ingredient would be required to make a double mixture?
 - How much of each ingredient would be required to make half the mixture?



- 1 How many quarter pieces can be cut out of these 3 melons?



- 2 Does this mean the same as 'How many times does a quarter go into 3?'
- 3 Can this calculation be represented by writing $3 \div \frac{1}{4}$?
- 4 Is this the same as $\frac{3}{1} \times \frac{4}{1}$?

So dividing a number by $\frac{1}{4}$ is the same as multiplying the number by $\frac{4}{1}$, and $\frac{4}{1}$ is the reciprocal of $\frac{1}{4}$.

More examples are: The reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$. The reciprocal of $2\frac{3}{5}$ is $\frac{5}{13}$.

To divide a number by a fraction we multiply by its reciprocal.

Example

$$1\frac{7}{8} \div 2\frac{1}{2}$$

Solution

$$\begin{aligned} 1\frac{7}{8} \div 2\frac{1}{2} &= \frac{15}{8} \div \frac{5}{2} \\ &= \frac{15}{8} \times \frac{2}{5} \\ &= \frac{3}{4} \times \frac{1}{1} \\ &= \frac{3}{4} \end{aligned}$$

- 5 Copy and complete the following. Do all the working in your head.

a (i) There are _____ halves in one, so $1 \div \frac{1}{2} = \underline{\hspace{2cm}}$. (ii) $1 \times 2 = \underline{\hspace{2cm}}$

b (i) There are _____ halves in five, so $5 \div \frac{1}{2} = \underline{\hspace{2cm}}$. (ii) $5 \times 2 = \underline{\hspace{2cm}}$

c (i) There are _____ fifths in two, so $2 \div \frac{1}{5} = \underline{\hspace{2cm}}$. (ii) $2 \times 5 = \underline{\hspace{2cm}}$

- 6 Find the reciprocals of these fractions:

a $\frac{1}{7}$

b $\frac{3}{8}$

c $\frac{7}{16}$

d $\frac{10}{7}$

e 9

f 36

g $3\frac{1}{2}$

h $10\frac{3}{4}$

- 7 Calculate:

a $6 \div \frac{1}{2}$

b $10 \div \frac{1}{3}$

c $1 \div \frac{3}{4}$

d $10 \div 2\frac{1}{2}$

e $\frac{3}{4} \div \frac{1}{8}$

f $\frac{2}{5} \div \frac{8}{15}$

g $\frac{3}{14} \div \frac{3}{7}$

h $\frac{4}{9} \div \frac{5}{6}$

i $2\frac{1}{2} \div \frac{1}{2}$

j $2\frac{1}{4} \div \frac{3}{4}$

k $10\frac{1}{2} \div 1\frac{1}{2}$

l $3\frac{2}{5} \div 5\frac{1}{3}$

Change all mixed numbers to improper fractions first. Now change the division sign to a multiplication sign and tip the fraction after the sign upside down. Proceed as for multiplication. Cancel down whenever possible and change any answers that are improper fractions back to mixed numbers.

Example

Divide these fractions:

a $\frac{3}{4} \div \frac{1}{2}$

$$\begin{aligned} \frac{3}{4} \div \frac{1}{2} &= \frac{3}{4} \times \frac{2}{1} \\ &= \frac{3}{2} \times \frac{1}{1} \\ &= \frac{3}{2} \\ &= 1\frac{1}{2} \end{aligned}$$

b $1\frac{2}{3} \div \frac{5}{6}$

$$\begin{aligned} 1\frac{2}{3} \div \frac{5}{6} &= \frac{5}{3} \div \frac{5}{6} \\ &= \frac{5}{3} \times \frac{6}{5} \\ &= \frac{1}{1} \times \frac{2}{1} \\ &= \frac{2}{1} \\ &= 2 \end{aligned}$$

c $1\frac{7}{8} \div 2\frac{1}{2}$

$$\begin{aligned} 1\frac{7}{8} \div 2\frac{1}{2} &= \frac{15}{8} \div \frac{5}{2} \\ &= \frac{15}{8} \times \frac{2}{5} \\ &= \frac{3}{4} \end{aligned}$$

Solution

Exercise 10J

1 Find the answers to the following:

a $\frac{3}{4} \div \frac{1}{8}$

b $\frac{2}{5} \div \frac{8}{15}$

c $\frac{1}{2} \div \frac{6}{11}$

d $\frac{1}{8} \div \frac{4}{7}$

e $\frac{1}{3} \div \frac{4}{9}$

f $\frac{6}{7} \div \frac{7}{9}$

g $\frac{3}{14} \div \frac{3}{7}$

h $\frac{2}{15} \div \frac{10}{21}$

i $\frac{4}{9} \div \frac{5}{6}$

j $\frac{3}{10} \div \frac{11}{12}$

k $\frac{4}{7} \div \frac{9}{14}$

l $\frac{7}{12} \div \frac{5}{6}$

2 Calculate:

a $\frac{2}{5} \div \frac{4}{15}$

b $\frac{8}{21} \div \frac{2}{7}$

c $\frac{3}{4} \div \frac{9}{16}$

d $\frac{1}{8} \div \frac{4}{7}$

e $1\frac{1}{4} \div \frac{5}{6}$

f $\frac{9}{14} \div 1\frac{1}{17}$

g $\frac{12}{21} \div 1\frac{2}{7}$

h $2\frac{4}{11} \div \frac{1}{22}$

i $\frac{5}{12} \div 1\frac{1}{4}$

j $2\frac{1}{4} \div \frac{3}{4}$

k $\frac{4}{7} \div \frac{9}{14}$

l $4\frac{1}{2} \div \frac{5}{6}$

3 Evaluate the following:

a $2\frac{1}{2} \div 4\frac{1}{6}$

b $1\frac{5}{7} \div 1\frac{1}{3}$

c $1\frac{1}{9} \div 1\frac{2}{3}$

d $1\frac{1}{4} \div 3\frac{1}{2}$

e $6\frac{1}{8} \div 2\frac{4}{5}$

f $1\frac{5}{7} \div 1\frac{1}{2}$

g $2\frac{4}{7} \div 2\frac{1}{4}$

h $2\frac{2}{5} \div 2\frac{1}{2}$

i $3\frac{3}{4} \div 4\frac{1}{11}$

j $4\frac{1}{3} \div 2\frac{4}{11}$

k $6\frac{3}{4} \div 1\frac{5}{28}$

l $1\frac{8}{9} \div 1\frac{31}{54}$

4 Evaluate the following:

a $2 \div \frac{1}{8}$

b $8 \div \frac{8}{5}$

c $12 \div \frac{6}{11}$

d $8 \div \frac{4}{7}$

e $16 \div \frac{4}{9}$

f $21 \div \frac{7}{9}$

g $9 \div \frac{3}{7}$

h $4 \div \frac{1}{3}$

i $14 \div \frac{7}{6}$

j $7 \div \frac{21}{12}$

k $27 \div \frac{9}{8}$

l $26 \div \frac{13}{6}$

m $\frac{2}{5} \div 4$

n $8 \div \frac{2}{7}$

o $\frac{3}{4} \div 6$

p $8 \div \frac{4}{5}$

q $1\frac{1}{4} \div 6$

r $9 \div 1\frac{1}{17}$

s $20 \div 1\frac{2}{7}$

t $2\frac{4}{11} \div 2$

5 Copy and complete the following. Do all the working in your head.

a (i) There are ____ halves in one, so $1 \div \frac{1}{2} = \underline{\hspace{2cm}}$. (ii) $1 \times 2 = \underline{\hspace{2cm}}$

b (i) There are ____ halves in five, so $5 \div \frac{1}{2} = \underline{\hspace{2cm}}$. (ii) $5 \times 2 = \underline{\hspace{2cm}}$

c (i) There are ____ thirds in one, so $1 \div \frac{1}{3} = \underline{\hspace{2cm}}$. (ii) $1 \times 3 = \underline{\hspace{2cm}}$

d (i) There are ____ fifths in two, so $2 \div \frac{1}{5} = \underline{\hspace{2cm}}$. (ii) $2 \times 5 = \underline{\hspace{2cm}}$

6 Find the reciprocals of these fractions:

a $\frac{1}{7}$

b $\frac{3}{8}$

c $\frac{7}{16}$

d $\frac{10}{7}$

e 9

f 36

g $3\frac{1}{2}$

h $10\frac{3}{4}$

7 Calculate:

a $6 \div \frac{1}{2}$

b $10 \div \frac{1}{3}$

c $1 \div \frac{3}{4}$

d $10 \div 2\frac{1}{2}$

e $\frac{3}{4} \div \frac{1}{8}$

f $\frac{2}{5} \div \frac{8}{15}$

g $\frac{3}{14} \div \frac{3}{7}$

h $\frac{4}{9} \div \frac{5}{6}$

i $2\frac{1}{2} \div \frac{1}{2}$

j $2\frac{1}{4} \div \frac{3}{4}$

k $10\frac{1}{2} \div 1\frac{1}{2}$

l $3\frac{2}{5} \div 5\frac{1}{3}$

8 A plantation worker packs cocoa beans into $1\frac{1}{5}$ -kilogram bags. If a bucket contains $10\frac{3}{4}$ kilograms of cocoa beans, how many small cocoa bags can be packed from a bucket?

9 A developer buys $16\frac{2}{5}$ hectares of land, which is to be subdivided into $\frac{2}{5}$ -hectare house blocks. How many blocks will there be?

- 10** The copra warehouse at Yandina holds $\frac{5}{6}$ tonne of copra. The copra mill factory uses $\frac{1}{12}$ of this to convert to oil and the remainder is sold. What weight of copra, in tonnes, is used to convert to oil?
- 11** The West family has two water tanks with $40\frac{5}{8}$ kilolitres of water in each tank.
- How many kilolitres of water do they have in total?
 - If they use $2\frac{2}{3}$ kilolitres of water per week, how long will it take to empty the tanks if it does not rain?
 - If there are four people in the West household, how much water does each person use per week, on average?



The word 'of' can be replaced with the multiplication operation.

Example

1 Find $\frac{1}{4}$ of 12.

$$\begin{aligned}\frac{1}{4} \text{ of } 12 &= \frac{1}{4} \times \frac{12}{1} \\ &= \frac{12}{4} \\ &= 3\end{aligned}$$

2 Find $\frac{3}{5}$ of 20.

$$\begin{aligned}\frac{3}{5} \text{ of } 20 &= \frac{3}{5} \times \frac{20}{1} \\ &= \frac{3}{1} \times \frac{4}{1} \\ &= 12\end{aligned}$$

3 Find $\frac{1}{2}$ of $4\frac{2}{5}$.

$$\begin{aligned}\frac{1}{2} \text{ of } 4\frac{2}{5} &= \frac{1}{2} \times \frac{22}{5} \\ &= \frac{1}{1} \times \frac{11}{5} \\ &= \frac{11}{5} \\ &= 2\frac{1}{5}\end{aligned}$$

Solution

Exercise 10K

1 Find:

a $\frac{1}{4}$ of 16

b $\frac{1}{6}$ of 18

c $\frac{1}{9}$ of 18

d $\frac{2}{5}$ of 15

e $\frac{3}{4}$ of 12

f $\frac{2}{5}$ of 20

g $\frac{5}{6}$ of 30

h $\frac{3}{10}$ of 20

i $\frac{2}{5}$ of 5

j $\frac{1}{2}$ of 8

k $\frac{3}{5}$ of 40

l $\frac{3}{8}$ of 64

m $\frac{2}{3}$ of 45

n $\frac{4}{5}$ of 35

o $\frac{3}{7}$ of 42

p $\frac{5}{8}$ of 64

q $\frac{4}{9}$ of 108

r $\frac{7}{8}$ of 96

s $\frac{1}{3}$ of 60

t $\frac{11}{12}$ of 132

2 Evaluate the following:

a $\frac{2}{3}$ of \$60

b $\frac{4}{5}$ of \$400

c $\frac{2}{9}$ of \$360

d $\frac{1}{4}$ of \$1000

e $\frac{1}{2}$ of 500 metres

f $\frac{2}{5}$ of 200 metres

g $\frac{5}{6}$ of 300 kilometres

h $\frac{2}{7}$ of 14 centimetres

i $\frac{1}{3}$ of 60 minutes

j $\frac{3}{4}$ of 15 minutes

k $\frac{3}{8}$ of 40 seconds

l $\frac{1}{3}$ of 24 hours

m $\frac{7}{8}$ of 200 metres

n $\frac{5}{6}$ of \$1200

o $\frac{7}{12}$ of \$14 052

p $\frac{7}{10}$ of 4000 lollies

q $\frac{2}{5}$ of 4800 sheep

r $\frac{7}{9}$ of 364 950 ML

- 3 If Ali slept for $\frac{1}{4}$ of the day, for how many hours did he sleep?
- 4 Bronwyn took $\frac{2}{3}$ of her box of chocolates to school to share with friends. If the box contained 21 chocolates when full, how many did Bronwyn take to school?
- 5 Brandon caught 24 bonito fish but he had to throw $\frac{5}{8}$ back because they were undersized. How many fish did Brandon take home?



- 6 Travis earns \$87 from his newspaper round.
- He decides to save $\frac{1}{2}$ of his money. How much will he save?
 - He uses $\frac{1}{3}$ of his money to buy a DVD. What is the price of the DVD?
 - The last $\frac{1}{6}$ of his money he puts in his wallet. How much is that?
- 7 Lime is spread on a farm at $\frac{1}{2}$ a tonne per hectare.
- If the Nimeles have 16 hectares, how much lime do they need?
 - The Butafas have 26 hectares. How much lime do they need to spread?
 - The Teikas have $18\frac{2}{3}$ hectares. How much lime do they require for their property?
- 8 Milikada purchased $7\frac{13}{20}$ metres of material to sew island shirts for his three sons. Calculate how much material is needed to sew the shirts for the boys.
- 9 Amanda wishes to make $\frac{3}{4}$ of a butterscotch sauce recipe that requires 440 g brown sugar, 500 mL of cream and 250 g of butter. How much of each ingredient does she need?

Squaring a fraction is multiplying the fraction by itself, so the rules of multiplication apply. Mixed numbers must be changed into improper fractions. Always cancel down whenever possible and change an answer that is an improper fraction back to a mixed number.

Example

1 Evaluate:

a $\left(\frac{4}{5}\right)^2$

$$\begin{aligned}\left(\frac{4}{5}\right)^2 &= \frac{4}{5} \times \frac{4}{5} \\ &= \frac{16}{25}\end{aligned}$$

b $\left(2\frac{3}{4}\right)^2$

$$\begin{aligned}\left(2\frac{3}{4}\right)^2 &= \left(\frac{11}{4}\right)^2 \\ &= \frac{11}{4} \times \frac{11}{4} \\ &= \frac{121}{16} \\ &= 7\frac{9}{16}\end{aligned}$$

Solution

When finding the square root of a mixed number, the mixed number must first be changed into an improper fraction. Finding the square root of a fraction is the same as finding the square root of the numerator and the square root of the denominator. The square root can only be found without the use of a calculator if the numbers are perfect squares.

Perfect squares are numbers such as 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169 ...

Example

2 Evaluate:

a $\sqrt{\frac{4}{9}}$

$$\begin{aligned}\sqrt{\frac{4}{9}} &= \frac{\sqrt{4}}{\sqrt{9}} \\ &= \frac{2}{3}\end{aligned}$$

b $\sqrt{1\frac{9}{16}}$

$$\begin{aligned}\sqrt{1\frac{9}{16}} &= \sqrt{\frac{25}{16}} \\ &= \frac{\sqrt{25}}{\sqrt{16}} \\ &= \frac{5}{4} \\ &= 1\frac{1}{4}\end{aligned}$$

Solution

3 Use your calculator to find $\sqrt{\frac{3}{8}}$.

$$\sqrt{\frac{3}{8}} = 0.612 \text{ correct to 3 decimal places}$$

Exercise 10L

1 Find the answers to the following:

a $\left(\frac{1}{4}\right)^2$

b $\left(\frac{2}{5}\right)^2$

c $\left(\frac{5}{6}\right)^2$

d $\left(\frac{1}{3}\right)^2$

e $\left(\frac{2}{3}\right)^2$

f $\left(\frac{1}{2}\right)^2$

g $\left(\frac{9}{10}\right)^2$

h $\left(\frac{3}{8}\right)^2$

i $\left(\frac{5}{12}\right)^2$

j $\left(\frac{7}{11}\right)^2$

k $\left(\frac{4}{7}\right)^2$

l $\left(\frac{8}{9}\right)^2$

2 Evaluate the following:

a $\left(1\frac{1}{2}\right)^2$

b $\left(2\frac{1}{4}\right)^2$

c $\left(1\frac{2}{7}\right)^2$

d $\left(1\frac{2}{5}\right)^2$

e $\left(3\frac{1}{3}\right)^2$

f $\left(1\frac{2}{9}\right)^2$

g $\left(2\frac{1}{5}\right)^2$

h $\left(4\frac{1}{6}\right)^2$

i $\left(1\frac{7}{8}\right)^2$

j $\left(2\frac{5}{6}\right)^2$

k $\left(1\frac{9}{10}\right)^2$

l $\left(2\frac{6}{7}\right)^2$

3 Evaluate the following:

a $\sqrt{\frac{1}{4}}$

b $\sqrt{\frac{1}{9}}$

c $\sqrt{\frac{1}{25}}$

d $\sqrt{\frac{9}{25}}$

e $\sqrt{\frac{81}{100}}$

f $\sqrt{\frac{36}{49}}$

g $\sqrt{\frac{144}{169}}$

h $\sqrt{\frac{64}{100}}$

i $\sqrt{\frac{81}{121}}$

j $\sqrt{\frac{4}{81}}$

k $\sqrt{\frac{50}{338}}$

l $\sqrt{\frac{98}{162}}$

4 Evaluate the following mixed numbers:

a $\sqrt{2\frac{7}{9}}$

b $\sqrt{2\frac{1}{4}}$

c $\sqrt{5\frac{1}{16}}$

d $\sqrt{1\frac{11}{25}}$

e $\sqrt{6\frac{1}{4}}$

f $\sqrt{11\frac{1}{9}}$

g $\sqrt{5\frac{19}{25}}$

h $\sqrt{12\frac{1}{4}}$

i $\sqrt{3\frac{6}{25}}$

j $\sqrt{1\frac{7}{9}}$

k $\sqrt{20\frac{1}{4}}$

l $\sqrt{2\frac{2}{49}}$

5 Use your calculator to find the answers to the following, correct to 2 decimal places:

a $\sqrt{\frac{4}{7}}$

b $\sqrt{\frac{6}{17}}$

c $\sqrt{\frac{1}{3}}$

d $\sqrt{\frac{1}{5}}$

e $\sqrt{\frac{8}{9}}$

f $\sqrt{\frac{7}{8}}$

g $\sqrt{2\frac{3}{4}}$

h $\sqrt{5\frac{1}{3}}$

i $\sqrt{8\frac{1}{2}}$

j $\sqrt{6\frac{9}{10}}$

k $\sqrt{5\frac{4}{7}}$

l $\sqrt{1\frac{1}{8}}$

6 Calculate the side of a square whose area is:

a 16 units²

b $\frac{1}{16}$ units²

c $\frac{9}{16}$ units²

d $1\frac{9}{16}$ units²

The order of operations used for whole numbers in Chapter 1 also applies for fractions.

- **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 a fraction 'of' a number, then this is 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

Evaluate the following:

a $\left(\frac{2}{3} + \frac{1}{4}\right) \times \frac{6}{7} - \frac{1}{7}$

$$\begin{aligned} \left(\frac{2}{3} + \frac{1}{4}\right) \times \frac{6}{7} - \frac{1}{7} &= \left(\frac{2}{3} \times \frac{4}{4} + \frac{1}{4} \times \frac{3}{3}\right) \times \frac{6}{7} - \frac{1}{7} \\ &= \left(\frac{8}{12} + \frac{3}{12}\right) \times \frac{6}{7} - \frac{1}{7} \\ &= \frac{11}{12} \times \frac{6}{7} - \frac{1}{7} \\ &= \frac{11}{14} - \frac{2}{14} \\ &= \frac{9}{14} \end{aligned}$$

b $\frac{2}{3} + \sqrt{\frac{16}{25}} \div \frac{3}{8}$

$$\begin{aligned} \frac{2}{3} + \sqrt{\frac{16}{25}} \div \frac{3}{8} &= \frac{2}{3} + \frac{4}{5} \times \frac{8}{3} \\ &= \frac{2}{3} \times \frac{5}{5} + \frac{32}{15} \\ &= \frac{10}{15} + \frac{32}{15} \\ &= \frac{42}{15} \\ &= 2\frac{12}{15} \\ &= 2\frac{4}{5} \end{aligned}$$

Solution

Exercise 10M

1 Evaluate the following:

a $\frac{1}{2}$ of $8 + 2$

b $\frac{2}{3}$ of $9 - 2$

c $5 + \frac{2}{5}$ of 15

d $26 - \frac{5}{6}$ of 24

e $\frac{2}{7}$ of $14 - 3$

f $\frac{2}{5}$ of $15 - 2$

g $3 + 4\frac{3}{4} \times 2$

h $2 \times \frac{8}{25} \div 1\frac{1}{5}$

i $2\frac{2}{3} + 1 \times 2\frac{2}{3}$

j $6 + \frac{1}{3}$ of $18 \div 3$

k $9 - \frac{1}{2}$ of $6 \div 2$

l $4 + \frac{2}{5}$ of $25 \div 7$

2 Evaluate the following:

a $\frac{1}{2}$ of $8 - \frac{2}{3} \times \frac{6}{7}$

b $\frac{2}{3} \times \frac{9}{10} - \frac{1}{4}$

c $6\frac{2}{3} + 1\frac{1}{2} \times 2\frac{2}{5}$

d $6 - 2\frac{1}{2} \div \frac{5}{6}$

e $(2\frac{1}{2} + 3\frac{1}{3}) \times \frac{2}{7}$

f $6\frac{2}{3} \div \frac{4}{9} - 2\frac{2}{5}$

g $3\frac{1}{8} - \frac{1}{4}$ of $4\frac{3}{4}$

h $2\frac{1}{4} \times \frac{8}{25} \div 1\frac{1}{5}$

i $2\frac{1}{2} \times \frac{2}{3} + 1\frac{3}{4} \times 2\frac{2}{3}$

j $6 + \frac{1}{3}$ of $8 - (1\frac{1}{2} + \frac{2}{5})$

k $\frac{2}{5} \times \frac{2}{5} - \frac{1}{10} \times \frac{3}{5}$

l $2\frac{1}{8} - \frac{2}{3} \times \frac{5}{8} \div 2\frac{2}{3}$

m $4\frac{5}{8} + \frac{2}{3}$ of $12 - \frac{1}{2} \times \frac{13}{4}$

n $\frac{8}{9} \div \frac{4}{3} + \frac{2}{3} \times 2$

o $\frac{3}{4} \times \frac{6}{5} + \frac{1}{10} + 1$

3 Evaluate the following:

a $(\frac{2}{3})^2 + \frac{3}{4} \div 1\frac{1}{8}$

b $\frac{1}{2}$ of $\frac{3}{4} - (\frac{2}{5})^2$

c $\frac{3}{8} + (\frac{1}{6})^2 \times \frac{9}{11}$

d $1\frac{1}{2} + (\frac{3}{4})^2 - \frac{1}{3}$

e $(\frac{5}{6})^2 + 4\frac{2}{3} \div 1\frac{4}{5}$

f $(\frac{7}{12})^2 - \frac{5}{8} \div 2\frac{1}{2}$

g $\sqrt{\frac{36}{49}} + 2\frac{1}{4} \times 1\frac{2}{3}$

h $3\frac{2}{3} \div \sqrt{\frac{4}{81}} - 4\frac{3}{4}$

i $\sqrt{\frac{1}{25}} \div 1\frac{2}{3} + 2\frac{4}{5}$

j $\frac{5}{8} \div 2\frac{2}{3} + \sqrt{\frac{2}{49}} \times 2\frac{1}{3}$

k $(1\frac{1}{2} + \frac{2}{5}) - \sqrt{1\frac{7}{9}}$

l $2\frac{1}{4} \times \frac{4}{50} \div \sqrt{12\frac{1}{4}}$

4 Evaluate:

a $(\frac{1}{4})^2 \times (\frac{2}{3})^2 + 5\frac{1}{2}$

b $\frac{1}{2}$ of $\sqrt{6\frac{1}{4}} + \frac{4}{5} \times 2\frac{2}{3}$

c $\frac{3}{4}$ of $\sqrt{3\frac{6}{25}} - \frac{1}{2}$

d $9\frac{1}{2} + \frac{2}{3}$ of $5\frac{2}{9} \times 10\frac{1}{8}$

e $\sqrt{\frac{49}{81}} \times \frac{3}{5} - \frac{1}{4} \times \frac{12}{13}$

f $(1\frac{2}{3})^2 - \frac{1}{4} \times \frac{2}{5}$

g $\frac{5}{6} + \sqrt{\frac{100}{144}} - (1\frac{1}{4})^2$

h $8\frac{19}{20} - (2\frac{2}{3})^2 + \sqrt{2\frac{7}{9}}$

i $\frac{8}{9} \div \sqrt{1\frac{19}{81}} - \frac{1}{5}$

j $(2\frac{7}{8})^2 + 1\frac{1}{2} \times \frac{3}{4}$

k $(2\frac{1}{4})^2 \div (\frac{1}{2} + \frac{5}{6})$

l $(3\frac{5}{6})^2 - (1\frac{1}{2})^2 \times \frac{3}{4}$

m $\sqrt{42\frac{1}{4}} \div \frac{26}{27} + \frac{1}{4}$

n $(\frac{3}{4})^2 + (1\frac{1}{4})^2 - \frac{7}{8}$

o $\frac{1}{5} \times \frac{2}{9} + \sqrt{\frac{64}{81}}$

BODMAS

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

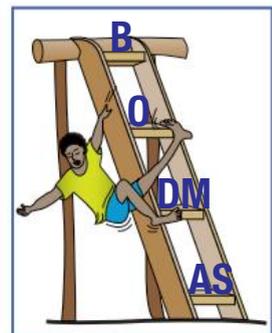
■ Brackets first.

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

■ Multiplication and division are on the third step.

■ Addition and subtraction are on the top 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.

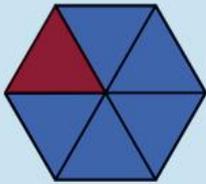




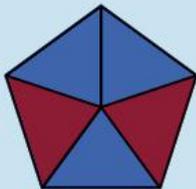
Puzzles

1 Express the shaded areas as fractions to answer the riddle:

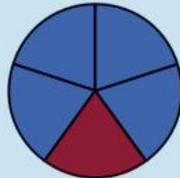
What happened to the **KOSSA** soccer player who got injured playing in the **O-League** soccer competition?



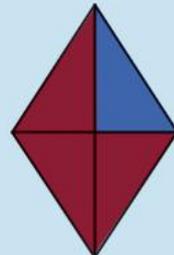
- (C) Fraction Red
- (D) Fraction Blue



- (E) Fraction Red
- (F) Fraction Blue

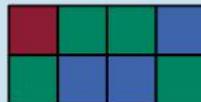
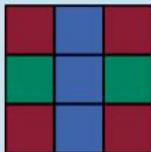


- (H) Fraction Red
- (I) Fraction Blue



- (L) Fraction Red
- (O) Fraction Blue

- (R) Fraction Red
- (S) Fraction Blue
- (T) Fraction Green



- (U) Fraction Red
- (V) Fraction Blue
- (Y) Fraction Green

$\frac{1}{5}$	$\frac{2}{5}$	$\frac{4}{5}$	$\frac{1}{3}$	$\frac{3}{5}$	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$
$\frac{4}{9}$	$\frac{2}{5}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{2}{5}$	$\frac{4}{9}$	$\frac{2}{5}$	$\frac{5}{6}$



2 Complete the equivalent fractions to answer the riddle:

Did you hear about the custom magic man from Marovo?

$$\frac{1}{2} = \frac{\mathbf{A}}{4} = \frac{8}{\mathbf{C}}$$

$$\frac{1}{3} = \frac{2}{\mathbf{D}} = \frac{\mathbf{E}}{12} = \frac{3}{\mathbf{F}}$$

$$\frac{1}{5} = \frac{\mathbf{H}}{15} = \frac{2}{\mathbf{I}}$$

$$\frac{5}{6} = \frac{\mathbf{P}}{18} = \frac{20}{\mathbf{R}}$$

$$\frac{3}{7} = \frac{6}{\mathbf{S}} = \frac{\mathbf{T}}{28} = \frac{9}{\mathbf{U}}$$

$$\frac{1}{4} = \frac{\mathbf{L}}{20} = \frac{2}{\mathbf{N}} = \frac{\mathbf{O}}{28}$$

$\frac{3}{12}$	$\frac{4}{3}$	$\frac{4}{4}$	$\frac{16}{15}$	$\frac{7}{2}$	$\frac{21}{14}$	$\frac{5}{2}$	$\frac{6}{12}$	$\frac{14}{14}$	$\frac{4}{4}$	$\frac{4}{4}$
----------------	---------------	---------------	-----------------	---------------	-----------------	---------------	----------------	-----------------	---------------	---------------

3 Calculate the answers to the following problems to find the answer to the riddle:

What happens to the student who does not keep up with school work?

a Simplify these fractions using addition or subtraction:

A $\frac{1}{4} + \frac{3}{4}$

E $\frac{6}{7} - \frac{4}{7}$

B $1\frac{2}{7} + \frac{1}{2}$

G $8\frac{9}{10} - 4\frac{3}{5}$

C $2\frac{4}{9} + 4\frac{1}{3}$

H $7\frac{5}{8} - 2\frac{1}{4} - 3\frac{1}{2}$

D $5\frac{3}{10} + 2\frac{4}{5} + 3\frac{1}{2}$

I $4 - \frac{3}{4}$

b Simplify these fractions using multiplication:

N $\frac{3}{4} \times \frac{8}{9}$

S $\frac{1}{4}$ of 20

O $6 \times \frac{2}{3}$

T $\frac{3}{5}$ of 500

P $1\frac{4}{5} \times \frac{1}{6}$

U $\frac{1}{3}$ of 63

R $4\frac{1}{8} \times 5\frac{1}{3} \times \frac{1}{6}$

V $\frac{3}{8}$ of 128



$\frac{300}{5}$	$\frac{1\frac{7}{8}}{300}$	$\frac{2}{21}$		$\frac{\frac{3}{10}}{\frac{2}{7}}$	$\frac{4}{\frac{2}{3}}$	$\frac{4}{300}$		$\frac{3\frac{2}{3}}{1\frac{7}{8}}$	$\frac{1}{1}$	$\frac{5}{5}$
$\frac{300}{4}$		$\frac{4\frac{3}{10}}{3\frac{1}{4}}$		$\frac{3\frac{1}{4}}{48}$	$\frac{2}{7}$			$\frac{21}{2}$	$\frac{3}{10}$	



Applications

Phases of the Moon



It takes the Moon 29·531 days to orbit the Earth, starting as a new moon and continuing through the phases of first quarter, full moon, last quarter and then back again to another new moon.

Research the terms ‘first quarter’, ‘new moon’, ‘last quarter’ and ‘full moon’.

How does each of these terms relate to the Moon’s orbit of the Earth?

Calculate how many days of the orbit have passed at each of the Moon’s phases.

Fraction patterns

Calculate each of the sums below:

$$\frac{1}{2} + \frac{1}{4} =$$

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} =$$

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} =$$

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} =$$

What do you predict will be the answer for the next sum in the pattern?

What happens if the addition sign is replaced with a subtraction sign?

$$\frac{1}{2} - \frac{1}{4} =$$

$$\frac{1}{2} - \frac{1}{4} - \frac{1}{8} =$$

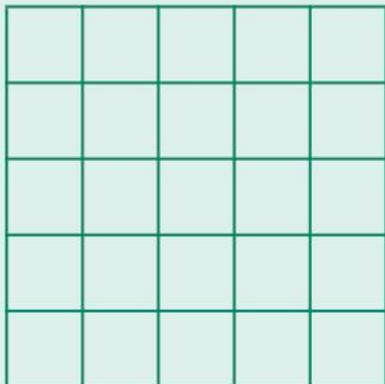
$$\frac{1}{2} - \frac{1}{4} - \frac{1}{8} - \frac{1}{16} =$$

Describe the pattern in your own words.

Fraction bingo

This is to be played in a group, with one person calling the fractions.

Players draw the following 5×5 grid in their books.



The players then write one fraction from the list below in each square. Write each fraction once only.

The caller then reads out fractions equivalent to those in the list below. Players must simplify the fractions by cancelling common factors, then cross out each fraction when it is called.

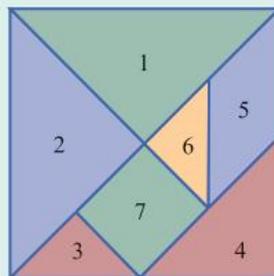
$\frac{1}{2}, \frac{1}{3}, \frac{2}{3}, \frac{1}{4}, \frac{3}{4}, \frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}, \frac{1}{6}, \frac{5}{6}, \frac{1}{7}, \frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}, \frac{6}{7}, \frac{1}{8}, \frac{3}{8}, \frac{5}{8}, \frac{7}{8}, \frac{1}{9}, \frac{2}{9}, \frac{4}{9}, \frac{5}{9}, \frac{7}{9}, \frac{8}{9}, \frac{1}{10}, \frac{3}{10}, \frac{7}{10}, \frac{9}{10},$
 $\frac{1}{11}, \frac{2}{11}, \frac{3}{11}, \frac{5}{11}, \frac{1}{12}, \frac{5}{12}, \frac{2}{13}, \frac{1}{15}, \frac{2}{15}, \frac{1}{20}, \frac{3}{20}.$

The winner is the first person to call out BINGO when they have crossed out a straight line horizontally, vertically or diagonally.

Chinese tangrams

The seven-piece Chinese tangram can be put together to form a square as shown.

Calculate what fraction of the whole square each piece of the tangram represents.



Squares

- Count the number of squares in the diagram.
- Calculate the size of each smaller square as a fraction of the large square.
- Calculate the size of each triangle as a fraction of the large square.





Enrichment

- 1 Modern fractions can easily be converted to Egyptian or unit fractions using this method. To convert $\frac{5}{9}$ to an Egyptian fraction, find the largest unit fraction that is smaller than $\frac{5}{9}$.

$$\frac{1}{3} < \frac{5}{9} \text{ while } \frac{2}{3} > \frac{5}{9} \quad \text{We will use } \frac{1}{3} \text{ to start the sum.}$$

$$\frac{5}{9} = \frac{1}{3} + ? \quad \text{To find ? } \frac{5}{9} - \frac{1}{3} = \frac{5}{9} - \frac{3}{9} = \frac{2}{9}$$

$$\frac{5}{9} = \frac{1}{3} + \frac{2}{9} \quad \frac{2}{9} \text{ is not a unit fraction so this needs to be converted further.}$$

$$\frac{1}{5} < \frac{2}{9} \text{ while } \frac{1}{4} > \frac{2}{9}$$

$$\frac{2}{9} = \frac{1}{5} + \frac{1}{5} + ? \quad \text{To find ? } \frac{2}{9} - \frac{1}{5} = \frac{10}{45} - \frac{9}{45} = \frac{1}{45}$$

As a unit fraction is left over, the sum can now be completed:

$$\frac{5}{9} = \frac{1}{3} + \frac{1}{5} + \frac{1}{45}$$

Convert the following fractions to Egyptian fractions:

a $\frac{3}{4}$ b $\frac{2}{5}$ c $\frac{2}{3}$ d $\frac{3}{10}$ e $\frac{3}{7}$ f $\frac{5}{6}$

- 2 Which is larger, $\frac{7}{10}$ or $\frac{5}{7}$?

You could use your calculator or division to convert the fractions to decimals.

$$\frac{7}{10} = 0.7 \text{ and } \frac{5}{7} = 0.71$$

Or use equivalent fractions:

$$\frac{7}{10} = \frac{49}{70} \text{ and } \frac{5}{7} = \frac{50}{70}$$

However, Egyptian fractions also give the answer effectively:

$$\frac{7}{10} = \frac{1}{2} + \frac{1}{5} \text{ and}$$

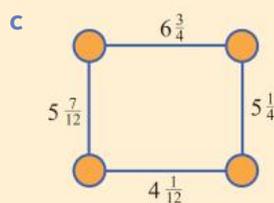
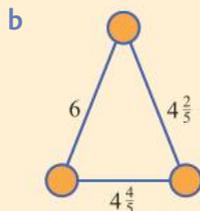
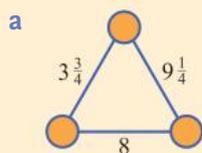
$$\frac{5}{7} = \frac{1}{2} + \frac{1}{5} + \frac{1}{70}$$

By using the sum of different unit fractions it can be seen that $\frac{5}{7}$ is larger by $\frac{1}{70}$.

Use Egyptian fractions to write each of the following fractions as a sum of different unit fractions. Use this information to state which fraction is larger in each of the pairs:

a $\frac{5}{6}$ or $\frac{8}{9}$ b $\frac{8}{9}$ or $\frac{9}{10}$ c $\frac{3}{4}$ or $\frac{4}{5}$ d $\frac{4}{9}$ or $\frac{5}{11}$ e $\frac{4}{5}$ or $\frac{7}{9}$ f $\frac{5}{8}$ or $\frac{7}{11}$

- 3 Copy and complete the following fraction triangles and square:



4 Complete the following magic squares. You will need to use your fraction skills:

a

$\frac{1}{4}$		
$\frac{7}{8}$		
$\frac{3}{4}$		1

b

$\frac{1}{3}$		$\frac{7}{15}$
$\frac{2}{3}$		
$\frac{3}{5}$		

c

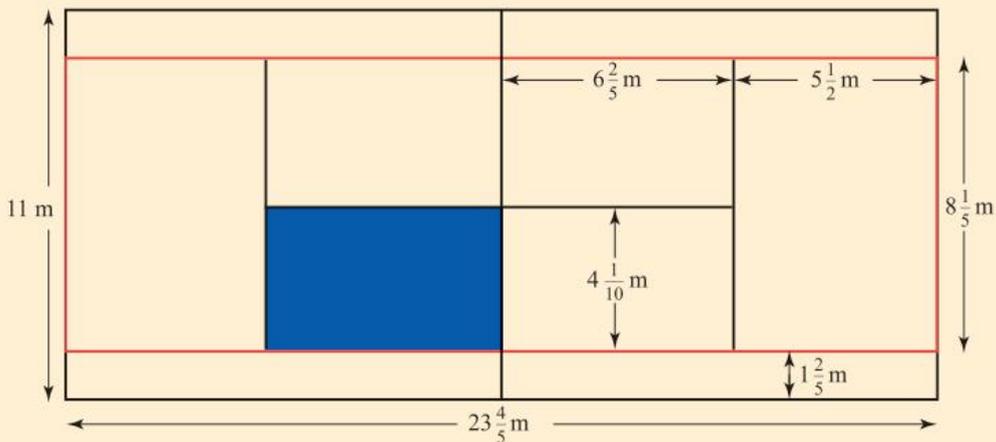
6	3	$3\frac{1}{2}$	$4\frac{1}{2}$
4	5		$2\frac{1}{2}$
		1	8

d

	3		
$1\frac{1}{2}$	$4\frac{1}{4}$	2	$2\frac{3}{4}$
4			$2\frac{1}{4}$
$3\frac{1}{4}$			1

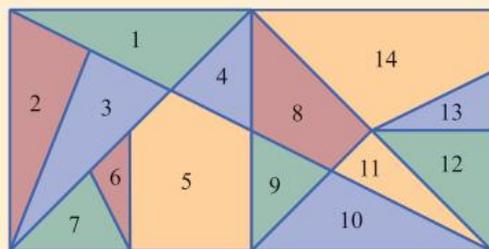
Can you make up your own 3×3 magic square with fractions?

5 Use this diagram of a tennis court to answer the following questions:



- Find the area of the service box shaded blue.
 - Find the area of the entire tennis court, including the doubles boxes.
 - What fraction of the total court area is the shaded service box?
 - What fraction of the total court area is the singles court? It is outlined in red.
 - Compare the area of court covered by players in different sports. For example, what area of a netball court is covered by the Centre player compared with that covered by the Goal Shooter? What area of a hockey ground is covered by a Wing player compared with that covered by a Centre Back?
- 6 The fourteen-piece Greco-Roman tangle called the Loculus of Archimedes or the stomachion is made from a rectangle in which the length is twice as long as the width. What fraction of the whole rectangle is represented by the following pieces.

- 8 and 9
- 1, 2 and 3
- 2, 3, 5, 6, 7, 9 and 10
- 8 to 14
- 4 to 11
- 12



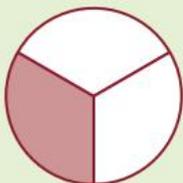


Revision/Assessment

Exercise 10A

1 Express the following diagrams as fractions:

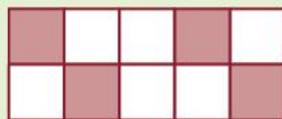
a



b



c



2 Simplify the following fractions:

a $\frac{20}{60}$

b $\frac{32}{56}$

c $\frac{35}{45}$

3 State whether the following are proper fractions, improper fractions or mixed numbers. Label the numerator, denominator and whole number where applicable:

a $\frac{16}{5}$

b $4\frac{1}{2}$

c $\frac{1}{3}$

Exercise 10B

4 Fill the gaps:

a $\frac{2}{5} = \frac{4}{25} = \frac{18}{25}$

b $\frac{3}{7} = \frac{3}{21} = \frac{36}{49}$

5 For each pair of fractions state which is larger:

a $\frac{2}{5}, \frac{3}{10}$

b $\frac{3}{7}, \frac{5}{11}$

c $\frac{1}{9}, \frac{1}{6}$

d $\frac{5}{8}, \frac{5}{7}$

6 Change the following improper fractions into mixed numbers:

a $\frac{12}{5}$

b $\frac{11}{3}$

c $\frac{20}{7}$

d $\frac{37}{8}$

7 Change the following mixed numbers into improper fractions:

a $2\frac{1}{4}$

b $4\frac{2}{7}$

c $3\frac{4}{5}$

d $1\frac{8}{11}$

Exercises 10C and 10D

8 Find the answers to the following:

a $1\frac{2}{5} + 2\frac{3}{5}$

b $\frac{2}{7} + \frac{4}{7}$

c $5\frac{1}{8} + \frac{3}{8}$

d $3\frac{9}{11} + 1\frac{5}{11}$

9 Add the following:

a $\frac{4}{7} + \frac{1}{3}$

b $\frac{3}{4} + \frac{5}{6}$

c $2\frac{7}{8} + 3\frac{1}{2}$

d $1\frac{4}{5} + 3\frac{4}{9}$

10 The Wade family has different types of flour to make bread with. They currently have $4\frac{1}{8}$ kg of light rye flour, $3\frac{5}{8}$ kg of dark rye flour, 6 kg of wholemeal flour and $2\frac{7}{8}$ kg of white flour. How many kilograms of flour do they have altogether?

11 Suzie buys $2\frac{3}{4}$ kg of apples, $1\frac{1}{3}$ kg of bananas and $\frac{1}{2}$ kg of oranges. What is the total weight of her fruit?

Exercises 10E and 10F

12 Subtract the following:

a $\frac{7}{8} - \frac{3}{8}$

b $2\frac{17}{20} - 1\frac{9}{20}$

c $5 - \frac{4}{11}$

d $3\frac{1}{2} - 2$

e $\frac{2}{3} - \frac{4}{7}$

f $4\frac{1}{2} - 1\frac{2}{5}$

g $6 - 2\frac{5}{8}$

h $7\frac{1}{4} - 3\frac{7}{9}$

13 Michael is $1\frac{3}{10}$ metres tall. His younger brother Wayne is $1\frac{7}{10}$ metres tall. Who is the taller and by how much?

14 Maria has $2\frac{2}{5}$ metres of material but she needs $4\frac{4}{5}$ metres of material to make a dress. How much more material should Maria buy?

Exercise 10H

15 Evaluate:

a $\frac{2}{3} \times \frac{7}{8}$

b $\frac{3}{4} \times \frac{10}{15} \times \frac{12}{25}$

c $5 \times 2\frac{1}{2} \times \frac{2}{7}$

d $1\frac{1}{4} \times \frac{2}{5} \times 3\frac{1}{6}$

16 James has 6 bottles of soft drink which each hold $\frac{3}{4}$ of a litre. How many litres does James have altogether?

17 A fruit punch mixture needs $\frac{2}{5}$ litre of orange juice, $\frac{1}{3}$ litre of pineapple juice and $2\frac{1}{2}$ litres of lemonade. If Ivan wants to make a mixture that is $4\frac{1}{2}$ times this volume, how much of each ingredient would he need?

Exercise 10J

18 Evaluate:

a $\frac{2}{5} \div \frac{3}{8}$

b $2\frac{1}{4} \div \frac{3}{5}$

c $3\frac{5}{6} \div 2\frac{2}{9}$

d $2\frac{4}{11} \div 4$

Exercise 10K

19 Calculate:

a $\frac{1}{4}$ of 32

b $\frac{2}{5}$ of 40

c $\frac{3}{8}$ of 24 hours

Exercise 10L

20 Evaluate:

a $\left(\frac{3}{4}\right)^2$

b $\left(\frac{2}{7}\right)^2$

c $\left(1\frac{5}{6}\right)^2$

d $\left(2\frac{1}{5}\right)^2$

e $\sqrt{\frac{16}{49}}$

f $\sqrt{\frac{9}{100}}$

g $\sqrt{7\frac{9}{16}}$

h $\sqrt{1\frac{19}{81}}$

Exercise 10M

21 Evaluate:

a $\frac{2}{3} \times \frac{4}{5} + 6\frac{1}{3}$

b $8\frac{1}{2} - 7 \div 1\frac{2}{5}$

c $\left(\frac{3}{4}\right)^2 - \frac{2}{3} \times \frac{7}{8} \div 1\frac{2}{5}$

CHAPTER

11

Time and Mass



Time and Mass

Galileo's work in physics and astronomy laid the basis for our space program today. The *Mir* space station took 4 hours to re-enter the Earth's atmosphere and splash into the ocean. Compare this with the time it took for a rock to fall from the top of the Leaning Tower of Pisa. The rock took a little more than 3 seconds to fall from the tower, which is 55 metres tall.

This chapter covers the following skills:

- Using clocks, calendars, timetables and schedules, including use of seconds and the 24-hour day
- Producing and using timelines
- Calculating time intervals when working with daylight saving, Solomon Islands and world time zones
- Expressing units of time and mass using different units

Time

1 minute = 60 seconds
1 hour = 60 minutes = 3600 seconds
1 day = 24 hours
1 fortnight = 14 days
1 year = 12 months
1 year = 365 days
1 leap year = 366 days

- Using and constructing timetables and calendars
- Working with questions involving mass

Mass

1 tonne = 1000 kg
1 kg = 1000 g
1 g = 1000 mg

Specific Learning Outcome (SLO)

Learners should be able to:

- 7.11.1.1** Define 'timeline'.
7.11.1.2 Identify different parts of a timeline.
7.11.2.1 Read and interpret information given on a timeline.
7.11.2.2 Construct timelines and identify dates, times etc. of events that occur in a given time-period.
7.11.2.3 Label and place dates and events on a timeline.
7.11.3.1 Identify the common units of time: *second, minute, hour, day, week, month and year.*
7.11.3.2 Convert one unit of time from one to another.
7.11.4.1 Define what BC and AD stand for.

7.11.4.2 Find number of years, months, days and time in a given period of time. Define what AM and PM stands for.

7.11.5.1 Identify two time systems: 12 hours and 24 hours time.

7.11.5.2 Find time using clock face and digital time.

7.11.5.3 Calculate time using 12 hours and 24 hours times.

7.11.6.1 Use and read time schedules given in tables that indicate when events and services are occurring.

7.11.7.1 Read times and their corresponding times in different parts of the world.

7.11.8.1 Arrange given information in order of their occurrences.

7.11.9.1 Use flowcharts to show the logical flow of information:



– Start or stop



– Use for decisions: YES or NO



– Use for instructions

7.11.10.1 Define mass.

7.11.10.2 Identify units of mass and calculate weights of various objects.

7.11.11.1 Change one unit of mass to another

1 tonne = 1 000 kg

1 g = 1 000 mg

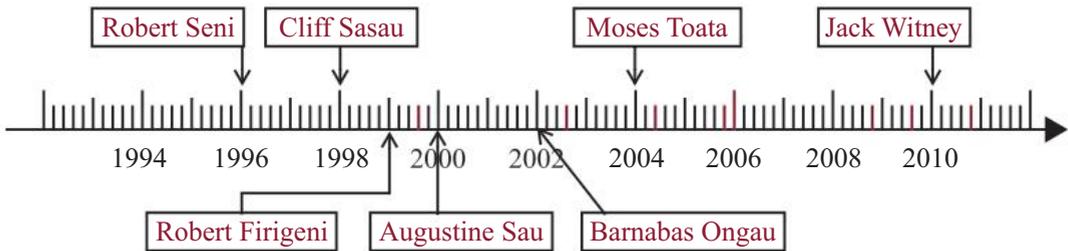
1 kg = 1 000 g

11A Timelines

A timeline is a line with a time scale that shows the position of events in order.

Example

- 1 Moses Toata found the following timeline for the KOSSA soccer players who had won the prestigious Sportsperson of the Year title since he became the senior coach for the club. From this timeline, list the players who have won and the year in which they did so.

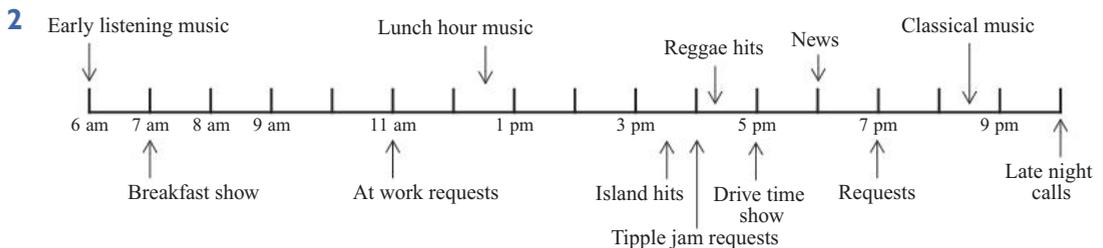


- 2 Place the following Wantok FM 96.3 programs on the timeline below: 10 pm Late night calls, 7 pm Requests, 3:30 pm Island hits, 6 am Easy listening music, 7 am Breakfast show, 12:30 pm Lunch hour music, 4:15 pm Reggae hits, 5 pm Drive time show, 8:30 pm Classical music, 6:00 pm News, 11 am At work requests, 4 pm Tipple jam requests.

Solution

- 1 Read the timeline from left to right, listing the names and years in order.

Name	Year
Robert Seni	1996
Cliff Sasau	1998
Robert Firigeni	1999
Augustine Sau	2000
Barnabas Ongau	2002
Moses Toata	2004
Jack Witney	2010



Exercise 11A

1 Place the dates for these food inventions on the timeline below:

1484: Hot dogs	1700: French fries	1890: Peanut butter
1554: Camembert cheese	1923: Vegemite	1870: Margarine
1762: Sandwiches	1861: Jelly beans	1853: Potato chips



2 Lilly enjoys playing netball and researched its history. She found the following information. Show the main events on a timeline.

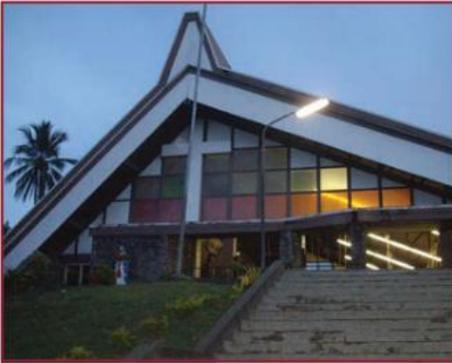
- Netball was adapted from basketball in about 1891 in the United States.
- The Ling Association drew up a code of rules in 1901.
- First national association was formed in New Zealand in 1924.
- England formed a national association in 1926.
- Australia formed a national association in 1927.
- The International Federation of Women's Netball Associations was founded in 1960.
- The World Netball Championships were first held in 1963.

3 The Solomon Islands Broadcasting Corporation (SIBC) programs on the short- and medium-wave frequencies from 6 am to 5 pm have been jumbled up. Those in green are broadcast in the morning, while the ones in red are broadcast in the afternoon. Place them in order, and so find the length of each program.

4:55	Music	5:00	BBC World News Relay
3:30	Music	4:15	Music
6:00	Morning Greetings	10:45	Weather Report
2:00	Afternoon News in Pidgin	4:30	Tok Sports
6:30	Morning News in Pidgin	10:30	Distaem Nao
1:00	BBC World Briefings	12:30	Services Messages
9:30	Music	11:30	Music
10:00	Mid Morning News in English	12:00	Midday News in English
4:00	RA World News/Pacific Beat Relay		



- 4 Draw a timeline and mark on it the years in which the following Churches arrived in Solomon Islands.



- 1861: Anglican Church
- 1914: Seventh Day Adventist Church
- 1894: South Seas Evangelical Church (SSEC)
- 1842: Roman Catholic Church
- 1902: Methodist Church

- 5 Draw a timeline and mark on it the years that correspond to the following events:

- 1986: Cyclone Namu hits Solomon Islands
- 1978: Solomon Islands gain its independence
- 1988: Melanesian Cup tournament began
- 2000: Militants topple the Government
- 1974: Queen Elizabeth II visits Solomon Islands
- 2008: Tsunami destroyed Choiseul and Western Province
- 2006: Riot in Honiara
- 2008: Royal Duke of Gloucester visits Honiara
- 2003: Arrival of RAMSI in Solomon Islands
- 1995: Lucky Dube Tour visits Honiara
- 1984: Pope John Paul II visits Solomon Islands

- 6 Place the following Power FM programs in telecast order. The programs in green are broadcast in the afternoon while the programs in red are broadcast in the morning.

- 11:40 Love songs till midnight
- 5:00 Afternoon Newsbeat
- 6:00 Breakfast with Joe and Araba
- 4:00 Afternoon Newsbeat
- 9:40 Mid-morning with Lani
- 6:30 Breakfast with Joe and Araba
- 5:30 Afternoon Newsbeat
- 8:30 Breakfast with Joe and Araba
- 6:00 Afternoon Newsbeat
- 7:00 Breakfast with Joe and Araba
- 2:00 Schools out with Lanita
- 8:00 Breakfast with Joe and Araba
- 6:30 Seventh Heaven
- 9:00 Breakfast with Joe and Araba
- 7:30 Wind-down hour – Terence
- 11:30 Mid-morning with Lani
- 12:00 Top hour News



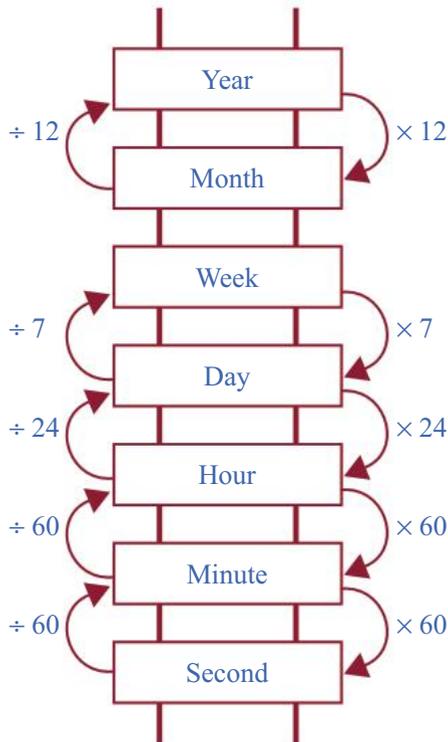
Time is measured in a number of units: seconds and minutes for short times; and hours, days and years for longer events. The ladder shows how to convert between different units of time.

The units are connected by either multiplication or division using the numbers on the ladder.

When climbing down the ladder, multiply.

When climbing up the ladder, divide.

- For years:
- 1 decade = 10 years
- 1 century = 100 years
- 1 year = 52 weeks
- 1 year = 365 days
- 1 leap year = 366 days



Example

Complete the following conversions:

a 2 minutes = _____ seconds

b 3 hours = _____ minutes

c 5 days = _____ hours

d 3 years = _____ days

e 240 seconds = _____ minutes

Solution

$2 \times 60 = 120$ seconds

$3 \times 60 = 180$ minutes

$5 \times 24 = 120$ hours

$3 \times 365 = 1095$ days

$240 \div 60 = 4$ minutes

Exercise B

- I State the units from the unit ladder above that could be used to measure the time:
 - a to cook a pot of rice
 - b a coconut tree to bear its first fruits
 - c between sunrise and sunset
 - d to travel from Henderson Airport to White River by car
 - e to travel from Honiara to Gizo by plane
 - f to play a netball game
 - g between seeing lightning and hearing the thunder
 - h you spend at school each day.

2 Convert the following by filling in the spaces:

- | | |
|-------------------------------|--|
| a 9 centuries = _____ years | b $5\frac{1}{2}$ centuries = _____ years |
| c 50 years = _____ decades | d $7\frac{1}{2}$ decades = _____ years |
| e 28 decades = _____ years | f 45 years = _____ decades |
| g 350 years = _____ centuries | h 75 years = _____ decades |
| i 575 years = _____ centuries | j 2.5 centuries = _____ decades |

3 Convert the following by filling in the spaces:

- | | |
|---------------------------------------|--------------------------------------|
| a 2 years = _____ days | b 5 years = _____ months |
| c 35 days = _____ weeks | d 9 weeks = _____ days |
| e 108 months = _____ years | f 5 weeks = _____ days |
| g $2\frac{1}{4}$ years = _____ months | h $7\frac{1}{2}$ years = _____ weeks |

4 Convert the following by filling in the spaces:

- | | |
|--|--|
| a 4 days = _____ hours | b 5 hours = _____ minutes |
| c 36 minutes = _____ seconds | d 420 seconds = _____ minutes |
| e 120 hours = _____ days | f 180 minutes = _____ hours |
| g $3\frac{1}{2}$ days = _____ hours | h $5\frac{1}{4}$ hours = _____ minutes |
| i $2\frac{3}{4}$ minutes = _____ seconds | j 200 minutes = _____ hours |

- 5 Bentley boasts that he can balance a ball on his nose for $2\frac{1}{2}$ minutes, while Gino says he can do the same for 140 seconds. Who can balance the ball the longest?
- 6 Una and Colin spend 19 days with their daughter Helen at Burns Creek and 3 weeks with their son Ian at Naha. With which child did they spend the most time?
- 7 The *Best Bake* recipe book states that a particular fruit cake needs to be cooked for 70 minutes. The *Solomons Cookbook* states that the baking time should be $1\frac{1}{2}$ hours. Which book's recipe uses the shorter cooking time?
- 8 Samantha has been collecting stamps for $2\frac{1}{2}$ years while Sean has been collecting for 29 months. Who has been collecting stamps for the longer time?
- 9 Chris is able to run around an obstacle course in 48 minutes, while Matthew takes three-quarters of an hour to complete the course. Who is quicker at completing the course?
- 10 Students grew crystals for a science experiment at home for the following times:
 Sam: $6\frac{1}{2}$ days Suzie: 150 hours Quruzu: 9240 minutes
 Convert the times into minutes and then state which person's experiment lasts:
- | | |
|---------------|----------------|
| a the longest | b the shortest |
|---------------|----------------|

- The years before the birth of Christ are represented by the initials BC starting from 1 BC.
- The years after the birth of Christ, *anno Domini*, are represented by the initials AD starting from 1 AD.

In a year the months have different numbers of days:

Days	Months
31	January, March, May, July, August, October, December
30	April, June, September, November
29	February in a leap year
28	February in a non-leap year

These facts can be remembered using the rhyme:

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.

The calendar for the year 2012 is shown here.

January						
S	M	T	W	T	F	S
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				

February						
S	M	T	W	T	F	S
			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			

March						
S	M	T	W	T	F	S
				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

April						
S	M	T	W	T	F	S
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					

May						
S	M	T	W	T	F	S
		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		

June						
S	M	T	W	T	F	S
					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

July						
S	M	T	W	T	F	S
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				

August						
S	M	T	W	T	F	S
			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	

September						
S	M	T	W	T	F	S
30						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

October						
S	M	T	W	T	F	S
	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			

November						
S	M	T	W	T	F	S
				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	

December						
S	M	T	W	T	F	S
30	31					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

Example

- 1 Using the year 2012 calendar, state the number of days from 1 January to 1 February.
- 2 How many years are there between:
 - a 75 BC and 15 BC?
 - b 23 BC and 56 AD?
- 3 Which months have 30 days?

Solution

Count the number of days (including the starting date) to the finishing date. A shortcut is to group the number of days in whole months and add them up.

$31 + 1 = 32$ days (including 1 January and 1 February)

75 to 15 BC:
 $75 - 15 = 60$ years

23 BC to 56 AD:
 $23 + 56 = 79$ years

From the rhyme above, September, April, June, November have 30 days.

Exercise 11C

- 1 Use the year 2011 calendar to find the number of days from midnight on 19 March to and including the following dates:

a 1 April	b 25 April	c 30 June
d 1 August	e 16 August	f 24 December
- 2 Find the number of days between and including the following dates:
 - a 15 December and 10 January
 - b 24 March and 1 August
 - c 16 August and 24 December
 - d 7 February and 24 August in a leap year
 - e 7 February and 24 August in a non-leap year
 - f 20 October and 19 February
 - g 30 June and 1 September
 - h 1 January and 22 May in a leap year
 - i 3 July and 8 December
 - j 20 March and 11 October
- 3 For each of the following people calculate the number of years they lived:
 - a Aristarchus of Samos (*c.* 310–*c.* 250 BC), a Greek astronomer, was reported as being the first to assert that the Earth revolves around the Sun.
 - b Aristotle (384–322 BC) was a Greek philosopher and scientist. He shares with Plato (428–347 BC) and Socrates (470–399 BC) the distinction of being the most famous of the Ancient Greek philosophers.
 - c Eudoxus (408–355 BC), Descartes (1596–1650), Archimedes (287–212 BC), Fermat (1601–1665), Pascal (1623–1662), Newton (1642–1727), Leibnitz (1646–1716), Euler (1707–1783), Lagrange (1736–1813) and Gauss (1777–1855) are all mathematicians.

- 4 In the year 2011 the following dates were noted:

New Year's Day: Sunday, 1 January

Good Friday: Friday, 22 April

Easter Monday: Monday, 25 April

Queen's Birthday (observed): Sunday, 10 June

Whit Monday: Wednesday, 13 June

Independence Day: Saturday, 7 July

National Day of Thanksgiving: Wednesday, 26 December

Observed as public holiday: Thursday, 27 December

Find the number of days between (i.e. not including) the following days:

- Easter Monday and Queen's Birthday
- Easter Monday and National Day of Thanksgiving
- Whit Monday and December observed public holiday
- Easter Monday and Independence Day
- New Year's Day and Queen's Birthday
- Good Friday and Independence Day



- 5 The following dates show the length of school terms for secondary schools in Solomon Islands for the year 2009:

Term 1: 19 January to 27 March

Term 2: 6 April to 12 June

Term 3: 13 July to 18 September

Term 4: 28 September to 4 December

If they go to school Monday to Friday, find the number of days that students were at school.

- 6 Find the number of years the following Kings of Assyria ruled. All the years are BC:

a 1132–1115: Ashurreshishi I

b 1114–1076: Tiglath-pileser I

c 1074–1076: Asharidapil-Ekur

d 1073–1056: Ashurbelkala

e 1055–1054: Eriba-Adad II

f 1053–1050: Shamshi-Adad IV

g 1049–1031: Ashurnasirpal I

h 1030–1019: Shalmaneser II

i 1081–1013: Ashurirari IV

j 1012–972: Ashurrabi II

k 971–967: Ashurreshishi II

l 966–935: Tiglath-pileser II

- 7 Find the number of years the following Roman Emperors ruled:

a Augustus: 27 BC to 14 AD

b Tiberius: 14–37 AD

c Caligula: 37–41 AD

d Nero: 54–68 AD

The time of day is usually given using either the older clockface system (such as half past 5 pm) or the digital system (such as 5:30 pm), working in groups of two lots of 12 hours, am for morning and pm for afternoon.

Sometimes the time of day is given using a single block of 24 hours known as the 24-hour clock time system. This system starts at midnight and the hours are numbered from 0 to 23 to the end of the day.

Example

Solution

- | | |
|--|---|
| 1 Give the digital time for the following: | |
| a quarter past 3 pm | 3:15 pm |
| b 23 minutes to 4 in the morning | 3:37 am |
| c noon | 12:00 |
| d 5 minutes past midnight | 12:05 am |
| 2 Give the clockface time for these digital times: | |
| a 3:07 am | 7 minutes past 3 am |
| b 7:43 pm | 17 minutes to 8 pm |
| 3 Give the 24-hour clock time for these times: | |
| a 4:23 am | 0423 hours |
| b 2:17 pm | $2 + 12 = 14$. Time is 1417 hours. |
| c a quarter to 5 pm | digital: 4:45 pm = 1645 hours |
| d 13 minutes past 9 am | 0913 hours |
| 4 How long is it from 7:35 am to 3:20 pm on the same day? | 7:35 to 8 am = 25 minutes
8 am to 3:20 pm = 7 hours 20 minutes
Total = 7 hours 45 minutes |

Exercise D

- 1** Give the digital time for the following:
- | | | | |
|-------------------------------|-----------------------------|--------------------------------|---------------------|
| a 0420 hours | b 0931 hours | c 0832 hours | d 1204 hours |
| e 1600 hours | f 1912 hours | g 2121 hours | h 2302 hours |
| i 23 minutes past 4 pm | j quarter past 6 am | k 14 minutes past 11 am | |
| l 24 minutes to 11 pm | m 12 minutes to 4 am | n 4 minutes to 8 pm | |
- 2** Give the 24-hour clock time for the following:
- | | | | |
|-------------------------------|----------------------------|-------------------------------|-------------------|
| a 5:10 am | b 7:51 am | c 5:11 am | d 1:13 pm |
| e 5:20 pm | f 7:38 pm | g 8:21 pm | h 11:52 pm |
| i 16 minutes past 5 am | j quarter past 7 am | k 17 minutes past 4 am | |
| l 13 minutes to 10 pm | m 8 minutes to 7 pm | n 17 minutes to 11 pm | |

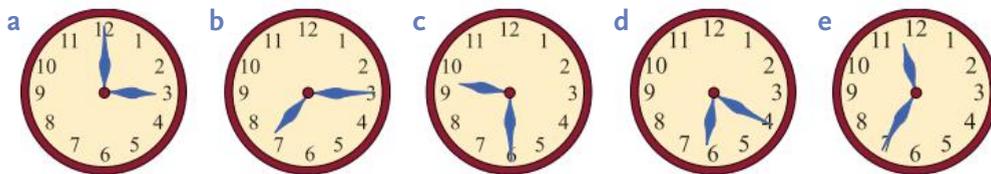
3 Give the clockface time for the following:

- a 4:15 am b 7:30 pm c 5:10 am d 9:35 am e 11:21 am
 f 0900 hours g 0118 hours h 1310 hours i 1525 hours j 1819 hours

4 Complete the following table:

Clockface time	Digital time	24-hour time
Half past 7 in the morning		
	2:15 am	
		1425 hours
	8:10 pm	
		2111 hours
16 minutes past 5 pm		
23 minutes to 11 in the morning		
		0011 hours
	12:29 pm	

5 Give the digital and 24-hour clock time for the time shown on these clockfaces. Each one shows the time in the morning:



6 Give the digital and 24-hour clock time for the time shown on these clockfaces. Each one shows the time in the afternoon:



7 Below is a part of a college schedule for their daily program (Monday to Thursday). Find the length of time for/between each activity.

6:00 am	Rising bell	2:45 pm	Class end
6:10 am	Worship	3:00 pm	Work session
7:00 am	Breakfast	5:00 pm	Sport
7:30 am	Class	6:30 pm	Dinner
10:10 am	Break	7:00 pm	Evening worship
10:30 am	Class	7:30 pm	Study time
11:50 am	Lunch	9:00 pm	Devotion
12:45 pm	Class	9:30 pm	Bedtime

11E Using timetables

Timetables are used to let people know when services, varying from school lessons to the movements of buses, are available.

Example

This is the morning bus timetable going from Burns Creek to Central Market.

Burns Creek	8:39 am	8:56 am	9:16 am	9:35 am
King George	8:42	8:59	9:19	9:38
Ranadi	8:45	8:02	9:22	9:41
Panatina Plaza	8:47	9:04	9:24	9:43
Kukum Campus	8:49	9:06	9:26	9:45
Woodford School	8:51	9:08	9:28	9:47
Hot Bread	8:53	9:10	9:30	9:49
Kukum Market	8:55	9:12	9:32	9:51
Rita Eleven	8:56	9:13	9:32	9:52
Kingdom Hall	8:58	9:15	9:35	9:54
Lawson Tama	9:00	9:17	9:37	9:56
China Town	9:03	9:20	9:40	9:59
Town Council	9:05	9:22	9:42	10:01
Central Market	9:08	9:25	9:45	10:04

- Use the timetable to find the time taken to travel from:
 - Burns Creek to Hot Bread
 - Kukum Campus to Central Market
- Which two bus stops are closest to each other, assuming that the bus travels at the same speed between bus stops?
- If you needed to be at Rita Eleven bus stop by 9:30 am, which bus should you take from Burns Creek?

Solution

- 8:39 to 8:53, or 8:56 to 9:10, or 9:16 to 9:30, or 9:35 to 9:49. Time taken = 14 minutes.
 - 8:49 to 9:08. Time taken = 19 minutes.
- The bus only takes 1 minute to travel between Kukum Market and Rita Eleven.
- The 8:39 and the 8:56 arrive at Rita Eleven bus stop before 9:30, the others arrive too late.



Exercise 11E

- 1 There is a boat service that crosses the sea from Point Cruz to Tulagi seven days a week according to the following schedule:

Point Cruz	7 am	9 am	11 am	1 pm	3 pm	5 pm	7 pm
Tulagi	7:35	9:35	11:35	1:35	3:35	5:35	7:35
Tulagi	8 am	10 am	12 noon	2 pm	4 pm	6 pm	8 pm
Point Cruz	8:35	10:35	12:35	2:35	4:35	6:35	8:35

- How long does the boat crossing take?
 - How long is it between the arrival and the departure of the ferry?
 - How long is it between the first departure and the last arrival for the day?
 - Joylene lives in Tulagi. She is meeting her friend Mai for lunch at 1:15 in Point Cruz but needs to be home by 5 pm. Plan Joylene's use of the boat for the day.
- 2 This is the bus timetable for the services between Naha and Lawson Tama.

	MonF ri	Sat	Sun
Naha (store)	12 noon	8:30 am	9:20 am
Kobito (arr)	3:29	12:08	12:55 pm
Kobito (dep)	3:45	12:20	1:10
Vura I (dep)	3:55	12:30	1:20
Kukum SDA	4:35	1:10	2:00
Kukum Hot Bread (dep)	6:05	1:20	2:10
Kukum Market (arr)	6:15	2:50	3:40
Kukum Market (dep)	6:45	3:20	4:10
Kingdom Hall	7:50	4:25	5:15
Lawson Tama	8:35	5:10	6:00

- When does the bus leave Kukum SDA for Lawson Tama on:
 - Wednesday?
 - Saturday?
 - Sunday?
 - Friday?
- At what time do buses travelling from Naha to Lawson Tama arrive at Kobito during this week?
- What is the time taken to travel from Naha to Lawson Tama for each service?
- How long does the bus spend at Kukum Market between arrival (arr) and departure (dep)?

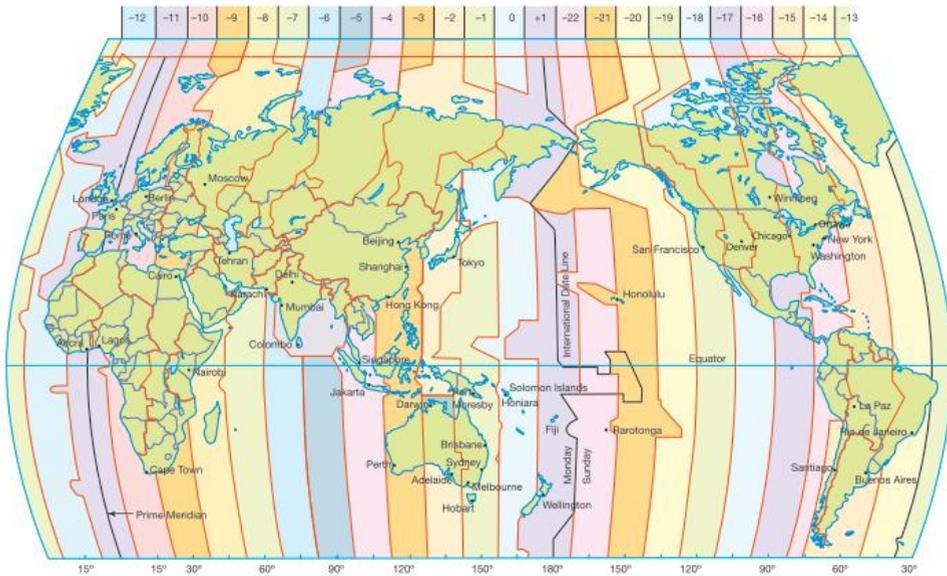


The Earth spins on its axis, so the right side of the map below is the first part of the world to see the sun rise. The left side moves into the sunlight later. This means that Solomon Islands and other Pacific Islands have different times from other countries in the world, each of which has its own time zone (sometimes more than one).

The time zones of Solomon Islands and other countries in the world are shown on the diagram below, which also shows the time differences between the zones.

Key

–4 How many hours ahead (+) or behind (–) each time zone is compared to Solomon Island time.

**Example**

If it is 2 pm in Solomon Islands, what time is it in:

- Wellington?
- Rarotonga?
- Cape Town?
- Ottawa?

Solution

Wellington is 1 hour ahead of Solomon Islands: 3 pm

Rarotonga is 22 hours behind Solomon Islands: 4 pm previous day

Cape Town is 10 hours behind Solomon Islands: 4 am

Ottawa is 16 hours behind Solomon Islands: 10 pm previous day

Exercise 11F

I If it is 3 pm on Wednesday in Solomon Islands, what time is it in:

- | | | |
|-------------|-------------|-----------|
| a Honolulu? | b Santiago? | c Ottawa? |
| d Perth? | e Tokyo? | f Lagos? |

- 2 If it is 6 am on Sunday in Solomon Islands, what time is it in:
- a San Francisco? b Rome? c Beijing?
 d New York? e Wellington? f Jakarta?
- 3 Complete the following table:

Time in Cape Town	Time in Perth	Time in Melbourne	Time in Wellington
	4:00 am		
5:30 pm			
		7:15 am	
			12 noon
	12 midnight		

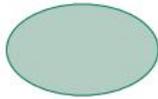
- 4 A Solomon Airlines Twin Otter plane takes 60 minutes to travel from Honiara to Kira Kira. If it leaves at 2:17 pm, at what time will it touch down at Kira Kira airport?
- 5 The Prime Minister and his family travel by plane from Honiara to Fiji. If they left at 0430 hours (Honiara time) and arrived at 0830 hours (Fiji time), how long did the flight take?
- 6 A plane leaves Honiara at 3 pm and flies directly to Port Moresby. If the flight takes 2 hours and 45 minutes, at what local time will it touch down at Jackson International airport in Port Moresby?
- 7 A plane leaves Honiara at 1715 hours and arrives in Brisbane at 2015 hours local time. Patrick wants to travel on this flight. It is recommended that people check in at the airport 90 minutes before the flight leaves. It is also known that it will take about 45 minutes for people to pick up their luggage and leave the airport at Brisbane.
- a At what time should Patrick check in at Henderson airport in Honiara?
 b At what time will he leave Brisbane airport?
 c How long will the journey take in total, including check-in and luggage pick-up?
- 8 During the months of June to December, Solomon Islands experience more hours of daylight than of night time. Assume that Solomon Islands has adopted a daylight saving time, during which the clocks are turned forward 1 hour so that 9 am becomes 10 am.

Using the above information, answer the questions below.

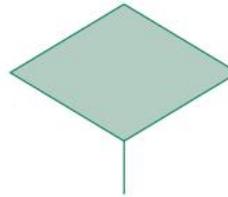
- a If it is 5 pm (daylight saving time) in Honiara, determine the time in the following places (assume that they are not on daylight saving time):
- i Melbourne ii Fiji iii Port Moresby
 iv Perth v Wellington
- b If it is 11 am in Fiji, what is the time in the following cities:
- i Brisbane ii Honiara (daylight saving time) iii Wellington
 iv Perth v Port Moresby

In order to complete a task efficiently, the order in which events need to occur must be planned carefully. This is true whether we are solving a maths problem, building a dog kennel or making a cup of coffee. Careful planning leads to successful completion of tasks.

In simple flow charts the following boxes are used:



Used for Start or Stop



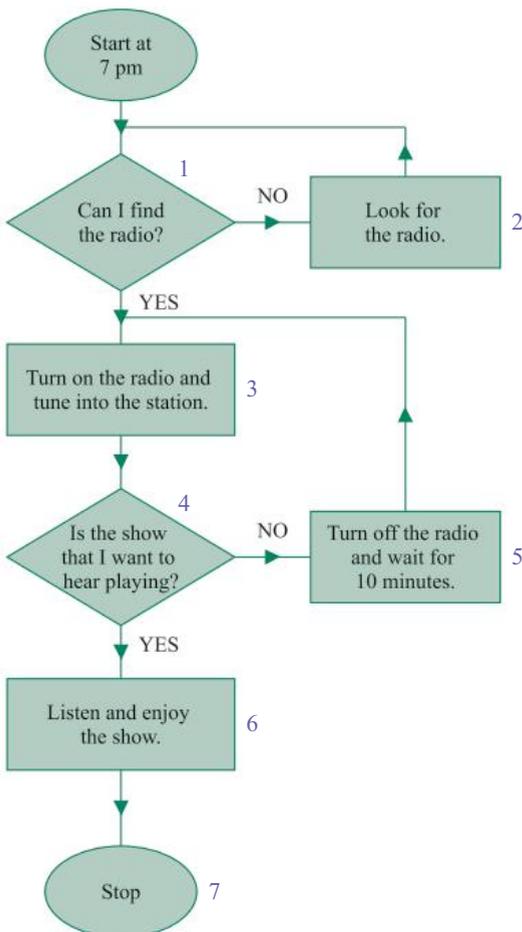
Used for decisions:
Yes or No



Used for instructions

Example

Explain the steps in this chart for tuning in to a favourite radio program that you think starts some time after 7 pm



Solution

Step 1: Can you find the radio? If not keep looking for it (Step 2).

Step 3: Turn on the radio and tune in to the station.

Step 4: Is the show playing? If not wait 10 minutes and try again (Step 5).

If it is, listen to the program and enjoy it (Step 6).

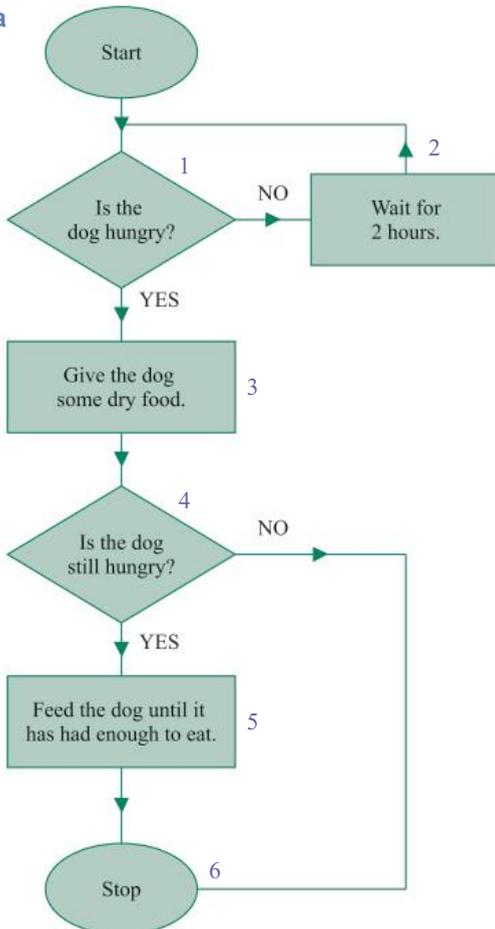
Step 7: Turn off the radio.



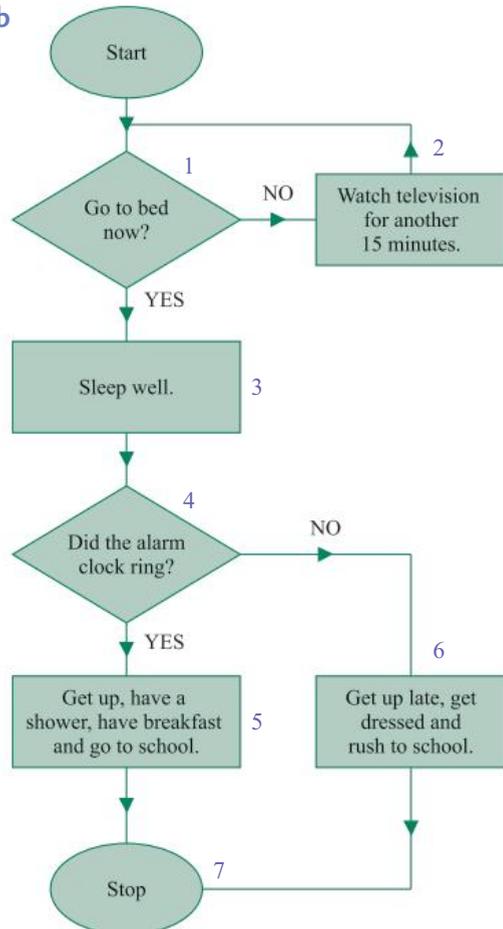
Exercise 11G

1 Explain the steps in the following flow charts:

a



b



2 Place these steps in the correct order in a flow chart:

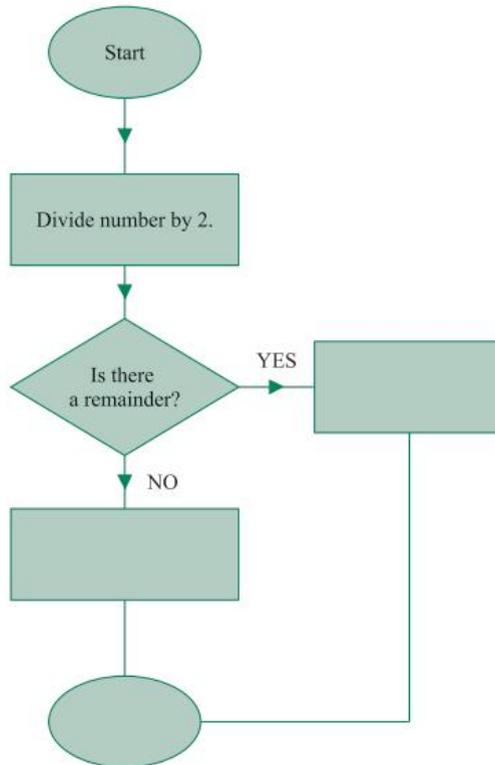
a Getting up in the morning and going to school

- Get out of bed
- Go to the kitchen
- Woken by the alarm clock
- Get dressed
- Go to school
- Eat breakfast
- Get ready for school

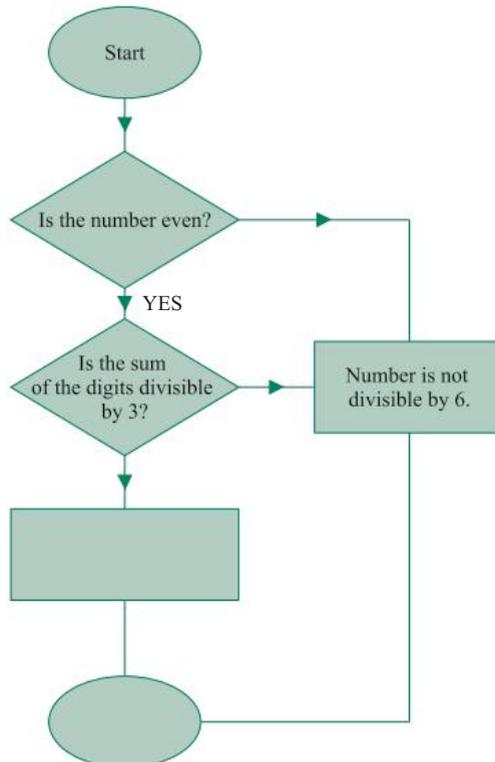
b Boiling and eating an egg

- Take egg out of boiling water after 3 minutes
- Break shell and eat the egg
- Boil water in saucepan
- Put egg into boiling water
- Get egg from fridge
- Put hot egg under cold water

- 3 Complete this flow chart, which tests whether a number is odd or even:



- 4 Complete this flow chart, which tests whether a number is divisible by 6:



- 5 The photographs below were taken from exactly the same position at various stages during a race. What is the correct order of the photographs?

a



b



c



d



- 6 The photographs below show a house being extended and having a second storey added.

The photographs show four stages:

- O original house
- 1 frame 1st storey
- 2 frame 2nd storey
- F finished 2nd storey

Each stage is photographed from three directions:

- R rear
- FL front left
- FR front right

For each of the 12 photographs identify the building stage and the direction from which it was photographed.

a



b



c



d



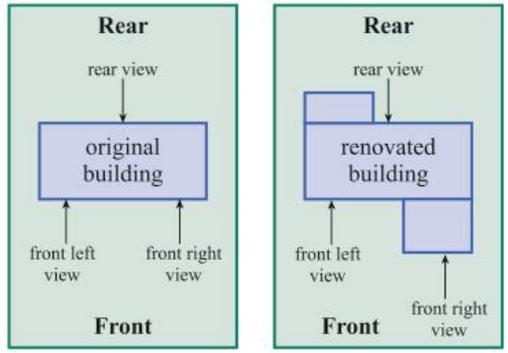
e



f



The plan shows the original ground floor plan and the new ground floor plan.



The mass of an object is a measure of how heavy it is. The metric system uses the units of grams, kilograms and tonnes to measure mass.

The mass of the Earth is about 5 940 000 000 000 000 000 tonnes, while the mass of the largest animal to have lived, the blue whale, is 190 tonnes.

Here are some examples of objects that are 1 unit of mass:

A grain of sand



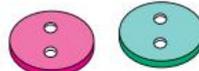
1 milligram

This bag of sugar



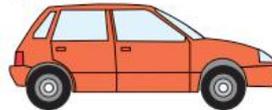
1 kilogram

Two buttons



1 gram

A small car



1 tonne

The relationship between these units is:

1 tonne = 1000 kilograms

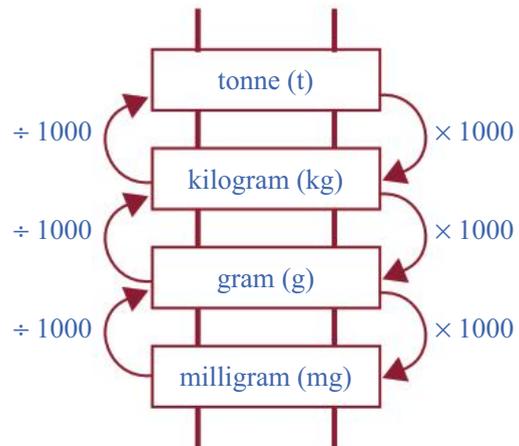
1 kilogram = 1000 grams

1 gram = 1000 milligrams

The units are connected by either multiplication or division using the numbers on the ladder.

When climbing down the ladder, multiply.

When climbing up the ladder, divide.



Example

Complete the following conversions:

- 2 tonnes = _____ kilograms
- 5 kilograms = _____ grams
- 9 grams = _____ milligrams
- 6400 kilograms = _____ tonnes
- 3900 grams = _____ kilograms
- 12 000 milligrams = _____ grams

Solution

- $$2 \times 1000 = 2000 \text{ kilograms}$$
- $$5 \times 1000 = 5000 \text{ grams}$$
- $$9 \times 1000 = 9000 \text{ milligrams}$$
- $$6400 \div 1000 = 6.4 \text{ tonnes}$$
- $$3900 \div 1000 = 3.9 \text{ kilograms}$$
- $$12\,000 \div 1000 = 12 \text{ grams}$$

Exercise H

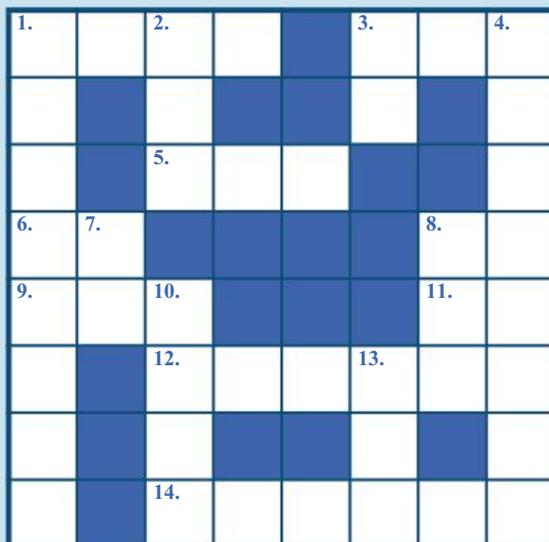
- 1 List the unit that is most appropriate to express the mass of the following:
- | | | |
|-------------------------|--------------------|--------------------------|
| a an ant | b a brick | c a car |
| d a person | e a pencil | f a trailer load of sand |
| g a feather | h twenty big books | i an elephant |
| j 3000 litres of petrol | k a truck | l a piece of paper |
- 2 a 2 tonnes = _____ kilograms b 3.6 t = _____ kg
 c 1.02 t = _____ kg d 3090 kg = _____ t
 e 540 kg = _____ t f 21 500 kg = _____ t
- 3 a 5 kilograms = _____ grams b 6.08 kg = _____ g
 c 10.02 kg = _____ g d 7 grams = _____ milligrams
 e 3254 g = _____ mg f 990 g = _____ mg
- 4 a 4000 milligrams = _____ grams b 8.3 g = _____ mg
 c 1200 mg = _____ g d 620 mg = _____ g
 e 5.4 g = _____ mg f 310 mg = _____ g
- 5 a 4300 grams = _____ kilograms b 8720 g = _____ kg
 c 450 g = _____ kg d 2600 kilograms = _____ tonnes
 e 340 kg = _____ t f 9900 kg = _____ t
- 6 Helen went shopping for varieties of mushrooms and bought bags containing 450 g, 1.0 kg and 672 g from three different shops. What was the total weight, in:
- a grams? b kilograms?
- 7 Julia bought a 3-kilogram container of ice cream. Julia ate 435 grams, Juan ate 50 grams and 1.2 kilograms was used in milkshakes. Find the amount of ice cream that was left, in:
- a grams b kilograms
- 8 Enormous Egbert the elephant was put on a short diet. Before beginning the diet he weighed 1323.4 kg. Over the next five weeks he lost 1.2 kg, 0.45 kg, 1.02 kg, 0.7 kg and 2.04 kg. Find the weight in grams and kilograms that:
- a Egbert has lost altogether
 b Egbert weighs at the end of the diet
- 9 Chips are sold in packets weighing 50 g, 100 g, 200 g and 250 g. Each size of packet is packed in boxes of 200 packets. Each empty box weighs 4.5 kg. Find the weight of a box of 200 packets for each packet size. Give your answer in grams and kilograms.
- 10 Lorris, Jenny and Linda plan to start a worm farm and are shown here choosing worms from a compost heap.
- They find that on average the worms weigh 12 g. Find the total weight of worms if Lorris wants 1200, Jenny 1500 and Linda 580 worms.





Puzzles

I Complete the cross-number puzzle.



Across

Find the number of minutes:

- in 3 days
- in $6\frac{1}{4}$ hours
- between 4:30 am and 5:15 pm
- in 1.3 hours – 50 minutes
- in 3 hours 10 minutes – 1 hour 45 minutes
- between midnight and 2:15 am
- between 11:38 am and 12:24 pm
- in 19 weeks and 3 days
- in 10 weeks

Down

Find the number of seconds in:

- 67 weeks
- 40 minutes – 36 minutes 3 seconds
- 0.55 minutes
- 95 weeks
- 1 minute 23 seconds
- 15 minutes 16 seconds – 1 minute 12 seconds
- 1 h 25 minutes 21 seconds
- 36 minutes 5 seconds – 22 minutes 37 seconds



2 Calculate the time difference in each question below. Use the answer and the matching letter to solve the riddle:

Why didn't the alarm clock work?

D 1 pm to 7 pm

C noon to 10 pm

U 3 am to 7 am

I 12:30 am to 8 am

S 5:30 am to noon

N 4 am to 6 pm

B 11:30 am to 7:30 pm

H 5:25 am to 10:15 am

E 3:10 pm to 7:40 pm

T 6:15 am to 11:55 pm

A midnight to 1:20 pm

8 h	$4\frac{1}{2}\text{ h}$	10 h	13 h 20 min	4 h	$6\frac{1}{2}\text{ h}$	$4\frac{1}{2}\text{ h}$	$7\frac{1}{2}\text{ h}$	17 h 40 min		
14 h	$4\frac{1}{2}\text{ h}$	$4\frac{1}{2}\text{ h}$	6 h	$4\frac{1}{2}\text{ h}$	6 h	13 h 20 min	4 h	13 h 50 min	14 h	6 h

3 Complete the mass conversions below and match the letters to the correct answers to solve the riddle:

What do you get when you cross a frog with a calendar?

A 1250 mg = _____ g

B 0.95 kg = _____ t

C 250 kg = _____ t

E 6400 kg = _____ t

G 0.64 t = _____ kg

L 0.12 t = _____ kg

P 1200 mg = _____ g

R 0.002 g = _____ mg

T 0.001 25 kg = _____ mg

O 0.25 t = _____ kg

U 950 g = _____ kg

Y 0.012 kg = _____ g

12	250	0.95		640	6.4	1250	1.25
120	6.4	1.25	1.2	12	6.4	1.25	2



Applications

- 1 Make a poster by drawing a timeline that represents the following sequence of the Lunar spacecraft expeditions:
- | | |
|---|--|
| 1959: March, Pioneer 4 (flyby) | |
| 1961: August, Ranger 1 (attempted test flight) | November, Ranger 2 (attempted test flight) |
| 1962: January, Ranger 3 (attempted impact) | April, Ranger 4 (impact) |
| October, Ranger 5 (attempted impact) | |
| 1964: January, Ranger 6 (impact) | July, Ranger 7 (impact) |
| 1965: February, Ranger 8 (impact) | March, Ranger 9 (impact) |
| 1966: May, Surveyor 1 (landed) | August, Lunar Orbiter |
| November, Lunar Orbiter 2 | |
| 1967: February, Lunar Orbiter 3 | April, Surveyor 3 (landed) |
| May, Lunar Orbiter 4 | August, Lunar Orbiter 5 |
| September, Surveyor 5 (landed) | November, Surveyor 6 (landed) |
| 1968: January, Surveyor 7 (landed) | December, Apollo 8 (manned orbiter) |
| 1969: May, Apollo 10 (orbiter) | July, Apollo 11 (manned landing) |
| November, Apollo 12 (manned landing) | |
| 1970: April, Apollo 13 (manned landing—aborted) | |
| 1971: January, Apollo 14 (manned landing) | July, Apollo 15 (manned landing) |
| 1972: April, Apollo 16 (manned landing) | |
| 1972: December, Apollo 17 (manned landing) | |

Find out any interesting events that occurred on these missions and show them on your display.

- 2 Make a poster that shows Sir Donald Bradman's century innings. Innings with * were 'not out' innings.

Tests against England

1929: December, 112 runs	March, 123 runs		
1930: June, 131 runs	June–July, 254 runs	July, 334 runs	August, 232 runs
1933: December '32–January '33, 103 runs			
1934: July, 304 runs	August, 244 runs		
1937: January, 270 runs	January–February, 212 runs	February–March, 169 runs	
1938: June, 144* runs	June, 102* runs	July, 103* runs	
1946: November–December 187 runs		December, 234 runs	
1948: June, 138 runs	July, 173* runs		

Tests against West Indies

1931: January, 223 runs	February, 152 runs
-------------------------	--------------------

Tests against India

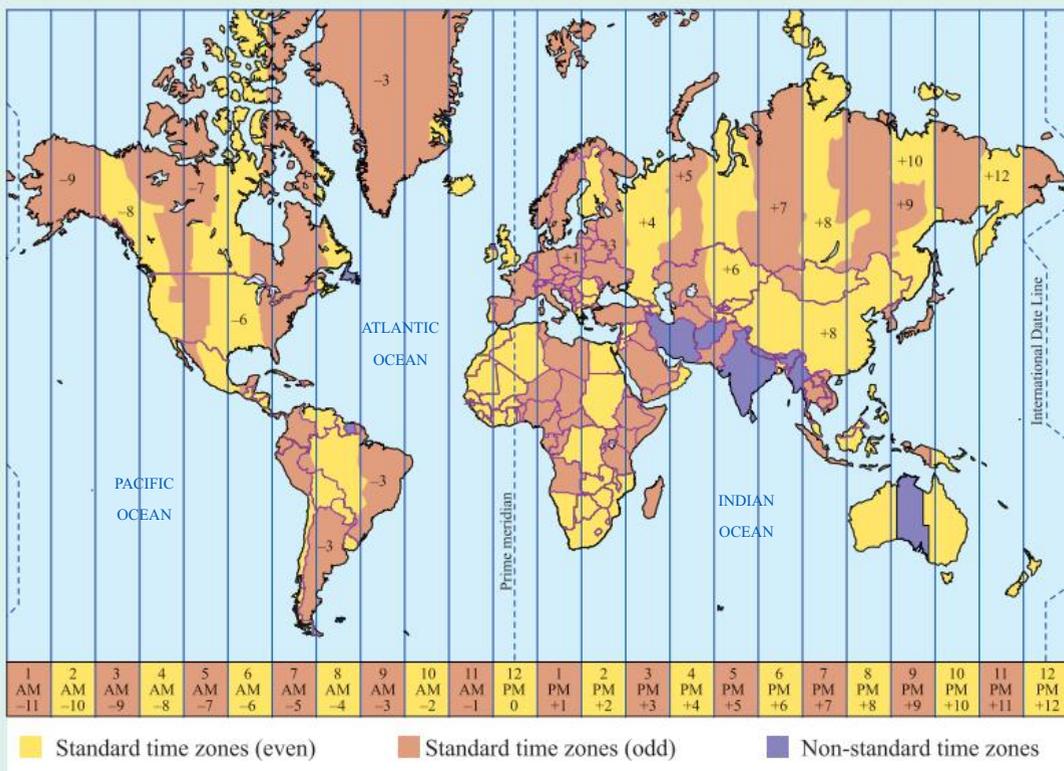
1947: November–December, 185 runs		
1948: January, 132 runs	January, 127* runs	January, 201 runs

Tests against South Africa

1931: November–December, 226 runs	December, 112 runs
December '31–January '32, 167 runs	
1932: January–February, 299* runs	

Research the events that occurred during any of the above innings and include them on your display.

- 3** The Chinese calendar operates on a 12-year cycle using 12 animals. The cycle begins with a rat and ends with a pig. List the twelve animals in the correct order beginning with the rat. Ask a number of people who live in your area the year they were born. The year 1900 was the year of the rat, so work out the animal that governs the birthday of the people in your survey. People born in the years with different animals are said to have different characteristics. List the characteristics of people born using the Chinese calendar and write a report saying whether the characteristics are true for the people in your survey.
- 4** The world is divided into 24 different time zones. The prime meridian running through Greenwich, near London, is where the time zones start. The International Date Line is on the opposite side of the Earth. It is the line that divides one day from another. East of the line it is 1 day earlier than to the west of the date line.



- a** Make a poster showing the international time zones above and explain what the map shows. Research the non-standard time zones and add them to your poster.
- b** State the countries that are in the same time zone as your town or city.
- c** Find a city in another country that is 1, 2, 3, 4 and 5 hours ahead of the time where you live.
- d** Find a city in another country that is 1, 2, 3, 4 and 5 hours behind the time where you live.
- e** Select a variety of cities from different zones and give examples of how the times in these zones relate to each other.
- f** You have friends living in London, Tokyo, Beijing, Los Angeles, New York, Budapest, Toronto, Paris, Athens, Singapore and Cape Town. At what time should you phone them at home if they are only available from 10 to 10:30 am on Monday morning?

Enrichment

- 1 Draw a timeline and mark on it the times for the rise and set of the following planets:

Planet	Rise	Set
Mercury	5:08 am	6:35 pm
Venus	8:59 am	7:38 pm
Mars	11:09 pm	1:48 pm
Jupiter	12:52 pm	10:44 pm
Saturn	12:05 pm	10:19 pm

Find the length of time that each planet is above the Earth's horizon.

- 2 Our calendar does not exactly fit a regular mathematical system. Every 4 years, 1 day needs to be added. The length of 1 year is approximately $365\frac{1}{4}$ days.

- a Find the number of days in:
- i 5 years in a row
 - ii 6 years in a row
 - iii 7 years in a row

We have 3 years in a row of 365 days and a leap year of 366 days, which occurs every 4 years. A leap year is usually a year that is divisible by 4. The rule is different for turn of the century years like 1900, 2000. These are leap years only if divisible by 400.

- b The first Olympic Games in the modern era was held in the year 1896 in Athens. Show that this was a leap year.
- c State the years in which the following Olympic Games were held. The cities in which they were held are given in order.

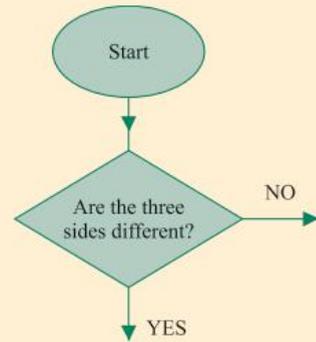
No games were held in 1916, 1940 or 1944.

Second Games: Paris, St Louis, London, Stockholm, Antwerp, Paris, Amsterdam, Los Angeles, Berlin, London, Helsinki, Melbourne, Rome, Tokyo, Mexico City, Munich, Montreal, Moscow, Los Angeles, Seoul, Barcelona, Atlanta, Sydney, Athens, Beijing.

- 3 The following are the term dates for the states and territories in Australia for one year (not a leap year). Use the information in the table to find the number of school days in each state or territory.

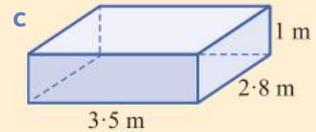
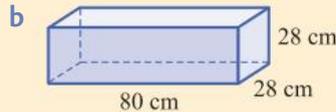
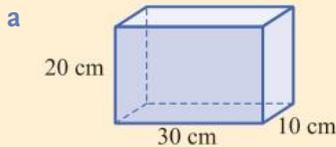
State or territory	VIC	NSW	QLD	SA	WA	TAS	ACT	NT
Term 1	25 Jan to 7 Apr	28 Jan to 14 Apr	31 Jan to 20 Apr	31 Jan to 14 Apr	1 Feb to 7 Apr	15 Feb to 2 Jun	28 Jan to 14 Apr	31 Jan to 7 Apr
Term 2	26 Apr to 23 Jun	1 May to 30 Jun	2 May to 30 Jun	1 May to 7 Jul	26 Apr to 30 Jun	19 Jun to 14 Sep	1 May to 30 Jun	17 Apr to 23 Jun
Term 3	10 Jul to 15 Sept	17 Jul to 8 Sept	18 Jul to 15 Sept	24 Jul to 15 Sept	17 Jul to 22 Sept	2 Oct to 20 Dec	17 Jul to 8 Sept	24 Jul to 29 Sept
Term 4	2 Oct to 19 Dec	3 Oct to 19 Dec	2 Oct to 15 Dec	3 Oct to 15 Dec	9 Oct to 15 Dec		3 Oct to 19 Dec	9 Oct to 15 Dec

- 4 An equilateral triangle has three equal sides, an isosceles triangle has two equal sides and a scalene triangle has no equal sides. Complete this flow chart, which can be used to find the type of triangle.



- 5 A delivery truck has 20 dozen bottles of lemonade. Each bottle weighs 800 grams and the crate, which holds a dozen bottles, weighs 1.2 kilograms. Four dozen bottles in crates are delivered to the local milk bar. Nine dozen bottles are delivered to the school canteen and nine loose bottles are delivered to the takeaway-food shop. What is the total weight of bottles and crates that were delivered to each place? What is the weight of the load that is left on the truck. Give your answer in both grams and kilograms.
- 6 The density of a material is a measure of the amount of material per unit volume. The unit of density is usually grams per cubic centimetre. The density of water at 4 degrees Celsius is 1 gram per cubic centimetre, that is a volume of 1 cubic centimetre of water weighs 1 gram at this temperature.

Find the weight of water, in grams and kilograms, needed to fill these fish tanks to the top:





Revision/Assessment

Exercise 11A

- 1 Draw a timeline and mark on it the events that correspond to the following dates:
- 1984 Pope John Paul visited Solomon Islands
 - 1986 Cyclone Namu hit Solomon Islands
 - 1978 Solomon Islands gained its independence
 - 2003 The Regional Assistance Mission to Solomon Islands (RAMSI) came to Solomon Islands
 - 2006 The April Riot in Honiara resulted in the burning down of China Town
 - 2000 The Malaita Eagle Force (MEF) took over through the Ulufalu Government
 - 2008 A tsunami hit Solomon Islands in the Choiseul and Western Provinces
 - 1970 The Commonwealth Development Cooperation (CDC) aid established SIPL
 - 1942 The Second World War was fought in Solomon Islands
 - 1999 The beginning of ethnic tension between Guadalcanal and Malaita people

Exercise 11B

- 2 Complete the following conversions:
- | | |
|-------------------------------|-------------------------------|
| a 5 centuries = _____ years | b 54 years = _____ decades |
| c 400 years = _____ centuries | d 3 years = _____ months |
| e 3 weeks = _____ days | f 7 days = _____ hours |
| g 32 minutes = _____ seconds | h 420 seconds = _____ minutes |

Exercise 11C

- 3 Find the number of days between (not including) these dates:
- | | |
|-----------------------------|---------------------------|
| a 13 May and 4 June | b 1 August and 1 November |
| c 13 December and 1 January | d 19 March and 19 May |
- 4 Find the number of years between and including:
- | | |
|---------------------|-----------------------|
| a 12 BC and 2 BC | b 1300 AD and 2001 AD |
| c 230 BC and 540 AD | d 120 BC and 1 AD |

Exercise 11D

- 5 Give the digital time for these times:
- | | | |
|--------------|-----------------------|------------------------|
| a 0930 hours | b 1230 hours | c 1600 hours |
| d 2142 hours | e a quarter past 3 am | f 20 minutes past 4 am |
- 6 Draw clockfaces to show the following times:
- a 5:15 am b 11:31 pm c 0900 hours d 1730 hours e 1720 hours
- 7 Find the number of hours and minutes between the following times on the same day:
- | | |
|-----------------------------|-----------------------------|
| a 9:00 am and 2:17 pm | b 9:32 am and 5:35 pm |
| c 1500 hours and 1724 hours | d 1423 hours and 1900 hours |
| e 0920 hours and 1328 hours | f 1431 hours and 1835 hours |

Exercise E

- 8 This is the morning bus timetable for Saturday between Lunga and Rove East:

Lunga	King George	Panatina Plaza	Town Council	Rove	Rove West	Rove East
7:48	7:58	8:13	8:21 E	8:25	–	8:37
8:18	8:28	8:43	8:51 W	8:55	9:05	–
8:48	8:58	9:13	9:21 E	9:25	–	9:37
9:18	9:28	9:43	9:51 W	9:55	10:05	–
9:48	9:58	10:13	10:21 E	10:25	–	10:37
10:18	10:28	10:43	10:51 W	10:55	11:05	–
10:48	10:58	11:13	11:21 E	11:25	–	11:37
11:18	11:28	11:43	11:51 W	11:55	12:05	–
11:48	11:58	12:13	12:21 E	12:25	–	12:37

The letters E (east) and W (west) represent two different routes through Town Council.

- a Jill needs to be in Rove West by 11 o'clock for an appointment at the Prison Service Department. Which buses could she catch from King George to make the appointment on time?
- b How long does the bus take to travel from:
- i King George to Rove West?
 - ii Lunga to Town Council?
 - iii King George to Panatina Plaza?
 - iv Lunga to Rove?

Exercise F

- 9 If it is 4 pm in Honiara, use the time zone map on page 298 to determine the time in:
- a Brisbane
 - b Cape Town
 - c Port Moresby
 - d New York
 - e Beijing
 - f Tokyo

Exercise H

- 10 Complete the following conversions:

- a 5 tonnes = _____ kilograms
- b 6.9 t = _____ kg
- c 7.06 t = _____ kg
- d 9 grams = _____ mg
- e 3298 g = _____ mg
- f 770 g = _____ mg
- g 4380 milligrams = _____ grams
- h 1760 mg = _____ grams
- i 9400 mg = _____ g
- j 7620 kilograms = _____ tonnes
- k 780 kg = _____ t
- l 5800 kg = _____ t

CHAPTER

12

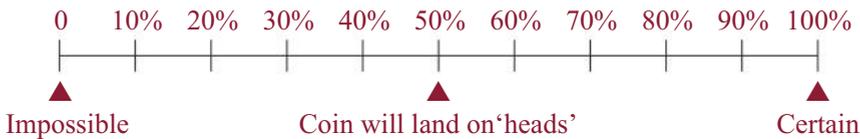
Probability



The likelihood of an event occurring is called probability or chance. Every day we use terms such as ‘unlikely’, ‘definitely’, ‘even chance’, ‘probably’ and ‘impossible’ to describe whether or not a particular event will happen. Some events are impossible and will not happen. For example, this book will not grow legs and run away. Some events are certain. All other events are called chance events. Is it likely or unlikely that you will leave class early today?

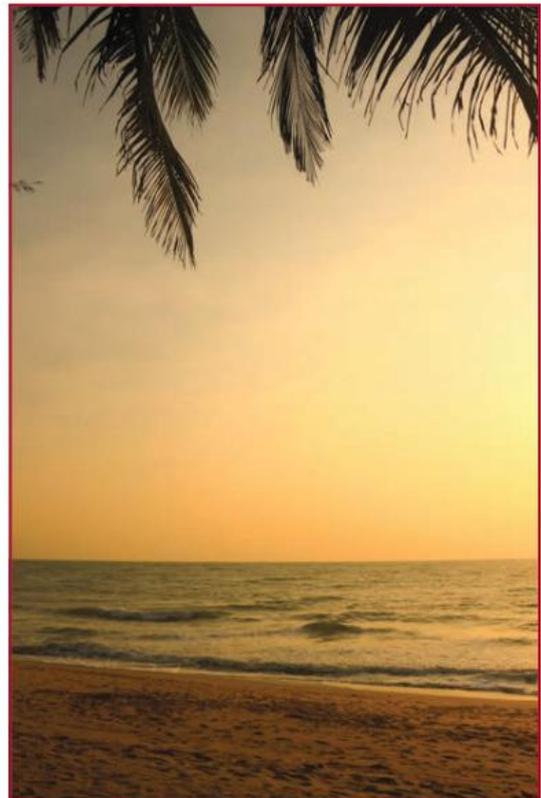
To be able to compare probabilities, we can use words or percentages, fractions or decimals.

- If an event is impossible we say it has a zero chance of occurring.
- If an event will definitely happen we say it is certain or it has a 100% chance.
- If an event is unlikely to happen we can say it has little chance of occurring.
- When you throw a coin there is an even chance that the coin will land on ‘heads’.



Exercise 12A

- 1 Write down a list of all the words or expressions relating to chance and probability that you know. Combine these with the expressions of other students in your class.
- 2 Rewrite the class list in order, beginning with *impossible*.
- 3 You have some control of your future, but which of the following are impossible (I), definite (D), or chance (C) events?
 - a You will play sport on the weekend.
 - b You will marry before your 21st birthday.
 - c You will blink within the next 30 minutes.
 - d You will watch the TV tonight.
 - e You will go to the movies sometime this month.
 - f You will leave your classroom today.
 - g You will wake up on Mars tomorrow.
 - h You will win a gold medal in an Olympic competition.
 - i You will earn \$1 million in your lifetime.
 - j The sun will rise tomorrow.

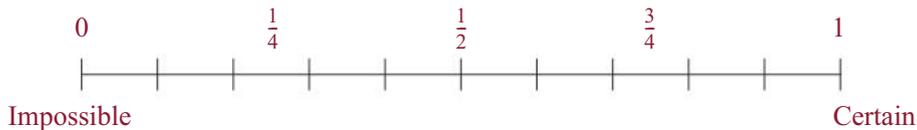


- 4 Which of the chance events in Question 3 is **i** most likely and **ii** least likely to happen to you? Explain your answer.
- 5 Write down an event that is impossible and an event that will definitely happen.
- 6 Write down three other chance events. Choose a word from the class list to match the chance of each occurring.
- 7 Choose an appropriate word from ‘unlikely’, ‘likely’, ‘possible’, ‘highly likely’ or ‘definite’ to describe the likelihood of the following:
- A woman will become the Solomon Islands Prime Minister in your lifetime.
 - It will rain at least once in Marovo during the month of April.
 - Naha FC will win the next soccer premiership.
 - Isabel will become a republic within a decade.
 - Solomon Islands will win the Soccer World Cup.
 - The sun will set over Temotu tonight.
- 8 Copy the probability number line on page 318 into your workbook. Mark on your number line where you think the probabilities of the following would lie:
- A woman will become the Solomon Islands Prime Minister next year.
 - It will rain at least once in Malaita during the month of April.
 - SOSSA will win the next Rugby premiership.
 - Renbel will become a republic within 100 years.
 - Choiseul will win the Solomon Cup in Soccer.
 - It will snow in Kirakira town.
- 9 Write down a possible or suitable event for each of these probabilities:
- impossible
 - maybe
 - certain
 - possible
 - more than likely
- 10 Use the following expressions to describe each event below. Use each expression once.

Event	Approximate probability
Throwing a five or a six on a die	Small chance
A mother planning three children will have three boys	Likely
Throwing different numbers on two dice	Even chance
Randomly selecting a red card from a pack of 52 playing cards	Very little chance
Randomly selecting a red lolly from a bag containing 24 red sweets and 1 black sweet	More than half a chance
Randomly choosing a girl from a class of 15 girls and 13 boys	Unlikely
Guessing correctly the numbers for a lottery win	Almost certain

12B Theoretical probability

Probabilities may be expressed as fractions in their simplest form between 0 and 1.

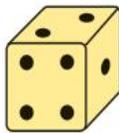


You can find probabilities by considering all the equally likely possibilities. To work out the probability of an event you need to consider all the possible outcomes, and find what fraction gives a success. Usually these probabilities are written as fractions in their simplest form.

$$\text{The probability of an event} = \frac{\text{the number of successes}}{\text{total number of possible outcomes}}$$

Example

What is the probability of getting a 4 when you throw a fair six-sided die?



Solution

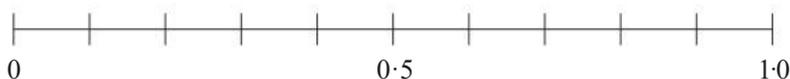
There are six possible outcomes: 1, 2, 3, 4, 5 and 6

There is only one success: 4

The probability of throwing a four = $\frac{1}{6}$.

Exercise 2 B

- 1 A fair six-sided die is rolled. What is the probability of:
 - a throwing a 6?
 - b *not* throwing a 6?
 - c throwing an even number?
 - d throwing a number less than 4?
- 2 Dawson has a set of 10 cards numbered from 1 to 10. He asks a friend to randomly select a card.
What is the probability that she will choose a card with a number:
 - a 7?
 - b below 4?
 - c above 3?
 - d that is even?
 - e that is divisible by 3?
 - f that is not divisible by 3?
- 3 Display the probabilities in Question 2 on a number line like the one below. You may like to convert each fraction into a decimal first.



- 4 You have a bag containing 12 sweets, 3 of them are red, 3 of them are black and 6 are yellow.
- When a sweet is chosen at random, what is the most likely colour?
 - What is the probability that a friend would randomly select a yellow sweet?
 - What is the probability that a friend would randomly select a black sweet?
 - What is the probability that a friend would *not* select a red sweet?
 - What is the probability that a friend would *not* select a green sweet?
- 5 Draw a number line like the one in Question 3. Use percentages to show the probabilities in Question 4 on the number line.
- 6 In a class of 30 students there are 12 boys and 18 girls.
- Is a girl or a boy more likely to be chosen at random?
 - Does each boy have more chance of being chosen than each girl?
 - What is the probability that a girl is chosen at random to be the class representative on a committee?
 - What is the probability that a boy is chosen at random to be the class representative on a committee?
- 7 It is believed that E is the most commonly used letter in the alphabet. What is the probability of randomly choosing the letter E from the following place names?
- | | | |
|------------|------------|-------------|
| a PANGOE | b BASIKANA | c HENDERSON |
| d BALLALAE | e SEGHE | f RENNELL |
- 8 What is the probability of randomly choosing the letter L from the names above?
- 9 Write a sentence to explain which you think is more likely:
- randomly choosing a boy from a class with 12 boys and 8 girls, or
 - randomly choosing a boy from a class with 14 boys and 10 girls.
- 10 The probability that a heart is randomly selected from a pack of cards is $\frac{1}{4}$. What is the probability that a randomly selected card is not a heart?
- 11 What is the chance of randomly choosing a person with a hat from this group of people?





12C Exploring simple experiments

Experiments can be used to estimate the probability of outcomes. It is important to repeat the experiment many times. The more trials you perform, the more accurate the results.

Learning task 12C

1 Coin toss

- If you throw a coin 50 times, how many times do you expect it to land on tails?
- Throw the coin 50 times. Copy and complete the table below.

Result	My guess	Tally	Total
Head			
Tail			

- Did your results match your guess?
- Would you change your guess next time? Explain your comments.



- Throw two coins 50 times. Copy and complete the table below.

No. of heads	Guess	Tally	Total
0			
1			
2			

- Is this what you expected?

2 Counters

You need a bag containing 20 counters: 5 red and 15 of another colour.

- Take a counter from the bag without looking.
- Replace it, then perform a total of 100 trials.
- Copy and complete the table below.

Result	Tally	Total
Red counter		
Other colour		

- How many times did you get a red counter?
- How many times did you get a counter of another colour?
- Based on these results, estimate the probability of getting a red counter:

$$\text{Probability} = \frac{\text{number of red counters}}{\text{total number of trials}}$$

- Is this what you expected?
- Choose a word from your list to describe the chance of choosing a red counter.

3 Numbered cards

You need 10 cards numbered from 1 to 10.

- Get a friend to shuffle the cards. Without looking at the number, take a card from your friend.
- Record the result in the table below. Replace it. Repeat this for 50 trials.
- Complete the table below.

Result	Tally	Total
Prime number 2, 3, 5, 7		
Not a prime number 1, 4, 6, 8, 9, 10		

- How many times did you get a prime number?
 - How many times did you get a non-prime number?
 - Choose a word to describe the chance of choosing a prime number.
 - Based on these results, estimate the probability of getting a prime number.
 - Is this what you expected?
- 4** Coloured stones

You need a bag containing 20 stones prepared by your teacher with unknown quantities of two different colours. Do not look in the bag.

- Take a stone from the bag without looking.
- Replace it, then perform a total of 50 trials.
- Copy and complete the table below.



Stone colours	Tally	Total
White stones		
Black stones		

- Use your results to predict the number of stones of each colour in the bag of 20.
- Open the bag and check the accuracy of your predictions.
- How many times did you get white coloured stones?
- Based on these results, estimate the probability of getting:

$$\text{Probability} = \frac{\text{number of white coloured stones}}{\text{total number of trials}}$$



12D Exploring spinners

Learning task 2 D

1 Spinner 1

- Make a spinner like the one shown.
- Estimate how often it would land on a yellow edge.
- Spin it 100 times and record the colour of the edge on which it lands.

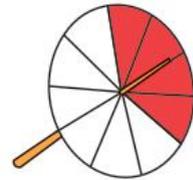


Result	Tally	Total
Red		
Blue		
Yellow		

- Did you get the results you expected?
- Compare your results with those of other students in your class.

2 Spinner 2

- Make a spinner like the one shown.
- Estimate how often it would land on the red section.
- Spin it 100 times and record the colour of the edge on which it lands.



Result	Tally	Total
Red		
White		

- Is this what you expected?
- Compare your results with those of other students in the class.

3 a Design a spinner to give the results shown in each table below.

i

Result	Total
Red	20
White	30
Blue	50

ii

Result	Total
Red	38
White	12
Blue	50

- Make the two spinners and spin each 100 times to check your predictions.
- Design a spinner of your own using at least two colours.
 - Ask another student to estimate the probability of landing on each section.
 - Spin it 100 times and check the predictions.



Learning task 12E

1 Two-up

In the game of two-up people bet on two coins that are thrown in the air. They usually bet on 'heads', 'tails' or 'odds'.

Heads: both coins land with heads facing up

Tails: both coins land with tails facing up

Odds: one coin lands tails and the other heads



a A person who bets on heads is hoping that both coins will land with the Queen's head facing upwards. Make a prediction about the chance that this will occur.

b Take two coins and throw them in the air 50 times. Record the result in the table below.

Result	Tally	Total	Chances out of 50
Heads (HH)			
Odds (HT) (TH)			
Tails (TT)			

c How many throws landed heads? What was the total number of throws? So what is the chance of a throw landing heads?

d What is the probability that a person who bets on heads will win?

2 Craps

In the game of craps, people bet on the scores of two dice added together. You will win if the total score on the dice is 7 or 11.

a With a partner, roll two dice 100 times.

b Record the total score for each roll in the table below.

Result	Tally	Total
Sum is 7		
Sum is 11		
Sum is neither 7 nor 11		

c Use your results to determine the chance:

i of a total of 7

ii of a total of 11

iii that you will win

iv that you will lose





12F Exploring card games

Learning task 12F

Use a pack of 52 playing cards to answer the following questions.

1 How many cards are of the following type:

- a Hearts
- b Diamonds
- c Spades
- d Clubs
- e Black cards
- f Red cards
- g Aces
- h Twos
- i Picture cards: kings, queens, jacks
- j Numbered cards



2 a Use the formula

$$\text{Pr}(\text{card}) = \frac{\text{number of particular card}}{\text{total number of cards in the pack}}$$

to calculate the probability of dealing the ace of spades from a well-shuffled pack of 52 cards.

- b If you deal one card from the pack 50 times, replacing the card each time, how many times would you expect to deal the ace of spades?
- c Perform an experiment to test the accuracy of your prediction. Deal one card from a well-shuffled pack of 52 playing cards. Record the card then replace it in the pack. Repeat this a total of 50 times.
- d Copy and complete the table below:

No. of times ace of spades	No. of times other card	Total
		50

- e Compare your findings with your prediction and comment on your results.



3 a Use the formula

$$\text{Pr}(\text{card}) = \frac{\text{number of particular card}}{\text{total number of cards in the pack}}$$

to calculate the probability of dealing a red card from a well-shuffled pack of 52 cards.

- b If you deal one card from the pack 50 times, replacing the card each time, how many times would you expect to deal a red card?
- c Perform an experiment to test the accuracy of your prediction. Deal one card from a well-shuffled pack of 52 playing cards. Record the card then replace in the pack. Repeat this a total of 50 times.
- d Copy and complete the table below:

No. of times red cards	No. of times black cards	Total
		50

- e Compare your findings with your prediction and comment on your results.

4 Use the formula

$$\text{Pr}(\text{card}) = \frac{\text{number of particular card}}{\text{total number of cards in the pack}}$$

to calculate the probability of dealing the following cards:

- a Hearts
- b Diamonds
- c Spades
- d Clubs
- e Black cards
- f Red cards
- g Aces
- h Picture cards: kings, queens, jacks
- i Numbered cards



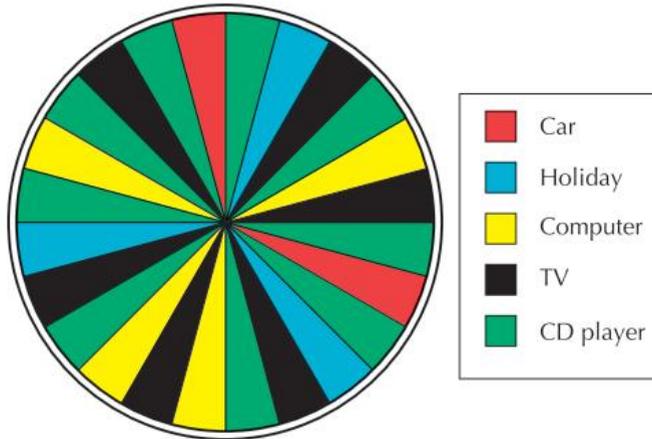
- 5 a Many other card games can be played using cards. They are: *Kua*, *Loka* (*Locker*), *Estimates* and others. Choose any one game from above and estimate the probability of winning a game.
- b Play the game a number of times and record in a table how many times you win and lose.

Win	Lose	Total

- c Compare your findings with your prediction and comment on your results.

Spinners can also be used to replace dice in board games, because they can be divided up into sectors. They also make great games at fundraising fetes and on television shows. The name of a prize can be written on each segment. Each of the sectors is equally likely, so the probability of a prize can be calculated using the formula below.

$$\text{The probability of a prize} = \frac{\text{number of prize sectors}}{\text{total number of sectors}}$$

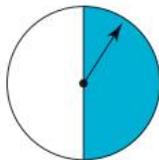


The spinner above is similar to the prize wheel on a TV show.

Example

- 1 a In the spinner above are you more likely to win a car or a CD player? Explain.
- b What is the probability of winning a holiday?

- 2 What is the probability that the pointer from the spinner lands on the blue section of this spinner?



Solution

There are two equally likely ways to win a car and nine ways for the CD player, so a CD player is more likely.

$$\begin{aligned} \text{Probability of winning a holiday} &= 3 \text{ chances out of } 24 \\ &= \frac{1}{8} \end{aligned}$$

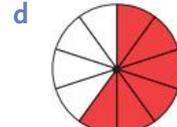
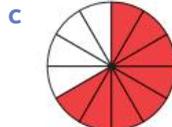
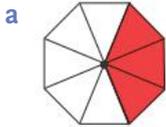
Half of the spinner is blue so there is an even chance of the pointer landing on blue. Probability that the pointer lands in the blue section = $\frac{1}{2}$.

Exercise 12G

- 1 How many sections are there in the spinner above?
- a How many sections are labelled with:
- i CD player?
 - ii car?
 - iii fridge?
 - iv computer?

b If the probability of an event = $\frac{\text{number of successes}}{\text{number of possible outcomes}}$,
work out the chance of winning each of the prizes in part a.

2 Calculate the probability of each spinner landing on red then choose a word to describe the probability:



3 Design then draw a spinner for which the probability of landing on a red edge is:

a certain

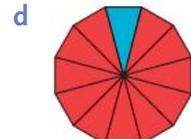
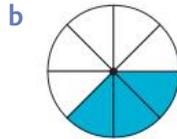
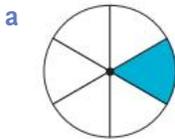
b unlikely

c probable

d even chance

4 Design a spinner for which the chance of landing on blue is most likely, red is unlikely, and yellow and black are highly unlikely.

5 What is the probability that the pointer of these spinners lands in the blue section?



6 Design a spinner for which the probability of the pointer landing in the blue section is:

a half

b less than half

c three times as likely as on red

7 Laura and Zac were doing some experiments to test their spinners. Unfortunately they mixed up their results. Match each of these spinners with its results.

Spinner	Results	Spinner	Results
a	40 red and 20 green	b	10 red and 40 green
c	30 red and 60 green	d	4 red and 12 green
e	60 red and 40 green	f	10 red and 15 green

When you try to estimate the probability of an event, you usually think back to previous experiences. 'KOSSA hasn't won many games in the 2011 DJ soccer league season. I won't pick them as the winner in the season. They probably won't win.'

Weather forecasters often predict the chance of rain by using data collected over a period of time. The National Olympic Committee of Solomon Islands (NOCSI) had to choose between three provinces, Western, Malaita and Makira provinces, to host the Solomon Games. Makira was chosen for the Solomon Games because it was less likely to have bad weather and rain than other parts of the Solomons. Collect some data on the rainfall of these three provinces over a number of years to make predictions and decisions. The Internet and libraries can be used as sources of information.

Example

Records show that in Honiara in one particular week in September it rained in 5 years out of 20.
Using this data, predict the chance of rain.

Solution

$$\begin{aligned} \text{Probability of rain} &= \frac{\text{number of years it rained}}{\text{total number of years}} \\ &= \frac{5}{20} \\ &= 0.25 \\ &= 25\% \end{aligned}$$

Exercise 2 H

- In a netball game a player had 32 attempts at shooting and scored 7 goals. What is the probability that she will score a goal with her next shot?
- In a soccer game James Naka made 12 attempts to shoot at goal and scored 3 goals. What is the probability that he will score a goal with his next shot?
- The table below lists reasons why people from different islands wanted to go to Honiara each year. Use the data in the table to estimate the probability that people from the villages will still go to Honiara.

Reason for travel	Number of travellers
Work	35 000
School	120 000
Visit relatives/wantoks	40 000
Play sports	15 000
Total	

Use the data in the table to estimate the probability that a randomly chosen passenger is travelling to Honiara:

- to visit relatives/wantoks
- to attend school
- to work
- to play sports.

- 4 This table gives the average number of rainy days for each month in five islands in the Solomon Islands.

Islands	J	F	M	A	M	J	J	A	S	O	N	D
Simbo	4	4	6	9	13	15	16	16	13	11	8	6
Shortland	13	14	15	11	10	8	7	7	7	9	10	12
Tikopia	7	5	7	7	8	9	10	11	10	9	10	12
Bellona	8	7	9	12	14	14	15	16	15	14	12	11
Rennell	3	3	4	8	14	17	18	17	14	11	7	4

- Which island is most likely to have a rainy day in January?
- Which island is most likely to have a rainy day in June?
- Which island is least likely to have a rainy day in September?
- What is the probability of rain in Tikopia on a particular day in March?
- What is the probability that it doesn't rain in Bellona on a particular day in April?
- Overall, which island is most likely to have a rainy day?
- Overall, which island is least likely to have a rainy day?



Puzzles

I The words in the list below are hidden in the word search. Can you find them? Words can go up or down as well as forwards and backwards.

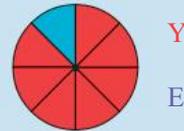
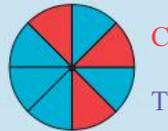
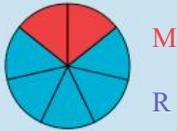
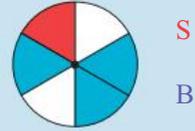
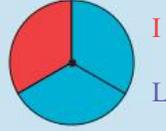
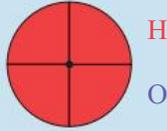
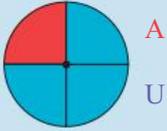
Certain Chance Counter Definite Diagram Dice
 Even Head Impossible Likely Odds Prime
 Probability Raffle Table Tails Tree Venn

C	E	R	T	A	I	N	E	R	E	S
E	L	F	F	A	R	S	H	E	A	D
L	I	K	E	L	Y	E	V	E	L	I
B	P	A	M	E	E	C	I	D	V	A
I	D	D	I	C	E	N	N	E	C	G
S	E	E	R	T	C	A	E	F	O	R
S	R	D	P	F	T	H	V	I	U	A
O	D	D	S	T	A	C	E	N	N	M
P	R	O	B	A	B	I	L	I	T	Y
M	I	T	A	I	L	S	T	T	E	P
I	E	A	N	N	E	V	R	E	R	O



- 2 For each spinner, calculate the probability of landing on red or blue. Match each letter to the correct probability for each colour below to solve the riddle:

Why did the coach give lighters to the football team?



$\frac{1}{2}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{5}{8}$	1	$\frac{1}{8}$	$\frac{7}{8}$		
$\frac{2}{3}$	0	$\frac{1}{6}$	$\frac{5}{8}$		$\frac{1}{4}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{5}{8}$	1	$\frac{1}{8}$	$\frac{1}{3}$	$\frac{5}{7}$
$\frac{2}{7}$	$\frac{1}{4}$	$\frac{5}{8}$	$\frac{3}{8}$	1	$\frac{1}{8}$	$\frac{1}{6}$						

- 3 Calculate the probability of randomly selecting the cards from a deck of 52 playing cards. Match the letters to the correct probability to solve the riddle:

Why did the farmer plough his fields with a steamroller?

A Heart ♥

E Picture card JQK

H Ace

N Black picture card

P Not an ace

S King or Queen of spades ♠

W Not a heart ♥

D Jack of hearts ♥

G Red card

M Red or black card

O Even-numbered diamond ♦

R 13 of clubs ♣

T Odd-numbered red card

(not including aces)

$\frac{1}{13}$	$\frac{3}{13}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{26}$	$\frac{2}{13}$	$\frac{3}{13}$	$\frac{1}{52}$	$\frac{2}{13}$	$\frac{5}{52}$
$\frac{1}{2}$	0	$\frac{5}{52}$	$\frac{3}{4}$	1	$\frac{1}{4}$	$\frac{1}{26}$	$\frac{1}{13}$	$\frac{3}{13}$	$\frac{1}{52}$
$\frac{12}{13}$	$\frac{5}{52}$	$\frac{2}{13}$	$\frac{1}{4}$	$\frac{2}{13}$	$\frac{5}{52}$	$\frac{3}{13}$	$\frac{1}{26}$		



Applications

Surveys

Sometimes it is impossible to do an experiment when we want to find the probability of an event or characteristic occurring. So we might instead choose to do a survey. Have you ever been questioned in your area in Honiara or on your island or in your village/community or even your house? For example, some people might come around and ask you questions. During census day, people went around asking how many people there were in each household—this was basically done to count the number of people in Solomon Islands. Some people went around the villages carrying out surveys for the RAMSI, while others carried out medical surveys. People go around carrying out surveys to get the information they want to use. The bigger the group that is surveyed, the more likely it is that the results will be accurate.

Estimate the probability of these chance events in your class:

- a student is left handed
 - a student is a twin
 - a student is born in February
 - a student is male
 - a student has brown eyes
 - a student travels to school by bus
 - a student is from a family of three or more children.
- a Choose some of the events above and survey the class.
- b Based on the data collected estimate the probability of each of the chance events.
- c Would these results be different if you surveyed a different class or a different school? Discuss.

Drawing pins

You will need a drawing pin. Work with a partner so that one person can throw while the other records the results. Throw the drawing pin to see which way it lands. If the point is touching the desk, record DOWN. If the point is straight up, record UP.

Result	Tally	Total
UP		
DOWN		

- a What is the chance of your thumbtack landing safely DOWN?
- b Compare your results with those of other groups in your class. Are the results similar?

A gamble

Many people love to gamble on chance events. Listed below are some of the things on which people will risk money:

- horse racing
- pokies
- roulette wheel at the casino
- Lotto
- card games at the casino
- dog racing
- scratchies
- footy tipping

- a Which of these are you most likely to win or lose money on?
 b Try to rank these activities in order from most likely to least likely to win money.

Letters

You will need a book or magazine for this exercise.

- Randomly choose a page of your book or a magazine.
- Count the number of times each letter occurs in the first 200 words of the page.
- Record your results in a table like this.

Letter	Tally	Number	Probability	Percentage = probability \times 100
A				
B				
C				
.				
.				
.				
.				
Z				
Total			1	

- a Which letters were more likely to occur?
 b Did any letters not occur? Does this mean that there is a zero probability of these letters occurring? Explain your answer.
 c Compare your results with those of a friend. Explain any possible differences.
 d In the English language the probability of each of the letters of the alphabet occurring is as listed in this table:

Letters	Probability
E	13%
T	9%
I, N, R	8%
A, O	7%
S	6%
D, L, G	4%
C, F, H, M, P, U	3%
B, V, W, Y, K	1%
J, Q, X, Z	Less than 1%



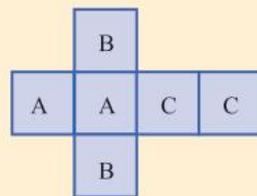
- e Compare these with your results.



Enrichment

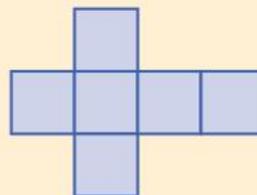
- 1 Four students, Amy, Brenton, Caroline and David, sit in a row on a bench.
 - a If we use letters to represent their names, write down all the different possible arrangements. ABCD, ACDB, DCAB ... You may like to write A, B, C and D and rearrange them until you have all the possible arrangements. Assume that they sit down randomly.
 - b How many of your arrangements have David sitting next to Caroline? What is the probability that Caroline sits next to David?
 - c Brenton does not like David. How many of your arrangements have David sitting next to Brenton? What is the probability that they do not sit next to each other?
 - d What is the probability that Amy sits between Brenton and David?
 - e Repeat the exercise, this time adding a fifth student, Elizabeth.
 - f What if the students sit in a circle?

- 2 The adjacent cardboard nets are folded and glued to form a lettered die. List the probability of each letter coming up when each die is rolled:



- a a net of a cube 2 faces A, 2 faces B, 2 faces C
- b a net of a cube 1 face A, 4 faces B, 1 face C
- c a net of a tetrahedron 2 faces A, 1 face B, 1 face C

- 3 Copy the net and use it to design a die that has:



- a an equal chance of rolling black, blue, red, yellow, white and green
- b an equal chance of rolling yellow, green and white
- c an even chance of throwing a 6 and more chance of throwing a 2 than a 1
- d more chance of an A than a B and more chance of a C than an A

- 4 Design a spinner that will produce the results shown in each of the tables below:

a

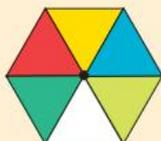
Colour	Chance
Red	$\frac{1}{2}$
Black	$\frac{1}{4}$
Gold	$\frac{1}{4}$

b

Symbol	Probability
A	$\frac{1}{8}$
B	$\frac{1}{2}$
C	$\frac{1}{4}$
D	$\frac{1}{8}$

c

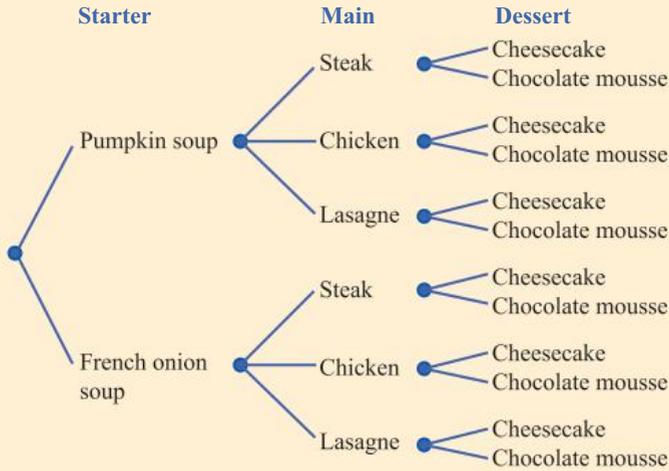
Symbol	Probability
A	$\frac{1}{5}$
B	$\frac{2}{5}$
C	$\frac{2}{5}$



5 At a wedding reception the following courses were available and served randomly to the guests.

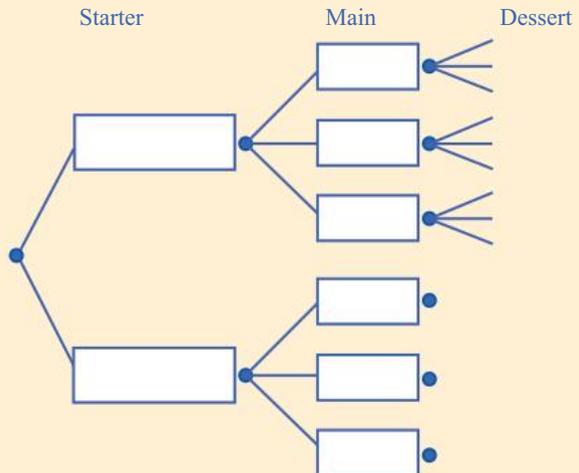
- Starter: Pumpkin soup or French onion soup
 Main: Steak, peppercorn chicken or vegetable lasagne
 Dessert: Cheesecake or chocolate mousse

These choices could be displayed in a tree diagram:



- List the different meals available.
- How many possible arrangements are available?
- How many arrangements have mousse as a dessert?
- If one person is chosen at random, what is the probability that the person has:
 - chocolate mousse as a dessert?
 - steak as a main?
 - pumpkin soup as a starter?
 - cheesecake as a dessert and fish as a main?
 - pumpkin soup or lasagne?

6 Repeat Question 5a–d, but now the options are:
 Starter: Pumpkin soup or French onion soup
 Main: Steak, fish or vegetable lasagne
 Dessert: Cheesecake, chocolate mousse or strawberry torte
 Use a tree like this one:





Revision/Assessment

Exercise 12A

- Use an appropriate word to describe the following chance events:
 - You will travel to Europe.
 - You will play tennis on the weekend.
 - People will have holidays on the Moon in your lifetime.
 - You will get homework tonight.
 - It will snow on Uluru in February.
- Place the events described in Question 1 on the number line below.



Exercise 12B

- A bag contains 30 marbles. Some of the marbles are red, the rest are black. Kyle wanted to estimate the probability of getting a red marble when one is taken from the bag without looking. He decided to do an experiment in which he took a marble from the bag, recorded its colour and replaced it. He repeated this 50 times. These are his results:

Colour	Number	Probability as a fraction	Probability as a percentage
Red	32		
Black	18		
	50		100%

- Copy the table into your workbook and fill in the missing information. You may use a calculator to find the probability as a percentage.
 - What is the probability of Kyle getting a red marble?
 - What is the probability of Kyle getting a black marble?
 - Estimate the number of red marbles in the bag.
- The bag in Question 3 actually contains 20 red and 10 black marbles. What is the probability that a randomly selected marble:
 - is black?
 - is green?
 - is red?
 - is not black?
 - What is the probability that an odd number shows when a normal six-sided die is rolled?
 - What is the probability that a girl is randomly selected from a group of 8 girls and 12 boys?
 - A card is randomly chosen from a set of cards numbered from 1 to 12.
 - What is the probability that the number on the card is a prime number?
 - What is the probability that the number on the card is not a prime number?
 - The probability of having three boys in a family of three children is $\frac{1}{8}$. What is the probability that a three-child family does not have three boys?

- 9 In a class of 25 students there are 8 with blue eyes, 3 with hazel eyes and 14 with brown eyes. Use these results to estimate the probability that:
- a randomly selected person has blue eyes
 - a randomly selected person does not have brown eyes

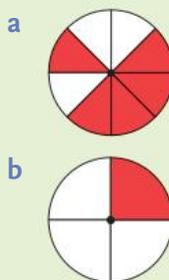
Exercise 2 G

- 10 These are the results of an experiment to test a spinner:

	Number of spins
Red	50
White	30
Blue	20
TOTAL	100

- Explain what the spinner could look like.
- Draw a possible sketch of the spinner.

- 11 What is the probability that the spinners shown will land with a red edge touching the surface?



Exercise 2 H

- 12 The table shows the number of students who dropped out of a National Mathematics Exam in the past decade (10 years).

Years	No. of dropouts	Total number of students who sat for the exam.
2002	995	2360
2003	1505	3122
2004	1715	3580
2005	1802	4177
2006	1482	4323
2007	1837	4596
2008	1721	4665
2009	1733	4779
2010	1358	4517
2011	1187	4477
TOTAL		

- Based on these statistics, calculate the probability that a student selected at random would drop out of the National Exam in 2006.
- Use your calculator to write the fraction in part a as a decimal.
- Calculate the probability and the decimal form for each of the other years.

CHAPTER

13

Polygons



Polygons

Tessellations occur when an area is covered with shapes without any overlaps or gaps. The shapes are usually polygons with more than four angles. Many tessellations occur in nature. Did you know that the honeycomb made by bees is a tessellation of regular hexagons? A tessellated pavement is a flat area of rock marked with a mosaic pattern. This occurs when weathered rock dries out and shrinks. Cracks appear where the rock is weakest, as they do in mud or clay, creating a tessellated pattern.

This chapter covers the following skills:

- Identifying a polygon
- Defining polygons
A polygon is a flat, enclosed figure with straight sides
- Identifying the relationship between the number of sides of regular and irregular polygons (3-, 4-, 5-, 6-sided) and the sum of their interior angles
- Naming triangles according to their side or angle properties
- Finding the angle sum of a triangle
Angle sum $\triangle = 180^\circ$
- Identifying the interior and exterior angle properties of a triangle
- Identifying special quadrilaterals and their properties
- Finding the angle sum of a quadrilateral
Angle sum $\square = 360^\circ$
- Recognising angle relationships in parallel lines
- Using angle relationships to work out angle size

Specific Learning Outcome (SLO)

Learners should be able to:

- 7.13.1.1** Identify the different properties of given triangles and the marks or symbols that identify some of their properties.
- 7.13.2.1** Measure the dimensions (sides) of different triangles and name them according to their side properties: *scalene, isosceles and equilateral*.
- 7.13.3.1** Name triangles according to angle properties.
- 7.13.3.2** Measure the angles of given triangles and name them according to their angle properties: *acute, obtuse and right-angled triangles*.
- 7.13.4.1** Identify the three interior angles of any given triangles.
- 7.13.5.1** Calculate the third missing interior angle, given the other two angles.
- 7.13.6.1** Identify the supplementary exterior angles of the three interior angles of any given triangle.

7.13.7.1

Use the given formula to find the exterior angle.
Exterior angle = sum of the two interior opposite angles

7.13.8.1

Identify and name different types of quadrilaterals according to their properties.

7.13.9.1

Find the angles of quadrilaterals by using the protractor to measure them.

7.13.9.2

Calculate the angle-sum of different quadrilaterals and missing angles.

7.13.10.1

Define the term 'polygon'.

7.13.10.2

Identify and name different polygons from pictures and shapes: *triangle, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon and dodecagon*.

7.13.11.1

Use total degrees in a *triangle = 180^\circ* to calculate the total interior angles in any quadrilateral.

7.13.11.2

Divide polygon shapes into triangles to find the total sum of interior angles.

7.13.12.1

Calculate the angle-sum of any given polygon using the formula:
Angle-sum = (n - 2) \times 180^\circ
Where n = number of sides of a polygon.

7.13.13.1

Construct triangles and quadrilaterals using protractors.

7.13.14.1

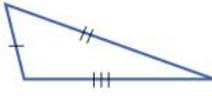
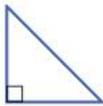
Construct regular polygons in a circle using a ruler and a protractor.

7.13.15.1

Use polygon shapes to create geometrical designs and patterns.

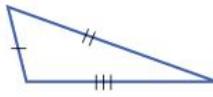
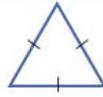
13A Triangles: Side properties

Special symbols

Symbol	Description
	Side lengths with a different number of dashes have different lengths.
	Side lengths with the same number of dashes are the same length.
	By marking an angle with a small square we indicate that the angle is a right angle or 90° .
	Parallel lines, like tram tracks or train tracks, are always the same distance apart. Sides marked with an equal number of arrows are parallel.

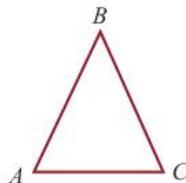
There are many different types of triangles. We can name them according to their side properties or their angle properties. Triangles named according to their side properties are scalene, isosceles or equilateral.

Side properties

Type of triangle	Diagram	Description
Scalene		In a scalene triangle all the side lengths are different.
Isosceles		In an isosceles triangle two of the sides are equal in length.
Equilateral		In an equilateral triangle all three sides are equal in length.

Example

Measure the lengths of the sides in triangle ABC and name it according to its side properties.



Solution

$$\overline{AB} = 2.1 \text{ cm}$$

$$\overline{BC} = 2.1 \text{ cm}$$

$$\overline{AC} = 1.7 \text{ cm}$$

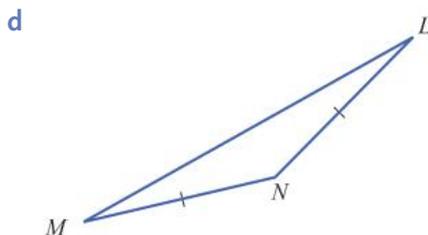
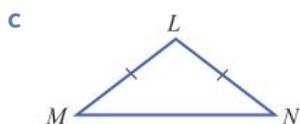
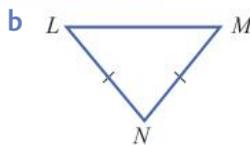
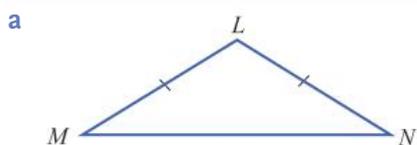
$$\overline{AB} = \overline{BC}$$

Two sides are equal, therefore $\triangle ABC$ is isosceles.

Exercise 3

- 1 Use your protractor to measure the magnitude, or size, of each angle in the following isosceles triangles. Copy and complete the table and fill in the missing words in the sentence below:

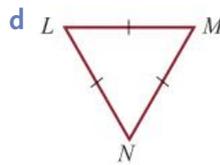
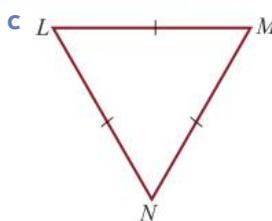
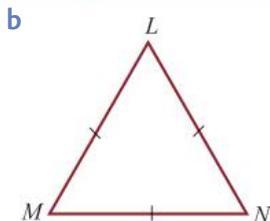
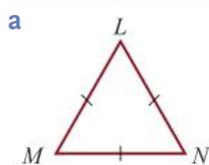
Triangle	Magnitude or size of angle		
	$\angle L$	$\angle M$	$\angle N$
a			
b			
c			
d			



An isosceles triangle has ___ sides of equal length and ___ angles of equal magnitude.

- 2 Use your protractor to measure the magnitude, or size, of each angle in the following equilateral triangles. Use your findings to complete the table and fill in the missing words in the sentence below:

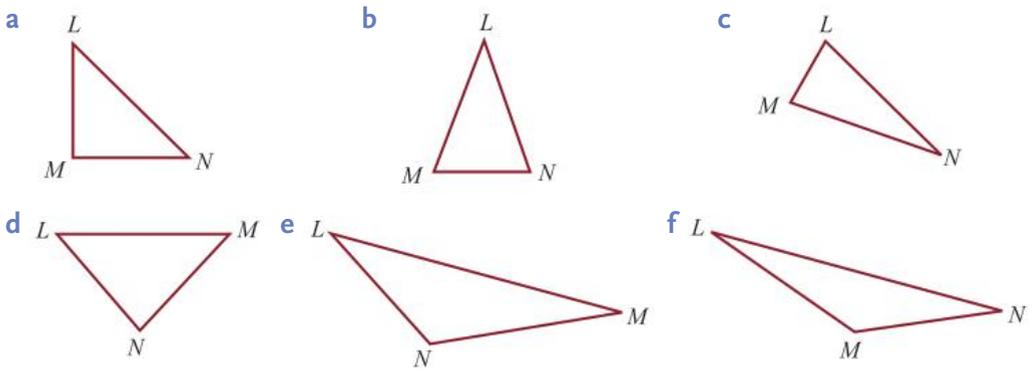
Triangle	Magnitude or size of angle		
	$\angle L$	$\angle M$	$\angle N$
a			
b			
c			
d			



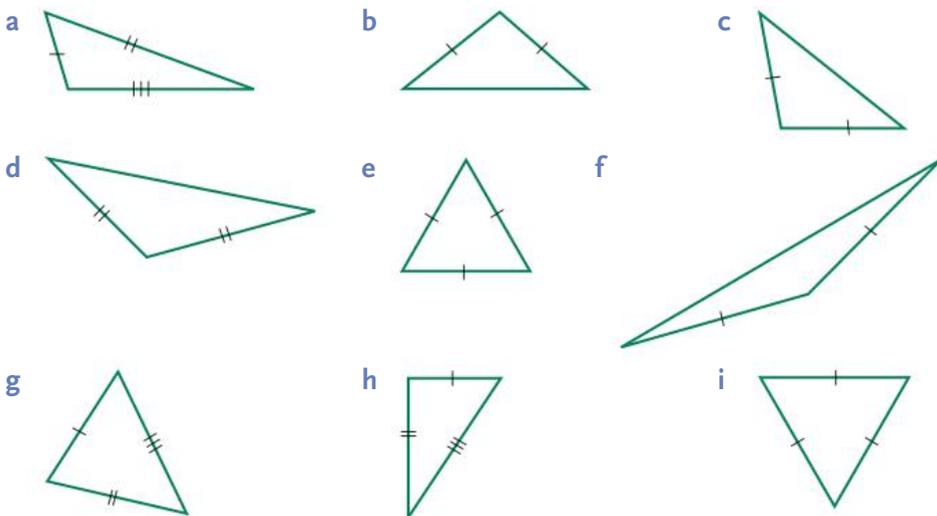
An equilateral triangle has ___ sides of equal length and ___ angles of equal magnitude.

- 3 Use your ruler to measure the lengths of each side in the following triangles. Copy the table into your workbook and complete it as you go. Use your results to determine the type of triangle shown (scalene, isosceles, equilateral):

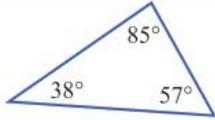
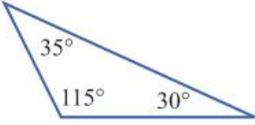
Triangle	Length of side			Type of triangle
	\overline{LM}	\overline{MN}	\overline{LN}	
a				
b				
c				
d				
e				
f				



- 4 Without measuring, state whether the following triangles are scalene, isosceles or equilateral triangles:

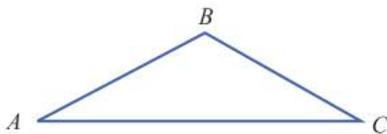


Triangles named according to their angle properties are acute, obtuse and right-angled.

Type of triangle	Diagram	Description
Acute-angled		In an acute-angled triangle, all the angles are acute, that is, all the internal angles are between 0° and 90° .
Right-angled		In a right-angled triangle, one of the internal angles is 90° .
Obtuse-angled		In an obtuse-angled triangle, one of the internal angles is obtuse, that is, between 90° and 180° .

Example

Measure the magnitude of each angle and name this triangle according to its angle properties:



Solution

$$\angle A = 28^\circ$$

$$\angle B = 123^\circ$$

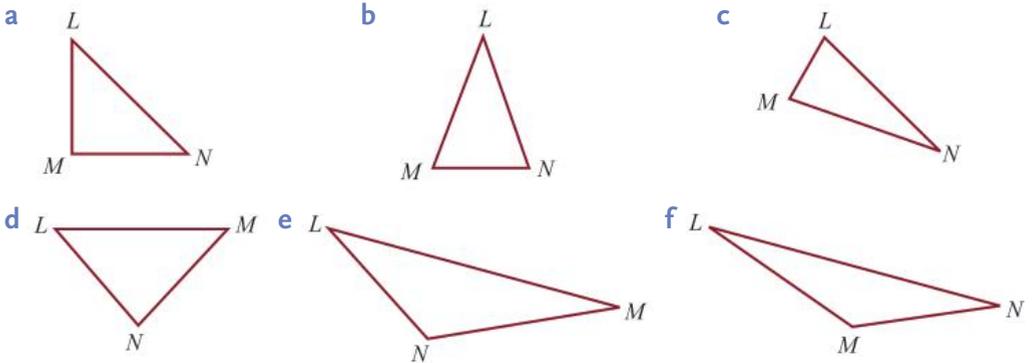
$$\angle C = 29^\circ$$

One angle is between 90° and 180° .
Therefore, $\triangle ABC$ is an obtuse-angled triangle.

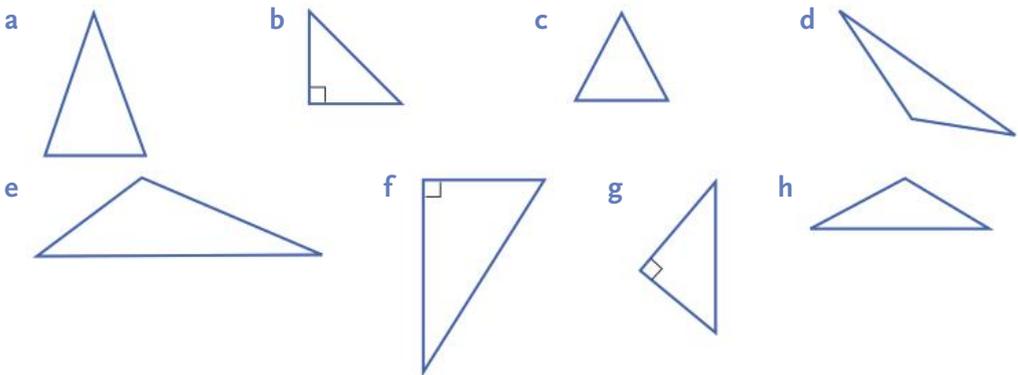
Exercise 13B

- 1 Use your protractor to measure the angles in each of the following triangles. Copy and complete the table below, naming each triangle as acute-, right- or obtuse-angled:

Triangle	Magnitude or size of angle			Type of triangle
	$\angle L$	$\angle M$	$\angle N$	
a				
b				
c				
d				
e				
f				



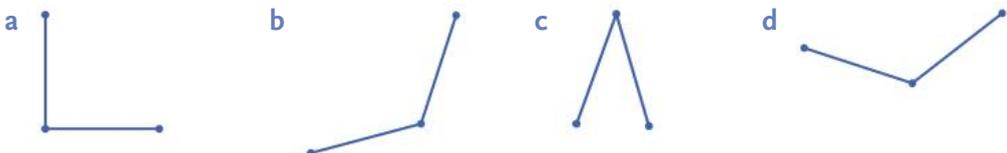
2 Name the following triangles, giving each an angle name such as acute-, right- or obtuse-angled triangle:



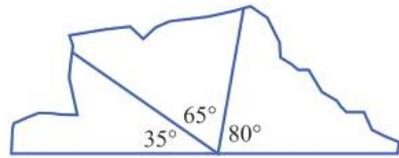
3 Name the triangles marked in the following photographs, giving each triangle a side and an angle name:



4 Copy each of the diagrams below and add in the third side to create a triangle. Measure the sides of each triangle and give it both a side and an angle name:



If you draw a triangle with the angles 35° , 65° and 80° , and then tear off or fold down each corner, you can form a straight angle by placing each angle next to the other as shown. As there are 180° in a straight angle, we know that the sum of the interior angles in any triangle is 180° .

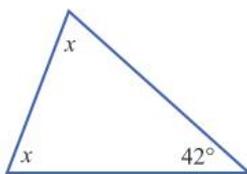


Example

- 1 Consider a triangle in which we don't know the size of one of the angles:



- 2 Consider an example where we don't know the size of two of the angles in the triangle:



Solution

$125^\circ + 30^\circ = 155^\circ$. There are 180° in a triangle, so the size of the third angle is:

$$180^\circ - 155^\circ = 25^\circ$$

$$x = 25^\circ$$

There are 180° in a triangle, so

$$x + x + 42^\circ = 180^\circ$$

$$2x + 42^\circ = 180^\circ$$

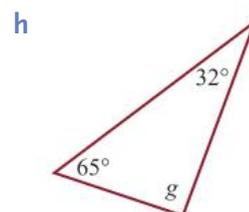
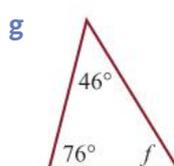
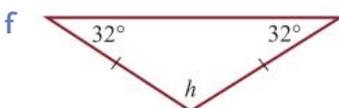
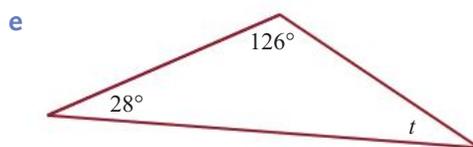
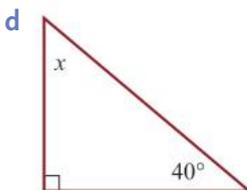
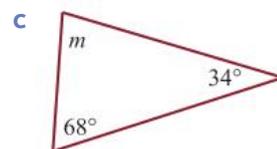
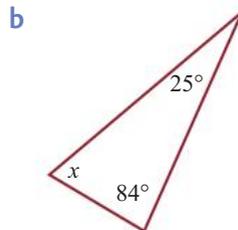
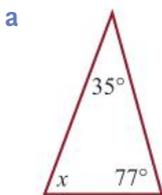
$$2x = 180^\circ - 42^\circ$$

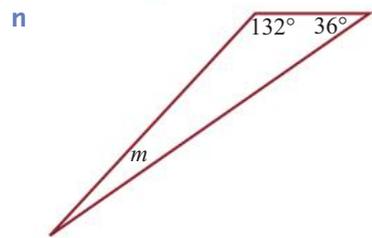
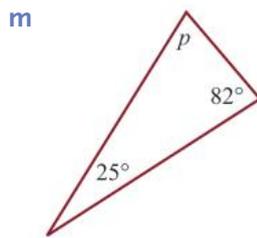
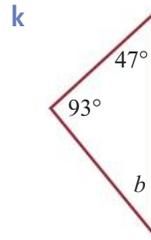
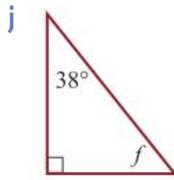
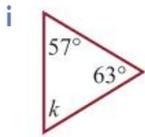
$$= 138^\circ$$

$$x = 69^\circ$$

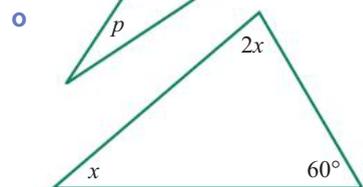
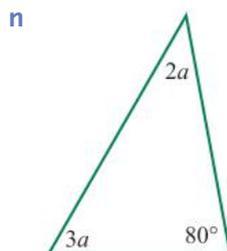
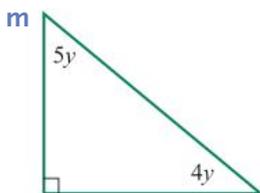
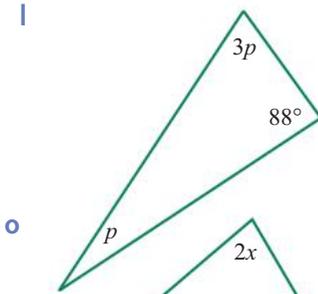
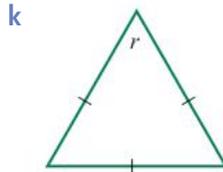
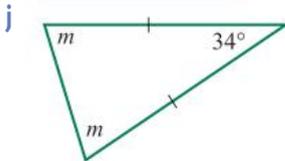
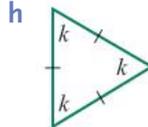
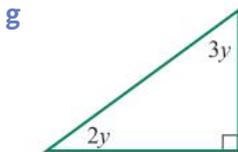
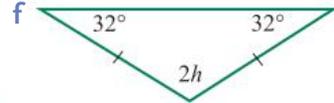
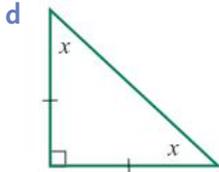
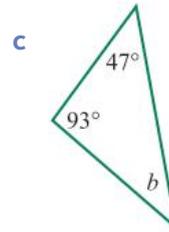
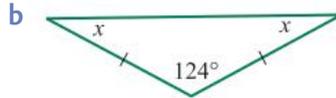
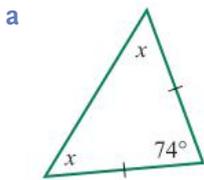
Exercise 9

- 1 Calculate the size of the third angle in each of the following triangles:





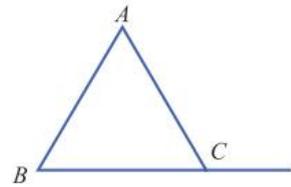
2 Calculate the size of the pronumeral (letter) in each of the following triangles. Angles with the same pronumeral are the same size:



Angle C is known as an exterior angle in the triangle shown.

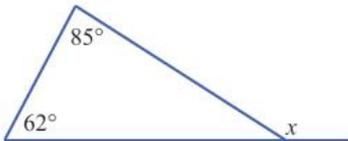
In any triangle the sum of the two interior opposite angles is equal to the size of the exterior angle.

That is, $\angle A + \angle B = \angle C$



Example

Find the size of the unknown angle:



Solution

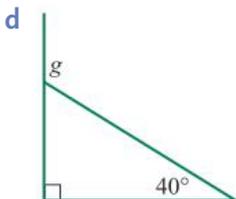
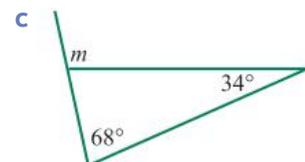
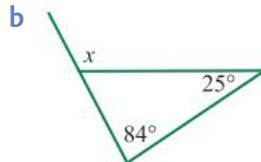
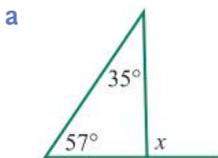
$$x = 85^\circ + 62^\circ$$

$$= 147^\circ$$

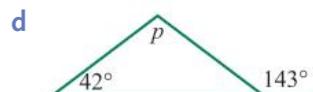
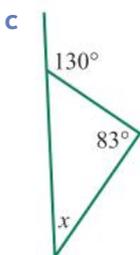
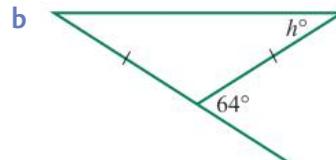
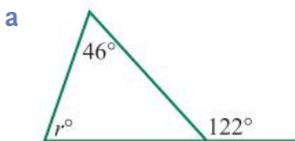
exterior angle property

Exercise 1D

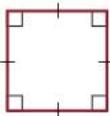
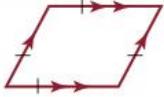
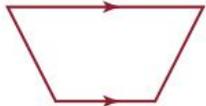
1 Using this property, find the size of the exterior angle marked in the following triangles:



2 Find the size of one of the interior angles marked in the following triangles:



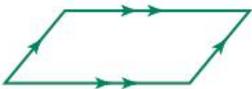
Quadrilaterals are figures with four corners and four sides. There are six main types of quadrilaterals that have special properties.

Type of quadrilateral	Diagram	Description
Rectangle		In a rectangle opposite sides are equal, and all angles are equal and measure 90° .
Square		In a square all sides are equal, and all angles are equal and measure 90° .
Parallelogram		A parallelogram has two pairs of opposite sides that are equal and parallel.
Rhombus		A rhombus is a parallelogram with all sides equal.
Kite		A kite has two pairs of adjacent sides equal and one pair of opposite angles equal.
Trapezium		A trapezium has one pair of opposite sides that are parallel.

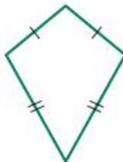
Exercise 1E

1 Name each of the following quadrilaterals:

a



b



c



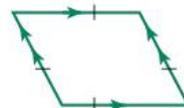
d



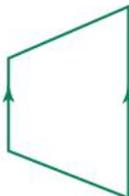
e



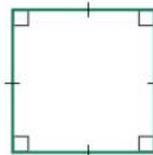
f



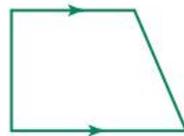
g



h



i



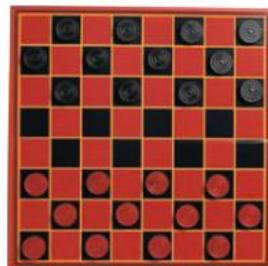
2 Use the following pictures to identify as many quadrilaterals and triangles as you can:



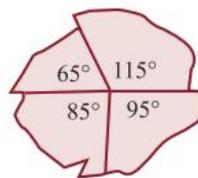
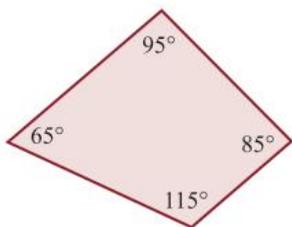
3 Copy each of the diagrams below and add in two additional sides to create a quadrilateral. From each diagram, can you make a square, a rectangle, a parallelogram, a rhombus, a kite and a trapezium?



4 How many squares are there on a checkers board?
(Hint: There are more than 64 squares on the board.)



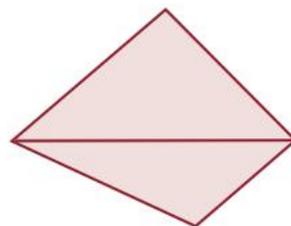
We can find the angle sum of a quadrilateral with angles measuring 65° , 95° , 85° and 115° , as shown below:



When the corners are placed adjacent to one another, we see that they combine to form a perigon, or full circle. As there are 360° in a full circle, we know that the sum of the interior angles in any quadrilateral is 360° .

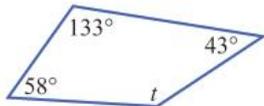
We could also show that this quadrilateral can be split into two triangles, as shown.

There are 180° in a triangle and as any quadrilateral can be shown to be made up of two triangles we can say that the sum of the angles in a quadrilateral is $2 \times 180^\circ$, which is 360° .



Example

Find the missing angle:



Solution

The shape is a quadrilateral.

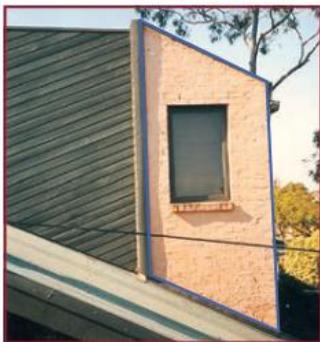
There are 360° in a quadrilateral.

$$\begin{aligned} 133^\circ + 43^\circ + 58^\circ &= 234^\circ \\ t &= 360^\circ - 234^\circ \\ &= 126^\circ \end{aligned}$$

Exercise 5

- 1 Use a protractor to measure all four angles in the quadrilaterals shown in the photographs below. Show that the angle sum of each quadrilateral is 360° .

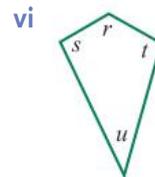
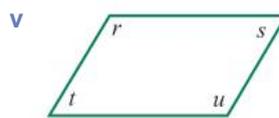
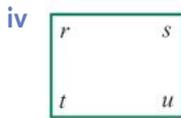
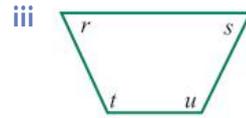
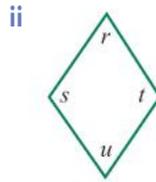
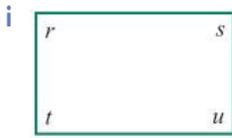
a



b



2 a Use a protractor to measure the angles in the quadrilaterals below:

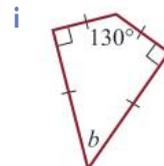
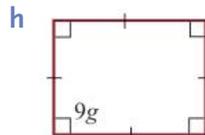
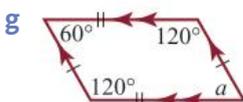
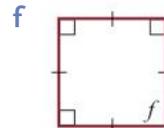
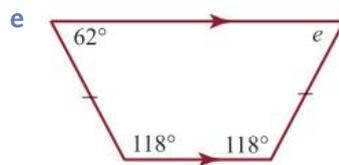
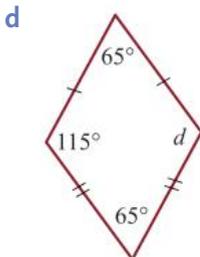
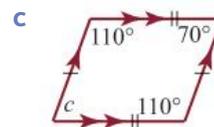
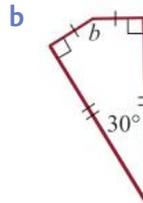
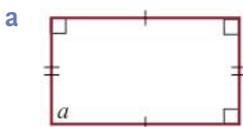


b Copy and complete the table using the quadrilaterals above:

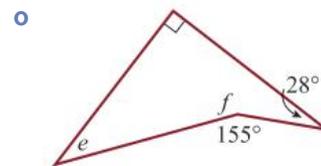
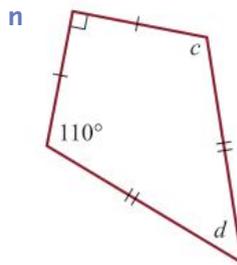
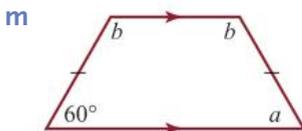
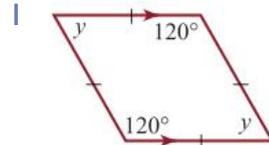
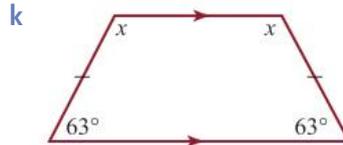
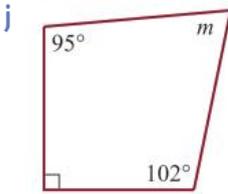
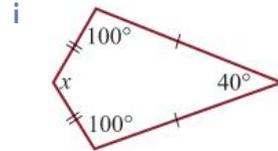
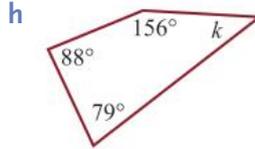
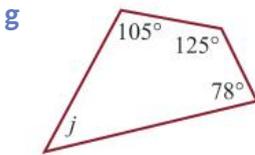
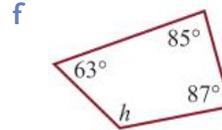
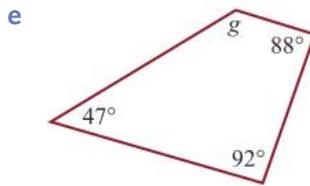
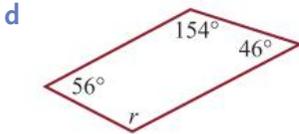
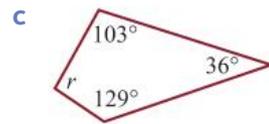
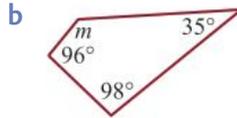
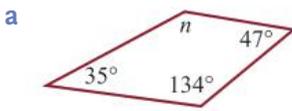
Shape	angle r	angle s	angle t	angle u	Angle sum
a					
b					
c					
d					
e					
f					

c Write a sentence (in words) describing the relationship between the four angles in any quadrilateral.

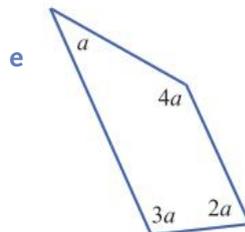
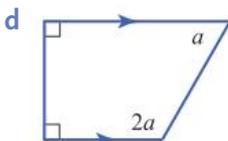
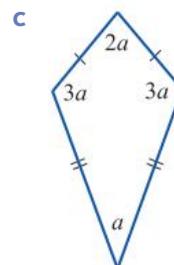
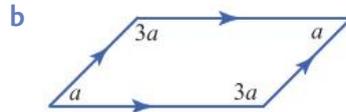
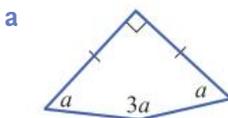
3 Find the size of the unknown angle in each of the following quadrilaterals:



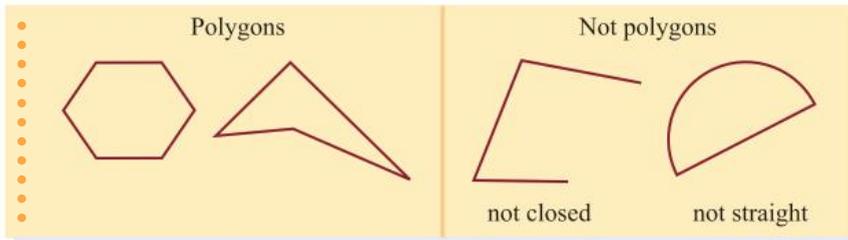
4 Find the size of the unknown angle in the following quadrilaterals:



5 Find the pronumeral in each of the following quadrilaterals:



The word polygon is taken from a Greek word meaning ‘many angles’. A **polygon** is a flat enclosed figure with straight sides.



In a regular polygon all the sides are of equal length and all the angles are equal in size.

Number of sides	Shape	Name of polygon
3		Equilateral triangle
4		Square
5		Regular pentagon
6		Regular hexagon
7		Regular heptagon
8		Regular octagon
9		Regular nonagon
10		Regular decagon

Polygons with more than 10 sides do not always have a special name. An 11-sided polygon is called an 11-agon. A polygon with 35 sides is called a 35-agon. In general, a polygon with n -sides is called an n -agon.

Exercise 1G

1 Identify the polygons in the photographs below:

a



b



c



d



e

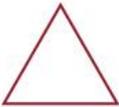


f



2 Name each of the regular polygons below:

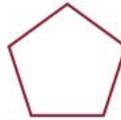
a



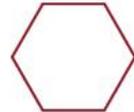
b



c



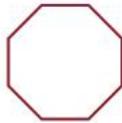
d



e



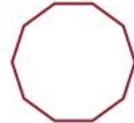
f



g



h



3 i Use a protractor to measure all internal angles in the regular polygons above.

ii Copy and complete the table below. The first row has been done for you:

Polygon	Name	Number of sides	Number of internal angles	Size of internal angles	Angle sum
a	Equilateral triangle	3	3	60°	180°
b					
c					
d					
e					
f					
g					
h					

In section 13F we saw that the angle sum of any quadrilateral can be found by splitting the quadrilateral into triangles. We can use this approach to find the angle sum of any polygon.

Name of polygon	n polygon split into triangles	Number of triangles	Angle sum of the polygon
Triangle		1	$1 \times 180^\circ = 180^\circ$
Square		2	$2 \times 180^\circ = 360^\circ$
Pentagon		3	$3 \times 180^\circ = 540^\circ$
Hexagon		4	$4 \times 180^\circ = 720^\circ$
Heptagon		5	$5 \times 180^\circ = 900^\circ$
Octagon		6	$6 \times 180^\circ = 1080^\circ$

We can extend the table to generate the angle sum of any polygon.

Example

- Find the sum of the angles in a dodecagon (12 sides).



Solution

There are 10 triangles.

$$\begin{aligned} \text{Sum of the angles} &= 10 \times 180^\circ \\ &= 1800^\circ \end{aligned}$$

When we have polygons with many sides, it is not always practical to draw the shape and divide it into triangles. It can be useful to know a relationship between the number of sides and the number of triangles.

In an n -sided polygon there are $n - 2$ triangles, so the angle sum in any polygon is $(n - 2) \times 180^\circ$.

Example

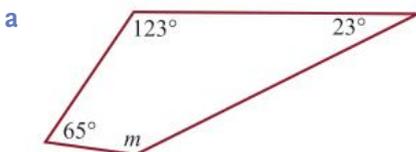
- 2 Find the sum of the angles in a 21-agon.

Solution

There are 21 sides and $21 - 2$ triangles.

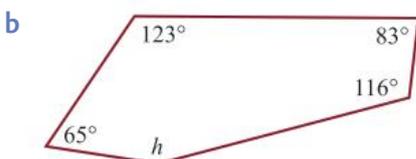
$$\begin{aligned} \text{Sum of the angles} &= (21 - 2) \times 180^\circ \\ &= 3420^\circ \end{aligned}$$

- 3 Find the missing angle:



There are 360° in a quadrilateral.

$$\begin{aligned} \angle m &= 360^\circ - (123^\circ + 23^\circ + 65^\circ) \\ &= 360^\circ - 211^\circ \\ &= 149^\circ \end{aligned}$$



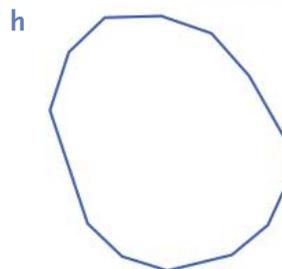
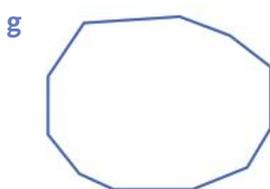
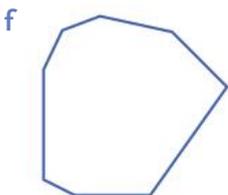
The shape is a pentagon.

There are 540° in a pentagon.

$$\begin{aligned} \angle h &= 540^\circ - (65^\circ + 123^\circ + 83^\circ + 116^\circ) \\ &= 540^\circ - 387^\circ \\ &= 153^\circ \end{aligned}$$

Exercise 13H

- 1 Name the following polygons and find their angle sum by first splitting the polygon into triangles:



- 2 Find the total number of degrees, or the angle sum, of the following polygons without drawing them first:

a 15-agon

b 17-agon

c 23-agon

d 35-agon

e 42-agon

f 50-agon

g 74-agon

h 150-agon

i 33-agon

j 13-agon

k 51-agon

l 11-agon

m 20-agon

n 37-agon

o 17-agon

p 52-agon

q 61-agon

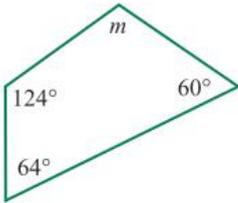
r 73-agon

s 43-agon

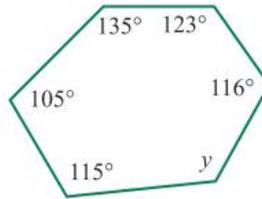
t 49-agon

3 Find the value of the missing angle in each of the following polygons:

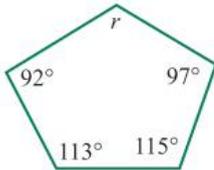
a



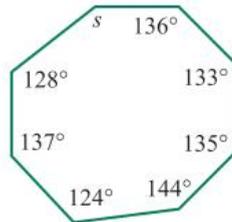
b



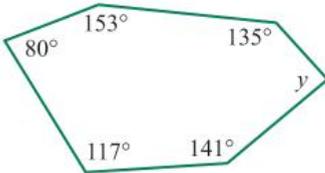
c



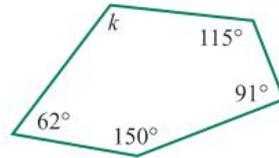
d



e

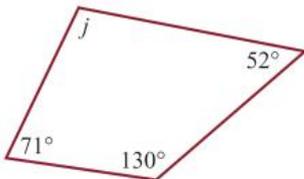


f

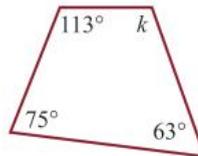


4 Find the value of the missing angle in each of the following polygons. Angles marked with the same pronumeral (letter) are the same size:

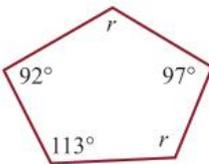
a



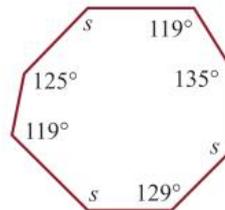
b



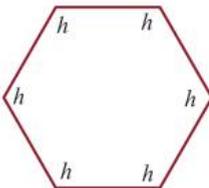
c



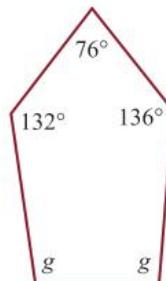
d



e



f





131 Exploring polygon constructions

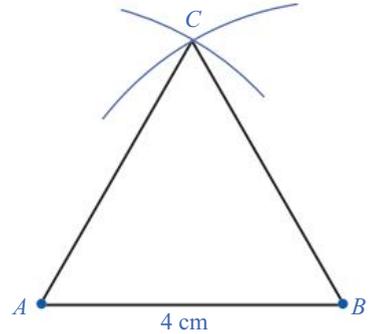
Learning task

Triangles and quadrilaterals can be constructed by using a compass and a straight edge.

Equilateral triangle

Side length of 4 cm

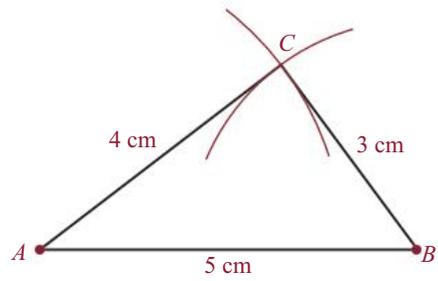
- Draw a 4-cm baseline. Label the endpoints A and B .
- Draw arcs from points A and B to intersect above the line.
- Label the point C .
- Use a straight edge to join the points A , B and C .



Right-angled scalene triangle

Side lengths 3 cm, 4 cm, 5 cm

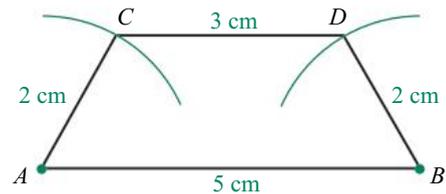
- Rule a 5 cm baseline and label the endpoints A and B .
- Open the compass to 4 cm and draw an arc from point A .
- Open the compass to 3 cm and draw an arc from point B to intersect the other arc above the line.
- Label this point C .
- Use a straight edge to join the points A , B and C .



Quadrilateral

Trapezium with side lengths 2 cm, 2 cm, 3 cm, 5 cm

- Rule a 5 cm baseline and label the endpoints A and B .
- Open the compass to 2 cm and draw arcs from points A and B .
- Rule a line where the two arcs are exactly 3 cm apart and parallel to line AB .
- Label the points of intersection C and D .
- Use a straight edge to join the points A , B , C and D .



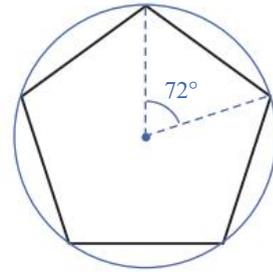
Construct the following polygons:

- an equilateral triangle of side length 3 cm
- a scalene triangle with side lengths 2 cm, 4 cm, 6 cm
- an isosceles triangle with two sides 3.5 cm and one side 7 cm
- a right-angled triangle with side lengths 4.5 cm, 6 cm and 7.5 cm
- a square of side length 4 cm
- a kite with two sides 4.5 cm and two sides 6 cm
- a rectangle with two sides 2.5 cm and two sides 7 cm
- a trapezium with side lengths 2.8 cm, 2.8 cm, 3.6 cm, 4.5 cm

Regular polygons can be drawn in a circle by using a ruler and a protractor to measure the required angles.

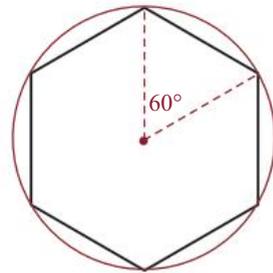
Pentagon

- Draw a circle.
- Using a protractor, mark points at 72° intervals around the circumference of the circle.
- Use a ruler or straight edge to join the five points.



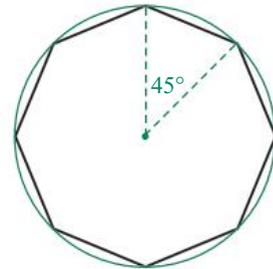
Hexagon

- Draw a circle.
- Using a protractor, mark points at 60° intervals around the circumference of the circle.
- Use a ruler or straight edge to join the six points.



Octagon

- Draw a circle.
- Using a protractor, mark points at 45° intervals around the circumference of the circle.
- Use a ruler or straight edge to join the eight points.



- 2
 - a Draw a pentagon in a circle of radius 4 cm.
 - b Use the ruler to measure all side lengths.
 - c Use the protractor to measure each of the five angles in the pentagon.
 - d Explain why you divided the circle into 72° intervals.
- 3
 - a Draw a hexagon in a circle of radius 4 cm.
 - b Measure the side lengths and internal angles and label the diagram.
 - c Explain why you divided the circle into 60° intervals.
- 4
 - a Draw an octagon in a circle of radius 4 cm.
 - b Measure the side lengths and internal angles and label the diagram.
 - c Explain why you divided the circle into 45° intervals.
- 5
 - a Draw a heptagon in a circle of radius 4 cm.
 - b Explain how you calculated the angle you used to divide the circle into intervals.
- 6
 - a Draw a decagon in a circle of radius 4 cm.
 - b Explain how you calculated the angle you used to divide the circle into intervals.



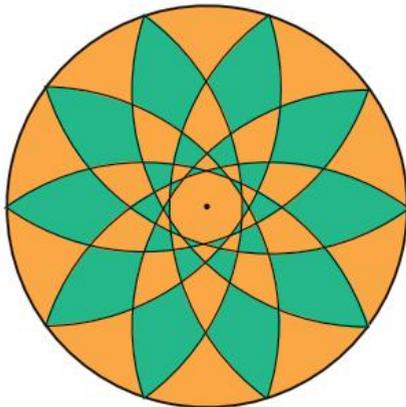
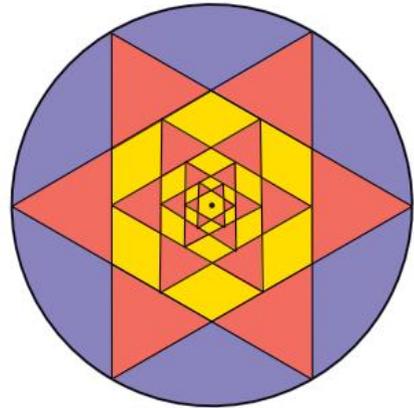
13J Exploring geometric designs

Geometric designs are used in sport, industry and commerce to create logos and icons. Many designs can be constructed using a ruler, compass and protractor.

Learning task

Disappearing triangles

- 1 Draw a circle of radius 8 centimetres.
- 2 Divide its circumference into angles of 60° .
- 3 Join every second point to produce two overlapping triangles.
- 4 Mark the midpoints of the six sides of the hexagon in the centre of the triangles.
- 5 Join the points to produce two more triangles.
- 6 Repeat the steps.

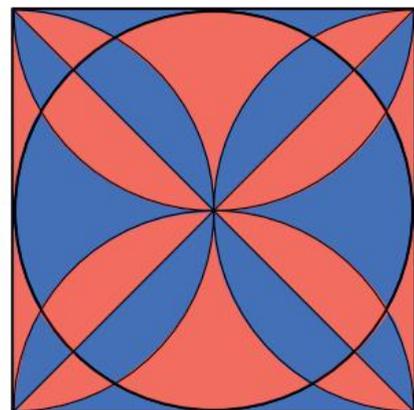


Kaleidoscope

- 1 Draw a circle of radius 8 centimetres.
- 2 Divide the circumference into angles of 36° .
- 3 Place the tip of the compass on one point and open the compass to reach the second point around the circumference.
- 4 Draw an arc to join two points.
- 5 Continue around the circle.
- 6 Colour the design.

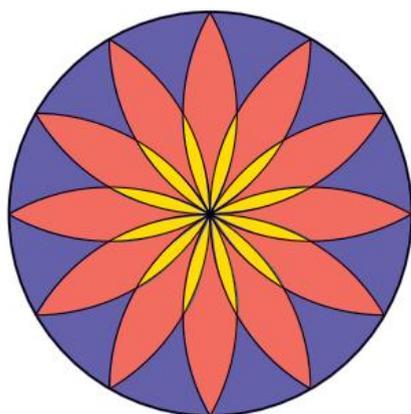
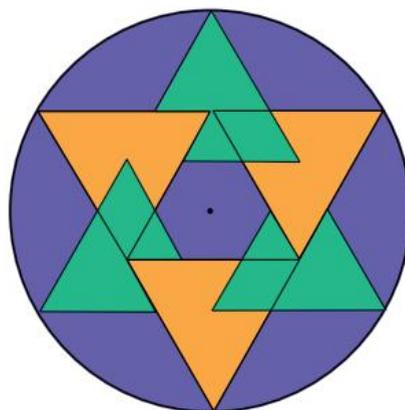
Symmetrical tiles

- 1 Draw a circle of radius 8 centimetres.
- 2 Mark a point at the top of the circle.
- 3 Place the tip of the compass at the point and draw an arc through the centre of the circle and extending well outside the circle.
- 4 Repeat at 90° angles around the circle.
- 5 Join the points where the arcs intersect outside the circle to produce an enclosing square.
- 6 Rule in the two diagonals of the square.
- 7 Colour it in to create an interesting pattern.



Triangle design

- 1 Draw a circle of radius 8 centimetres.
- 2 Divide the circumference into angles of 60° .
- 3 Join every second point to produce two overlapping triangles.
- 4 Colour it in to create the design shown.
- 5 Experiment with different ways to colour in the triangles to create different designs.

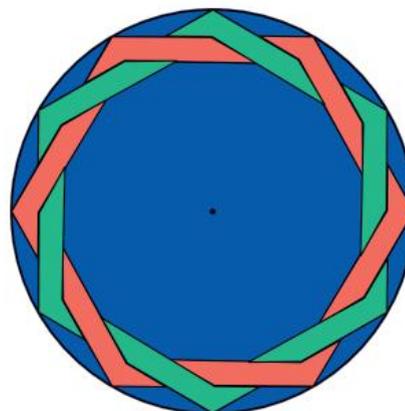


Flower petals

- 1 Draw a circle of radius 8 centimetres.
- 2 Mark a point at the top of the circle.
- 3 Keep the compass open at 8 centimetres. Place the tip of the compass on the point and draw an arc to intersect twice with the circumference.
- 4 Continue around the circle.
- 5 Colour the design to highlight two rows of petals.
- 6 Experiment with different ways to colour the petals.
- 7 This design produces a flower with 12 petals. Can you construct a flower with 24 petals?

Woven hexagons

- 1 Draw a circle of radius 8 centimetres.
- 2 Divide the circumference using angles of 30° .
- 3 Join every second point to produce two overlapping hexagons.
- 4 Mark the midpoints of the six sides of the hexagons.
- 5 Join the points to produce two more hexagons.
- 6 Colour it in so that the hexagons appear to overlap.
- 7 Experiment with different angles to produce similar designs.

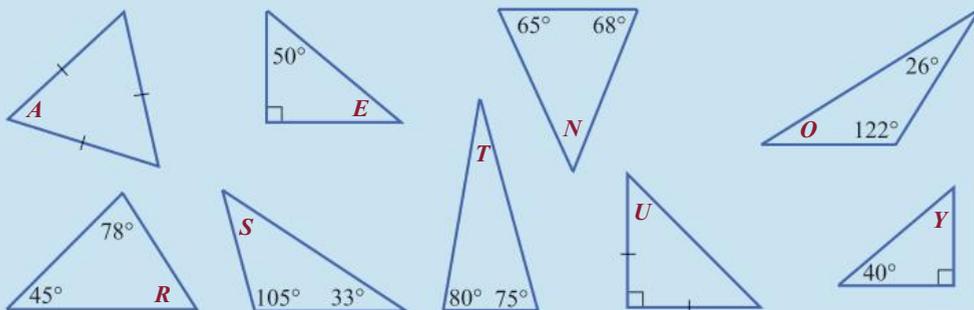




Puzzles

1 Answer the questions below and match the number to the correct letter to solve the riddle:

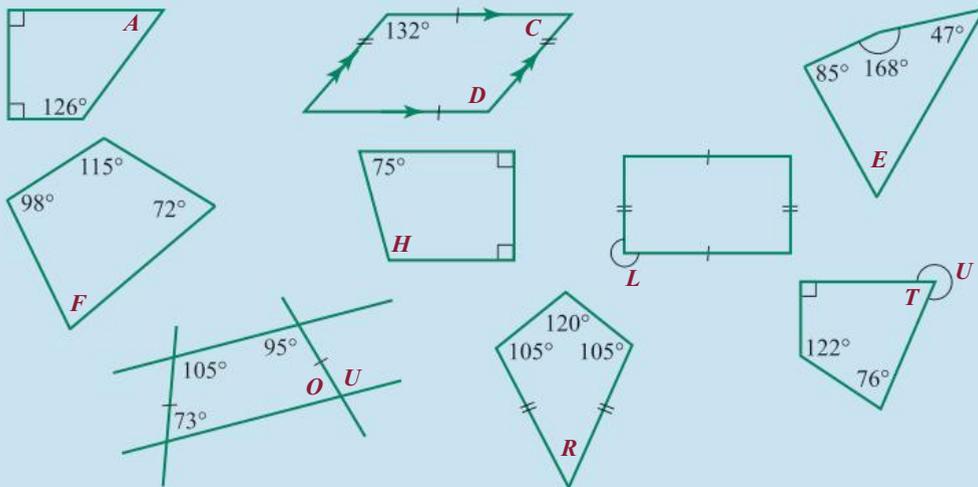
What did the doctor say to the sick man from Yandina, Central Province?



50°	32°	45°	60°	57°	40°	25°	32°	32°
25°	40°	47°	42°	40°				

2 Find the missing angles in the problems below and match the letter to the correct angle to solve the riddle:

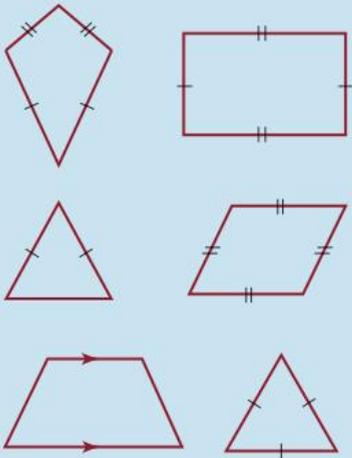
What was the referee's call in a basketball match between Temotu Arrows and Renbel Chiefs during the Solomon Games?



72°	105°	60°	30°	60°	75°	60°	30°	60°	60°	
48°	54°	270°	270°	60°	132°	54°	75°	87°	288°	270°

3 Below are 16 clues. Cross out the answers in the word search. The 18 letters that remain spell out the names of important equipment in geometry.

Names of these six shapes:



M	U	I	Z	E	P	A	R	T
P	L	S	T	H	G	I	R	R
O	A	U	T	R	E	A	E	C
E	R	B	M	U	S	S	C	E
T	E	M	T	O	U	E	T	L
U	T	O	R	X	T	C	A	G
C	A	H	O	I	B	M	N	N
A	L	R	K	S	O	P	G	A
D	I	A	G	O	N	A	L	I
R	U	L	E	R	A	S	E	R
S	Q	X	E	L	F	E	R	T
S	E	L	E	C	S	O	S	I

A three-sided polygon

Angle between 0° and 90°

Angle between 180° and 360°

Angle between 90° and 180°

Used to draw a straight line

An angle of 90° is a _____ angle

The angle _____ of a triangle is 180°

A hexagon has _____ sides

A _____ joins opposite corners of a rectangle

Initials for Eastern Standard Time



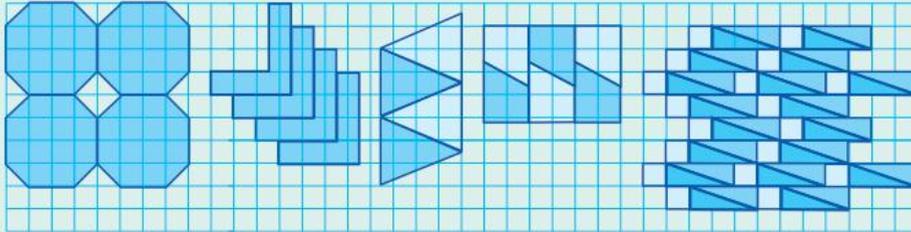


Applications

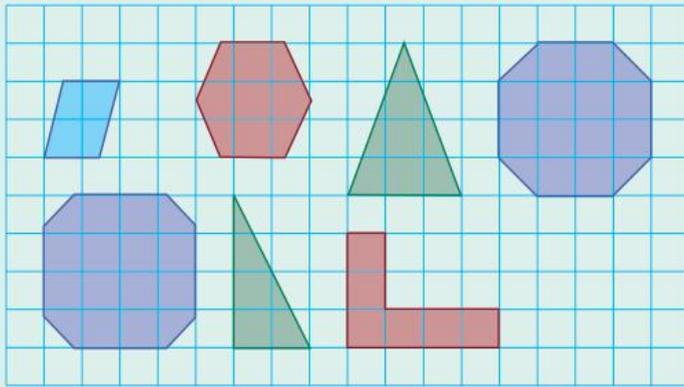
Polygon patterns

Some shapes will cover a surface completely. These shapes are said to tessellate.

Some possible designs are shown below. Name the polygons used in each design:

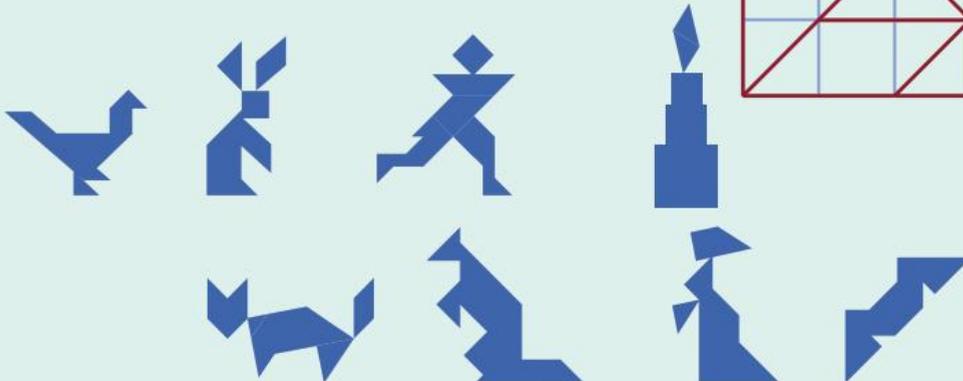
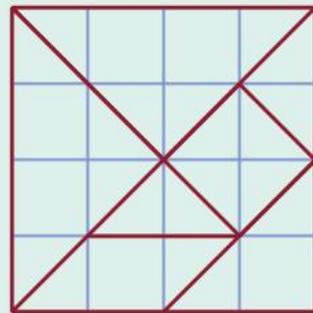


On grid paper draw some tessellating patterns using these polygons:



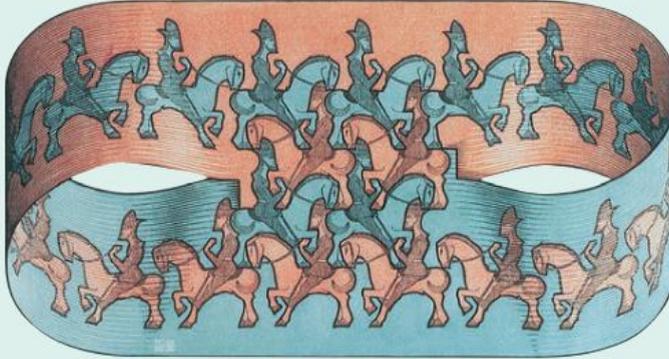
Tangrams

Tangrams are ancient Chinese puzzles. To make your tangrams, enlarge the grid below to a size of 10 cm × 10 cm. Using stiff cardboard, carefully cut out the seven tangram pieces. Using each of the seven pieces, can you make the silhouettes shown below? How many other shapes can you make?

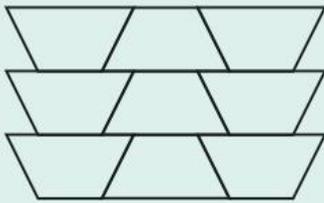


Escher artwork

Maurits Escher was born in The Netherlands in 1898. He was a traditionally trained artist who was skilled in graphic design. He based many of his designs on tessellating polygons.



To create an Escher-type tessellation, first draw a tessellation of a simple polygon such as a trapezium.

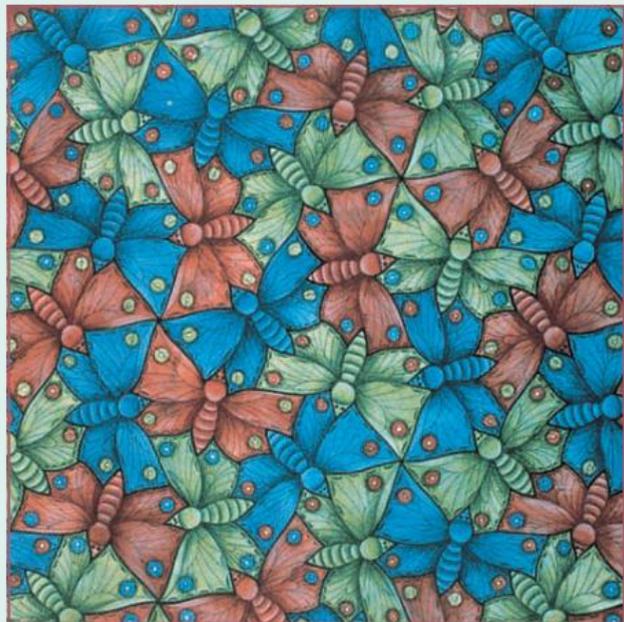


From each trapezium, cut out a simple piece from the top and add it to the bottom of the next shape.



Complicated tessellations such as this Escher design are based on repeating simple polygons. In this case, the basic repeating shape appears to be a trapezium.

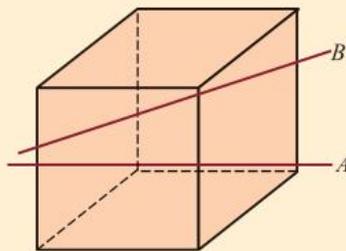
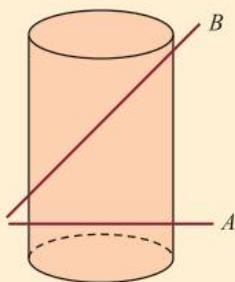
- Design your own Escher-type tessellation.



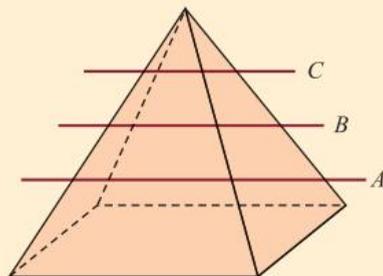
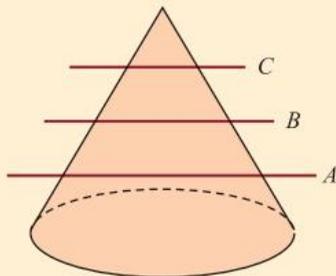


Enrichment

- 1 How many sides are there in a polygon whose angle sum is the following?
- a 540° b 720° c 1080° d $10\,800^\circ$
- 2 Rob made a cylinder and a cube from a solid block of wood. He used a saw to make two cuts through the solids as shown below.
- Cut A was parallel to the base. If Rob looked down on the solid after cut A , what would the surface look like?
- a Draw a cross-section of the surface of the solid created by cut A .
- Cut B was at angle of about 45° to the base.
- b Draw a cross-section of the surface of the solid created by cut B .
- c What would happen if he cut the prisms using a vertical cut at right angles to the base? Draw the cross-section resulting from a vertical cut.
- d Which of the cross-sections are polygons?



- 3 a Draw a triangular-based prism and a sphere.
- b Draw three lines A , B and C so that A cuts horizontally, B cuts at a 45° angle and C cuts vertically.
- c Draw each cross-section.
- d Which of the cross-sections is a polygon?
- 4 Rani made a cone and a pyramid from a solid block of wood. She then made three cuts A , B and C as shown below.
- a Draw each of the cross-sections A , B and C .
- b Describe the similarities and differences in the cross-sections.



- 5 Draw an example of each of the polygons (triangle, square, pentagon, etc.). For each polygon, show all possible diagonals. Copy and complete the table to record your findings, and so find a rule to describe the pattern. The first few have been done for you.

Name of polygon	n lygon	Number of diagonals	Rule
Triangle		0	$\frac{3(3-3)}{2} = 0$
Square		2	$\frac{4(4-3)}{2} = 2$
Pentagon		5	$\frac{5(5-3)}{2} = 5$
Hexagon			
Heptagon			
Octagon			
Nonagon			
Decagon			

From the table we can generate a rule for the number of diagonals for any polygon.

Copy and complete this sentence in your workbook:

In an n -sided polygon there are _____ diagonals.

- 6 Use your rule to find the number of diagonals for each of the following polygons:
- a pentagon b octagon c dodecagon
d 18-agon e 200-agon
- 7 Use your rule to find the number of diagonals in a regular:
- a 14-agon b 25-agon c 40-agon
- 8 Using cardboard or straws make a model of a geodesic dome.

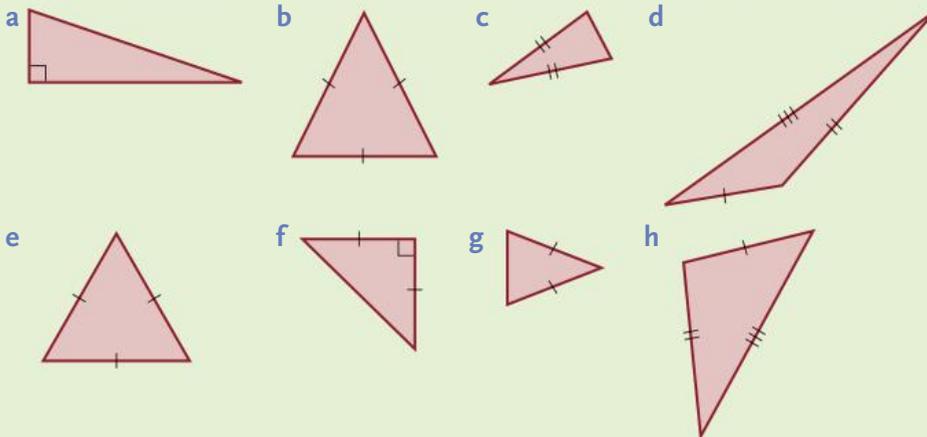




Revision/Assessment

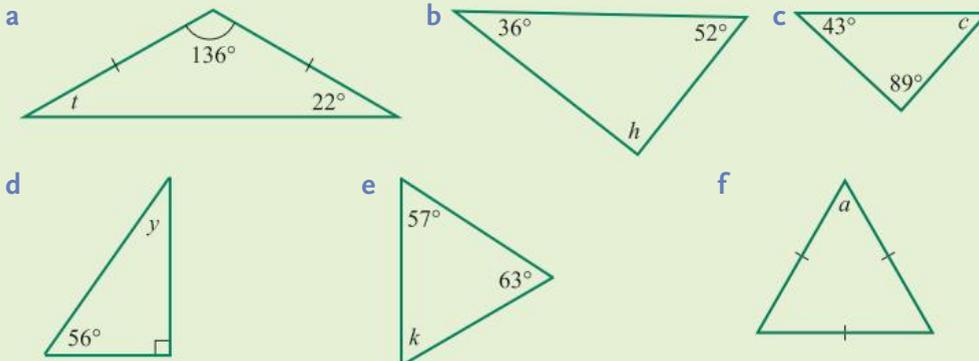
Exercises 1A and 1B

1 Look at the triangles in the following diagrams. Give each triangle two names, one according to its side properties and the other according to its angle properties:



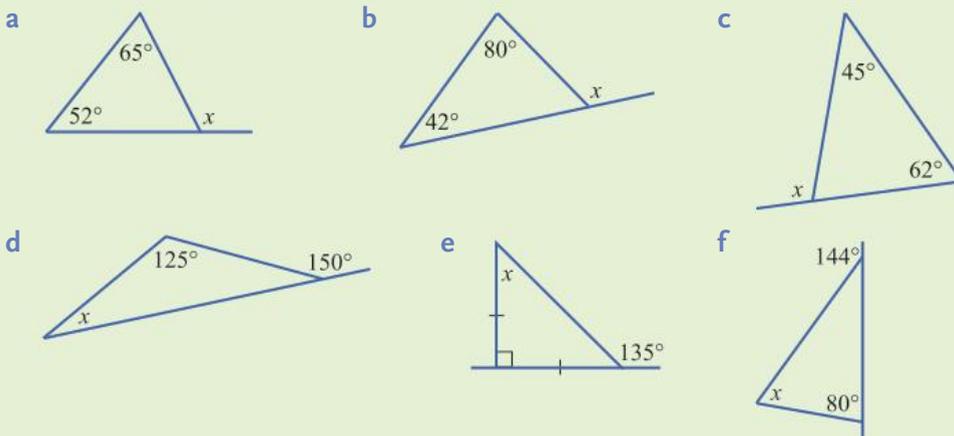
Exercise 1C

2 Find the size of the unknown angle in each of the following triangles:



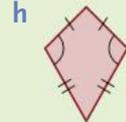
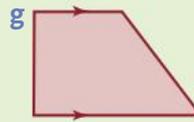
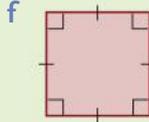
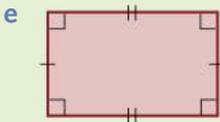
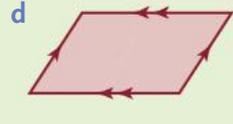
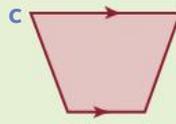
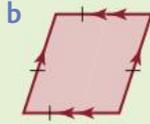
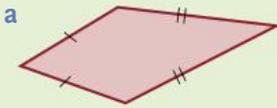
Exercise 1D

3 Find the size of the unknown angle:



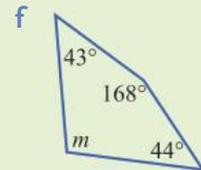
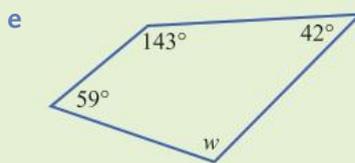
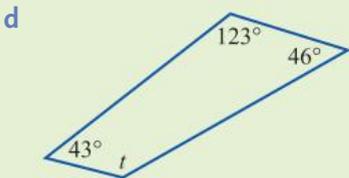
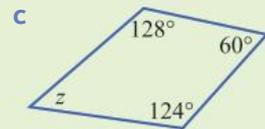
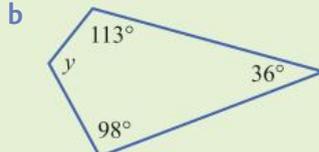
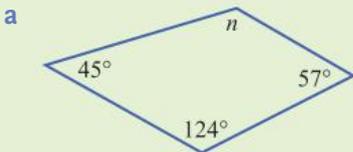
Exercise 5

4 Write down the correct mathematical name for these shapes:



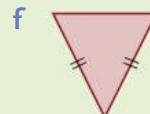
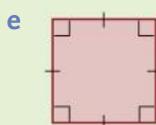
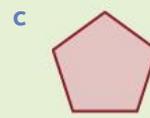
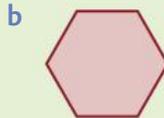
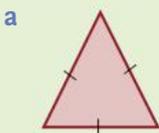
Exercise 5

5 Find the size of the unknown angle in each of the following quadrilaterals:



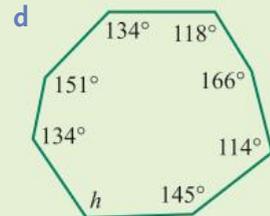
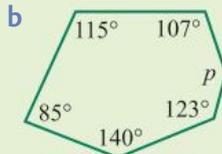
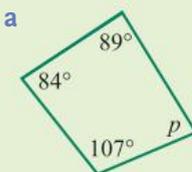
Exercise 6

6 Write down the correct mathematical name for each of these shapes:



Exercise 7

7 Find the size of the unknown angle in each polygon:



CHAPTER

14

Area and
Volume



Area and Volume

Drum beating is a common practice in some parts of Solomon Islands, especially in Are'Are and Kwaio. A drum is made by cutting out a hollow space inside a piece of tree trunk. There can be big wooden drums as well as small ones. The sounds they make depend on the size of the piece of tree trunk and the volume of the hollow space being cut out. The bigger the volume, the lower the pitch and the further the sound can be heard. A big volume also means a big surface area for the wooden drum.

This chapter covers the following skills:

- Finding and comparing areas
- Using grids to find area
- Calculating the area of triangles and quadrilaterals

Area rules

Rectangle: length \times width

Parallelogram: base \times height

Triangle: $\frac{1}{2} \times$ base \times height

- Calculating the volumes of prisms

Volume rules

Rectangular prism: length \times width \times height

General prism: area base \times height

7.14.6.1

Determine the volume of solids by counting the number of cubic units that fit inside the shape.

7.14.6.2

Count the number of cubes to determine the volume of each shape if each cube is a cubic centimetre.

7.14.7.1

Derive a Rule or Formula using blocks or tables that can be used to calculate the volume of shapes and objects.

7.14.8.1

Calculate the volume of shapes and prisms using the formula:

Volume = length \times width \times height

7.14.9.1

Calculate the volume of prisms and objects by determining the area of the base first.

Volume = area of base \times height

Specific Learning Outcome (SLO)

Learners should be able to:

7.14.1.1 Define area.

7.14.2.1 Determine areas of shapes by using a grid.

7.14.2.2 Use a square grid to determine the area of various regular shapes.

7.14.3.1 Estimate and determine the area of regular and irregular shapes using a grid.

7.14.4.1 Use the correct formulas and rules to calculate the area of polygon shapes:

– Rectangle : area = length \times width

– Parallelogram: area = base \times height

– Triangle: area = $\frac{1}{2}$ base \times height

– Rhombus:

i. Area = base \times height

ii. Product of the two diagonals $\div 2$

OR

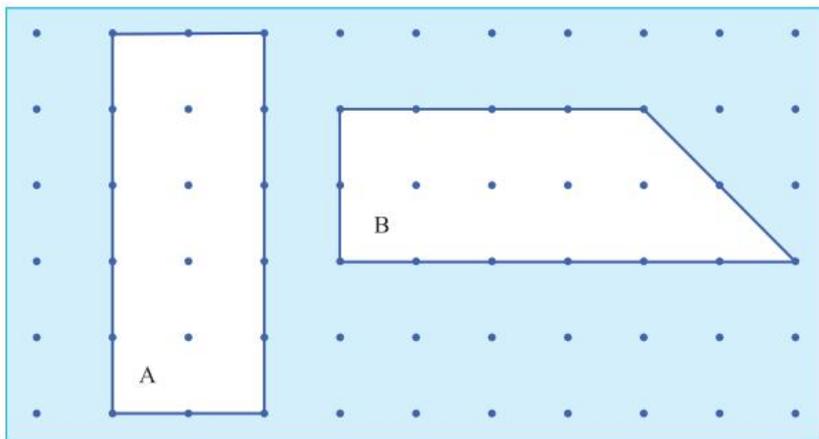
$$\text{Area} = \frac{D1 \times D2}{2}$$

7.14.5.1 Define volume.

The **area** of a shape is the amount of two-dimensional space inside that shape. We can measure the area of a shape by dividing it into square units and counting the number of squares that we can fit inside it.

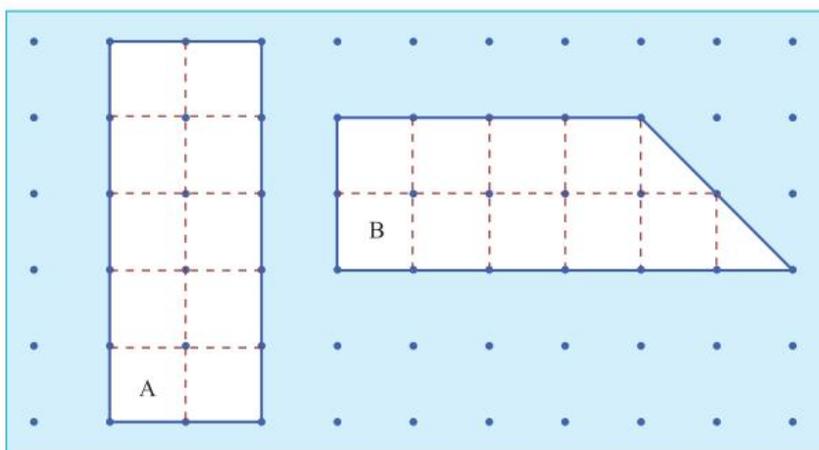
Example

Using the square grid below, find which shape has the larger area:



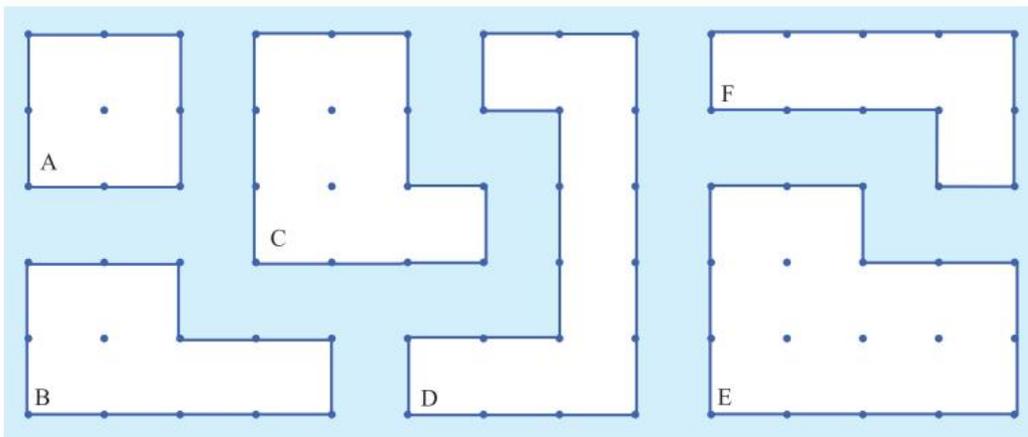
Solution

- Step 1: Divide the shapes into squares using the grid, combining half squares to make whole squares.
- Step 2: Count up the number of squares within each shape. The larger the number of squares inside the shape the larger its area.
- Step 3: Shape A has 10 squares. Shape B has 10 squares. So they have the same area.

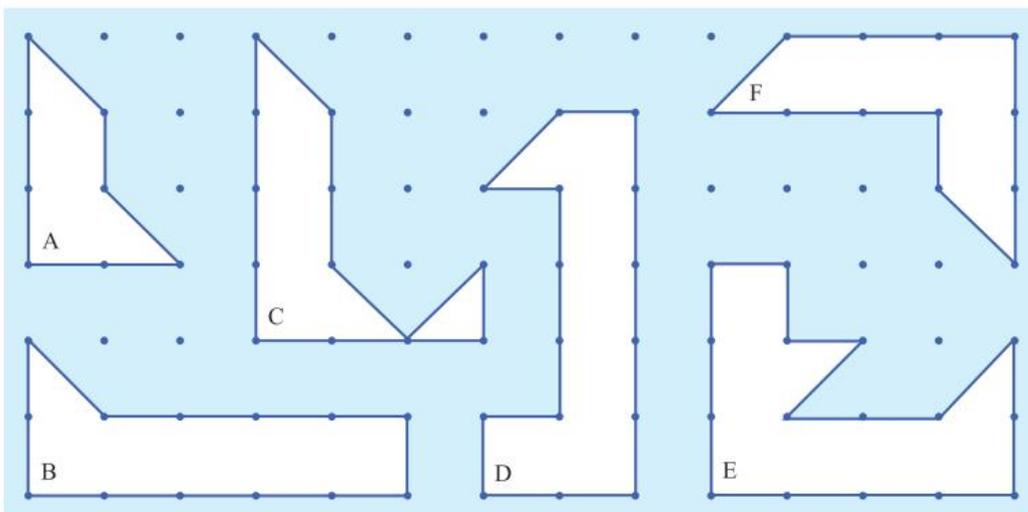


Exercise 14A

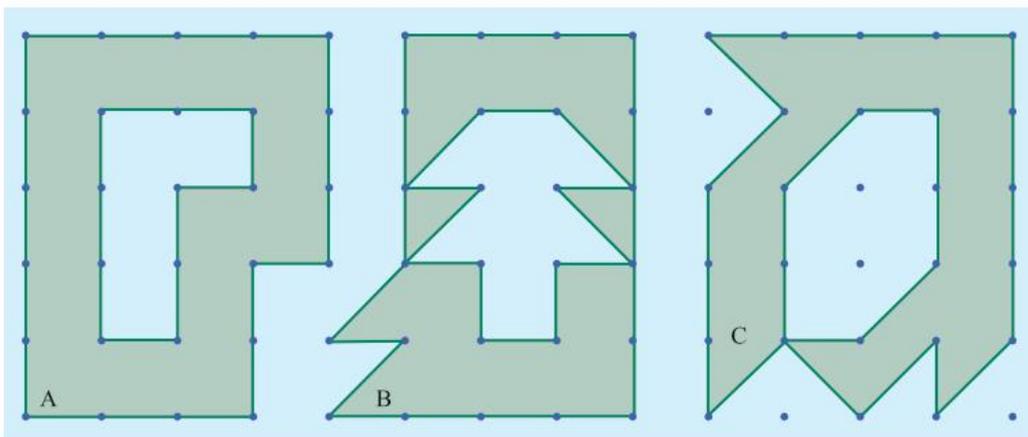
- 1 Order the following shapes from largest area to smallest area:



- 2 Order the following shapes from largest area to smallest area:



- 3 Use the dot paper to estimate the shaded area of the following shapes:

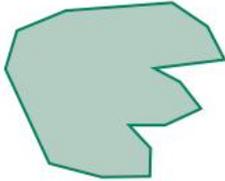


14B Using grids to find areas

Usually the shapes we find in nature are irregular and don't have straight sides that can be easily placed on a grid. We can only find the area of these shapes by counting the squares that fit inside it in an approximate way.

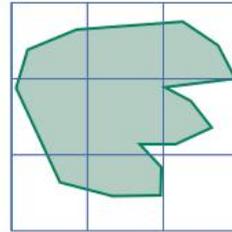
Example

Find the area of this animal footprint which was found in the sand of a South Pacific beach.

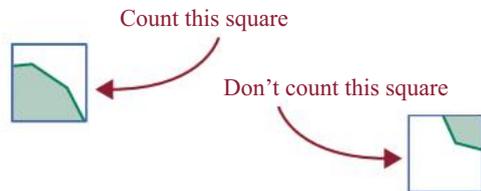


Solution

Step 1: Place a centimetre grid over the shape.



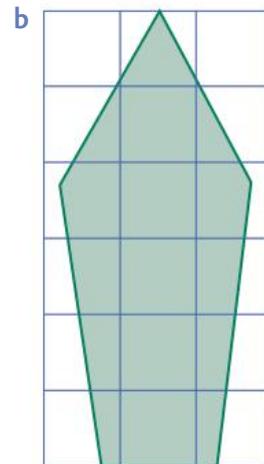
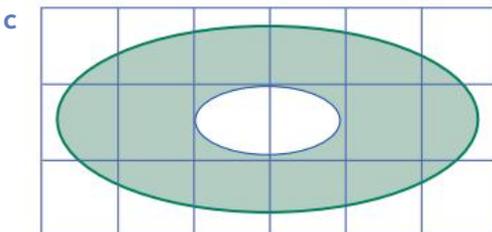
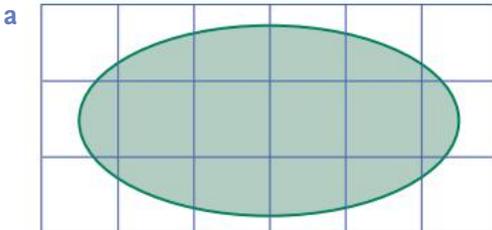
Step 2: Count the number of squares in the shaded area in the following way: Those squares which are at least half filled count as a whole square. Those squares which are not at least half filled do not count at all.

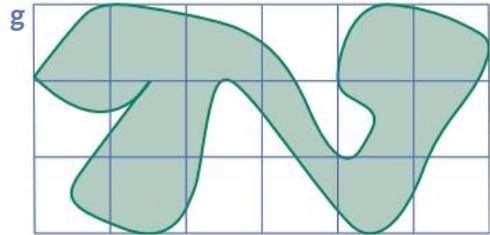
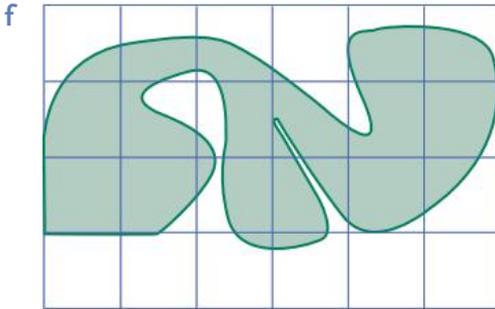
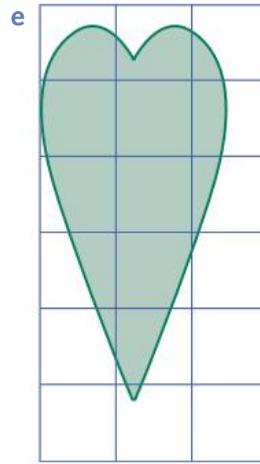
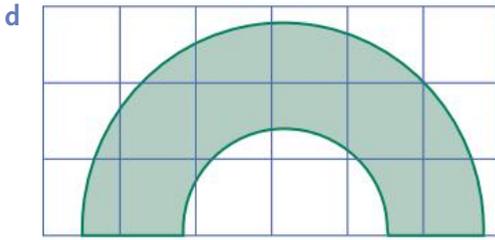


Area is approximately 4 square centimetres or 4 cm^2 .

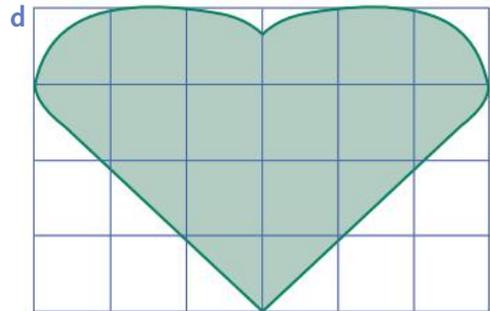
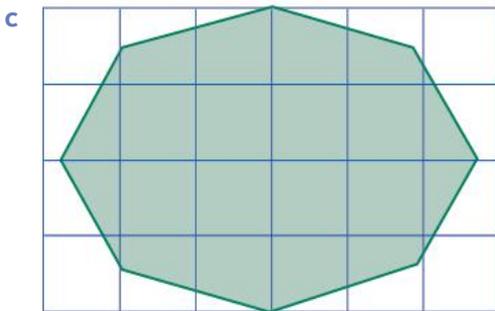
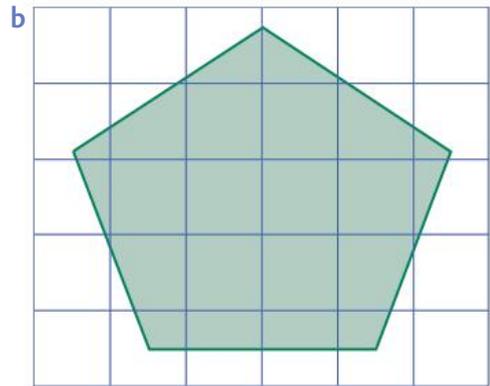
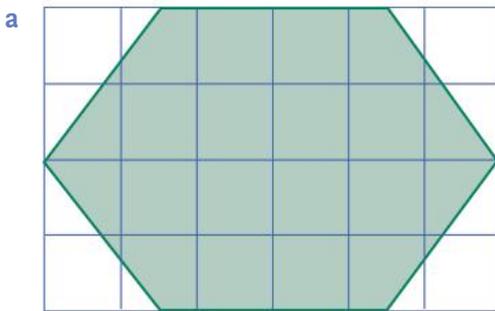
Exercise 14B

Use the centimetre grids to estimate the area of the following shapes:





2 Use the centimetre grids to estimate the area of the following shapes:





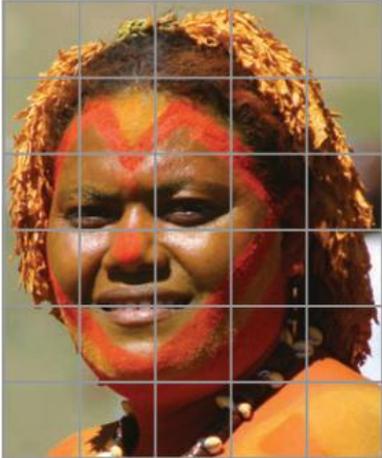
14C Exploring areas of faces

Areas of shapes can be estimated using centimetre grids.

Learning task 14C

Use the centimetre grids to estimate the area of the faces below:

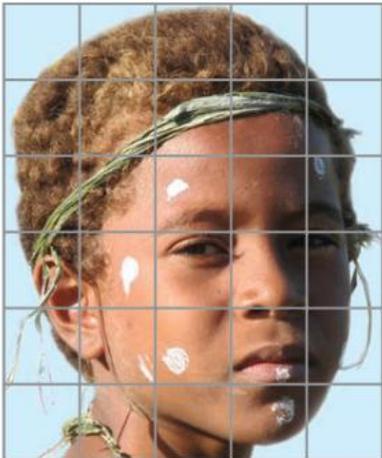
a



b



c



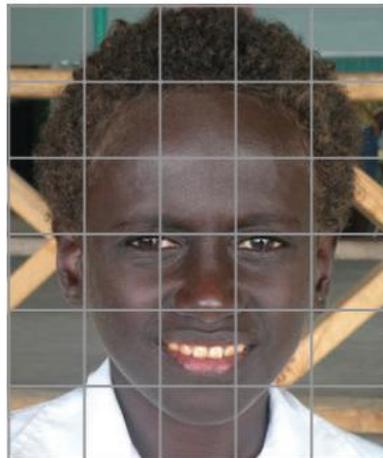
d



e



f

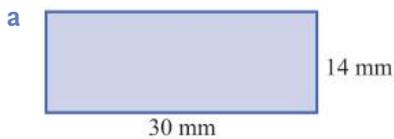


A rule can be used to find the area of a rectangle. Multiply the length by the width. Make sure that the measurements for length and width have the same units. The units for area are squared, for example square centimetres or cm^2 , because area is the measure of two-dimensional space.

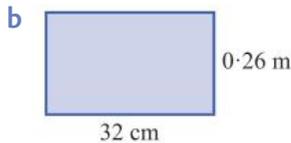
• Area = length \times width

Example

Find the areas of these rectangles:



$$\begin{aligned} \text{Area} &= \text{length} \times \text{width} \\ &= 30 \times 14 \\ &= 420 \text{ mm}^2 \end{aligned}$$



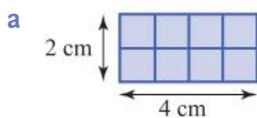
First convert the width into centimetres:
 $0.26 \times 100 = 26 \text{ cm}$

Use the formula
 Area = length \times width
 $= 32 \times 26$
 $= 832 \text{ cm}^2$

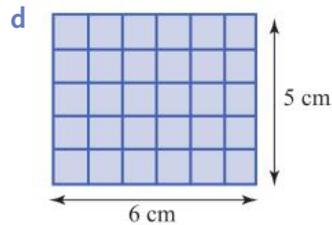
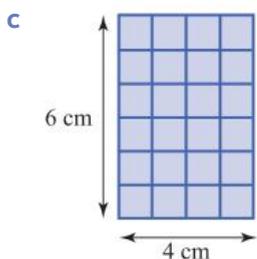
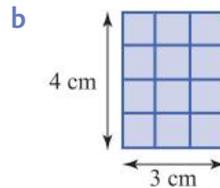
Exercise 14D

1 Find the area of each of the following rectangles by:

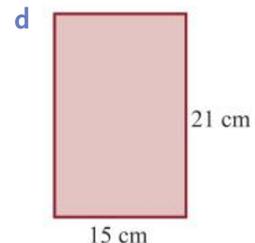
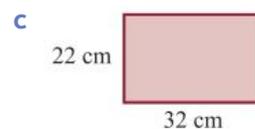
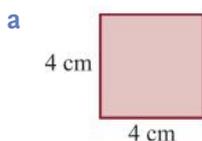
i counting the squares



ii using the rule

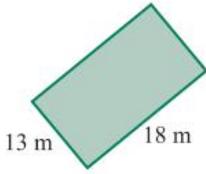


2 Find the area of the following rectangles:

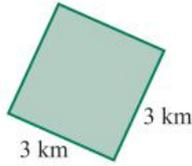


3 Find the area of the following rectangles:

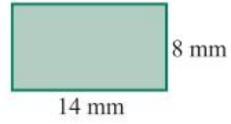
a



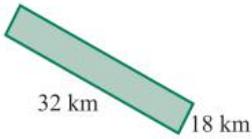
b



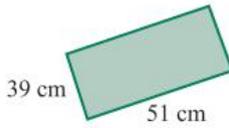
c



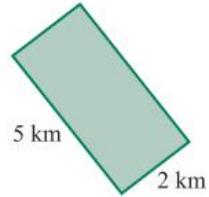
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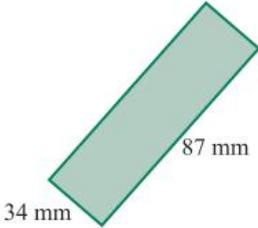
e



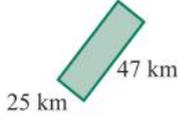
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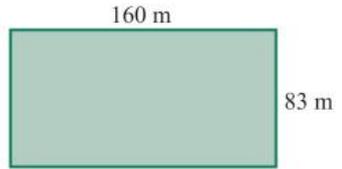
g



h

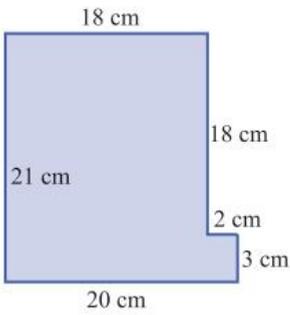


i

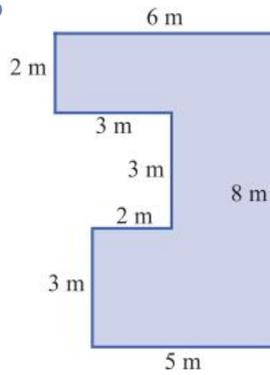


4 Divide the following shapes into rectangles and use the rule to find the total area:

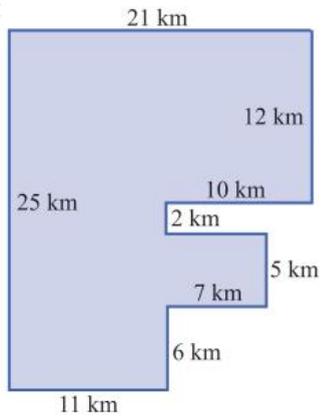
a



b

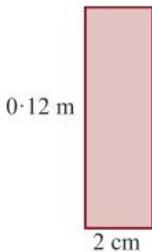


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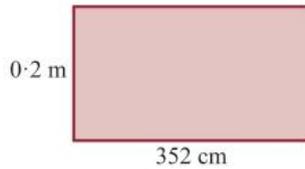


5 Find the area of the following shapes expressed in square centimetres:

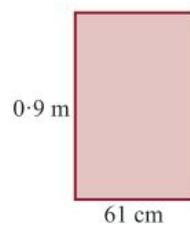
a



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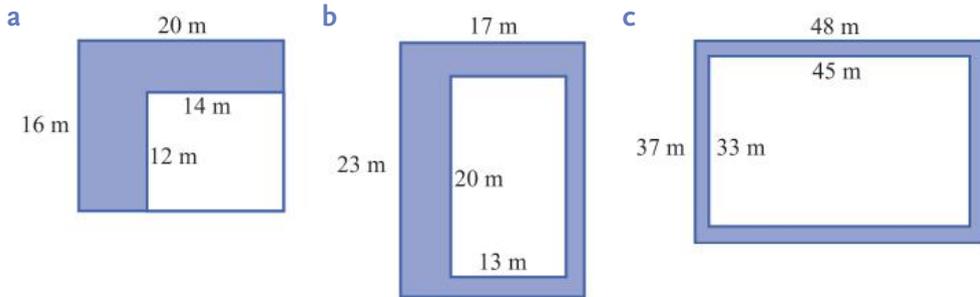
c



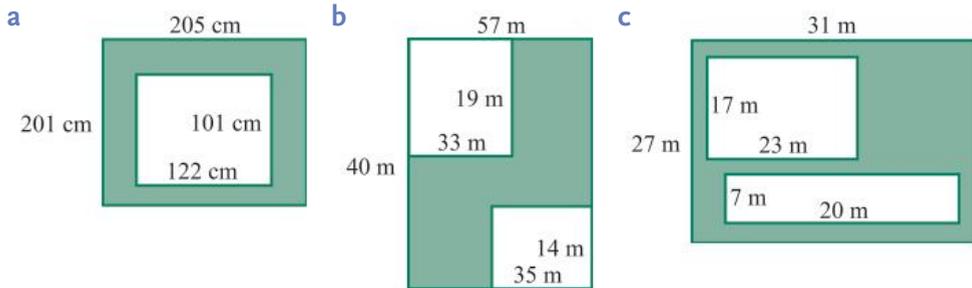
6 Find the area of the following shapes:

- a a rectangle with length 32 mm and width 56 mm
- b a rectangle with length 1.2 km and width 960 m (in square kilometres)
- c a rectangle 30 cm long by 260 mm wide (in square millimetres)
- d a square with side length 45 mm

7 Find the shaded area in the following rectangles:



8 Find the shaded area in the following shapes:



9 A backyard in the shape of a rectangle measures 14 metres by 20 metres. In it there are three garden beds which measure 1.2 m by 5 m, 7 m by 4.5 m and 3.8 m by 14 m. The rest of the backyard is grass.

- a Find the area of the garden beds.
- b Find the area of grass in the backyard.

10 A rectangular envelope which is 15 cm by 25 cm has a rectangle drawn inside it 3 cm from the outside edge. The margin is coloured red. Find the area of the red margin.



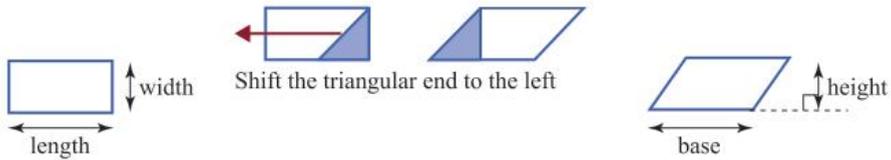
11 A chess board contains 64 squares. Each square is 4 cm by 4 cm.

- a What is the area of one square?
- b What is the area of all the squares?
- c What is the area of the white squares?
- d The border around the chess board is 2 cm wide, what is the area of the border?



14E Area of parallelograms

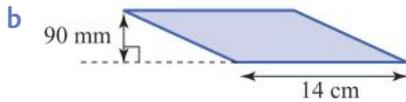
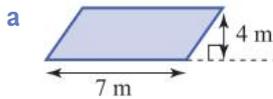
A parallelogram can be made from a rectangle by shifting a triangular piece as shown below. The rule for finding the area of a parallelogram is similar to that for a rectangle.



Rectangle	Parallelogram
Area = length \times width	Area = base \times height

Example

Find the area of these parallelograms:



Solution

The units are the same, so you can use the rule straight away.

$$\begin{aligned} \text{Area} &= \text{base} \times \text{height} \\ &= 7 \times 4 \\ &= 28 \text{ m}^2 \end{aligned}$$

Change the units of the base to centimetres to make the units the same.

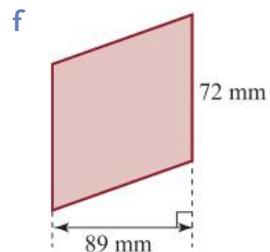
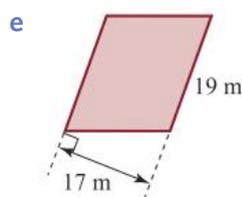
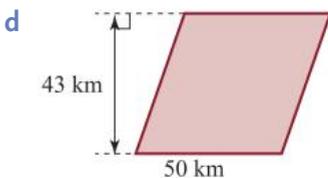
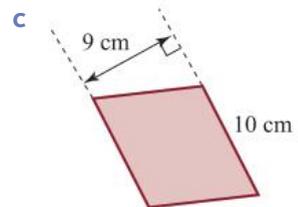
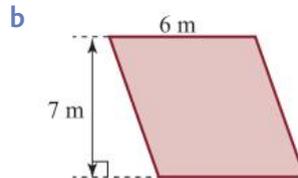
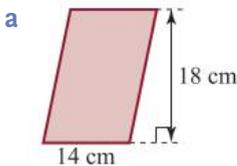
$$90 \text{ mm} \div 10 = 9 \text{ cm}$$

Use the rule:

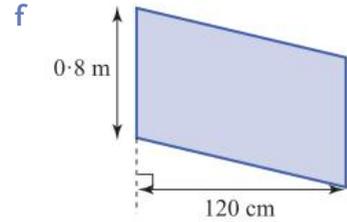
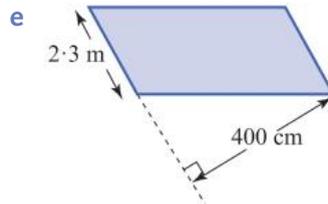
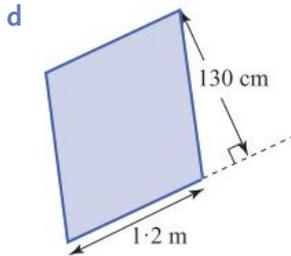
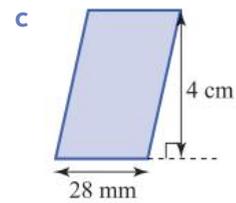
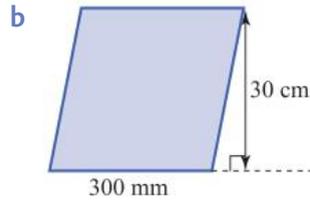
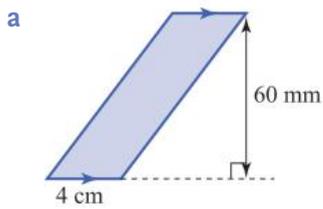
$$\begin{aligned} \text{Area} &= \text{base} \times \text{height} \\ &= 14 \times 9 \\ &= 126 \text{ cm}^2 \end{aligned}$$

Exercise 14E

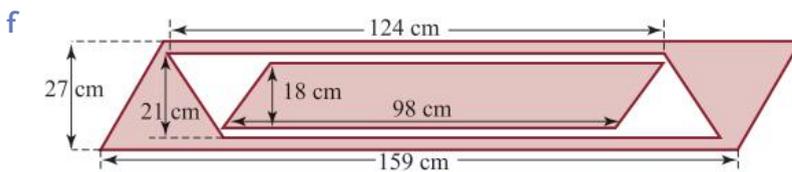
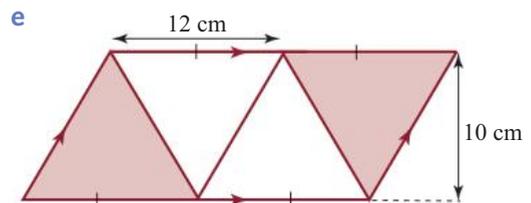
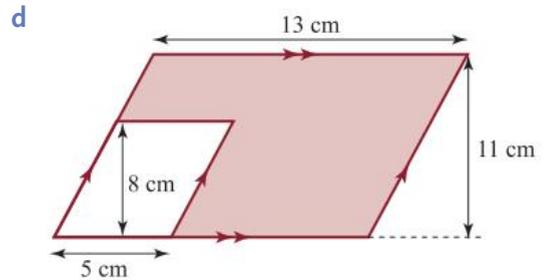
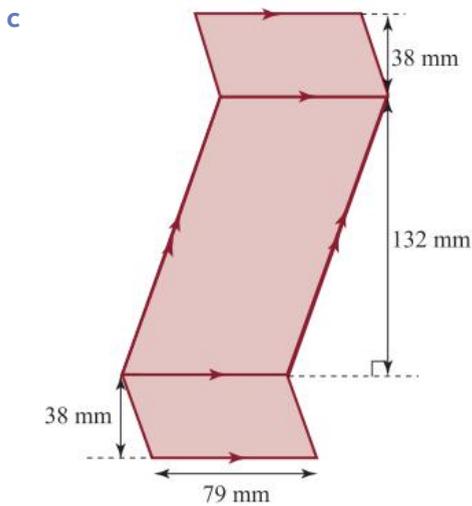
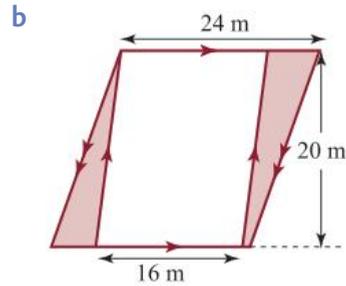
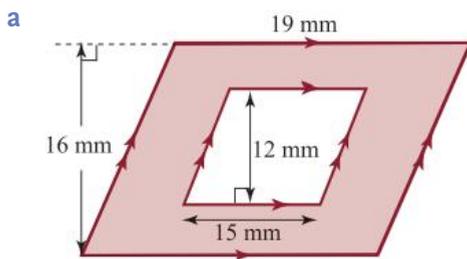
1 Find the area of the following parallelograms:



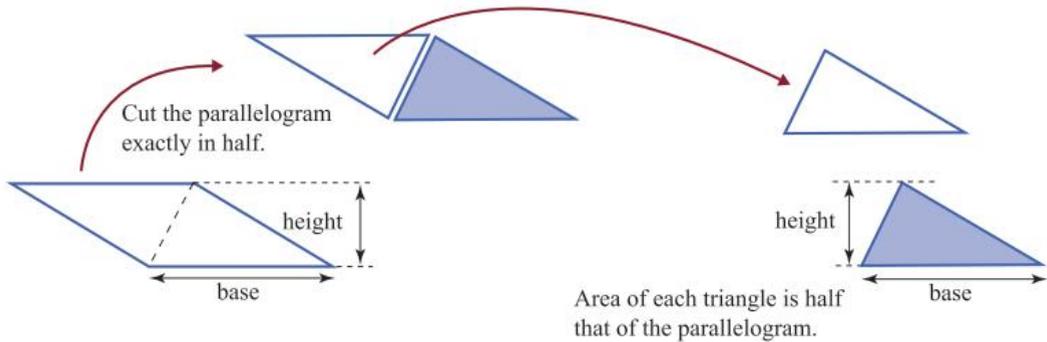
2 Find the area of the following parallelograms in square centimetres:



3 Find the area of the shaded regions in the following shapes:



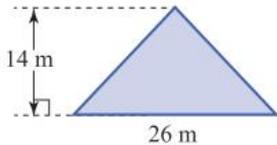
Two identical triangles can be joined together to make a parallelogram as shown below. The area of the triangle is half that of the resulting parallelogram.



Parallelogram	Triangle
Area = base \times height	Area = $\frac{1}{2} \times$ base \times height

Example

Find the area of the triangle.

**Solution**

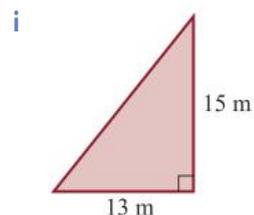
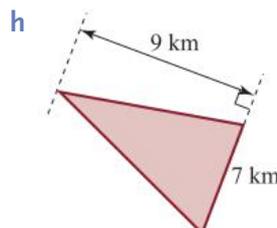
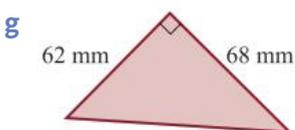
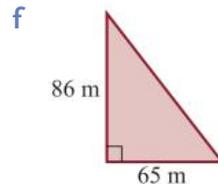
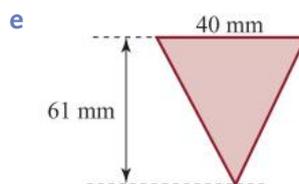
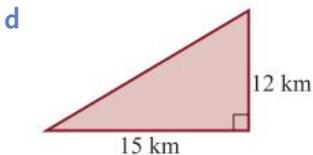
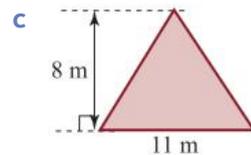
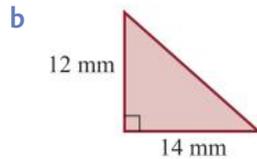
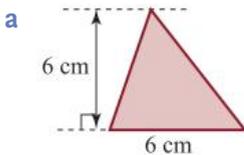
height = 14 m base = 26 m

The units are the same so use the rule.

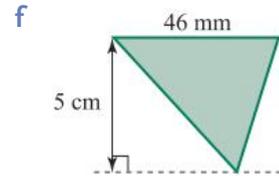
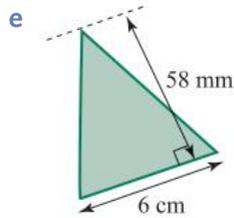
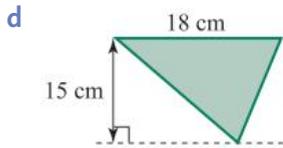
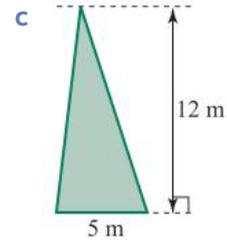
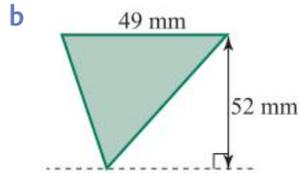
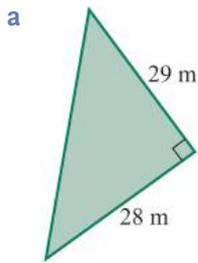
$$\begin{aligned} \text{Area} &= \frac{1}{2} \times \text{base} \times \text{height} \\ &= \frac{1}{2} \times 14 \times 26 \\ &= 182 \text{ m}^2 \end{aligned}$$

Exercise 14 F

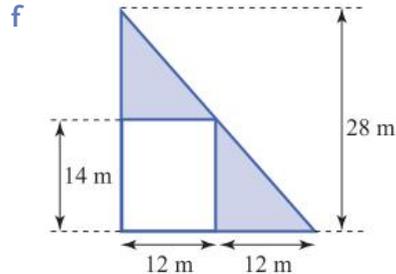
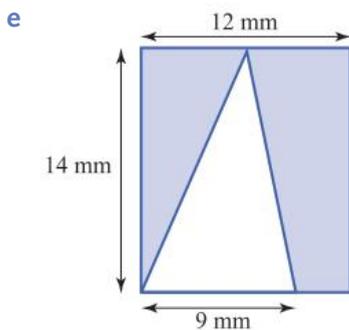
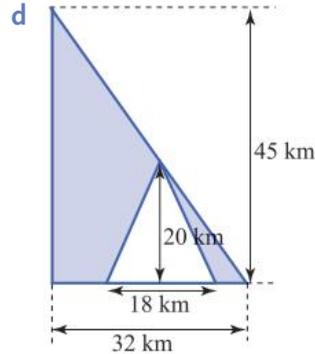
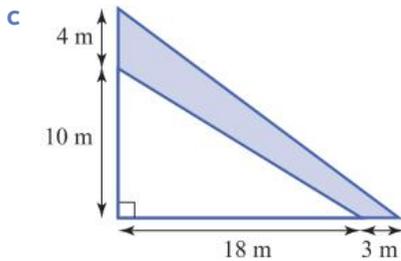
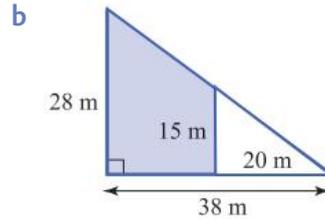
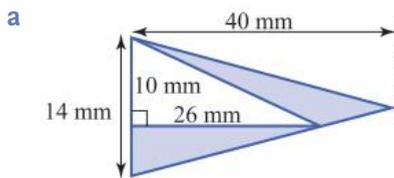
1 Find the area of these triangles:



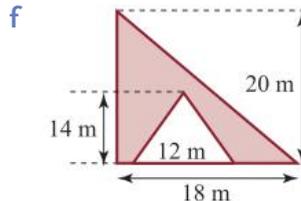
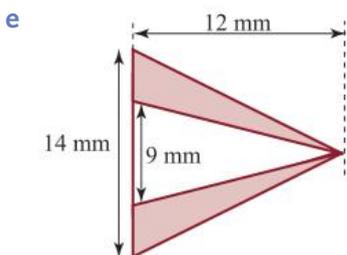
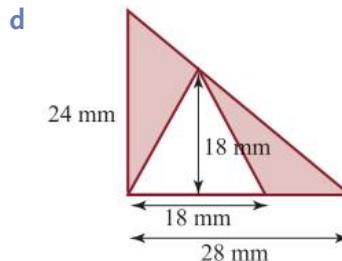
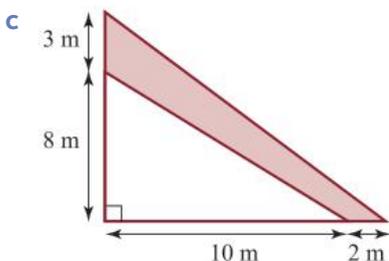
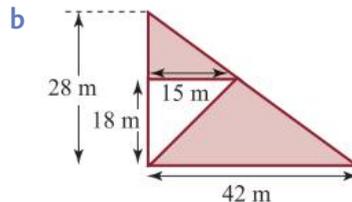
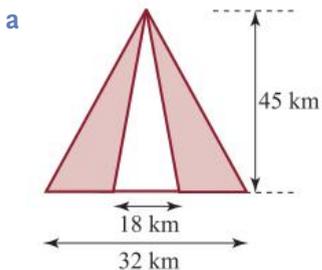
2 Find the area of these triangles:



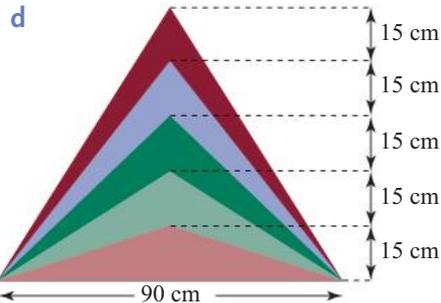
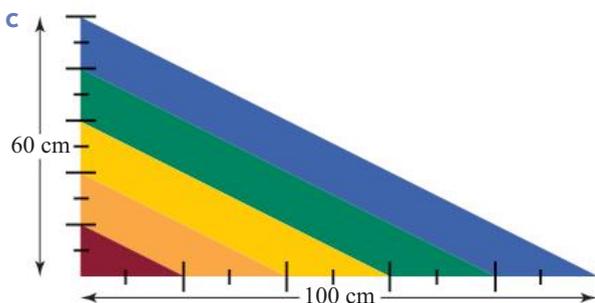
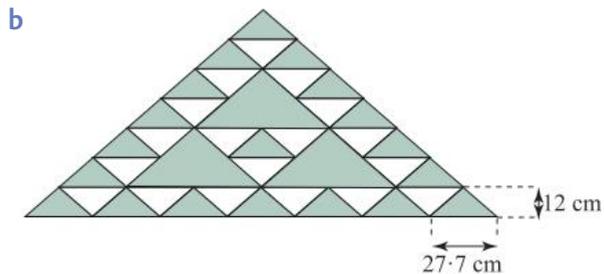
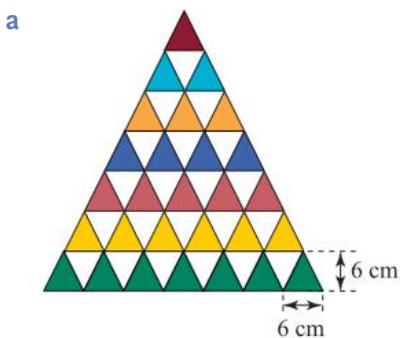
3 Find the area of the shaded regions in the following shapes:



4 Find the shaded areas in each of the following:

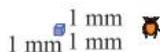


5 Find the total area for each different colour of the given shapes in these designs:



The volume of a solid is the amount of space contained in it. Cubic units are used because volume is the measure of three-dimensional space.

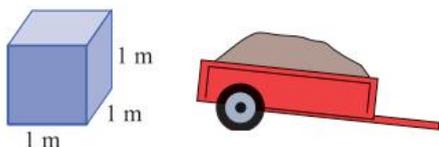
The volume of a beetle is measured using cubic millimetres or mm^3 .



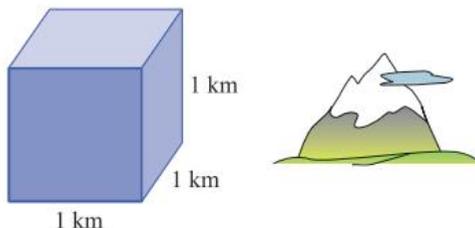
The volume of a fish tank is measured in cubic centimetres or cm^3 .



The volume of soil carried in a trailer is measured in cubic metres or m^3 .

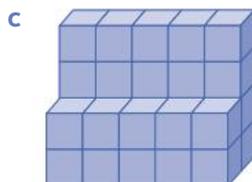
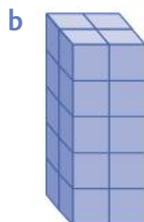
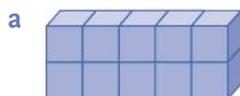


The volume of a mountain is measured in cubic kilometres or km^3 .



Example

Find the volume of the following solids if each cube is a cubic centimetre:



Solution

The cubes are all the same size so you can add them up.

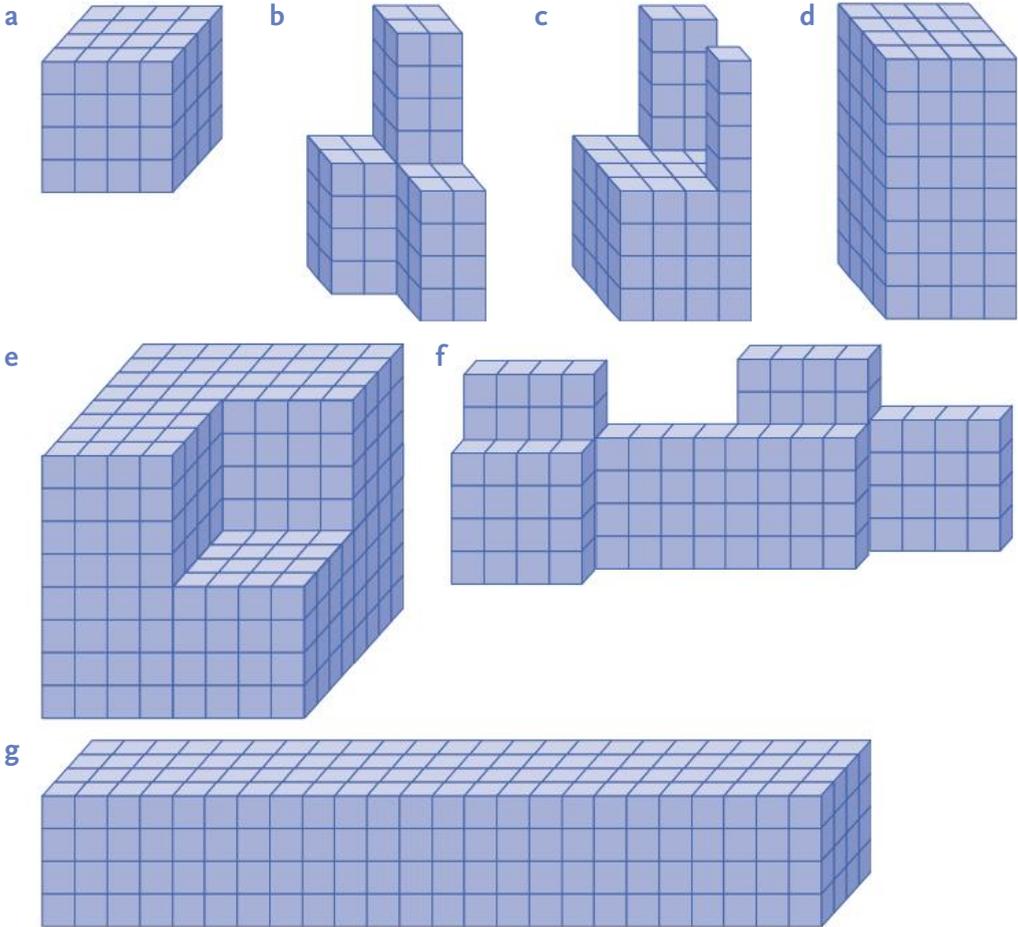
Two rows of 5 cubes
= 10 cubes
Volume is 10 cm^3 .

Five rows of 4 cubes
= 20 cubes
Volume is 20 cm^3 .

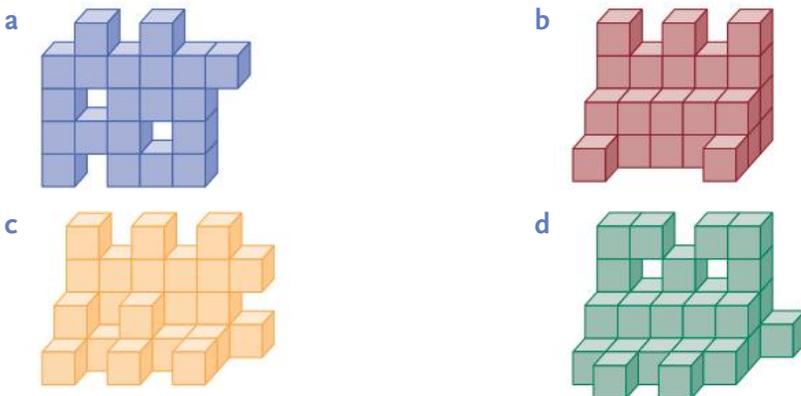
Back section has four rows of 5 cubes
= 20 cubes
Front section has two rows of 5 cubes
= 10 cubes
Volume
= $20 + 10 = 30$ cubes
Volume is 30 cm^3 .

Exercise 1 G

1 Count the number of cubes to find the volume of each shape. Each cube is a cubic centimetre:



2 Find the volume of these structures by counting the centimetre cubes:

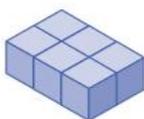




A short-cut method can be used to find the volume of a rectangular prism. The method can be found by building a number of rectangular prisms to find a pattern using blocks.

Learning task 14H

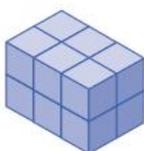
- 1 a Build the following rectangular prism with your blocks. Each block is 1 cubic unit. Copy and complete the following statements:



Length is _____ units.
 Width is _____ units.
 Height is _____ units.

The volume of the rectangular prism is _____ cubic units.

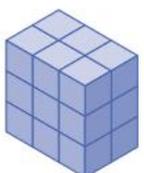
- b Now add another layer onto the rectangular prism.



Length is _____ units.
 Width is _____ units.
 Height is _____ units.

The volume of the rectangular prism is _____ cubic units.

- c Now add another complete layer onto the rectangular prism.



Length is _____ units.
 Width is _____ units.
 Height is _____ units.

The volume of the rectangular prism is _____ cubic units.

- d Copy and complete the following table about the rectangular prism you have constructed:

P ism	Units in length (l)	Units in width (w)	Units in base (area) (A)	Units in height (h)	Volume of prism (V)
1	3	2	6	1	6
2				2	
3				3	

- e i Write a general statement in words about the length, width and area of the prism's base.
 ii Write a rule in symbols for the area, A , of the base in terms of length, l , and width, w .
 iii Write a general statement in words connecting the area of the base and the height and volume of this prism.
 iv Write two rules for the volume, V , of the prism, the first in terms of A and the height, h , and the second in terms of l , w and h .
 v Check your findings using prisms of different sizes.
- 2 Try this for a prism with a length of 4 cubes and a width of 3 cubes. First, build the rectangular prisms. Then complete a table and check that your rule works.
- 3 a In your own words, describe a rule that would help you to determine the volume of a rectangular prism of any size.
 b Does this rule hold for a cube? Construct a variety of cubes to apply and verify your rule.

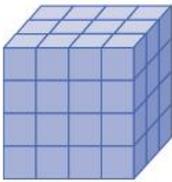
A rectangular prism has the base of a rectangle with straight sides. Finding the volume by counting the cubes takes a lot of time. The short cut is to find the number of cubes in the base layer (which is the same as the area of the base, length \times width) and multiplying that by the number of layers (the height).

- Volume = area of base \times height
- = length \times width \times height

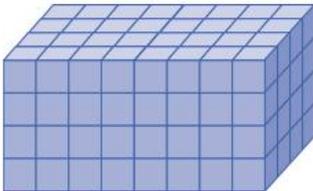
Example

Find the volume of the following solids:

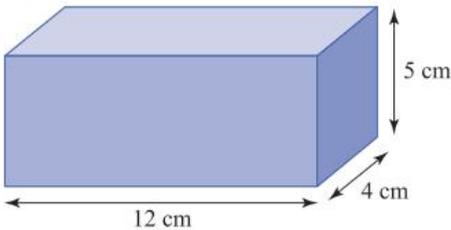
a



b



c

**Solution**

Base:

4 cubes across the front by 3 cubes deep
 $4 \times 3 = 12$ cubes in the base

There are 4 layers.

Number of cubes: $4 \times 12 = 48$

Volume of solid is 48 cubes or 48 cubic units.

Base:

8 cubes across the front by 4 cubes deep
 $8 \times 4 = 32$ cubes in the base

There are 4 layers.

Number of cubes: $4 \times 32 = 128$

Volume of solid is 128 cubes or 128 cubic units.

Base:

Area = $12 \times 4 = 48 \text{ cm}^2$

Height is 5 cm

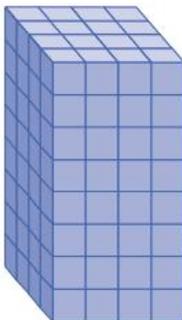
Volume = area of base \times height
 $= 5 \times 48$
 $= 240 \text{ cm}^3$

Volume of solid is 240 cm^3 .

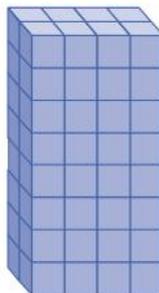
Exercise 141

I Use the rule Volume = number of cubes in base \times number of layers to find the volume of the following prisms:

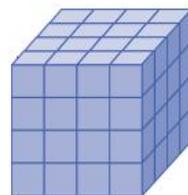
a



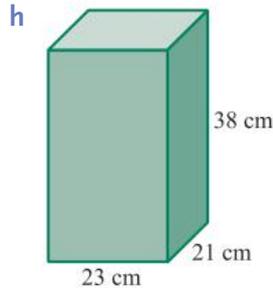
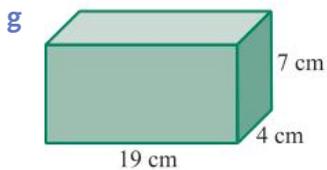
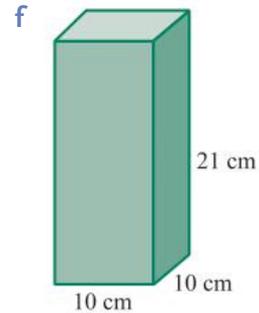
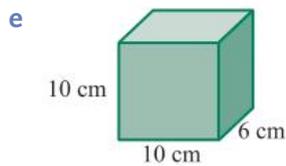
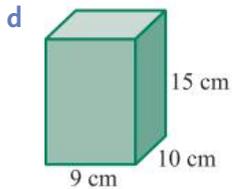
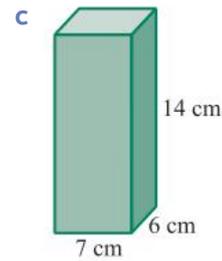
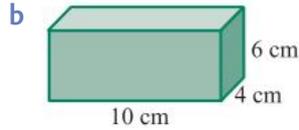
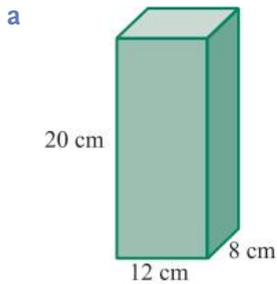
b



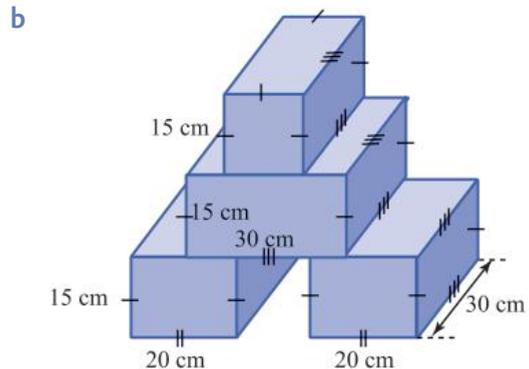
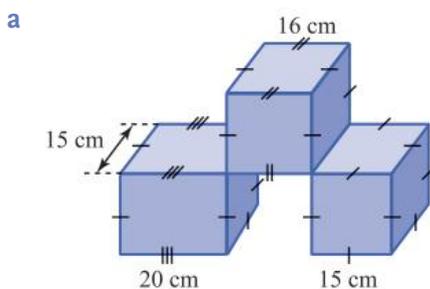
c



2 Use the rule $\text{Volume} = \text{area of base} \times \text{height}$ to find the volume of these solids:



3 Find the total volume of each of these groups of blocks: (**Instruction:** Same number of strokes means equal length.)



4 State the dimensions of three different rectangular prisms with the same volumes of:

a 54 cm^3

b 36 cm^3

c 48 cm^3

d 144 cm^3

5 State the dimensions of groups of blocks with the following volumes:

a 2 blocks with a total volume of 24 cm^3

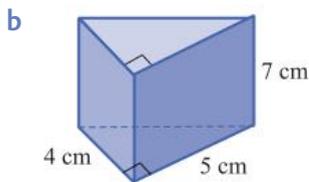
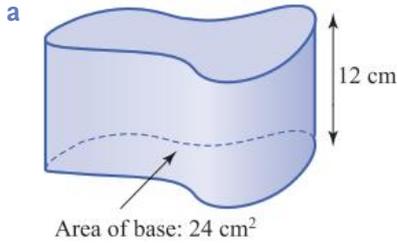
b 3 blocks with a total volume of 42 cm^3

A prism is a three-dimensional shape with a regular cross-section. The volume of any prism can be found by using the rule:

$$\bullet \text{ Volume of a prism} = \text{area of base} \times \text{height}$$

Example

Find the volume of the following prisms:

**Solution**

$$\begin{aligned} \text{Volume} &= \text{area of base} \times \text{height} \\ &= 24 \times 12 \\ &= 288 \text{ cm}^3 \end{aligned}$$

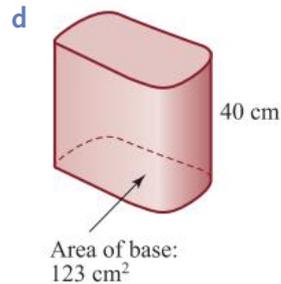
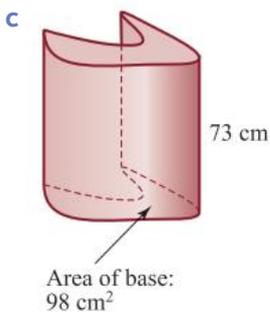
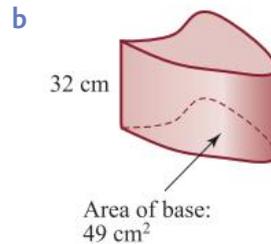
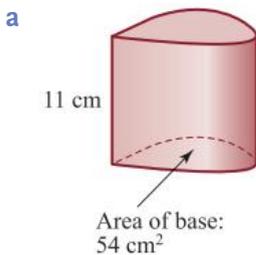
$$\text{Volume} = \text{area of base} \times \text{height}$$

$$\begin{aligned} \text{Base area} &= \frac{1}{2} \times 4 \times 5 \\ &= 10 \text{ cm}^2 \end{aligned}$$

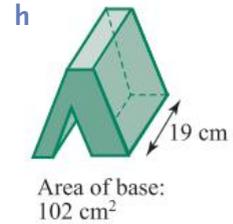
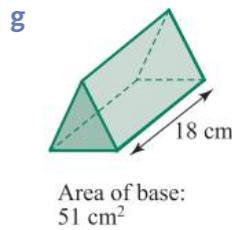
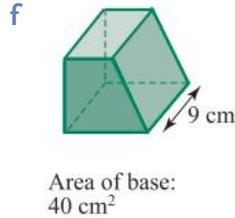
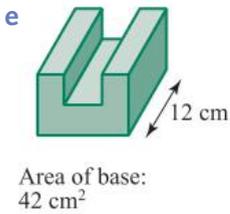
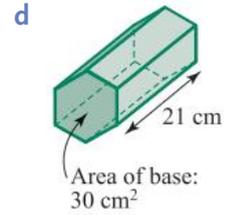
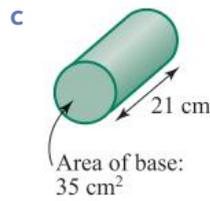
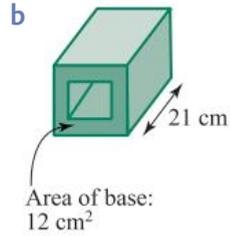
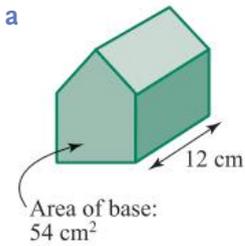
$$\begin{aligned} \text{Volume} &= 10 \times 7 \\ &= 70 \text{ cm}^3 \end{aligned}$$

Exercise 14j

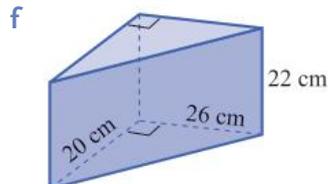
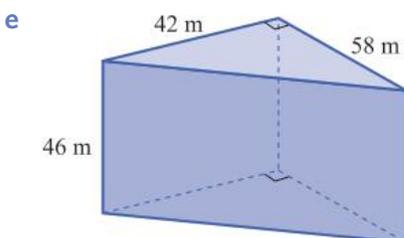
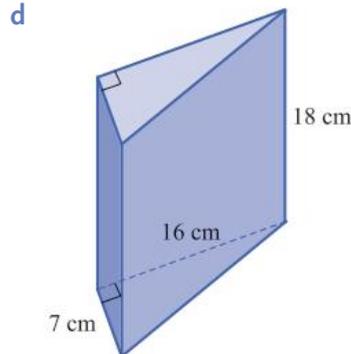
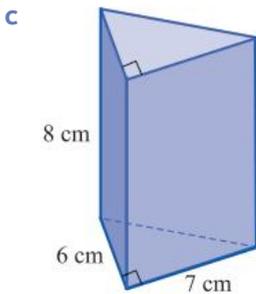
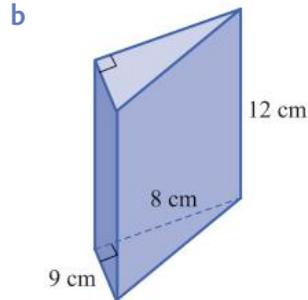
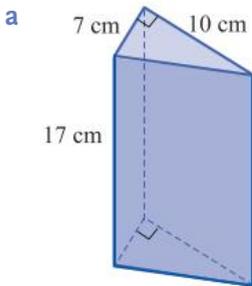
I Find the volume of these solids:



- 2 Find the volume of the following prisms—they have been tipped over on their sides so that the base is facing you:



- 3 Find the volume of the following solids by finding the area of the triangular base and multiplying by the height:

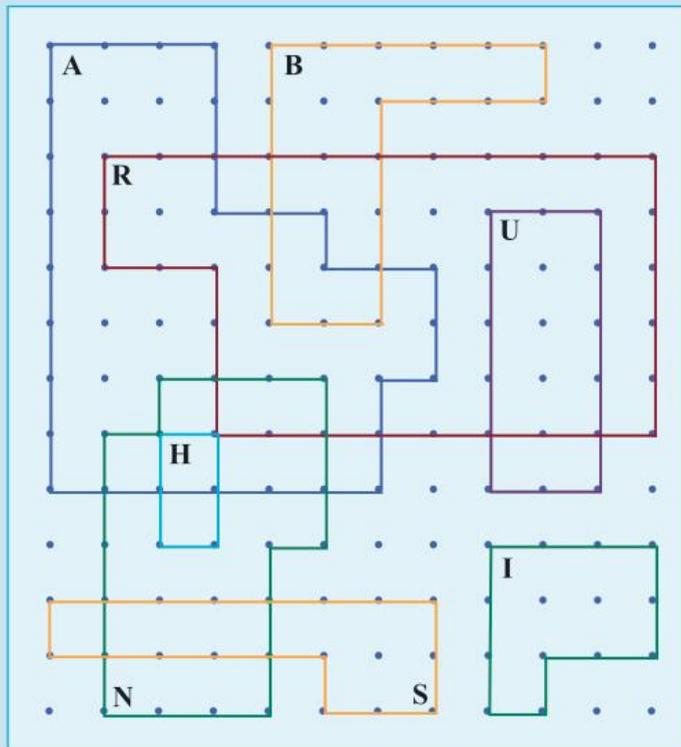




Puzzles

- 1 Find the area of each coloured shape then match the letter to the answer below to solve the riddle:

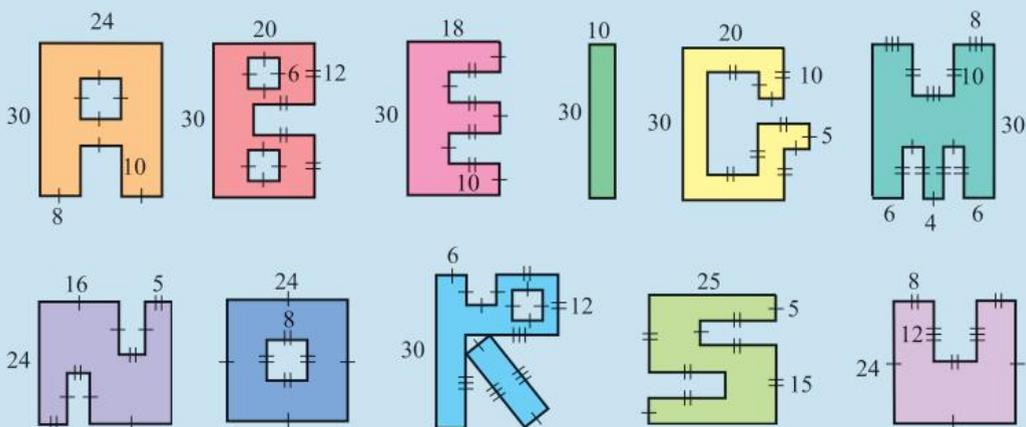
What has a lid and flies?



40	44	10	13	13	7	9	2	13	7	20
----	----	----	----	----	---	---	---	----	---	----

- 2 Calculate the area of each letter then match the letter to the correct area to solve the riddle:

What did the woman in the clothing shop say when she answered the phone?



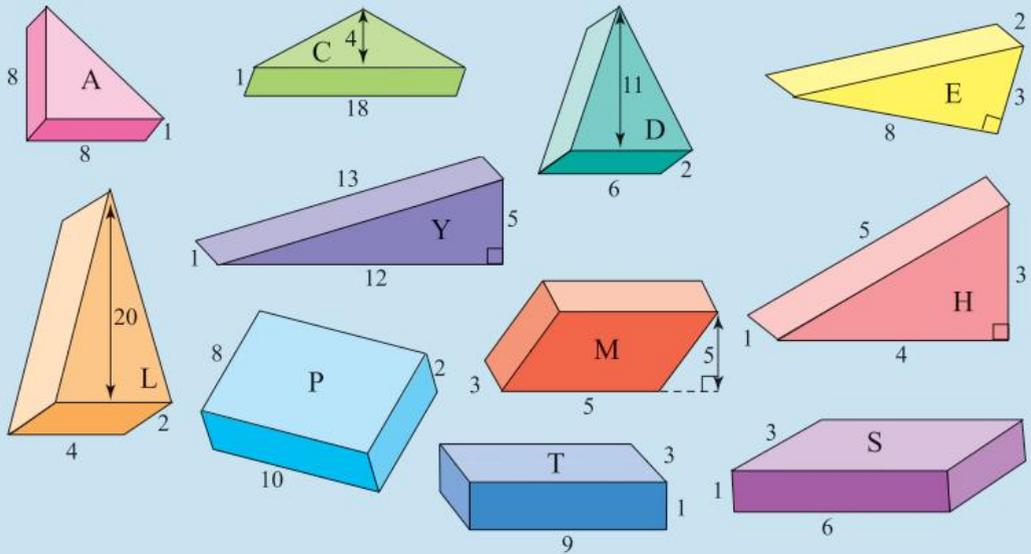
<u>475</u>	<u>576</u>	<u>432</u>	<u>300</u>		<u>475</u>	<u>576</u>	<u>432</u>	<u>512</u>	<u>464</u>	<u>400</u>
<u>464</u>	<u>480</u>	<u>560</u>	<u>456</u>	<u>420</u>	<u>432</u>					



3 Calculate the volume of each prism and match the letter to the answer below to solve the riddle:

What happened to the optometrists who fell over?

(All measurements are in centimetres.)



<u>27</u>	<u>6</u>	<u>24</u>	<u>30</u>		<u>75</u>	<u>32</u>	<u>66</u>	<u>24</u>		<u>32</u>
<u>18</u>	<u>160</u>	<u>24</u>	<u>36</u>	<u>27</u>	<u>32</u>	<u>36</u>	<u>80</u>	<u>24</u>		



Applications

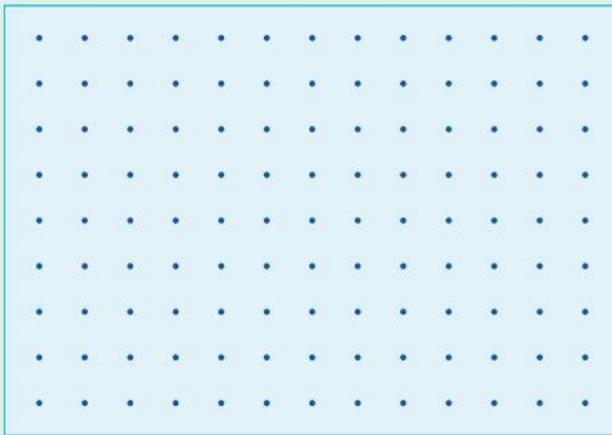
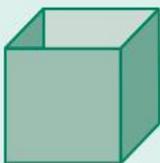
How big is your hand?

Trace around your hand onto a sheet of grid paper to cover the maximum number of whole squares as possible. Estimate the area of your hand by counting the squares. Trace around your foot onto a piece of grid paper and estimate the area of your foot. How much bigger is your foot than your hand? Compare your results with those of other students in the class.

The open box activity

You will need several sheets of grid paper that measures 12 cm by 8 cm.

Cut square corners out of the paper and fold up the sides to make an open box.



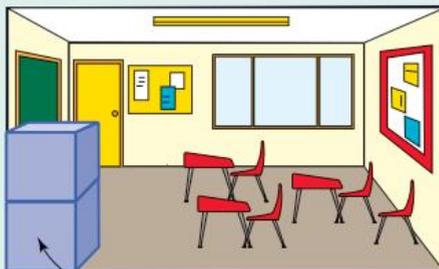
Make three boxes by cutting out squares with edge lengths of 1 cm, 2 cm and 3 cm and calculate the volume of each box. List the boxes in order from largest volume to smallest volume. Cut different-sized squares out of the piece of paper to find the box with the largest volume.

Estimating quantities

Cut out squares of paper with edge lengths of 10 cm, 30 cm and 50 cm and put them on the wall next to each other. Write the area of each square on it in bright letters. Choose a rectangular object such as a book or a folder and judge which square has the closest area to it—you can place the objects against the square to help you estimate. Measure the lengths and widths of your chosen object and calculate its area. Record the difference between its area and the area of the square of paper. Repeat this with other rectangular objects.

What is the volume of your classroom? Find a classroom which is a large rectangular prism. Your task is to estimate the number of boxes with a volume of 1 cubic metre that will fit into the room, and so estimate the volume in cubic metres.

Improve your estimate by estimating the volume of the room in cubic centimetres.



Volume = 1 cm³

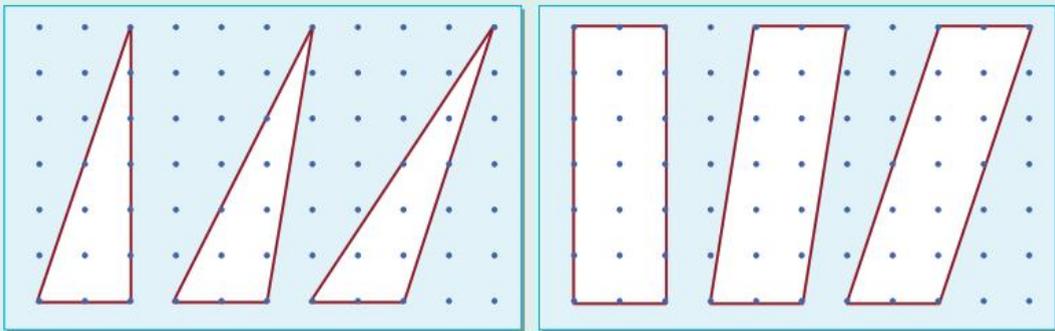
Triangles

The triangles shown below all have a base length of 2 grid units and are 6 grid units high. On dot paper, draw another three different-shaped triangles with the same base length and height.

Draw blue lines inside the triangles between the dots. Cut the triangles out and then cut the triangles into smaller shapes along the blue lines.

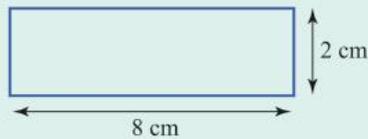
Combine these small shapes to make a rectangle and so find the area of each triangle. Glue your shapes into your book and write a report showing what you found.

Repeat this investigation using the parallelograms shown on the grid below.



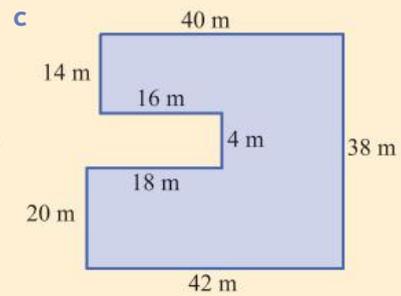
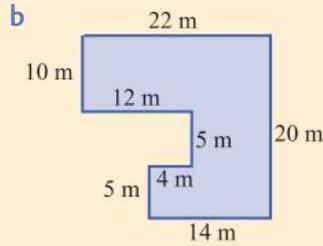
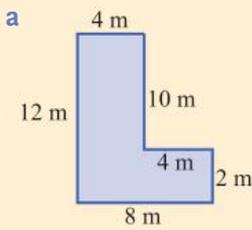
Rectangles

This rectangle has a perimeter of 20 cm. Draw as many other rectangles as possible which have perimeters of 20 cm. Use whole numbers of centimetres only. Record your results in a table and identify a pattern. Repeat the table for rectangles with perimeters of 30 cm, 40 cm and 50 cm. A farmer has 2000 metres of fencing and needs to construct a temporary rectangular enclosure for his sheep. What sized enclosure should he make so that it has the maximum area?

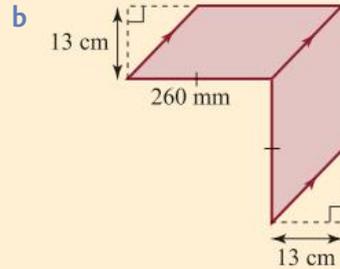
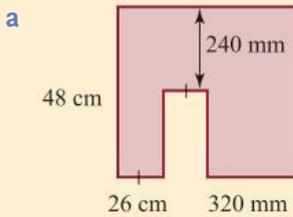


Enrichment

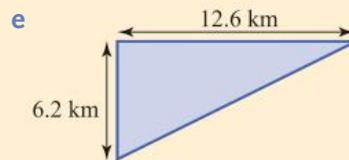
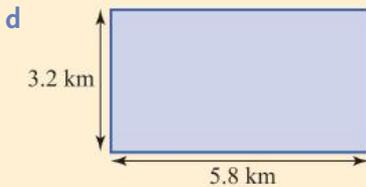
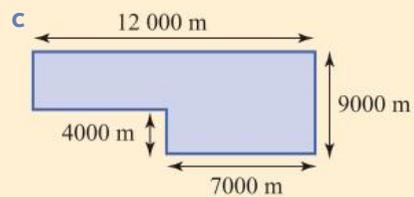
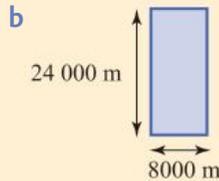
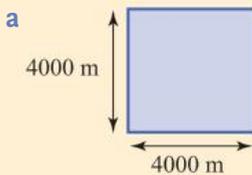
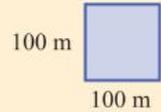
- 1 A path 1 metre wide is to go around each of the following garden beds. Find the area of path for each:



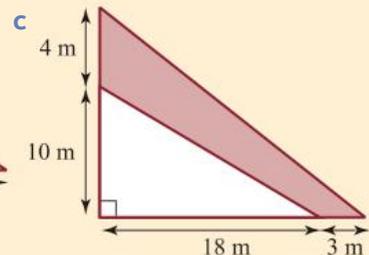
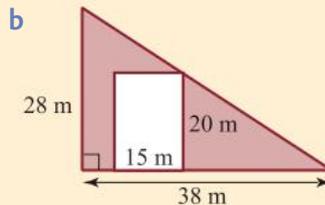
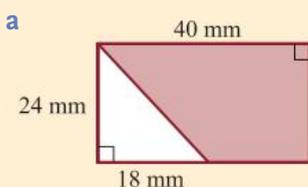
- 2 Find the areas of the following shapes. Give your answer in square centimetres:



- 3 The area of a hectare is defined as being that contained in a square 100 metres by 100 metres. Express the area of the following paddocks in hectares: ($10\,000\text{ m}^2 = 1\text{ ha.}$)



- 4 Find the area of the shaded regions:



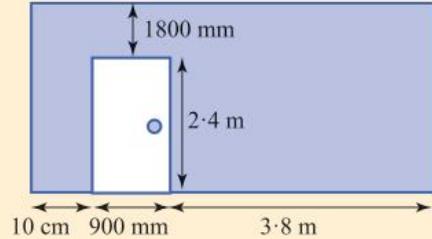
- 5 Bill is about to tile an external wall with tiles that are 20 cm long and 10 cm wide.
- How many tiles will be needed if the wall measures 2.4 m by 6.2 m.
 - If the tiles are sold in boxes of 20, how many boxes should he buy?

After checking the tiles he finds that 10% of the tiles have cracks and can't be used.

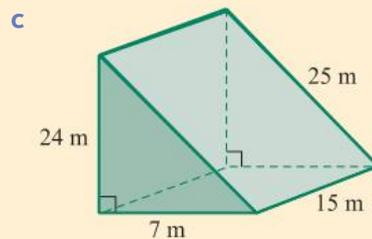
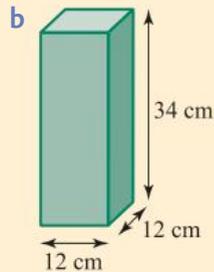
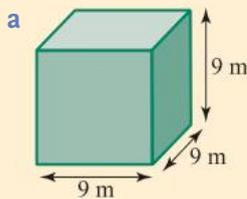
- How many boxes of tiles should he order now?
- How many good tiles will he have left over?

Bill now tiles a neighbour's wall, which includes a door as shown. He uses 20 cm by 40 cm tiles.

- Find the number of tiles needed to complete the job.



- 6 Find the area of all the surfaces of the following solids:



- 7 A flat rectangular life form from another galaxy measures 6 mm by 8 mm at noon. It doubles its dimensions (length and width) every 2 hours.

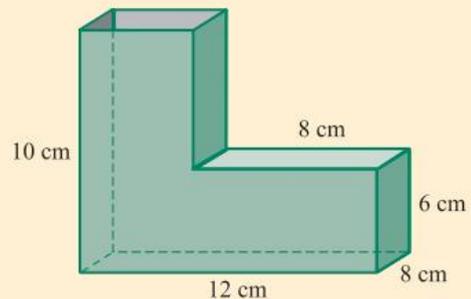
- Find its area at 2 pm, 4 pm, 6 pm and so on to midnight.
- Express the area at each time interval as a percentage of its area at noon.

Another organism under investigation is in the form of a cuboid which measures 2 cm tall by 3 cm wide by 4 cm long at noon. It also doubles its length, width and height every 2 hours.

- Find the organism's volume at 2-hourly intervals from noon to midnight.
- Express the volume at each time interval as a percentage of its volume at noon.

- 8 A liquid is poured into this container so that its level rises 1 centimetre every 10 seconds.

- How long will it take for the container to be completely full?
- What volume of liquid will there be in the container after 10, 20, 30, 40 seconds ... until it is full?
- How many millilitres of liquid does the container hold? ($1 \text{ cm}^3 = 1 \text{ millilitre}$)

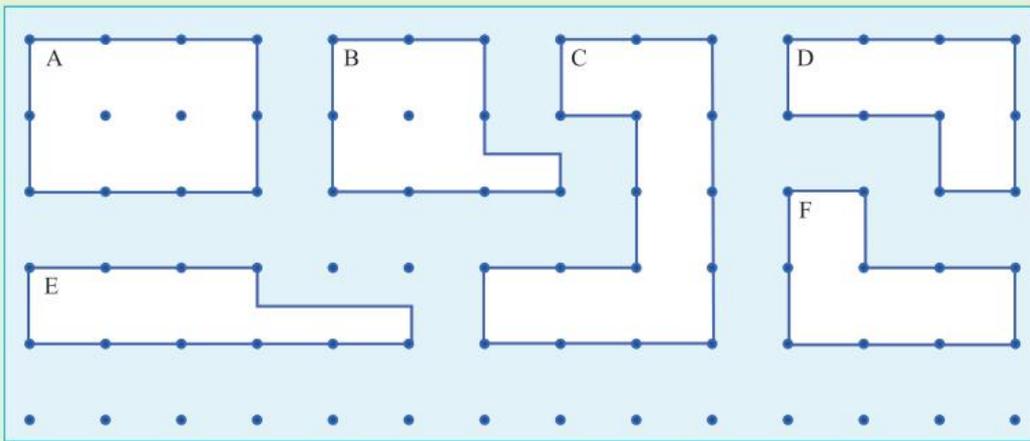




Revision/Assessment

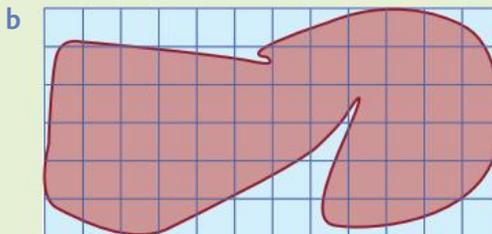
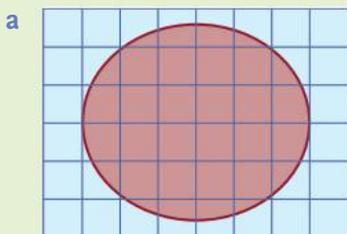
Exercise 14A

1 Order the following shapes from largest area to smallest area:



Exercise 14B

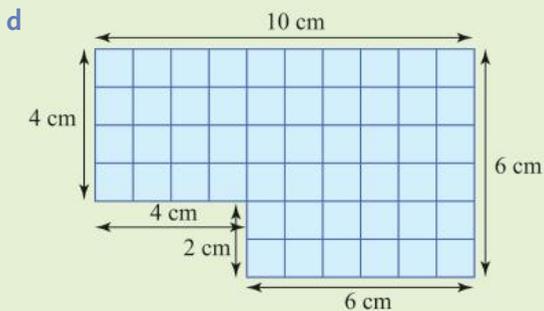
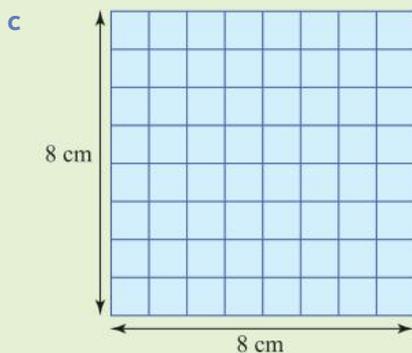
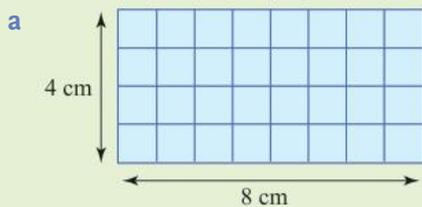
2 Estimate the area of the following shapes by using the grids shown:



3 Find the area of each of the rectangles by:

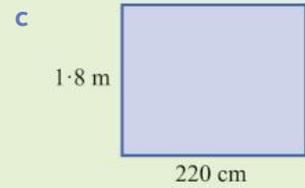
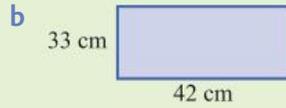
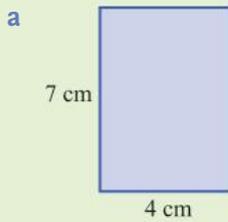
i counting the squares

ii using the rule

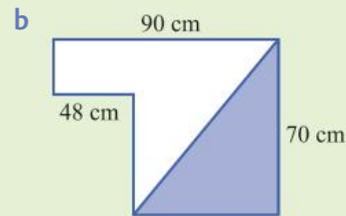
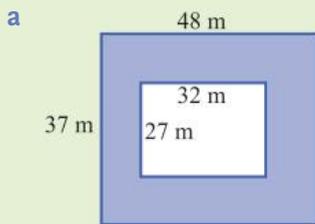


Exercise 4 D

4 Find the area of each of the following rectangles:

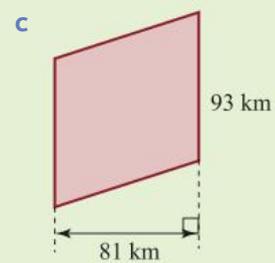
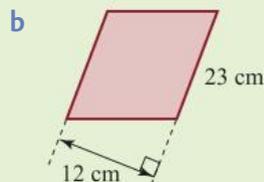
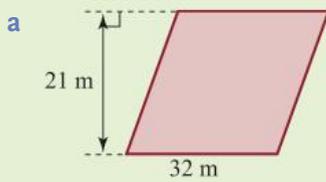


5 Find the shaded area:

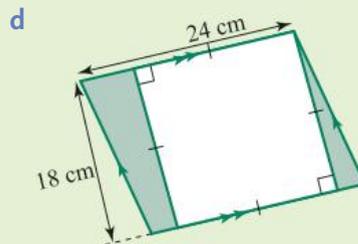
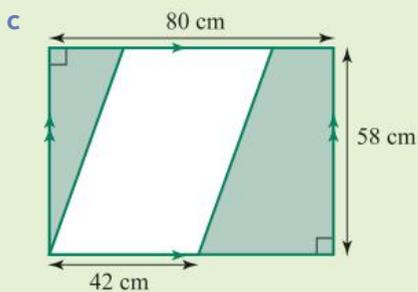
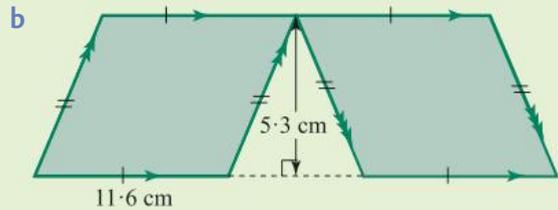
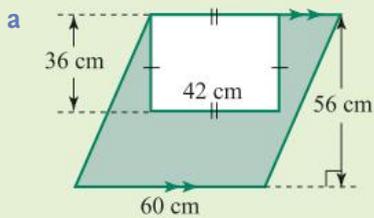


Exercise 4 E

6 Find the area of the following parallelograms:

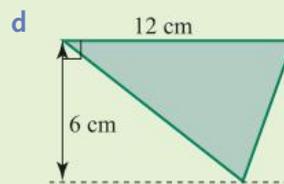
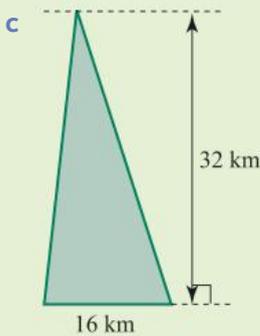
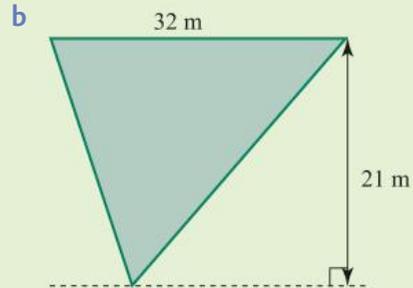
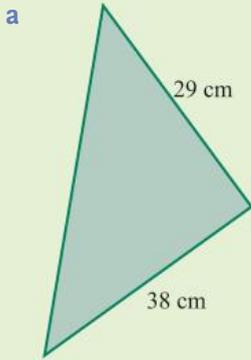


7 Find the shaded area:



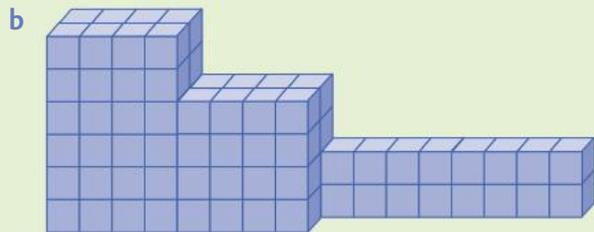
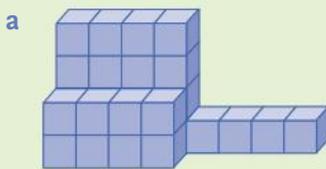
Exercise 14F

8 Find the area of the following triangles:



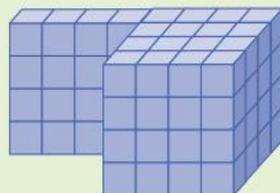
Exercise 14G

9 Count the number of cubes in each solid and so find its volume. The volume of each cube is 1 cubic centimetre:



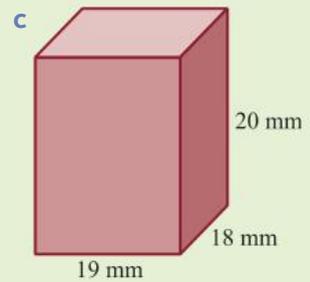
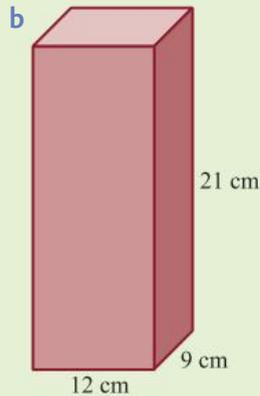
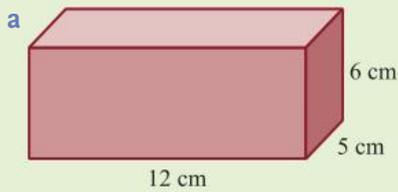
Learning task 14H

10 Use the rule $\text{Volume} = \text{number of cubes in base} \times \text{number of layers}$ to find the volume of this prism:



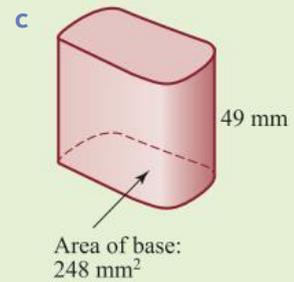
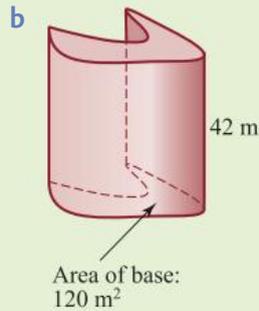
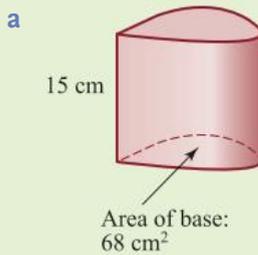
Exercise 4 I

11 Use the rule $\text{Volume} = \text{area of base} \times \text{height}$ to find the volume of these solids:

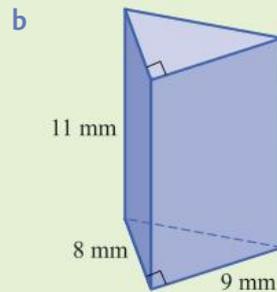
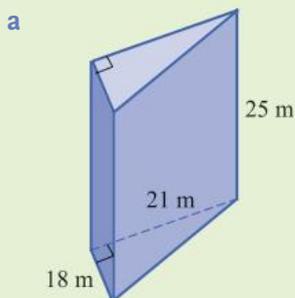


Exercise 4 J

12 Find the volume of these solids:



13 Find the volume of the following solids by finding the area of the triangular base and multiplying by the height:

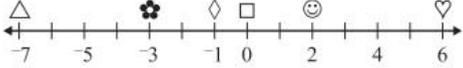


Answers

These are selected answers only.

Chapter 8

Exercise A

- 1 a -7°C b 1000 m
 c $-\$90$ d -275 m
 e 21°C f $\$76$
 g 5°C h -2°C
 i 0 m j Level -3 or B3
- 2 a A = -8, T = -6, N = -4, C = -2, R = -1, E = 0, G = 2, E = 4, L = 5
 Rectangle
 b D = -7, D = -5, A = -2, M = 1, O = 2, I = 4, N = 7
 Diamond
 c N = -6, O = -5.5, A = -4, T = -1, O = 1, C = 3, G = 5.75
 Octagon
 d M = -6.5, P = -5, T = -4, Z = -3, U = -2, E = 0, A = 2.25, R = 4, I = 5.75
 Trapezium
- 3 a 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28
 b 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70
 c -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7
 d -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
 e -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7
 f 14
- 4 a 
 b Hello
 c How are you today?
 d Do you have a cat?
 e I am thirteen.

Exercise B

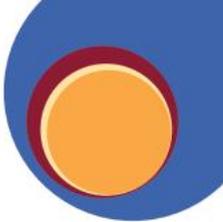
- 1 a 8, 7, 6, 5, 4, 3, 2, 1, 0, -1
 b 15, 10, 5, 0, -5, -10, -15, -20, -25, -30
 c -3, -5, -7, -9, -11, -13, -15, -17, -19, -21
 d -30, -27, -24, -21, -18, -15, -12, -9, -6, -3
 e -14, -10, -6, -2, 2, 6, 10, 14
 f -16, -13, -10, -7, -4, -1, 2, 5
 g $3\frac{1}{2}$, 3, $2\frac{1}{2}$, 2, $1\frac{1}{2}$, 1, $\frac{1}{2}$, 0, $-\frac{1}{2}$, -1
 h -2.3, -2.0, -1.7, -1.4, -1.1, -0.8, -0.5, -0.2, 0.1, 0.4
- 2 a $\$5.36$, $\$5.50$, $\$5.42$, $\$5.56$, $\$5.48$, $\$5.62$, $\$5.54$, $\$5.68$, $\$5.60$, $\$5.74$, $\$5.66$, $\$5.80$, $\$5.72$, $\$5.86$
 b Assuming the shares were bought on day 1, on day 14 they will be worth $\$5.86$.
- 3 a $\$73$, $\$61$, $\$49$, $\$37$, $\$25$, $\$13$, $\$1$, 0
 b It will take 7 weeks to fully pay back the money.

- c Marau will have $\$11$ to open his bank account.
 d $\$11$, $\$23$, $\$35$, $\$47$, $\$59$, $\$71$, $\$83$, $\$95$

- 4 a 1 b -4 m
 c $3 \cdot 8$ d $13 \cdot 8\text{ m}$

Exercise C

- 1 a $\$83$
 b 48°C
 c -12 m
 d $-\$150\,000$
 e -58°C
 f 4 storeys high
 g 2330 m
 h $\$68.85$
- 2 a The temperature at the swimming pool was 23°C .
 b The temperature in the freezer was -10°C .
 c The boy charged $\$50$ to his credit card, so that his balance was $-\$50$.
 d The building was 89 m high.
- 3 a -11, -10, -6, -2, 5, 7, 8, 9
 b -8, -7, -3, -1, 3, 5, 6, 7
 c -52, -31, -13, -12, -6, 14, 20, 28, 46
 d -33, -22, -14, -13, -8, 5, 8, 12, 17, 21
 e $-6\frac{3}{4}$, -6, $-5\frac{1}{2}$, $-2\frac{3}{4}$, $-1\frac{1}{4}$, 0, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$
 f -4, $-3\frac{1}{2}$, -3, $-2\frac{1}{4}$, $-1\frac{1}{2}$, 4, $5\frac{1}{2}$, $6\frac{3}{4}$, 8, 10
 g -6, -4.5 , -4.1 , -1.5 , 0, 2.2, 3, 3.1, 4.6, 7.2
 h -6.9, -5.2 , -4.9 , -4.8 , -4.1 , 2.8, 6, 6.5, 7.2, 8
 i -8, -5.5 , -3.1 , $-2\frac{1}{2}$, -1.8 , 0, 2, 2.9, $4\frac{1}{2}$, 7
 j -7.1 , -5, $-3\frac{1}{3}$, -2.2 , 3, 5, 8.1, 9, $12\frac{1}{2}$, 14
- 4 a True b True c False d False
 e False f False g True h False
 i True j True k False l True
- 5 Zero is neither positive nor negative.
- 6 a 9 b 0 c -2 d -3 e 2
 f -3 g -5 h -11 i -5
- 7 a True b False c True d True
 e False f False g False h True
 i True
- 8 a $2 < 8$ b $-3 < 5$ c $0 > -6$
 d $-4 > -9$ e $-3 < 1$ f $-11 > -20$
 g $-4 < 0$ h $4 > -6$ i $-5 < -1$
 j $6 > -4$
- 9 Minimum temperature reached was 19°C .
- 10 a John still owed $\$27.50$.
 b $-\$27.50$ c $-\$54$
 d John needs to pay $\$54$ to have a zero balance.
- 11 Total distance between divers and wreck is 14.5 m.



- 12 c** Initial position of canoes correlates to +8 on the number line.
d Student's position after paddling correlates to -3 on the number line.
e The students have to walk 3 kilometres upstream to reach the camp.
- 13 a** Dolphin's position was -2 m.
b Aeroplane's position is +300 m.
c Dolphin's position was -40 m.
d Distance between the dolphin and the plane is 340 m.

Learning task 8

- 1 a** 9 **b** 12 **c** 8 **d** 4 **e** 1
f 2 **g** -3 **h** -5 **i** -3
- 2 a** 22 **b** 5 **c** 5 **d** 2 **e** 1
f 5 **g** -1 **h** 4 **i** 2 **j** -8
k -19 **l** -27 **m** -13 **n** -20 **o** -13
p -27 **q** -49 **r** -62 **s** -1 **t** -2
u -25

Exercise 8

- 1 a** 19 **b** 9 **c** 9 **d** 5 **e** 10
f -6 **g** 9 **h** -3 **i** 2 **j** 6
k 5 **l** 5 **m** -5 **n** -7 **o** -3
p -10 **q** 2 **r** -3 **s** 4 **t** -2
- 2 a** False **b** True **c** False **d** True
e False **f** False **g** False **h** True
i False **j** True **k** True **l** False
m False **n** True **o** True **p** False

Learning task 8

- 1 a** 12 **b** 11 **c** 5 **d** 14 **e** 19
- 2** When subtracting a negative number the end result is an increase.
- 3 a** 0 **b** -3 **c** -4 **d** -8 **e** -8
- 4** When subtracting a negative number the end result is an increase.
- 5 a** 13 **b** 21 **c** 30 **d** 26 **e** -10
f -2 **g** 17 **h** 4 **i** 5 **j** 10
k -4 **l** 2 **m** 12 **n** -5 **o** -2
- 6 a** 7 **b** 1 **c** -7 **d** -1 **e** 1 **f** 7
- 7 a** $3 + +4 = 3 + 4 = 7$ **b** $3 - +4 = 3 - 4 = -1$
c $3 + -4 = 3 - 4 = -1$ **d** $3 - -4 = 3 + 4 = 7$
- 8 a** When two signs are together and different, change to subtraction.
b When two signs are together and the same, change to addition.

Exercise 6

- 1 a** 3 **b** 5 **c** 4 **d** 12 **e** -2
f 8 **g** -3 **h** 7 **i** -3 **j** 7
k 20 **l** -3 **m** 15 **n** 8 **o** 10
p 26
- 2 a** 3 **b** -9 **c** -2 **d** 6 **e** -12
f 14 **g** 6 **h** -6 **i** -11 **j** 0
k 7 **l** 7 **m** -11 **n** -2 **o** 10
p -2 **q** -6 **r** -18 **s** -6 **t** -2

Exercise 8

- 1** Students to draw number lines.
- 2 b** You give away 4 lots of \$3, which means you have \$12 less than before.
c You give away 5 lots of \$2, which means you have \$10 less than before.
d You are given 1 bill of \$6, which means you have to pay \$6.
- 3 a** 12 **b** 66 **c** 36 **d** 56 **e** 20
f 12 **g** 35 **h** 110
- 4 a** \$72 **b** $3 \times -\$24 = -\72

Exercise 8

- 1 a** 8 **b** 4 **c** 5 **d** 5 **e** 2
f 9 **g** 7 **h** 10
- 2 a** 4 **b** 5 **c** 2 **d** 5 **e** 5
f 11 **g** 11 **h** 12
- 3 a** -6 **b** -7 **c** -8 **d** -8 **e** -2
f -5 **g** -10 **h** -8
- 4 a** -4 **b** -6 **c** -11 **d** -4 **e** -4
f -8 **g** -10 **h** -3
- 5 a** 6 **b** -4 **c** 6 **d** -3 **e** -12
f 2 **g** -4 **h** 2 **i** 7 **j** -8
k -7 **l** 8 **m** -3 **n** 7 **o** -4
p 8
- 6 a** -2 **b** 4 **c** -6 **d** 4 **e** -4
f 6 **g** 6 **h** -4 **i** -2 **j** -3
k -2 **l** 5 **m** 3 **n** 3 **o** 4
p 2
- 7 a** \$5 **b** $-15 \div 3 = -\$5$
- 8 a** -15°C **b** Fell by 4°C per hour
c $-20 \div 5 = -4^\circ\text{C}$ per hour

Exercise 8

- 1 a** -7 **b** -1 **c** 23 **d** -7 **e** -5 **f** -3
g 2 **h** -9 **i** -13 **j** -3 **k** -8 **l** -7
m -2 **n** -6 **o** 3 **p** -2 **q** -3 **r** -2
s -9 **t** 12 **u** 3



- 2 a** $(16 - 8) \div -2 = -4$ **b** $2 \times -3 + 5 = -1$
c $3 + 7 - -4 = 14$ **d** $4 \times -6 \div 8 = -3$
e $(12 \div -3) + 4 = 0$ **f** $(14 - 5) + 3 = 12$
g $(-36 + -6) \div -7 = 6$ **h** $(-12 + 8) \div -2 = 2$
i $\frac{1}{2} \times -72 \div -6 = 6$ **j** $\frac{1}{4} \times -48 \times -3 = 36$
k $\frac{1}{4} \times -8 + 5 = 3$ **l** $\frac{2}{3} \times 15 - -1 = 11$

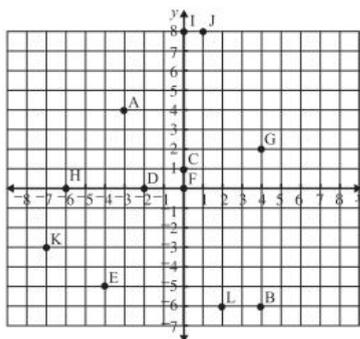
Exercise 8

- 1 a** 3 **b** -9 **c** 4 **d** -12 **e** -7
f -13 **g** -2 **h** -12 **i** -9 **j** -11
k -17 **l** -11
- 2 a** False **b** True **c** True **d** False
e True **f** False **g** False **h** False
i True **j** False **k** True **l** True
- 3 a** -8 **b** -4 **c** -6 **d** -2 **e** -6
f 2 **g** -6 **h** 4 **i** -6 **j** -11
k -3 **l** 1 **m** -5 **n** 2 **o** -9
p -15
- 4 a** True **b** True **c** False **d** False
e False **f** True **g** False **h** False
i True **j** False **k** True **l** True
- 5 a** -150 **b** 96 **c** -40 **d** 36 **e** 14 **f** -42
g 45 **h** -96 **i** -48 **j** -30 **k** 24 **l** 108
- 6 a** 7 **b** 7 **c** 2 **d** -2.5 **e** 11 **f** -6.5
g 2 **h** -2 **i** -1 **j** 2 **k** 1 **l** 3
- 7 a** 2 **b** 3 **c** -8 **d** 5 **e** -36 **f** -9.5
g 2 **h** -26 **i** -8 **j** 9 **k** -15 **l** -3
m 6 **n** 16 **o** -9 **p** -20

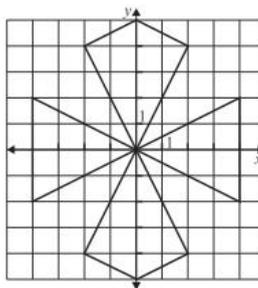
Exercise 8

- 1 a** Triangle = (-4, -6) **b** Cross = (-5, 2)
 Cross = (-3, 0) Square = (-3, 0)
 Smiley = (-1, -2) Triangle = (-3, -6)
 Square = (0, 0) Smiley = (1, 6)
 Heart = (2, -4) Heart = (3, 3)
 Star = (3, 5) Circle = (3, 0)
 Circle = (5, 0) Diamond = (5, -2)

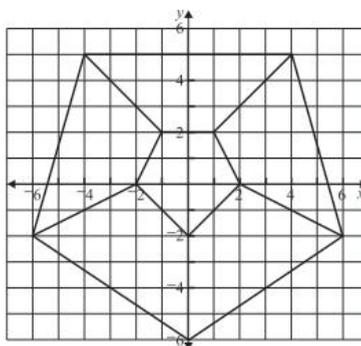
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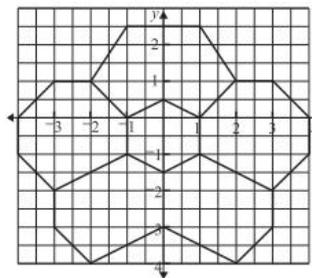
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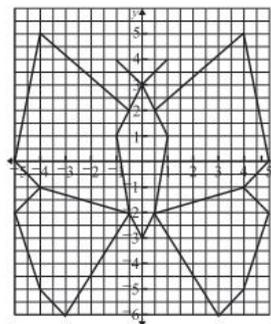
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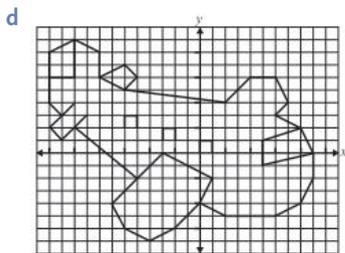
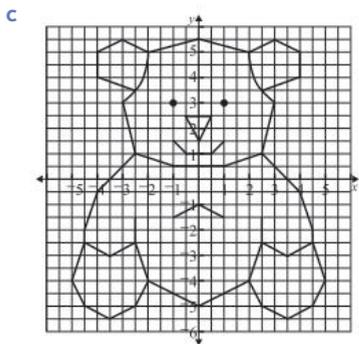
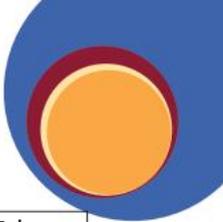


5 a



b





Applications

A game of golf

Par = 0, birdie = -1, eagle = -2, albatross = -3,
bogey = 1, double bogey = 2, triple bogey = 3

Graham's golf score would be +1, or one over par.

Roger's score would be -3, or three under par;
Roger would be the winner.

Enrichment

1 a

Date	Deposit	Withdrawal	Balance
1 January			\$40
3 January	\$160		\$200
8 January		\$50	\$150
9 January		\$30	\$120
11 January	\$10		\$130
15 January		\$250	-\$120
23 January	\$40		-\$80
25 January		\$10	-\$90
29 January		\$5	-\$95
31 January	\$100		\$5

1 b

Date	Deposit	Withdrawal	Balance
1 February			\$5
9 February	\$16·50		\$21·50
12 February		\$4·30	\$17·20
19 February		\$20	\$2·80
21 February		\$55·30	-\$58·10
22 February	\$12·50		-\$45·60
23 February		\$9·60	-\$55·20
26 February	\$80		\$24·80
27 February		\$4·60	\$20·20
28 February	\$42·30		\$62·50

Revision

- 1 a -\$30 b Level 6 c -63°C
 2 ♥ = -7·7 ↑ = -5 + = -3·2
 ♠ = 0 ★ = +1·5 ▲ = +5
 3 a -17, -14, -11, -8, -5, -2, 1, 4
 b 44, 33, 22, 11, 0, -11, -22, -33
 c $14\frac{1}{2}$, -13, $11\frac{1}{2}$, -10, $8\frac{1}{2}$, -7, $5\frac{1}{2}$, -4, $2\frac{1}{2}$, -1
 4 a $0 > -5$ b $-2 < 9$ c $4 < 7$
 d $-3 > -10$ e $-6 < 3$ f $-8 > -10$
 g $-4 < 3$ h $0 < 5$
 5 a -8, -6, -4, -3, -1, 0, 2, 3, 5, 10
 b -3·8, $-3\frac{3}{4}$, $-3\frac{1}{4}$, $-2\frac{1}{2}$, -1·4, 0·3, 5, $6\frac{1}{2}$, 7, $10\frac{3}{4}$
 6 a 10 b -11 c 5 d -1 e 5
 f -7 g -9 h 4 i 6 j -3
 k -6 l 4
 7 a 6 b -9 c 11 d -5 e 3
 f -6 g -11 h 4 i -3 j -8
 k 25 l -3
 8 a 18 b 14 c -54 d -12 e 56
 f -132 g 28 h -27 i -48 j 26
 k -66 l 20
 9 a 4 b -8 c -6 d 3 e -4
 f 4 g 12 h -7 i -19 j 2
 k 4 l -8
 10 a 12 b 7 c 3
 d -10 e 4 f -1

ANSWER TO Enrichment Question 2

2 a Average temperature is $30\cdot25$ degrees

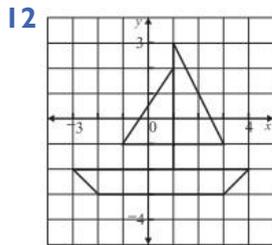
b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp. ($^{\circ}\text{C}$)	31	30	29	27	29	27	26	28	32	34	35	35
Difference	0·75	-0·25	-1·25	-3·25	-1·25	-3·25	-4·25	-2·25	1·75	3·75	4·75	4·75

c Zero



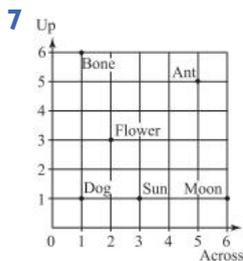
- 11 $E = (6, 3)$ $I = (-2, -4)$ $N = (-4, 5)$
 $O = (3, -2)$ $R = (4, 5)$ $S = (0, 4)$
 $V = (-3, 0)$



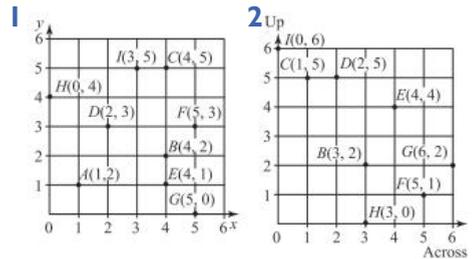
Chapter 9

Exercise 9A

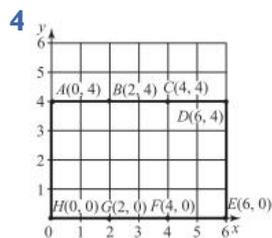
- 1 a 2 across, 2 up b 4 across, 2 up
 c 3 across, 4 up d 6 across, 0 up
 e 1 across, 4 up f 0 across, 2 up
- 2 a 5 across, 2 up b 2 across, 6 up
 c 1 across, 2 up d 4 across, 2 up
 e 2 across, 3 up f 1 across, 5 up
- 3 a 3 across, 3 up b 3 across, 5 up
 c 2 across, 6 up d 5 across, 1 up
 e 2 across, 3 up f 4 across, 2 up
- 4 a 5 across, 2 up b 5 across, 4 up
 c 5 across, 5 up d 6 across, 3 up
 e 3 across, 2 up f 4 across, 3 up
- 5 a 3 across, 1 up b 4 across, 1 up
 c 5 across, 2 up d 4 across, 1 up
- 6 a 3 across, 1 down b 4 across, 1 down
 c 5 across, 2 down d 4 across, 1 down



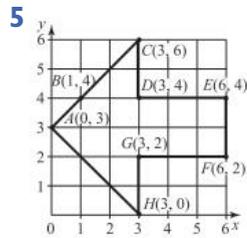
Exercise 9B



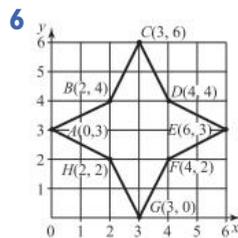
- 3 a C b B c H d A
 e E f G g D h F
 i K j I k L l J



Rectangle

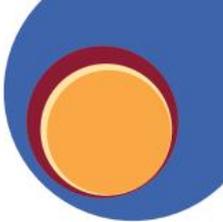


Arrow

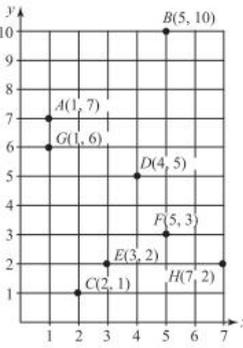


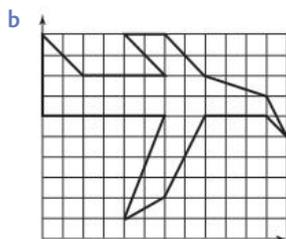
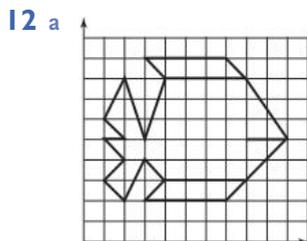
Star

- 7 START (1, 2), (11, 2), (11, 8), (8, 11), (8, 13), (7, 13), (7, 12), (6, 13), (1, 8), (1, 2) STOP
 START (3, 9), (5, 9), (5, 7), (3, 7), (3, 9) STOP
 START (7, 9), (9, 9), (9, 7), (7, 7), (7, 9) STOP
 START (4, 2), (4, 5), (8, 5), (8, 2) STOP
- 8 Bridge (200, 500) Camp (0, 0)
 Toilet (100, 0) Dam (600, 100)
 Cave (500, 400) Lookout (400, 500)
 Obstacle course (300, 300)



- 9 a**  (4, 6) **10 a**  (6, 7)
- b**  (1, 5) **b**  (4, 1)
- c**  (3, 4) **c**  (2, 8)
- d**  (4, 3) **d**  (4, 5)
- e**  (6, 3) **e**  (3, 2)
- f**  (2, 3) **f**  (7, 3)
- g**  (5, 1) **g**  (6, 4)
- h**  (2, 1) **h**  (8, 6)

11 a  **b** HI



Exercise 9D

- 1 a** 1:500 **b** 1:250 **c** 1:200 **d** 1:300
e 1:1000 **f** 1:400 000 000
g 1:27 500 **h** 1:100 000 000
- 2 a** 10 cm **b** 50 cm **c** 2.5 m **d** 1 m
e 1.5 m **f** 5 m **g** 250 m **h** 1 km

3 1 cm represents 10 km
 110 km = 11 × 10 km
 Distance on map will be 11 cm.

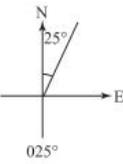
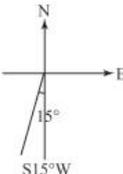
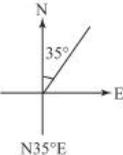
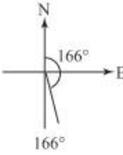
- 4 a** **i** 500 m **ii** 5 km
iii 40 km **iv** 13.25 km
- b** **i** 18 cm **ii** 1.8 cm
iii 5.4 cm **iv** 8.1 cm
- c** **i** 28.5 km **ii** 26.5 km
iii 12.5 km **iv** 25 km
- d** The area of Guadalcanal Island is estimated to be about 6475 sq km.

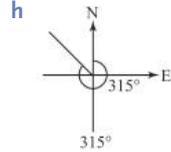
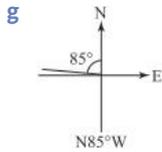
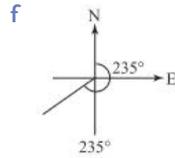
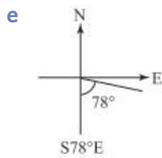
5 Check with your teacher.

Exercise 9E

	Angle, as shown, from boy to girl	True bearing	Compass bearing
a	40°	040°	N40°E
b	70°	070°	N70°E
c	110°	110°	S70°E
d	140°	140°	S40°E
e	160°	160°	S20°E
f	180°	180°	S
g	200°	200°	S20°W
h	305°	305°	N55°W
i	90°	090°	E or N90°E
j	235°	235°	S55°W
k	270°	270°	W or S90°W
l	306°	306°	N54°W

- 2** **A** 022°, N22°E **B** 060°, N60°E
C 135°, S45°E **D** 215°, S45°W
E 250°, S70°W **F** 280°, N80°W
G 330°, N30°W

- 3 a**  **b** 
- c**  **d** 

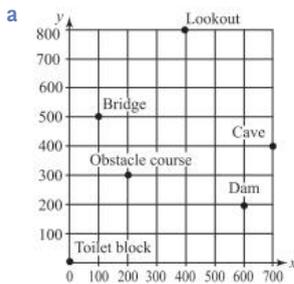


4 Due north is 000° , due south is 180° , due west is 270° and due east is 090° .

- 5 a**
- i** 690 m
 - ii** 1040 m
- b**
- i** $40\text{ m} \times 35\text{ m}$
 - ii** $30\text{ m} \times 30\text{ m}$
- c**
- i** 320°
 - ii** 135°
 - iii** 280°

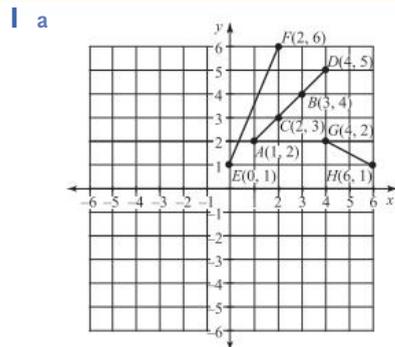
Applications

Orienteering



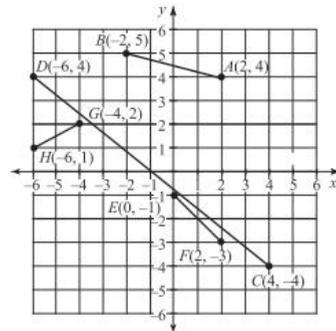
- b** Scale 6 mm : 100 m
- i** 500 m
 - ii** 800 m
 - iii** 900 m
- c** 600 m

Enrichment



- b** 045°
- c**
- i** 045°
 - ii** 022°
 - iii** 117°

2 a

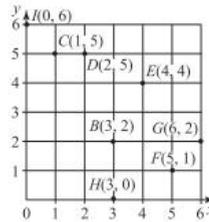


- b** 285°
- c**
- i** 308°
 - ii** 135°
 - iii** 243°

Revision

- 1 a** 3 across and 1 up
- b** 3 across and 5 up
- c** 4 across and 2 up
- d** 5 across and 1 up
- e** 2 across and 4 up
- f** 0 across and 5 up

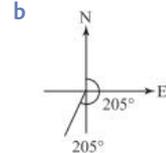
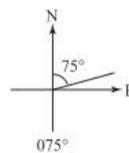
2



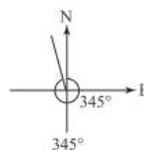
- 3 a** (5, 0)
- b** (2, 1)
- c** (0, 3)
- d** (3, 4)
- e** (2, 5)
- f** (6, 1)
- 4 a** (9, 11)
- b** (12, 11)
- c** (9, 3)
- d** (2, 3)
- e** (11, 8)
- f** (4, 1)
- g** (8, 6)
- h** (2, 6)
- i** (3, 8)

- 5 a** 1:500
- b** 1:500 000
- c** 1:250
- d** 1:400 000
- 6 a** 10 m
- b** 5 m
- c** 80 cm
- d** 100 m

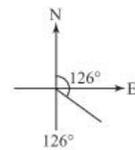
7 a

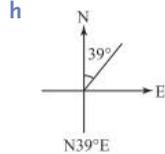
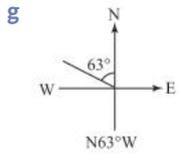
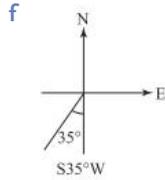
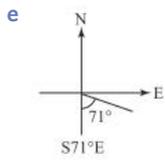


c



d





Chapter 10

Exercise 10A

- 1 a $\frac{5}{6}$ b $\frac{2}{3}$ c $\frac{1}{4}$ d $\frac{1}{6}$ e $\frac{3}{8}$ f $\frac{2}{5}$
 g $\frac{4}{5}$ h $\frac{7}{8}$ i $\frac{1}{3}$ j $\frac{1}{2}$ k $\frac{1}{8}$ l $\frac{3}{4}$
- 2 a P b M c P d I e M f P
 g M h I i P j M k I l I
 m M n P o I
- 3 a $\frac{3}{4}$ b $\frac{1}{4}$ c $\frac{1}{2}$ d $\frac{2}{3}$ e $\frac{1}{4}$ f $\frac{2}{3}$
 g $\frac{5}{6}$ h $\frac{2}{5}$ i $\frac{1}{2}$ j $\frac{7}{8}$ k $\frac{1}{5}$ l $\frac{1}{3}$
 m $\frac{11}{12}$ n $\frac{3}{10}$ o $\frac{5}{8}$ p $\frac{4}{7}$ q $\frac{7}{12}$ r $\frac{5}{8}$
 s $\frac{3}{11}$ t $\frac{6}{13}$ u $\frac{4}{5}$ v $\frac{6}{7}$ w $\frac{7}{12}$ x $\frac{3}{5}$
 y $\frac{4}{5}$

Exercise 10B

- 1 a $\frac{5}{2}$ b $\frac{17}{5}$ c $\frac{5}{4}$ d $\frac{13}{3}$ e $\frac{8}{5}$
 f $\frac{17}{6}$ g $\frac{51}{5}$ h $\frac{25}{7}$ i $\frac{17}{12}$ j $\frac{25}{9}$
 k $\frac{19}{6}$ l $\frac{23}{4}$ m $\frac{35}{8}$ n $\frac{23}{12}$ o $\frac{94}{9}$
 p $\frac{102}{11}$ q $\frac{11}{3}$ r $\frac{39}{5}$ s $\frac{31}{7}$ t $\frac{101}{8}$
- 2 a $2\frac{2}{3}$ b $3\frac{1}{2}$ c $1\frac{4}{5}$ d $4\frac{5}{6}$ e $2\frac{3}{8}$
 f $2\frac{1}{4}$ g $3\frac{3}{8}$ h $2\frac{2}{7}$ i $4\frac{3}{7}$ j $4\frac{1}{5}$
 k $4\frac{5}{9}$ l $7\frac{1}{3}$ m $8\frac{3}{10}$ n $7\frac{8}{11}$ o $2\frac{1}{6}$

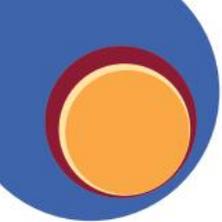
- p $4\frac{3}{4}$ q $4\frac{1}{8}$ r $6\frac{4}{7}$ s $9\frac{4}{5}$ t $7\frac{7}{10}$

- 3 a $\frac{1}{2} = \frac{6}{12} = \frac{4}{8}$ b $\frac{2}{3} = \frac{10}{15} = \frac{14}{21}$
 c $\frac{3}{5} = \frac{12}{20} = \frac{18}{30}$ d $\frac{3}{4} = \frac{12}{16} = \frac{21}{28}$
 e $\frac{5}{6} = \frac{10}{12} = \frac{25}{30}$ f $\frac{2}{7} = \frac{18}{63} = \frac{22}{77}$
 g $\frac{4}{5} = \frac{12}{15} = \frac{36}{45}$ h $\frac{1}{4} = \frac{8}{32} = \frac{5}{20}$
 i $\frac{4}{9} = \frac{8}{18} = \frac{20}{45}$ j $\frac{3}{10} = \frac{18}{60} = \frac{33}{110}$
 k $\frac{1}{8} = \frac{2}{16} = \frac{4}{32}$ l $\frac{5}{9} = \frac{20}{36} = \frac{35}{63}$

- 4 a $\frac{6}{7}$ b $\frac{10}{11}$ c $\frac{2}{3}$ d $\frac{5}{6}$ e $\frac{4}{9}$ f $\frac{3}{10}$

Exercise 10C

- 1 a $\frac{3}{5}$ b $\frac{6}{7}$ c $\frac{11}{13}$ d $\frac{2}{3}$ e $\frac{13}{17}$
 f $\frac{4}{5}$ g $\frac{3}{4}$ h $\frac{4}{7}$ i $1\frac{2}{3}$ j $1\frac{2}{5}$
 k 1 l $1\frac{1}{5}$ m $1\frac{1}{3}$ n $1\frac{1}{4}$ o $\frac{25}{31}$
 p $1\frac{1}{2}$ q 1 r 2 s 2 t 2
- 2 a $1\frac{2}{3}$ b $1\frac{5}{9}$ c $1\frac{1}{8}$
 d $1\frac{14}{17}$ e $1\frac{17}{22}$ f $2\frac{17}{40}$
- 3 a $4\frac{4}{5}$ b $6\frac{1}{2}$ c $9\frac{5}{7}$ d $7\frac{2}{5}$ e 6
 f $7\frac{9}{11}$ g $3\frac{1}{2}$ h $2\frac{4}{7}$ i 12 j $7\frac{1}{3}$
 k 6 l $4\frac{1}{5}$ m $15\frac{1}{3}$ n $10\frac{2}{3}$ o $5\frac{5}{13}$
 p $6\frac{4}{11}$
- 4 a 7 b $9\frac{3}{5}$ c $13\frac{7}{8}$
 d $20\frac{1}{3}$ e $18\frac{11}{20}$ f $31\frac{4}{11}$
- 5 a $\frac{1}{8}$ b $\frac{3}{8}$ c $\frac{1}{2}$
- 6 6 m 7 $6\frac{1}{5}$ kg 8 $19\frac{7}{10}$ m



9 $1\frac{1}{3}$ h

10 $1\frac{4}{7}$ h

11 a Mark ate 4 slices, Sue ate 2 slices, Dale ate 1 slice
b 5 slices

12 a Sandra 4 slices, Jemila Matangi 6 slices,
Julia 2 slices

b 4 slices c $\frac{1}{4}$ remained

Exercise D

1 a $\frac{13}{20}$ b $\frac{31}{42}$ c $\frac{13}{15}$ d $1\frac{13}{24}$

e $\frac{7}{10}$ f $\frac{7}{8}$ g $\frac{7}{18}$ h $\frac{31}{35}$

i $\frac{14}{15}$ j $1\frac{17}{20}$ k $1\frac{2}{15}$ l $1\frac{1}{18}$

2 a $6\frac{7}{10}$ b $6\frac{19}{35}$ c $4\frac{46}{63}$ d $12\frac{35}{72}$

e $5\frac{3}{4}$ f $6\frac{41}{63}$ g $9\frac{2}{3}$ h $3\frac{29}{40}$

i $21\frac{5}{9}$ j $24\frac{8}{25}$ k $15\frac{7}{10}$ l $7\frac{1}{4}$

3 a $1\frac{1}{12}$ b $1\frac{1}{10}$ c $1\frac{17}{28}$ d $1\frac{11}{18}$

e $\frac{107}{110}$ f $1\frac{39}{88}$ g $1\frac{11}{26}$ h $1\frac{27}{40}$

i $12\frac{1}{2}$ j $7\frac{1}{2}$ k $17\frac{7}{8}$ l $4\frac{1}{4}$

m $8\frac{1}{2}$ n $8\frac{11}{24}$ o $9\frac{9}{28}$ p $11\frac{11}{40}$

q $7\frac{2}{5}$ r $8\frac{19}{45}$ s $6\frac{9}{100}$ t $11\frac{19}{30}$

u $\frac{115}{126}$ v $8\frac{11}{15}$ w $10\frac{79}{100}$ x $8\frac{7}{50}$

4 a $2\frac{9}{40}$ b $1\frac{8}{15}$ c $1\frac{37}{60}$ d $2\frac{7}{20}$

e $1\frac{3}{5}$ f 2 g $8\frac{1}{12}$ h $10\frac{7}{40}$

i $8\frac{7}{44}$ j $13\frac{21}{52}$ k $14\frac{83}{88}$ l $14\frac{323}{360}$

5 a 35 b $\frac{17}{35}$ c $\frac{29}{35}$

6 a $1\frac{3}{20}$ h b $1\frac{11}{63}$ h c $\frac{5}{8}$ h

d $1\frac{7}{15}$ h e $1\frac{7}{30}$ h

7 $23\frac{1}{6}$ m 8 $8\frac{3}{20}$ kg 9 $\frac{15}{28}$

10 $5\frac{2}{5}$ h

11 $16\frac{1}{3}$ h

Exercise E

1 a $\frac{1}{2}$ b $\frac{2}{3}$ c $\frac{3}{11}$ d $\frac{1}{2}$ e $\frac{3}{13}$

f $\frac{15}{31}$ g $\frac{5}{19}$ h $\frac{3}{5}$ i 1 j $1\frac{1}{8}$

k $1\frac{2}{13}$ l $\frac{6}{11}$ m $1\frac{2}{25}$ n $2\frac{1}{3}$ o 2

p $2\frac{2}{5}$

2 a $3\frac{1}{2}$ b $7\frac{3}{5}$ c $3\frac{6}{13}$ d $6\frac{4}{11}$ e $1\frac{1}{8}$

f $6\frac{2}{5}$ g $3\frac{4}{7}$ h $7\frac{4}{9}$ i $9\frac{2}{5}$ j $7\frac{3}{10}$

k $6\frac{2}{7}$ l $7\frac{3}{5}$ m $6\frac{5}{19}$ n $2\frac{4}{7}$ o $5\frac{2}{5}$

p $9\frac{1}{2}$ q $7\frac{4}{9}$ r $4\frac{8}{11}$ s $2\frac{1}{2}$ t $\frac{2}{5}$

3 a $\frac{2}{11}$ b $\frac{1}{13}$ c $\frac{13}{25}$ d $\frac{13}{15}$ e $\frac{17}{24}$

f $\frac{1}{12}$ g $5\frac{8}{11}$ h $2\frac{1}{9}$ i $7\frac{1}{5}$ j $\frac{13}{18}$

k $2\frac{11}{20}$ l $1\frac{17}{24}$

4 $\frac{5}{8}$ cake 5 $1\frac{1}{2}$ bags 6 $6\frac{1}{2}$ m 7 $\frac{1}{2}$ tin

8 a $13\frac{1}{4}$ b $8\frac{1}{2}$ c $27\frac{9}{25}$

9 $1\frac{3}{5}$ litres

10 a 37 months or $3\frac{1}{12}$ years, 5 months or $\frac{5}{12}$ year,

23 months or $1\frac{11}{12}$ years

b 7 months; $\frac{7}{72}$

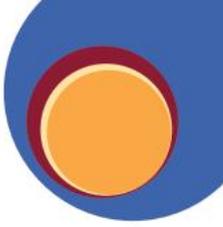
c $\frac{23}{72}$

Exercise F

1 a $\frac{1}{10}$ b $\frac{1}{10}$ c $\frac{3}{4}$ d $\frac{7}{15}$

e $\frac{3}{20}$ f $\frac{7}{12}$ g $\frac{13}{30}$ h $\frac{4}{21}$

i $\frac{11}{63}$ j $\frac{13}{30}$ k $\frac{23}{55}$ l $\frac{11}{26}$



2 a $2\frac{1}{4}$ b $4\frac{3}{10}$ c $6\frac{1}{3}$ d $5\frac{1}{8}$

e $5\frac{9}{35}$ f $2\frac{7}{20}$ g $2\frac{1}{2}$ h $5\frac{3}{10}$

i $8\frac{5}{19}$ j $6\frac{3}{8}$ k $3\frac{7}{10}$ l $6\frac{9}{10}$

3 a $\frac{61}{88}$ b $\frac{25}{56}$ c $\frac{4}{63}$ d $\frac{1}{36}$

e $\frac{37}{66}$ f $\frac{3}{40}$ g $\frac{7}{22}$ h $\frac{8}{65}$

i $6\frac{7}{30}$ j $2\frac{19}{56}$ k $2\frac{10}{63}$ l $1\frac{19}{40}$

m $2\frac{1}{10}$ n $7\frac{7}{24}$ o $14\frac{3}{10}$ p $7\frac{3}{17}$

q $6\frac{9}{10}$ r $8\frac{37}{72}$ s $1\frac{23}{28}$ t $3\frac{19}{40}$

u $2\frac{17}{30}$ v $\frac{11}{12}$ w $1\frac{79}{100}$ x $3\frac{5}{6}$

4 a $\frac{1}{9}$ b $\frac{19}{120}$ c $\frac{3}{10}$ d $\frac{5}{18}$

e $\frac{1}{4}$ f $\frac{1}{48}$ g $4\frac{17}{20}$ h $8\frac{3}{14}$

i $4\frac{41}{60}$ j $8\frac{1}{24}$ k $1\frac{25}{42}$ l $4\frac{23}{120}$

5 $\frac{2}{3}$ hectare

6 $\frac{5}{12}$ hour

7 $240\frac{13}{20}$ m

8 $2\frac{3}{7}$ m

9 a $\frac{27}{40}$ b \$20, \$32

10 a $\frac{7}{8}$ b $\frac{1}{8}$

c \$125 on shoes and \$50 on snacks

Learning task G

1 $\frac{1}{2} \times \frac{1}{4}$ is the equivalent of finding one-half of one-quarter, which is one-eighth.

2 If you cut a pie into quarters, then took one of those pieces and cut it in half, you would have one-half of one-quarter of the pie, or one-eighth.

3 $\frac{1}{2} \times \frac{1}{4}$ is the same as $\frac{1}{4} \times \frac{1}{2}$

5 a $\frac{1}{2}$ b $\frac{1}{3}$ c $\frac{2}{5}$ d $\frac{2}{5}$ e $\frac{5}{28}$

f $\frac{9}{70}$ g $\frac{2}{15}$ h $\frac{3}{16}$ i $\frac{1}{4}$ j $\frac{1}{7}$

k $\frac{2}{15}$ l $\frac{1}{5}$ m $\frac{9}{20}$ n $\frac{1}{6}$ o $\frac{1}{9}$

Exercise H

1 a $\frac{1}{10}, \frac{7}{50}, \frac{9}{28}, \frac{25}{42}$

b During multiplication of two fractions, the numerators are multiplied together and the denominators are multiplied together to form the answer.

2 a $\frac{2}{3}$ b $\frac{3}{10}$ c $\frac{4}{11}$ d $\frac{3}{8}$ e $\frac{1}{7}$ f $\frac{8}{13}$

g $\frac{7}{12}$ h $\frac{8}{15}$ i $\frac{7}{15}$ j $\frac{4}{21}$ k $\frac{1}{27}$ l $\frac{1}{15}$

3 a $1\frac{1}{2}$ b $\frac{2}{3}$ c 0 d $\frac{8}{9}$ e 10 f 12

g $6\frac{1}{4}$ h $7\frac{1}{5}$ i 3 j $5\frac{1}{3}$ k $1\frac{1}{5}$ l $2\frac{5}{9}$

4 a $2\frac{7}{16}$ b $36\frac{4}{21}$ c 3 d $9\frac{1}{3}$

e $16\frac{1}{2}$ f $4\frac{11}{16}$ g $2\frac{2}{5}$ h $1\frac{3}{4}$

i $10\frac{1}{2}$ j 15 k $21\frac{3}{5}$ l $25\frac{2}{3}$

5 \$52 6 $1\frac{11}{16}$ hour 7 $240\frac{5}{6}$ km

8 a \$166.40

b \$353.60

9 a 3 cups of flour 2 tspns of vanilla essence

1 cup of jam $\frac{1}{4}$ kg of butter

$1\frac{1}{3}$ cups of sugar 6 eggs

$\frac{3}{5}$ litre of cream $\frac{1}{2}$ cup of milk

b $\frac{3}{4}$ cup of flour $\frac{1}{2}$ tspn of vanilla essence

$\frac{1}{4}$ cup of jam $\frac{1}{16}$ kg of butter

$\frac{1}{3}$ cup of sugar $1\frac{1}{2}$ eggs

$\frac{3}{20}$ litre of cream $\frac{1}{8}$ cup of milk

Exercise I

1 12

2 Yes.

3 Yes.

4 Yes.

5 a i 2 ii 2

b i 10 ii 10

c i 10 ii 10



6 a 7 b $\frac{8}{3}$ c $\frac{16}{7}$ d $\frac{7}{10}$

e $\frac{1}{9}$ f $\frac{1}{36}$ g $\frac{2}{7}$ h $\frac{4}{43}$

7 a 12 b 30 c $1\frac{1}{3}$ d 4

e 6 f $\frac{3}{4}$ g $\frac{1}{2}$ h $\frac{8}{15}$

i 5 j 3 k 7 l $\frac{51}{80}$

Exercise J

1 a 6 b $\frac{3}{4}$ c $\frac{11}{12}$ d $\frac{7}{32}$

e $\frac{3}{4}$ f $1\frac{5}{49}$ g $\frac{1}{2}$ h $\frac{7}{25}$

i $\frac{8}{15}$ j $\frac{18}{55}$ k $\frac{8}{9}$ l $\frac{7}{10}$

2 a $1\frac{1}{2}$ b $1\frac{1}{3}$ c $1\frac{1}{3}$ d $\frac{7}{32}$

e $1\frac{1}{2}$ f $\frac{17}{28}$ g $\frac{4}{9}$ h 52

i $\frac{1}{3}$ j 3 k $\frac{8}{9}$ l $5\frac{2}{5}$

3 a $\frac{3}{5}$ b $1\frac{2}{7}$ c $\frac{2}{3}$ d $\frac{5}{14}$

e $2\frac{3}{16}$ f $1\frac{1}{7}$ g $1\frac{1}{7}$ h $\frac{24}{25}$

i $\frac{11}{12}$ j $1\frac{5}{6}$ k $5\frac{8}{11}$ l $1\frac{1}{5}$

4 a 16 b 5 c 22 d 14

e 36 f 27 g 21 h 12

i 12 j 4 k 24 l 12

m $\frac{1}{10}$ n 28 o $\frac{1}{8}$ p 10

q $\frac{5}{24}$ r $8\frac{1}{2}$ s $15\frac{5}{9}$ t $1\frac{2}{11}$

5 a i 2 ii 2

b i 10 ii 10

c i 3 ii 3

d i 10 ii 10

6 a 7 b $\frac{8}{3}$ c $\frac{16}{7}$ d $\frac{7}{10}$

e $\frac{1}{9}$ f $\frac{1}{36}$ g $\frac{2}{7}$ h $\frac{4}{43}$

7 a 12 b 30 c $1\frac{1}{3}$ d 4

e 6 f $\frac{3}{4}$ g $\frac{1}{2}$ h $\frac{8}{15}$

i 5 j 3 k 7 l $\frac{51}{80}$

8 $8\frac{23}{24}$ bags **9** 41 blocks **10** $\frac{5}{72}$ tonne

11 a $81\frac{1}{4}$ kilolitres b $30\frac{15}{32}$ weeks

c $\frac{2}{3}$ kilolitre

Exercise K

1 a 4 b 3 c 2 d 6 e 9 f 8

g 25 h 6 i 2 j 4 k 24 l 24

m 30 n 28 o 18 p 40 q 48 r 84

s 20 t 121

2 a \$40 b \$320 c \$80

d \$250 e 250 m f 80 m

g 250 km h 4 cm i 20 min

j $11\frac{1}{4}$ min k 15 s l 8 h

m 175 m n \$1000 o \$8197

p 2800 lollies q 1920 sheep r 283 850 ML

3 6 hours **4** 14 **5** 9

6 a \$43.50 b \$29 c \$14.50

7 a 8 tonnes b 13 tonnes c $9\frac{1}{3}$ tonnes

8 $2\frac{11}{20}$ metres

9 330 g sugar, 375 mL cream, 187.5 g butter

Exercise L

1 a $\frac{1}{16}$ b $\frac{4}{25}$ c $\frac{25}{36}$ d $\frac{1}{9}$

e $\frac{4}{9}$ f $\frac{1}{4}$ g $\frac{81}{100}$ h $\frac{9}{64}$

i $\frac{25}{144}$ j $\frac{49}{121}$ k $\frac{16}{49}$ l $\frac{64}{81}$

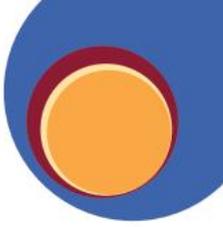
2 a $2\frac{1}{4}$ b $5\frac{1}{16}$ c $1\frac{32}{49}$ d $1\frac{24}{25}$

e $11\frac{1}{9}$ f $1\frac{40}{81}$ g $4\frac{21}{25}$ h $17\frac{13}{36}$

i $3\frac{33}{64}$ j $8\frac{1}{36}$ k $3\frac{61}{100}$ l $8\frac{8}{49}$

3 a $\frac{1}{2}$ b $\frac{1}{3}$ c $\frac{1}{5}$ d $\frac{3}{5}$

e $\frac{9}{10}$ f $\frac{6}{7}$ g $\frac{12}{13}$ h $\frac{4}{5}$



- i $\frac{9}{11}$ j $\frac{2}{9}$ k $\frac{5}{13}$ l $\frac{7}{9}$
- 4 a** $1\frac{2}{3}$ b $1\frac{1}{2}$ c $2\frac{1}{4}$ d $1\frac{1}{5}$
- e $2\frac{1}{2}$ f $3\frac{1}{3}$ g $2\frac{2}{5}$ h $3\frac{1}{2}$
- i $1\frac{4}{5}$ j $1\frac{1}{3}$ k $4\frac{1}{2}$ l $1\frac{3}{7}$
- 5 a** 0.76 b 0.59 c 0.58 d 0.45
- e 0.94 f 0.94 g 1.66 h 2.31
- i 2.92 j 2.63 k 2.36 l 1.06
- 6 a** 4 units b $\frac{1}{4}$ unit c $\frac{3}{4}$ unit d $1\frac{1}{4}$ units

Exercise D M

- 1 a** 6 b 4 c 11 d 6
- e 1 f 4 g $12\frac{1}{2}$ h $\frac{8}{15}$
- i $5\frac{1}{3}$ j 8 k $7\frac{1}{2}$ l $5\frac{3}{7}$
- 2 a** $3\frac{3}{7}$ b $\frac{7}{20}$ c $10\frac{4}{15}$ d 3
- e $1\frac{2}{3}$ f $12\frac{3}{5}$ g $1\frac{15}{16}$ h $\frac{3}{5}$
- i $6\frac{1}{3}$ j $6\frac{23}{30}$ k $\frac{1}{10}$ l $1\frac{31}{32}$
- m 11 n 2 o 2
- 3 a** $1\frac{1}{9}$ b $\frac{43}{200}$ c $\frac{35}{88}$ d $1\frac{35}{48}$
- e $3\frac{31}{108}$ f $\frac{13}{144}$ g $4\frac{17}{28}$ h $11\frac{3}{4}$
- i $2\frac{23}{25}$ j $3\frac{109}{192}$ k $\frac{17}{30}$ l $\frac{9}{175}$
- 4 a** $5\frac{19}{36}$ b $3\frac{23}{60}$ c $\frac{17}{20}$ d $44\frac{3}{4}$
- e $\frac{46}{195}$ f $2\frac{61}{90}$ g $\frac{5}{48}$ h $3\frac{91}{180}$
- i $\frac{3}{5}$ j $9\frac{25}{64}$ k $3\frac{51}{64}$ l $13\frac{1}{144}$
- m 7 n $1\frac{1}{4}$ o $\frac{14}{15}$

Applications

Rises of the Moon

- At new moon, the cycle begins and no days have passed.
 At first quarter, 7.38 days have passed.
 At full moon, 14.77 days have passed.
 At last quarter, 22.15 days have passed.

Fraction patterns

$$\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$$

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{4}{8} + \frac{2}{8} + \frac{1}{8} = \frac{7}{8}$$

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} = \frac{8}{16} + \frac{4}{16} + \frac{2}{16} + \frac{1}{16} = \frac{15}{16}$$

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} = \frac{16}{32} + \frac{8}{32} + \frac{4}{32} + \frac{2}{32} + \frac{1}{32} = \frac{31}{32}$$

The answer to the next question will be $\frac{63}{64}$.

If the additions signs are replaced with subtraction signs, the answer will always be equal to the last fraction:

$$\frac{1}{2} - \frac{1}{4} - \frac{1}{8} - \frac{1}{16} - \frac{1}{32} = \frac{16}{32} - \frac{8}{32} - \frac{4}{32} - \frac{2}{32} - \frac{1}{32} = \frac{1}{32}$$

Chinese tangrams

$$\frac{1}{4}, \frac{1}{4}, \frac{1}{16}, \frac{1}{8}, \frac{1}{8}, \frac{1}{16}, \frac{1}{8}$$

Squares

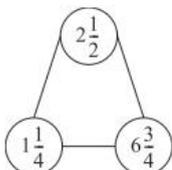
a 5 b $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$ c $\frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{64}$

Enrichment

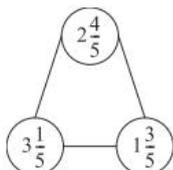
- 1 a** $\frac{3}{4} = \frac{1}{2} + \frac{1}{4}$ b $\frac{2}{5} = \frac{1}{3} + \frac{1}{15}$
- c $\frac{2}{3} = \frac{1}{2} + \frac{1}{6}$ d $\frac{3}{10} = \frac{1}{4} + \frac{1}{20}$
- e $\frac{3}{7} = \frac{1}{3} + \frac{1}{11} + \frac{1}{231}$ f $\frac{5}{6} = \frac{1}{2} + \frac{1}{3}$
- 2 a** $\frac{5}{6} = \frac{1}{2} + \frac{1}{3}$ and $\frac{8}{9} = \frac{1}{2} + \frac{1}{3} + \frac{1}{18}$, so $\frac{8}{9}$ is larger
- b $\frac{8}{9} = \frac{1}{2} + \frac{1}{3} + \frac{1}{18}$ and $\frac{9}{10} = \frac{1}{2} + \frac{1}{3} + \frac{1}{15}$, so $\frac{9}{10}$ is larger
- c $\frac{3}{4} = \frac{1}{2} + \frac{1}{4}$ and $\frac{4}{5} = \frac{1}{2} + \frac{1}{4} + \frac{1}{20}$, so $\frac{4}{5}$ is larger
- d $\frac{4}{9} = \frac{1}{3} + \frac{1}{9}$ and $\frac{5}{11} = \frac{1}{3} + \frac{1}{9} + \frac{1}{99}$, so $\frac{5}{11}$ is larger
- e $\frac{4}{5} = \frac{1}{2} + \frac{1}{4} + \frac{1}{20}$ and $\frac{7}{9} = \frac{1}{2} + \frac{1}{4} + \frac{1}{36}$ so $\frac{4}{5}$ is larger
- f $\frac{5}{8} = \frac{1}{2} + \frac{1}{8}$ and $\frac{7}{11} = \frac{1}{2} + \frac{1}{8} + \frac{1}{88}$, so $\frac{7}{11}$ is larger



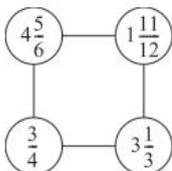
3 a



b



c



4 a Magic number is $1\frac{7}{8}$

$\frac{1}{4}$	$1\frac{1}{8}$	$\frac{4}{8}$
$\frac{7}{8}$	$\frac{5}{8}$	$\frac{3}{8}$
$\frac{3}{4}$	$\frac{1}{8}$	1

b Magic number is $1\frac{3}{5}$

$\frac{1}{3}$	$\frac{4}{5}$	$\frac{7}{15}$
$\frac{2}{3}$	$\frac{8}{15}$	$\frac{2}{5}$
$\frac{3}{5}$	$\frac{4}{15}$	$\frac{11}{15}$

c Magic number is 17

$\frac{1}{2}$	$7\frac{1}{2}$	7	2
6	3	$3\frac{1}{2}$	$4\frac{1}{2}$
4	5	$5\frac{1}{2}$	$2\frac{1}{2}$
$6\frac{1}{2}$	$1\frac{1}{2}$	1	8

d Magic number is $10\frac{1}{2}$

$1\frac{3}{4}$	3	$1\frac{1}{4}$	$4\frac{1}{2}$
$1\frac{1}{2}$	$4\frac{1}{4}$	2	$2\frac{3}{4}$
4	$\frac{3}{4}$	$3\frac{1}{2}$	$2\frac{1}{4}$
$3\frac{1}{4}$	$2\frac{1}{2}$	$3\frac{3}{4}$	1

5 a $26\frac{6}{25}$ m² b $261\frac{4}{5}$ m² c $\frac{656}{6545}$

d Singles court = $8\frac{1}{5}$ m \times $23\frac{4}{5}$ m

Fraction of court = $\frac{41}{55}$

6 a $\frac{1}{8}$ b $\frac{1}{4}$ c $\frac{1}{2}$ d $\frac{1}{2}$ e $\frac{1}{2}$ f $\frac{1}{16}$

Revision

1 a $\frac{1}{3}$ b $\frac{5}{8}$ c $\frac{2}{5}$

2 a $\frac{20}{60} = \frac{1}{3}$ b $\frac{32}{56} = \frac{4}{7}$ c $\frac{35}{45} = \frac{7}{9}$

3 a Improper fraction b Mixed number
c Proper fraction

4 a $\frac{2}{5} = \frac{4}{10} = \frac{10}{25} = \frac{18}{45}$

b $\frac{3}{7} = \frac{9}{21} = \frac{36}{84} = \frac{21}{49}$

5 a $\frac{2}{5}$ b $\frac{5}{11}$ c $\frac{1}{6}$ d $\frac{5}{7}$

6 a $2\frac{2}{5}$ b $3\frac{2}{3}$ c $2\frac{6}{7}$ d $4\frac{5}{8}$

7 a $\frac{9}{4}$ b $\frac{30}{7}$ c $\frac{19}{5}$ d $\frac{19}{11}$

8 a 4 b $\frac{6}{7}$ c $5\frac{1}{2}$ d $5\frac{3}{11}$

9 a $\frac{19}{21}$ b $1\frac{7}{12}$ c $6\frac{3}{8}$ d $5\frac{11}{45}$

10 The Wade family has a total of $16\frac{5}{8}$ kg of flour.

11 $4\frac{7}{12}$ kg is the total weight of Suzie's fruit.

12 a $\frac{1}{2}$ b $1\frac{2}{5}$ c $4\frac{7}{11}$ d $1\frac{1}{2}$

e $\frac{2}{21}$ f $3\frac{1}{10}$ g $3\frac{3}{8}$ h $3\frac{17}{36}$

13 $1\frac{7}{10} - 1\frac{3}{10} = \frac{2}{5}$, so Wayne is taller by 40 cm.

14 $4\frac{4}{5} - 2\frac{2}{5} = 2\frac{2}{5}$, so Maria needs to buy another $2\frac{2}{5}$ m of material.

15 a $\frac{7}{12}$ b $\frac{6}{25}$ c $3\frac{4}{7}$ d $1\frac{7}{12}$

16 James has $4\frac{1}{2}$ litres of soft drink.

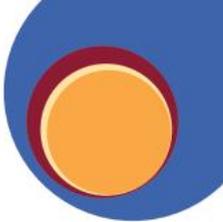
17 $1\frac{4}{5}$ litres of orange juice

$1\frac{1}{2}$ litres of pineapple juice and

$11\frac{1}{4}$ litres of lemonade

18 a $1\frac{1}{15}$ b $3\frac{3}{4}$ c $1\frac{29}{40}$ d $\frac{13}{22}$

19 a 8 b 16 c 9 h



20 a $\frac{9}{16}$ b $\frac{4}{49}$ c $3\frac{13}{36}$ d $4\frac{21}{25}$
 e $\frac{4}{7}$ f $\frac{3}{10}$ g $2\frac{3}{4}$ h $1\frac{1}{9}$

21 a $6\frac{13}{15}$ b $3\frac{1}{2}$ c $\frac{7}{48}$

Chapter 1

Exercise A

3	6:00 am	Morning Greetings	(30 min)
	6:30 am	Morning News in Pidgin	(3 hours)
	9:30 am	Music	(30 min)
	10:00 am	Mid Morning News in English	(30 min)
	10:30 am	Distaem Nao	(15 min)
	10:45 am	Weather Report	(45 min)
	11:30 am	Music	(30 min)
	12 Noon	Midday News in English	(30 min)
	12:30 pm	Services Messages	(30 min)
	1:00 pm	BBC World Briefings	(1 hour)
	2:00 pm	Afternoon News in Pidgin	(90 min)
	3:30 pm	Music	(30 min)
	4:00 pm	RA World News/ Pacific Beat Relay	(15 min)
	4:15 pm	Music	(15 min)
	4:30 pm	Tok Sports	(25 min)
	4:55 pm	Music	(5 min)
	5:00 pm	BBC World News Relay	

Exercise B

- | | | | |
|-----|---------|---|---------|
| 1 a | Minutes | b | Years |
| c | Hours | d | Hours |
| e | Hours | f | Minutes |
| g | Seconds | h | Hours |
- 2 a 900 years b 550 years
 c 5 decades d 75 years
 e 280 years f 4.5 decades
 g 3.5 centuries h 7.5 decades
 i 5.75 centuries j 25 decades
- 3 a 730 days b 60 months
 c 5 weeks d 63 days
 e 9 years f 35 days
 g 27 months h 390 weeks
- 4 a 96 hours b 300 minutes
 c 2160 seconds d 7 minutes
 e 5 days f 3 hours
 g 84 hours h 315 minutes
 i 165 seconds j $3\frac{1}{3}$ hours
- 5 Bentley 6 Ian 7 Best Bake
 8 Samantha 9 Matthew

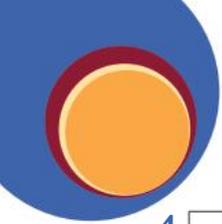
- 10 Sam: 9360 minutes Suzie: 9000 minutes
 Quruzu: 9240 minutes
 a Sam b Suzie

Exercise C

- 1 a 13 b 37 c 103 d 135 e 150 f 280
- 2 a 27 b 131 c 131 d 199 e 198
 f 123 g 64 h 142 i 159 j 206
- 3 a Aristarchus 60 years
 b Aristotle 62 years
 Plato 81 years
 Socrates 71 years
 c Eudoxus 53 years
 Descartes 54 years
 Archimedes 75 years
 Fermat 64 years
 Pascal 39 years
 Newton 85 years
 Leibnitz 70 years
 Euler 76 years
 Lagrange 77 years
 Gauss 78 years
- 4 a 45 days b 244 days c 196 days
 d 72 days e 159 days f 75 days
- 5 Term 1: 50 days Term 2: 50 days
 Term 3: 50 days Term 4: 50 days
 Total of 200 days
- 6 a 17 b 38 c 2 d 17
 e 1 f 3 g 18 h 11
 i 68 j 40 k 4 l 31
- 7 a 41 b 23 c 4 d 14

Exercise D

- 1 a 4:20 am b 9:31 am c 8:32 am
 d 12:04 pm e 4:00 pm f 7:12 pm
 g 9:21 pm h 11:02 pm i 4:23 pm
 j 6:15 am k 11:14 am l 10:36 pm
 m 3:48 am n 7:56 pm
- 2 a 0510 b 0751 c 0511 d 1313
 e 1720 f 1938 g 2021 h 2352
 i 0516 j 0715 k 0417 l 2147
 m 1852 n 2243
- 3 a a quarter past 4 am b half past 7 pm
 c 10 min past 5 am d 25 min to 10 am
 e 21 min past 11 am f 9 am
 g 18 min past 1 am h 10 min past 1 pm
 i 25 min past 3 pm j 19 min past 6 pm



4

Clockface time	Digital time	24-hour time
Half past 7 in the morning	7:30 am	0730 hours
Quarter past 2 in the morning	2:15 am	0215 hours
25 min past 2 in the afternoon	2:25 pm	1425 hours
10 min past 8 in the evening	8:10 pm	2010 hours
11 min past 9 in the evening	9:11 pm	2111 hours
16 min past 5 pm	5:16 pm	1716 hours
23 min to 11 in the morning	10:37 am	1037 hours
11 min past midnight	12:11 am	0011 hours
29 min past midday	12:29 pm	1329 hours

- 5** a 3:00 am, 0300 hours b 7:15 am, 0715 hours
 c 9:30 am, 0930 hours d 6:20 am, 0620 hours
 e 11:35 am, 1135 hours
- 6** a 5:00 pm, 1700 hours b 6:30 pm, 1830 hours
 c 1:15 pm, 1315 hours d 9:20 pm, 2120 hours
 e 2:55 pm, 1455 hours

- 7** Rising bell: 10 minutes
 Worship: 50 minutes
 Breakfast: 30 minutes
 Class: 2 hours 40 minutes (or 160 minutes)
 Break: 20 minutes
 Class: 1 hour 20 minutes (or 80 minutes)
 Lunch: 55 minutes
 Class: 2 hours (or 120 minutes)
 Class ends–Work session: 15 minutes
 Work session: 2 hours (or 120 minutes)
 Sport: 1 hour 30 minutes (or 90 minutes)
 Dinner: 30 minutes
 Evening worship: 30 minutes
 Study time: 1 hour 30 minutes (or 90 minutes)
 Devotion: 30 minutes
 Bedtime–Rising bell: 8 hours and 30 minutes (if tomorrow is a Tuesday, Wednesday or Thursday. Otherwise, length of time is unknown.)

Exercise E

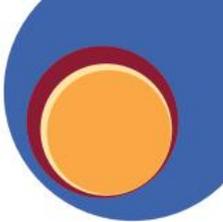
- 1** a 7 am to 7:35 am: 35 minutes
 b 7:35 am to 8:00 am: 25 minutes
 c First departure: 7 am
 Last arrival: 8:35 pm
 Time between: 13 h 35 min
 d Joylene could, at the latest, take the 12 noon boat from Tulago which would still give her ample time to meet her friend and go to lunch on time. To arrive home by 5 pm she needs to catch the 3 pm boat from Point Cruz.
- 2** a i 4:35 pm ii 1:10 pm iii 2 pm iv 4:35 pm
 b 3:29 pm
 c Mon–Fri: 8 h 35 min Sat, Sun: 8 h 40 min
 d 30 minutes

Exercise F

- 1** a 6 pm Tuesday b 12 pm Tuesday
 c 11 pm Tuesday d 12 noon Wednesday
 e 1 pm Wednesday f 5 am Wednesday
- 2** a 11 am Saturday b 8 pm Saturday
 c 3 am Sunday d 2 pm Saturday
 e 7 am Sunday f 2 am Sunday
- 3**
- | Time in Cape Town | Time in Port Moresby | Time in Melbourne | Time in Wellington |
|-------------------|----------------------|-------------------|--------------------|
| 9:00 pm | 4:00 am | 6:00 am | 8:00 am |
| 5:30 pm | 12:30 am | 2:30 am | 4:30 am |
| 10:15 am | 5:15 am | 7:15 am | 9:15 am |
| 1:00 am | 8:00 am | 10:00 am | 12 noon |
| 5:00 pm | 12 midnight | 2:00 am | 4:00 am |
- 4** 3:17 pm **5** 3 hours
6 4:45 pm
7 a Patrick should arrive at Honiara airport at 3:45 pm (5:15 pm – 90 min).
 b Patrick will leave Honiara airport at 2315 hours (2230 hours + 45 min).
 c 6 hours 30 minutes
- 8** a i 3 pm ii 5 pm iii 3 pm
 iv 1 pm v 5 pm
 b i 9 am ii 11 am iii 11 am
 iv 8 am v 9 am

Exercise G

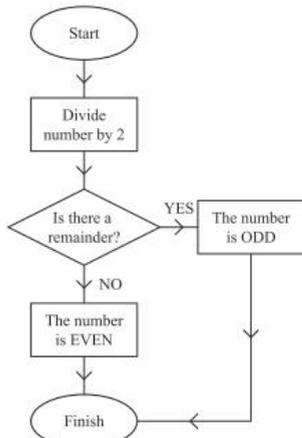
- 1** a This flow chart examines whether the dog is hungry, on two separate occasions. If the dog is hungry, you feed it.
 b First if you don't want to go to bed now, watch TV for 15 minutes. This loop continues until you go to bed. Sleep well and if the alarm clock rings, get



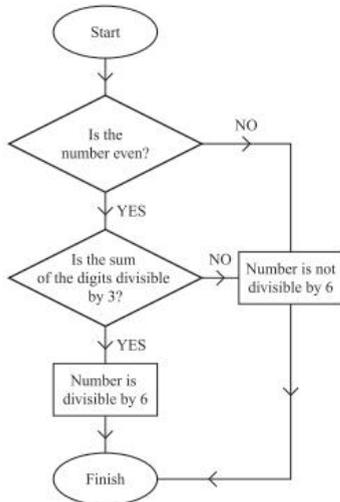
up on time, have breakfast and go to school. If the alarm clock doesn't ring, wake up late and rush to school without having breakfast.

- 2 a**
- Woken by alarm clock
 - Get out of bed
 - Get dressed
 - Go to the kitchen
 - Eat breakfast
 - Get ready for school
 - Go to school
- b**
- Boil water in saucepan
 - Get egg from fridge
 - Put egg into boiling water
 - Take egg out of boiling water after 3 minutes
 - Put hot egg under cold water
 - Break shell and eat the egg

3



4



- 5** d, a, b, c
- 7 a** F, FL **b** O, FR **c** 1, FL **d** 1, R
e 2, FL **f** O, R **g** 2, FR **h** 1, FR
i O, FL **j** 2, R **k** F, FR **l** F, R

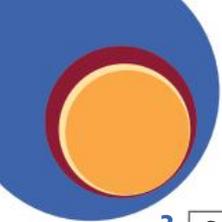
Exercise H

- 1 a** Milligram **b** Kilogram **c** Tonne
d Kilogram **e** Gram **f** Tonne
g Milligram **h** Kilogram **i** Tonne
j Tonne **k** Tonne **l** Gram
- 2 a** 2000 kg **b** 3600 kg **c** 1020 kg
d 3·090 t **e** 0·54 t **f** 21·5 t
- 3 a** 5000 g **b** 6080 g
c 10 020 g **d** 7000 mg
e 3 254 000 mg **f** 990 000 mg
- 4 a** 4 g **b** 8300 mg **c** 1·2 g
d 0·620 g **e** 5400 mg **f** 0·310 g
- 5 a** 4·3 kg **b** 8·72 kg **c** 0·45 kg
d 2·6 t **e** 0·34 t **f** 9·9 t
- 6 a** 2122 g **b** 2·122 kg
- 7 a** 1315 g **b** 1·315 kg
- 8 a** 5410 g, 5·41 kg **b** 1317·99 kg, 1317 990 g
- 9** 50 g: 14·5 kg **10** 39·36 kg
 100 g: 24·5 kg
 200 g: 44·5 kg
 250 g: 54·5 kg

Enrichment

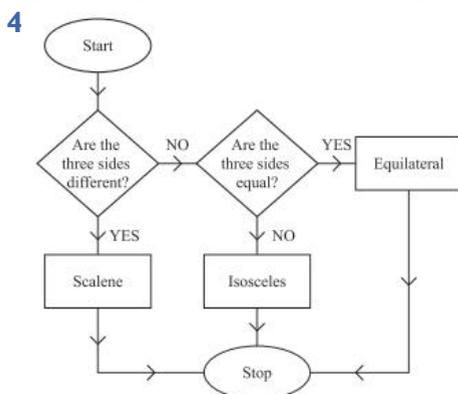
Planet	Rise	Set	Time above Earth's horizon
Mercury	5:08 am	6:35 pm	13 h 27 min
Venus	8:59 am	7:38 pm	10 h 39 min
Mars	11:09 pm	1:48 pm	14 h 39 min
Jupiter	12:52 pm	10:44 pm	9 h 52 min
Saturn	12:05 pm	10:19 pm	10 h 14 min

- 2 a**
- 1826 days or 1827 days starting with a leap year
 - 2191 days or 2192 days starting with a leap year
 - 2556 days or 2557 days starting with a leap year
- b** $\frac{1896}{4} = 474$
 As 1896 is divisible by four it was a leap year.
- c**
- | | | | |
|-------------|------|-------------|------|
| Paris | 1900 | Melbourne | 1956 |
| St Louis | 1904 | Rome | 1960 |
| London | 1908 | Tokyo | 1964 |
| Stockholm | 1912 | Mexico City | 1968 |
| No games | 1916 | Munich | 1972 |
| Antwerp | 1920 | Montreal | 1976 |
| Paris | 1924 | Moscow | 1980 |
| Amsterdam | 1928 | Los Angeles | 1984 |
| Los Angeles | 1932 | Seoul | 1988 |
| Berlin | 1936 | Barcelona | 1992 |
| No games | 1940 | Atlanta | 1996 |
| No games | 1944 | Sydney | 2000 |
| London | 1948 | Athens | 2004 |
| Helsinki | 1952 | Beijing | 2008 |



3

State or Territory	Number of school days
Vic	$73 + 59 + 68 + 79 = 279$ days
NSW	$77 + 61 + 54 + 78 = 270$ days
Qld	$80 + 60 + 60 + 75 = 275$ days
SA	$74 + 68 + 54 + 74 = 270$ days
WA	$66 + 66 + 68 + 68 = 268$ days
Tas	$108 + 88 + 80 = 276$ days
ACT	$77 + 61 + 54 + 78 = 270$ days
NT	$67 + 68 + 68 + 68 = 271$ days



5 1 dozen bottles in crate weigh
 $12 \times 800 \text{ g} + 1200 \text{ g} = 10\,800 \text{ g}$ or 10.8 kg

Milk bar

4 dozen bottles: $4 \times 10\,800 \text{ g}$
 $= 43\,200 \text{ g} = 43.2 \text{ kg}$

School canteen

9 dozen bottles: $9 \times 10\,800 \text{ g}$
 $= 97\,200 \text{ g} = 97.2 \text{ kg}$

Takeaway shop

9 bottles: $9 \times 800 \text{ g}$
 $= 7200 \text{ g} = 7.2 \text{ kg}$

Total weight on truck

20 dozen bottles: $20 \times 10\,800 \text{ g}$
 $= 216\,000 \text{ g} = 216 \text{ kg}$

Load left on truck

$216\,000 \text{ g} - 43\,200 \text{ g} - 97\,200 \text{ g} - 7200 \text{ g}$
 $= 68\,400 \text{ g} = 68.4 \text{ kg}$

- 6**
- a** Volume = $20 \times 30 \times 10 = 6000 \text{ cm}^3$
 Weight: $6000 \text{ g} = 6 \text{ kg}$
- b** Volume = $80 \times 28 \times 28 = 62\,720 \text{ g} = 62.72 \text{ kg}$
- c** Volume = $3.5 \text{ m} \times 2.8 \text{ m} \times 1 \text{ m}$
 $= 9\,800\,000 \text{ g} = 9800 \text{ kg}$

Revision

- 1** 1942 The Second World War was fought in Solomon Islands
- 1970 The Commonwealth Development Cooperation (CDC) aid established SIPL

- 1978 Solomon Islands gained its independence
- 1984 Pope John Paul visited Solomon Islands
- 1986 Cyclone Namu hit Solomon Islands
- 1999 The beginning of ethnic tension between Guadalcanal and Malaita people
- 2000 The Malaita Eagle Force (MEF) took over through the Ulufalu Government
- 2003 The Regional Assistance Mission to Solomon Islands (RAMSI) came to Solomon Islands
- 2006 The April Riot in Honiara resulted in the burning down of China Town
- 2008 A tsunami hit Solomon Islands in the Choiseul and Western Provinces

- 2**
- a** 500 years **b** 5.4 decades
- c** 4 centuries **d** 36 months
- e** 21 days **f** 168 hours
- g** 1920 seconds **h** 7 minutes
- 3**
- a** 21 days **b** 91 days
- c** 18 days **d** 60 days
- 4**
- a** 11 years **b** 702 years
- c** 770 years **d** 121 years
- 5**
- a** 9:30 am **b** 12:30 pm **c** 4:00 pm
- d** 9:42 pm **e** 3:15 am **f** 4:20 am
- 6**
- a** 5:15 am **b** 11:31 pm



c 0900 hours

d 1730 hours



e 1720 hours

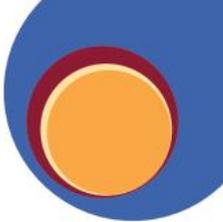


7 Time between the following times on the same day:

- a** 5 hours 17 min **b** 8 hours 3 min
- c** 2 hours 24 min **d** 4 hours 37 min
- e** 4 hours 8 min **f** 4 hours 4 min

- 8**
- a** Jill can catch the 8:28 or the 9:28 bus.
- b** **i** 37 minutes **ii** 33 minutes
- iii** 25 minutes **iv** 37 minutes
- 9**
- a** 3 pm **b** 6 am **c** 3 pm
- d** 12 midnight **e** 1 pm **f** 2 pm

- 10**
- a** 5000 kilograms **b** 6900 kg
- c** 7060 kg **d** 9000 mg
- e** 3 298 000 mg **f** 770 000 mg
- g** 4.380 g **h** 1.760 grams
- i** 9.400 g **j** 7.620 t
- k** 0.78 t **l** 5.8 t

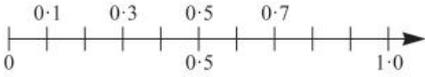
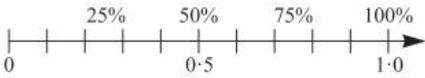


Chapter 12

Exercise 2 A

- 1 Unlikely, likely, definite, even chance, probably, possible, impossible, certain, maybe
- 2 Impossible, unlikely, maybe, possible, even chance, likely, probably, definite, certain
- 3 a C b C c D d C e C
f D g I h C i C j D
- 4 i c ii g
- 5 An impossible event is that you will grow a third arm overnight.
An event that will definitely happen is that you will breathe.
- 6 It is **possible** that it will rain on New Year's Day next year.
It is **unlikely** that we will ever meet Martians.
There is an **even chance** your first child will be female.
- 7 a Possible b Likely
c Possible d Possible
e Unlikely f Definite
- 8 Student's own answers
- 9 Student's own answers
- 10 There is a small chance of throwing a five or a six.
Three boys are unlikely.
You are likely to throw different numbers.
There is an even chance of selecting a red card.
It is almost certain you will select a red lolly.
There is more than half a chance of selecting a girl.
There is negligible chance of winning lotto.

Exercise 2 B

- 1 a $\frac{1}{6}$ b $\frac{5}{6}$ c $\frac{1}{2}$ d $\frac{1}{2}$
- 2 a $\frac{1}{10}$ b $\frac{3}{10}$ c $\frac{7}{10}$ d $\frac{1}{2}$ e $\frac{3}{10}$ f $\frac{7}{10}$
- 3 
- 4 a yellow b $\frac{1}{2}$ c $\frac{1}{4}$
d $\frac{3}{4}$ e 1
- 5 
- 6 a girl b no c $\frac{3}{5}$ d $\frac{2}{5}$

7 a $\frac{1}{6}$ b 0 c $\frac{2}{9}$ d $\frac{1}{8}$ e $\frac{2}{5}$ f $\frac{2}{7}$

8 a 0 b 0 c 0 d $\frac{3}{8}$ e 0 f $\frac{2}{7}$

9 The first is more likely. 10 $\frac{3}{4}$ 11 $\frac{1}{10}$

Learning task 2 C

- 1 a 25
b Student's own answer
f You would expect to get 0 heads 25% of the time, 1 head 50% of the time and 2 heads 25% of the time.
- 2 a f Student's own answers
g You would expect to get a red counter in about 25% of the trials.
h Student's own answer
- 3 a e Student's own answer
f There is an almost even chance of choosing a prime number.
g Student's own answer
h You would expect to get a prime number 40% of the time.
- 4 Student's own answer

Learning task 2 D

1 b $\text{Pr}(\text{yellow}) = \frac{1}{8}$ 2 b $\text{Pr}(\text{red}) = \frac{2}{5}$

Learning task 2 E

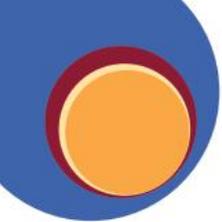
1 a 1 out of 4 d $\frac{1}{4}$

Learning task 2 F

- 1 a 13 b 13 c 13 d 13 e 26
f 26 g 4 h 4 i 12 j 40
- 2 a $\frac{1}{52}$ b 1
- 3 a $\frac{1}{2}$ b 25 times
- 4 a $\frac{1}{4}$ b $\frac{1}{4}$ c $\frac{1}{4}$ d $\frac{1}{4}$ e $\frac{1}{2}$
f $\frac{1}{2}$ g $\frac{1}{13}$ h $\frac{3}{13}$ i $\frac{10}{13}$
- 5 Student's own answers

Exercise 2 G

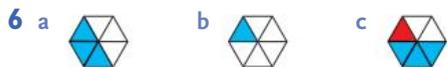
- 1 a i 9 ii 2 iii 0 iv 4
b i $\frac{3}{8}$ ii $\frac{1}{12}$ iii 0 iv $\frac{1}{6}$



- 2 a $\frac{3}{8}$, which is possible
 b $\frac{5}{6}$, which is very likely
 c $\frac{2}{3}$, which is likely d $\frac{3}{5}$, which is likely



- 5 a $\frac{1}{6}$ b $\frac{3}{8}$ c $\frac{3}{20}$ d $\frac{1}{12}$



- 7 a 10 red and 40 green b 4 red and 12 green
 c 60 red and 40 green d 40 red and 20 green
 e 10 red and 15 green f 30 red and 60 green

Exercise 2 H

- 1 $\frac{7}{32}$
 2 $\frac{1}{4}$
 3 a $\frac{40\,000}{210\,000} = 0.19, 19\%$ b $\frac{120\,000}{210\,000} = 0.57, 57\%$
 c $\frac{35\,000}{210\,000} = 0.17, 17\%$ d $\frac{15\,000}{210\,000} = 0.14$
 4 a Shortland b Rennell c Shortland
 d $\frac{7}{31}$ e $\frac{3}{5}$ f Bellona g Tikopia

Enrichment

- 1 a ABCD, ABDC, ACBD, ACDB, ADBC, ADCB, BACD, BADC, BCAD, BCDA, BDAC, BDCA, CABD, CADB, CBAD, CBDA, CDAB, CDBA, DABC, DACB, DBAC, DBCA, DCAB, DCBA
 b $\frac{1}{2}$ c $\frac{1}{2}$ d $\frac{1}{6}$ e $\frac{1}{20}$ f $\frac{1}{3}$
 2 a $\Pr(A) = \frac{2}{6} = \frac{1}{3}$, $\Pr(B) = \frac{2}{6} = \frac{1}{3}$, $\Pr(C) = \frac{2}{6} = \frac{1}{3}$
 b $\Pr(A) = \frac{1}{6}$, $\Pr(B) = \frac{4}{6} = \frac{2}{3}$, $\Pr(C) = \frac{1}{6}$
 c $\Pr(A) = \frac{2}{4} = \frac{1}{2}$, $\Pr(B) = \frac{1}{4}$, $\Pr(C) = \frac{1}{4}$



- 5 b 12 c 6
 d i $\frac{1}{2}$ ii $\frac{1}{3}$ iii $\frac{1}{2}$ iv 0 v $\frac{2}{3}$

- 6 b 18 c 6
 d i $\frac{1}{3}$ ii $\frac{1}{3}$ iii $\frac{1}{2}$ iv $\frac{1}{9}$ v $\frac{2}{3}$

Revision

- 1 Student's own answers
 2 Student's own answers

- 3 b $\frac{16}{25}$ c $\frac{9}{25}$ d 19

- 4 a $\frac{1}{3}$ b 0 c $\frac{2}{3}$ d $\frac{2}{3}$

- 5 $\frac{1}{2}$ 6 $\frac{2}{5}$ 7 a $\frac{5}{12}$ b $\frac{7}{12}$

- 8 $\frac{7}{8}$ 9 a $\frac{8}{25}$ b $\frac{11}{25}$

- 10 a The spinner is divided into 10 equal segments, with 5 red, 3 white and 2 blue segments.



- 11 a $\frac{5}{8}$ b $\frac{1}{4}$

- 12 a $\frac{1482}{4323}$ b 0.3428

- c 2002 $\frac{995}{2360} = 0.4216$

- 2003 $\frac{1505}{3122} = 0.4821$

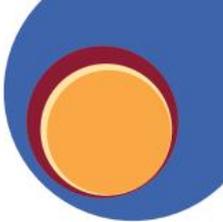
- 2004 $\frac{1715}{3580} = 0.4791$

- 2005 $\frac{1802}{4177} = 0.4314$

- 2007 $\frac{1837}{4596} = 0.3997$

- 2008 $\frac{1721}{4665} = 0.3689$

- 2009 $\frac{1733}{4779} = 0.3626$



$$2010 \quad \frac{1358}{4517} = 0.3006$$

$$2011 \quad \frac{1187}{4477} = 0.2651$$

Chapter 3

Exercise A

- 1 An isosceles triangle has **two** sides of equal length and **two** angles of equal magnitude.
- 2 An equilateral triangle has **three** sides of equal length and **three** angles of equal magnitude.

Triangle	Length of side			Type of triangle
	LM	MN	LN	
a	15 mm	15 mm	22 mm	isosceles
b	19 mm	13 mm	19 mm	isosceles
c	9 mm	21 mm	21 mm	isosceles
d	23 mm	17 mm	17 mm	isosceles
e	40 mm	26 mm	20 mm	scalene
f	23 mm	20 mm	40 mm	scalene

- 4 a Scalene b Isosceles c Isosceles
 d Isosceles e Equilateral f Isosceles
 g Scalene h Scalene i Equilateral

Exercise B

Triangle	Magnitude or size of angle			Type of triangle
	$\angle L$	$\angle M$	$\angle N$	
a	45°	90°	45°	right angled
b	40°	70°	70°	acute angled
c	77°	77°	26°	acute angled
d	47°	47°	86°	acute angled
e	33°	24°	123°	obtuse angled
f	20°	137°	23°	obtuse angled

- 2 a Acute-angled triangle
 b Right-angled triangle
 c Acute-angled triangle
 d Obtuse-angled triangle
 e Obtuse-angled triangle
 f Right-angled triangle
 g Right-angled triangle
 h Obtuse-angled triangle
- 3 a Right-angled scalene triangles
 b Acute-angled scalene triangles
- 4 a Right-angled isosceles triangle
 b Obtuse-angled isosceles triangle

- c Acute-angled isosceles triangle
 d Obtuse-angled isosceles triangle

Exercise C

- 1 a 68° b 71° c 78° d 50° e 26°
 f 116° g 58° h 83° i 60° j 52°
 k 40° l 14° m 73° n 12°
- 2 a 53° b 28° c 40° d 45° e 9°
 f 58° g 18° h 60° i 18° j 73°
 k 60° l 23° m 10° n 20° o 40°

Exercise D

- 1 a 92° b 109° c 102° d 130°
 e 154° f 64° g 122° h 120°
 i 140° j 128° k 143°
- 2 a 76° b 32° c 47° d 101°

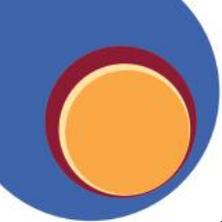
Exercise E

- 1 a Parallelogram b Kite c Trapezium
 d Rectangle e Parallelogram f Rhombus
 g Trapezium h Square i Trapezium
- 2 a Rectangle, right-angled triangle
 b Rectangle, square, isosceles triangle
 c Rectangle, square, parallelogram, triangle
 d Trapezium, rectangle
 e Rhombus, parallelogram, rectangle, triangle
 f Rectangle, square, equilateral triangle, trapezium
 g Rectangle, trapezium, square, isosceles triangle
 h Rectangle, trapezium, square, isosceles triangle
- 4 There are 204 squares on the board.

Exercise F

- 1 a Parallelogram b Diamond
- 2 a i $r = s = t = u = 90^\circ$
 ii $r = u = 70^\circ$ $s = t = 110^\circ$
 iii $r = s = 65^\circ$ $t = u = 115^\circ$
 iv $r = s = t = u = 90^\circ$
 v $r = u = 120^\circ$ $s = t = 60^\circ$
 vi $r = 124^\circ$ $s = 92^\circ$ $t = 104^\circ$ $u = 40^\circ$

Shape	$\angle r$	$\angle s$	$\angle t$	$\angle u$	Angle sum
a	90	90	90	90	360°
b	70	110	110	70	360°
c	65	65	115	115	360°
d	90	90	90	90	360°
e	120	60	60	120	360°
f	120	95	103	42	360°



c The angle sum in a quadrilateral is 360° .

- 3 a $a = 90^\circ$ b $b = 150^\circ$ c $c = 70^\circ$
 d $d = 115^\circ$ e $e = 62^\circ$ f $f = 90^\circ$
 g $a = 60^\circ$ h $g = 10^\circ$ i $b = 50^\circ$
- 4 a $n = 144^\circ$ b $m = 131^\circ$ c $r = 92^\circ$
 d $r = 104^\circ$ e $g = 133^\circ$ f $h = 125^\circ$
 g $j = 52^\circ$ h $k = 37^\circ$ i $x = 120^\circ$
 j $m = 73^\circ$ k $x = 117^\circ$ l $y = 60^\circ$
 m $a = 60^\circ, b = 120^\circ$ n $c = 110^\circ, d = 50^\circ$
 o $f = 205^\circ, e = 37^\circ$
- 5 a $a = 54^\circ$ b $a = 45^\circ$ c $a = 40^\circ$
 d $a = 60^\circ$ e $a = 36^\circ$ f $a = 60^\circ$

Exercise 6

- 1 a Triangle b Quadrilateral c Pentagon
 d Octagon e Rectangle f Octagon
- 2 a Triangle b Square c Pentagon
 d Hexagon e Heptagon f Octagon
 g Nonagon h Decagon

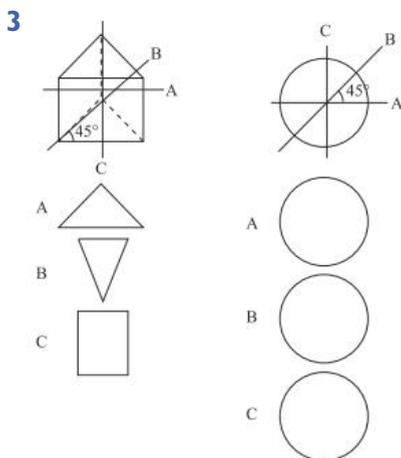
olygon	Name	No of sides	No of angles	Size of int angle	Angle sum
a	Equilateral triangle	3	3	60°	180°
b	Square	4	4	90°	360°
c	Pentagon	5	5	108°	540°
d	Hexagon	6	6	120°	720°
e	Heptagon	7	7	128.57°	900°
f	Octagon	8	8	135°	1080°
g	Nonagon	9	9	140°	1260°
h	Decagon	10	10	144°	1440°

Exercise 7

- 1 Angle sums are:
- a Square 360° b Hexagon 720°
 c Pentagon 540° d Octagon 1080°
 e Heptagon 900° f Octagon 1080°
 g 11-agon 1620° h 13-agon 1980°
- 2 a 2340° b 2700° c 3780° d 5940°
 e 7200° f 8640° g 12960° h 26640°
 i 5580° j 1980° k 8820° l 1620°
 m 3240° n 5760° o 2700° p 9000°
 q 10620° r 12780° s 7380° t 8460°
- 3 a $m = 112^\circ$ b $y = 126^\circ$ c $r = 123^\circ$
 d $s = 143^\circ$ e $y = 94^\circ$ f $k = 122^\circ$
- 4 a $j = 107^\circ$ b $k = 109^\circ$ c $r = 119^\circ$
 d $s = 151^\circ$ e $h = 120^\circ$ f $g = 98^\circ$

Enrichment

- 1 a $n = 5$ b $n = 6$ c $n = 8$ d $n = 62$
- 2 For cylinder:
 a circle b ellipse
 c rectangle d rectangle is a polygon
- For cube:
 a square b rectangle
 c square d rectangle and square are polygons



d Cut C in triangular-based pyramid is a polygon.

- 4 For cone: For square-based pyramid:

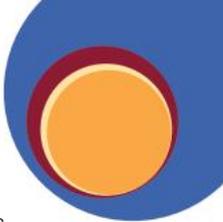


Size decreases as cuts are made further up the pyramid but all cross-sections are the same.

5

Name of polygon	Number of diagonals	Rule
Triangle	0	$\frac{3(3-3)}{2} = 0$
Square	2	$\frac{4(4-3)}{2} = 2$
Pentagon	5	$\frac{5(5-3)}{2} = 5$
Hexagon	9	$\frac{6(6-3)}{2} = 9$
Heptagon	14	$\frac{7(7-3)}{2} = 14$
Octagon	20	$\frac{8(8-3)}{2} = 20$
Nonagon	27	$\frac{9(9-3)}{2} = 27$
Decagon	35	$\frac{10(10-3)}{2} = 35$

In an n -sided polygon, there are $\frac{n(n-3)}{2}$ diagonals.



- 6** a 5 b 20 c 54 d 135 e 19700
7 a 77 b 275 c 740

Revision

- 1** a Right-angled triangle, scalene triangle
 b Acute-angled triangle, equilateral triangle
 c Acute-angled triangle, isosceles triangle
 d Obtuse-angled triangle, scalene triangle
 e Acute-angled triangle, equilateral triangle
 f Right-angled triangle, isosceles triangle
 g Acute-angled triangle, isosceles triangle
 h Obtuse-angled triangle, scalene triangle
- 2** a $t = 22^\circ$ b $h = 92^\circ$ c $c = 48^\circ$
 d $y = 34^\circ$ e $k = 60^\circ$ f $a = 60^\circ$
- 3** a $x = 117^\circ$ b $x = 122^\circ$ c $x = 107^\circ$
 d $x = 25^\circ$ e $x = 45^\circ$ f $x = 64^\circ$
- 4** a Kite b Rhombus c Trapezium
 d Parallelogram e Rectangle f Square
 g Trapezium h Kite
- 5** a $n = 134^\circ$ b $y = 113^\circ$ c $z = 48^\circ$
 d $t = 148^\circ$ e $w = 116^\circ$ f $m = 105^\circ$
- 6** a Equilateral triangle b Regular hexagon
 c Regular pentagon d Octagon
 e Square f Isosceles triangle
- 7** a $p = 80^\circ$ b $p = 150^\circ$ c $w = 115^\circ$ d $h = 118^\circ$

Chapter 4

Exercise 4 A

- 1** E, D, C, B, F, A **2** E, D, B, F, C, A
3 A = 14 cm² B = 11 cm² C = 12 cm²

Exercise 4 B

- 1** a 9 cm² b 10 cm² c 10 cm² d 9 cm²
 e 7 cm² f 14 cm² g 10 cm²
- 2** a 20 cm² b 14 cm² c 15 cm² d 18 cm²

Exercise 4 D

- 1** a 8 cm² b 12 cm² c 24 cm² d 30 cm²
2 a 16 cm² b 36 cm² c 704 cm²
 d 315 cm²
- 3** a 234 m² b 9 km² c 112 mm²
 d 576 km² e 1989 cm² f 10 km²
 g 2958 mm² h 1175 km² i 13 280 m²
- 4** a 384 cm² b 36 m² c 430 km²
- 5** a 24 cm² b 7040 cm² c 5490 cm²
- 6** a 1792 mm² b 1.152 km² c 78 000 mm²
 d 2025 mm²

- 7** a 152 m² b 131 m² c 291 m²
8 a 28 883 cm² b 1163 m² c 306 m²
9 a 90.7 m² b 189.3 m²
- 10** 204 cm²
- 11** a 16 cm² b 1024 cm² c 512 cm²
 d 272 cm²

Exercise 4 E

- 1** a 252 cm² b 42 m² c 90 cm²
 d 2150 km² e 323 m² f 6408 mm²
- 2** a 24 cm² b 900 cm² c 11.2 cm²
 d 15 600 cm² e 92 000 cm² f 9600 cm²
- 3** a 124 mm² b 160 m² c 16 432 mm²
 d 103 cm² e 120 cm² f 3453 cm²

Exercise 4 F

- 1** a 18 cm² b 84 mm² c 44 m²
 d 90 km² e 1220 mm² f 2795 m²
 g 2108 mm² h 31.5 km² i 97.5 m²
- 2** a 406 m² b 1274 mm² c 30 m²
 d 135 cm² e 17.4 cm² f 11.5 cm²
- 3** a 150 mm² b 382 m² c 57 m²
 d 540 km² e 105 mm² f 168 m²
- 4** a 315 km² b 453 m² c 26 m²
 d 174 mm² e 30 mm² f 96 m²
- 5** a Area of each triangle is 18 cm².
 Red: 18 cm² Crimson: 90 cm²
 Blue: 36 cm² Yellow: 108 cm²
 Orange: 54 cm² Green: 126 cm²
 Purple: 72 cm² White: 378 cm²
- b Area of each triangle is 166.2 cm².
 White: 2991.6 cm² Green: 5152.2 cm²
- c Red: 120 cm²
 Orange: 480 cm²
 Yellow: 1080 cm²
 Green: 1920 cm²
 Blue: 3000 cm²
- d Area of all colours is 675 cm².

Exercise 4 G

- 1** a 64 cm³ b 64 cm³ c 76 cm³
 d 128 cm³ e 448 cm³ f 112 cm³
 g 384 cm³
- 2** a 20 cm³ b 30 cm³ c 30 cm³ d 35 cm³



Learning task 4 H

Prism	bits in length	bits in width	bits in base (area)	bits in height	Volume of prism
1	3	2	6	1	6
2	3	2	6	2	12
3	3	2	6	3	18

- 1 d**
- The area of the base for a rectangular prism is equal to the length multiplied by the width.
 - Area of base = $l \times w$
 - The volume of the prism is equal to the area of the base multiplied by the height of the prism.
 - Volume = area of base \times height of prism or $V = l \times w \times h$.
- 3 a** Volume = area of the base \times number of layers or $V = l \times w \times h$.
- b** Yes this does work for a cube; however, the length, width and height will be the same.

Exercise 4 I

- 1 a** 128 cubes **b** 64 cubes **c** 64 cubes
- 2 a** 1920 cm³ **b** 240 cm³ **c** 588 cm³
- d** 1350 cm³ **e** 600 cm³ **f** 2100 cm³
- g** 532 cm³ **h** 18 354 cm³
- 3 a** 11 475 cm³ **b** 38 250 cm³
- 4** Some suggested answers:
- a** $1 \times 1 \times 54$ **b** $1 \times 1 \times 36$
 $2 \times 1 \times 27$ $2 \times 1 \times 18$
 $3 \times 2 \times 9$ $3 \times 2 \times 6$
- c** $1 \times 1 \times 48$ **d** $1 \times 1 \times 144$
 $2 \times 1 \times 24$ $2 \times 1 \times 72$
 $3 \times 2 \times 8$ $3 \times 2 \times 24$
- 5** Some suggested answers:
- a** $2 \times 2 \times 2$ **b** $2 \times 3 \times 4$
 $2 \times 2 \times 4$ $2 \times 2 \times 2$
 $1 \times 2 \times 5$

Exercise 4 J

- 1 a** 594 cm³ **b** 1568 cm³ **c** 7154 cm³
- d** 4920 cm³
- 2 a** 648 cm³ **b** 252 cm³ **c** 735 cm³
- d** 630 cm³ **e** 504 cm³ **f** 360 cm³
- g** 918 cm³ **h** 1938 cm³
- 3 a** 595 cm³ **b** 432 cm³ **c** 168 cm³
- d** 1008 cm³ **e** 56 028 cm³ **f** 5720 cm³

Enrichment

- 1 a** 44 m² **b** 96 m² **c** 196 m²
- 2 a** 3408 cm² **b** 676 cm²
- 3 a** 1600 hectares **b** 19 200 hectares
- c** 8800 hectares **d** 1856 hectares
- e** 3906 hectares
- 4 a** 744 mm² **b** 232 m² **c** 57 m²
- 5 a** 744 **b** 38 boxes **c** 42 boxes
- d** 12 good tiles **e** 225 tiles
- 6 a** 486 m² **b** 1920 cm² **c** 1008 m²
- 8 c** 704 millilitres

Revision

- 1** C, A, B, D, E, F
- 2 a** 24 squares **b** 54 squares
- 3 a** **i** 32 squares **ii** 32 cm²
- b** **i** 60 squares **ii** 60 cm²
- c** **i** 64 squares **ii** 64 cm²
- d** **i** 52 squares **ii** 52 cm²
- 4 a** 28 cm² **b** 1386 cm²
- c** 39 600 cm² or 3.96 m²
- 5 a** 912 m² **b** 1470 cm²
- 6 a** 672 m² **b** 276 cm² **c** 7533 km²
- 7 a** 1848 cm² **b** 122.96 cm² **c** 2204 cm²
- d** 108 cm²
- 8 a** 551 cm² **b** 336 m² **c** 256 km²
- d** 36 cm²
- 9 a** 28 cm³ **b** 96 cm³ **10** 80 cubes
- 11 a** 360 cm³ **b** 2268 cm³ **c** 6840 mm³
- 12 a** 1020 cm³ **b** 5040 m³ **c** 12 152 mm³
- 13 a** 4725 m³ **b** 396 mm³

Solomon Islands MATHEMATICS Year 7 Learner's Book

Book 2

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.

