11

NUMBER AND ALGEBRA, MEASUREMENT AND GEOMETRY

RATIOS, RATES AND TIME

Ratios and rates are used in many everyday situations to compare things. Ratios are used when mixing hair colour, mixing paint to the chosen colour, paying rent in a share house and constructing buildings from plans. Rates are used when calculating the amount of paint required for a job, measuring blood alcohol content and preparing a holiday budget. Time skills are needed when working out when to leave home to get to work on time or making travel plans.

Chapter outline

		Working mathematically				
11.01	Ratios	U	F			C
11.02	Ratio problems	U	F	PS	R	
11.03	Scale maps and plans	U	F	PS	R	C
11.04	Dividing a quantity in a given ratio	U	F	PS	R	
11.05	Rates	U	F		R	C
11.06	Best buys	U	F	PS	R	C
11.07	Rate problems	U	F	PS	R	C
11.08	Speed	U	F	PS	R	C
11.09	Travel graphs	U	F	PS	R	C
11.10	Sketching informal graphs	U	F	PS	R	C
11.11	Time differences	U	F	PS	R	C
11.12	World time zones	U	F	PS	R	C

Wordbank

best buy When comparing different brands or sizes during shopping, this is the item with the lowest unit cost and is the best value for money

per (symbol '/') A word used in rates to mean 'for each'

scaled length A length on a map or plan that represents an actual length, usually much smaller, but in proportion to it

speed A rate that compares distance travelled with time taken

time zone A region of the world where all places experience the same time of day

travel graph A line graph that describes a journey and shows distance travelled over time

unit price The price of one item or unit, such as 1 mL or 1 g

unitary method A method of finding a quantity by finding one part first

U = Understanding | **F** = Fluency | **PS** = Problem solving | **R** = Reasoning | **C** = Communication

Why do we have ratios?

Time

In this chapter you will:

- simplify ratios and solve problems involving ratios
- interpret and calculate using scales on maps, plans and images
- divide a quantity in a given ratio
- simplify rates and solve problems involving rates
- calculate unit prices to determine 'best buys'
- interpret and draw travel graphs, including the slope of the graph
- sketch informal graphs of practical situations
- solve problems involving time differences, including using 24-hour time
- interpret and use international time zones

SkillCheck ANSWERS ON P. 577

1 Copy and complete each conversion.

a 2 m = _____ cm **b** 3 h = _____ min **c** 3000 kg = _____ t

d 2.5 L = _____ mL **e** 380 cm = _____ m **f** 180 mg = _____ g

g 3 min = _____ s **h** 8.5 cm = _____ mm **i** 480 min = _____ h

j 7500 mL = _____ L **k** 9.15 km = _____ m **l** 3840 mm = _____ cm

2 Find the highest common factor (HCF) of each pair of numbers.

a 12 and 18 **b** 35 and 21 **c** 16 and 40

3 Complete each pair of equivalent fractions.

a $\frac{7}{10} = \frac{\square}{30}$ **b** $\frac{3}{5} = \frac{12}{\square}$ **c** $\frac{18}{45} = \frac{\square}{5}$

4 Find the lowest common multiple (LCM) of each pair of numbers.

a 2 and 3 **b** 4 and 8 **c** 5 and 3

5 Simplify each fraction.

a $\frac{18}{45}$ **b** $\frac{32}{64}$ **c** $\frac{80}{100}$ **d** $\frac{15}{36}$

6 Evaluate each expression.

a $\frac{2}{5} \times 20$ **b** $\frac{1}{3} \times 15$ **c** $\frac{3}{4} \times 24$ **d** $\frac{5}{6} \times 36$

e 7.6×100 **f** 5.4×10 **g** 0.39×100 **h** 25×10

24-hour time

7 Convert each time to 24-hour time.

a 7:15 a.m. **b** 3:45 p.m. **c** 8:50 p.m. **d** 12:10 a.m.

12- and 24-hour time

8 Convert each time to 12-hour time.

a 04:10 **b** 11:05 **c** 14:15 **d** 23:35

Ratios

11.01

A **ratio** consists of 2 or more numbers that compare the parts or shares of things of the same type, in the same units. For example, if a cake recipe uses sugar to flour in a ratio of 1 to 2, written '1 : 2', it means that for every one part of sugar we need 2 parts of flour.

Each number in a ratio is called a **term** of the ratio.

Equivalent ratios are *equal* ratios and can be found in a similar way to that used for finding **equivalent fractions**.

Equivalent ratios

To find an **equivalent ratio**, multiply or divide each term by the same number.

Example 1

Complete each pair of equivalent ratios.

a 6 : 4 = 18 : _____ **b** 3 : 4 = _____ : 24 **c** 12 : 8 = 3 : _____

Solution

a To find the missing term, look at the 2 known matching terms, 6 and 18.

6 is *multiplied* by 3 to give 18, so do the same thing to the 4.

$4 \times 3 = 12$

So 6 : 4 = 18 : 12

$\times 3$

$6 : 4 = 18 : 12$

$\times 3$

b The 2 known matching terms are 4 and 24.

4 is *multiplied* by 6 to give 24, so do the same thing to the 3.

$3 \times 6 = 18$

So 3 : 4 = 18 : 24

$\times 6$

$3 : 4 = 18 : 24$

$\times 6$

c The 2 known matching terms are 12 and 3.

12 is *divided* by 4 to give 3, so do the same thing to the 8.

$8 \div 4 = 2$

So 12 : 8 = 3 : 2

$\div 4$

$12 : 8 = 3 : 2$

$\div 4$

Simplifying ratios

- To simplify a ratio, keep dividing both terms by the same number, preferably a large number such as their highest common factor (HCF), until each term is as small as possible
- If all terms are even, divide by 2 or perhaps 4
- Otherwise, try dividing by the odd numbers 3, 5 or 7

Simplifying ratios

Example 2

Simplify each ratio.

a 25 : 40 **b** 24 : 16 **c** 18 : 30 : 15

Solution

a $25:40 = \frac{25}{5}:\frac{40}{5} = 5:8$

OR enter 25 : 40 as a fraction $\frac{25}{40}$ on the calculator:
25 $\square\!\!\square$ 40 =

Divide both terms by their HCF, 5.

$a^{b/c}$ is the fraction key on some calculators.

b $24:16 = \frac{24}{8}:\frac{16}{8} = 3:2$

OR enter 24 : 16 as an improper fraction $\frac{24}{16}$ on the calculator: 24 $\square\!\!\square$ 16 =

Then, to change the mixed numeral answer to an improper fraction, press:

SHIFT S⇔D or 2nd F $a^{b/c}$

Divide both terms by their HCF, 8.

c $18:30:15 = \frac{18}{3}:\frac{30}{3}:\frac{15}{3} = 6:10:5$

Divide all terms by their HCF, 3.

Because there are more than 2 terms in this ratio, the calculator cannot be used here.

Simplifying ratios

Example 3

Simplify each ratio.

a $\frac{3}{5}:\frac{1}{3}$ **b** 0.7 : 0.05

Solution

If a ratio has terms that are fractions or decimals, it can be simplified by converting the terms to **whole numbers**.

a For fractions, multiply both terms by a common multiple, preferably the **lowest common multiple** (LCM) of the denominators.

$\frac{3}{5}:\frac{1}{3} = \left(\frac{3}{5}\times 15\right):\left(\frac{1}{3}\times 15\right) = 9:5$

The LCM of 5 and 3 is 15.

b For decimals, multiply both terms by the appropriate power of 10. In this case, multiply by 100 (move the decimal place 2 places to the right).

$0.7:0.05 = (0.7\times 100):(0.05\times 100)$

$= 70:5$

$= 14:1$

Simplifying

Example 4

Simplify the ratio of 2 hours to 1 day.

Solution

First, change the values to the same units.

2 hours : 1 day = 2 hours : 24 hours 1 day = 24 hours

= 2 : 24

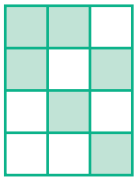
= 1 : 12

EXERCISE 11.01 ANSWERS ON P. 578

Ratios U F C

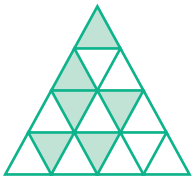
1 For each shape, write the ratio of shaded to unshaded parts. C

a

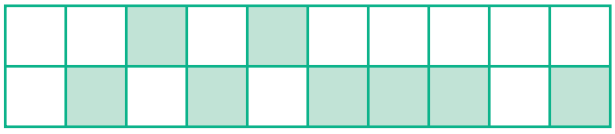


b

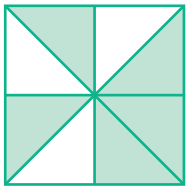
c



d



e



2 Copy and complete each pair of equivalent ratios. EXAMPLE 1

a	2 : 3 = 8 : _____	**b**	1 : 5 = 2 : _____	**c**	3 : 5 = ____ : 15
d	4 : 7 = _____ : 35	**e**	5 : 8 = 20 : _____	**f**	7 : 12 = 49 : _____
g	5 : 11 = _____ : 66	**h**	3 : 4 = _____ : 100	**i**	2 : 1 = 10 : _____
j	_____ : 9 = 20 : 36	**k**	12 : _____ = 3 : 1	**l**	17 : 34 = _____ : 2
m	_____ : 45 = 6 : 9	**n**	24 : 12 = 4 : _____	**o**	16 : _____ = 2 : 5
p	_____ : 20 = 15 : 60	**q**	24 : 20 = 6 : _____	**r**	50 : 40 = ____ : 20

3 Which of the following ratios is **not** equivalent to the ratio 32 : 48?
Select the correct answer **A**, **B**, **C** or **D**.

A 16 : 24 **B** 4 : 6 **C** 2 : 3 **D** 6 : 8

4 Simplify each ratio. EXAMPLE 2

a	10 : 100	**b**	12 : 24	**c**	12 : 30	**d**	35 : 49
e	18 : 12	**f**	56 : 24	**g**	1000 : 100	**h**	45 : 99
i	87 : 87	**j**	123 : 321	**k**	51 : 17	**l**	3 : 48
m	8 : 12 : 20	**n**	15 : 20 : 30	**o**	27 : 9 : 36	**p**	14 : 35 : 21 : 49

Foundation Standard Complex

EXAMPLE 3

5 Simplify each ratio.

a $\frac{1}{3} : \frac{2}{5}$	**b** $\frac{1}{4} : \frac{1}{3}$	**c** $\frac{3}{4} : \frac{2}{3}$	**d** $\frac{1}{2} : \frac{3}{8}$
e $\frac{2}{5} : \frac{3}{10}$	**f** $\frac{4}{5} : \frac{1}{2}$	**g** $\frac{5}{8} : \frac{1}{4}$	**h** $\frac{2}{3} : \frac{1}{2}$
i $\frac{3}{4} : \frac{7}{16}$	**j** $\frac{4}{5} : \frac{1}{2}$	**k** $\frac{5}{6} : \frac{2}{5}$	**l** $\frac{6}{5} : \frac{2}{3}$
m 0.4 : 0.7	**n** 1.3 : 0.8	**o** 0.5 : 0.3	**p** 0.9 : 1.8
q 0.6 : 0.8	**r** 3.6 : 2.4	**s** 0.05 : 0.2	**t** 0.25 : 0.5
u 0.375 : 0.25	**v** 12 : 8.4	**w** 2.4 : 1.2 : 3.6	**x** 4.5 : 1 : 0.9

EXAMPLE 4

6 Simplify each ratio.

a 50 cm to 2 m	**b** 300 g to 1.2 kg	**c** 5 days to 7 weeks
d 30 min to 2 hours	**e** 70 cents to $2.10	**f** 2 years to 6 months
g 15 hours to 2 days	**h** 20 mm to 1 m	**i** 4 tonnes to 350 kg
j 25 min to 3 hours	**k** 18 m to 1 km	**l** 8 months to 4 years
m 2 days to 8 hours	**n** 75 cents to $5	**o** $2.70 : $12

7 On a farm there are 200 orange and mandarin trees in total. If there are 120 orange trees, what is the ratio of orange to mandarin trees? C

8 In a class of 28 students, there are 16 girls. Find, in simplest form, the ratio of: C

a girls to boys	**b** boys to girls	**c** girls to students in the class

9 A store has 30 gas heaters and 20 electric heaters in its warehouse. Find the ratio of: C

a gas heaters to electric heaters

b gas heaters to all heaters

c all heaters to electric heaters

10 A man earns $75 000 a year and spends $63 000 a year. Find the ratio of his savings to earnings. Select **A**, **B**, **C** or **D**. C

A 25 : 21	**B** 21 : 25	**C** 4 : 25	**D** 4: 21

11 Zoe buys goods for $320 and sells them for $380. Find, in simplest form, the ratio of: C

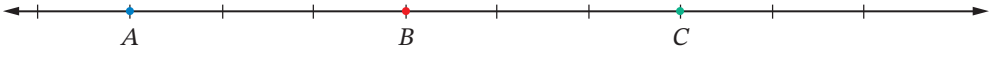
a the cost price to the selling price

b the selling price to the cost price

c the profit to the selling price

d the selling price to the profit

12 The line below is divided into units of length as shown.



Find each ratio of lengths. C

a $AB : BC$	**b** $AC : AB$	**c** $BC : AC$	**d** $AC : BC$

Foundation Standard Complex

9780170453141

13 A vending machine is filled with bottles and cans. The ratio of the number of bottles to the total number of contents is 3 : 8. C

a What fraction of the contents are cans?

b What is the ratio of the number of cans to the number of bottles?

14 0.5 m^3 of cement is added to $\frac{3}{8}$ m^3 of metal to make a mixture. What is the ratio of cement to metal? Select **A**, **B**, **C** or **D**. C

A 4 : 3 **B** 7 : 8 **C** 3 : 4 **D** 3 : 16

15 When comparing the rate at which babies are born in different countries (that have different population sizes), we use a base number of 1000. The annual birth rate in Australia is approximately 12 per 1000 people (a ratio of 12 : 1000). The rate in India is approximately 22 per 1000 people, or 22 : 1000. Express each ratio in simplest form. C

Ratio problems 11.02

Problems involving ratios can be solved using **equivalent ratios** or the **unitary method**. With the unitary method, we find the size of **one part** first. We have used this method before when calculating with percentages.

Example 5

The ratio of boys to girls in a class is 2 : 3. If there are 10 boys in the class, how many girls are there?

Solution

Method 1: Equivalent ratios

Write the problem as a pair of equivalent ratios.

Boys : girls = 2 : 3 = 10 : ___ (×5 above, ×5 below)

10 boys

Number of girls = 3 × 5 = 15
There are 15 girls in the class.

Method 2: Unitary method

Boys : girls = 2 : 3

'Unitary' means 'one'

2 parts (boys) = 10

1 part = 10 ÷ 2 = 5

Finding one part first.

3 parts (girls) = 3 × 5 = 15

There are 15 girls in the class.

Ratio problems

Ratio problems

Foundation Standard Complex

Example 6

To make concrete, a builder mixes sand and cement in the ratio 5 : 4. If a mix of concrete contains 20 kg of cement, find:

a the amount of sand in the mix

b the total mass of the mix.

Shutterstock.com/franco lucato

Solution

a **Method 1: Equivalent ratios**

Sand : cement = 5 : 4 = __ : 20 (×5 above, ×5 below)

20 kg of cement

Amount of sand = 5 × 5 = 25 kg

Method 2: Unitary method

Sand : cement = 5 : 4

4 parts (cement) = 20 kg

1 part = 20 ÷ 4 = 5 kg

5 parts (sand) = 5 × 5 = 25 kg

b Total mass = 20 kg + 25 kg = 45 kg

Cement and sand

So the total mixture was 45 kg.

EXERCISE 11.02 ANSWERS ON P. 578

Ratio problems U F PS R

EXAMPLE 5

1 Alison and Elena buy a length of material and divide it between them in the ratio 2 : 3. If Alison has 5.4 m, what length of material does Elena have? Select the correct answer **A**, **B**, **C** or **D**. PS

A 2.7 m **B** 3.6 m **C** 8.1 m **D** 13.5 m

2 A tiler uses 4 green tiles to every 3 white ones. How many white tiles are used if 100 green tiles are used? PS

3 When making concrete, sand and cement are mixed in the ratio 4 : 1. If 140 kg of cement has been delivered, what mass of sand is needed? PS

4 2 lengths of timber are in the ratio 4 : 7. The longer length is 56 cm. What is the shorter length?

EXAMPLE 6

5 In a college, the ratio of teachers to students is 1 : 18. If the college has 80 teachers, how many students are there? PS

11.02

6 The speeds of 2 boats are in the ratio 7 : 4. The speed of the slower boat is 10 km/h. Find the speed of the faster boat.

7 In a rectangle, the ratio of the width to the length is 5 : 12. The length is 48 cm. PS R

a Find the width of the rectangle.

b Find the perimeter of the rectangle.

8 An alloy contains copper and iron in the ratio 2 : 5. A quantity of alloy contains 20 kg of copper. What mass of iron does it contain?

9 Toudi, Ash and Felicity share a Lotto prize in the ratio 11 : 8 : 6. Ash received $720. PS R

a How much did Toudi and Felicity each receive?

b What was the total prize money shared?

10 In a triangle, the lengths of the sides are in the ratio 3 : 4 : 5. If the longest side is 45 cm long, find the perimeter of the triangle. Select **A**, **B**, **C** or **D**. PS R

A 57 cm **B** 72 cm **C** 81 cm **D** 108 cm

11 The masses of 2 packets of detergent are in the ratio 3 : 10. PS R

a If the lighter packet has a mass of 1.5 kg, what is the mass of the larger one?

b If the heavier packet costs $12.50 and the lighter packet costs $3.90, which packet is the cheaper per kilogram and by how much?

12 Ed's Farmers' Market buys fruit and vegetables in the ratio 7 : 9. The mass of vegetables ordered is 14.4 tonnes. What is the total mass of produce ordered? PS

13 Samantha and James' heights are in the ratio 7 : 6. If Samantha is 1.75 m tall, how tall is James?

14 In an outback mining town, the ratio of women to men is 2 : 5. If there are 240 women, how many men and women are there in the town altogether? Select **A**, **B**, **C** or **D**. PS R

A 840 **B** 600 **C** 960 **D** 1680

15 To make Superglue, the contents of Tube A and Tube B are mixed in the ratio 3 : 1. PS

a If 21 mL of Tube A is used, how much of Tube B is needed?

b How much glue is made altogether if 21 mL of Tube B is used?

Did you know?

Loose change

All Australian coins are made by mixing copper with other elements.

The $2 and $1 coins were introduced in 1988 to replace notes. They are made of copper, aluminium and nickel in the ratio 46 : 3 : 1.

The 50c, 20c, 10c and 5c coins are made of copper and nickel in the ratio of 3 : 1.

600 grams of aluminium are used to make some $2 coins. How much copper and nickel is used?

Shutterstock.com/Alex Bogatyrev

11.03 Scale maps and plans

WS Map of Adelaide

Scale maps and plans are a special application of ratios in real life. Lengths and distances on scale diagrams are in the same ratio as the real lengths and distances.

Scale ratios

The scale ratio on a scale diagram is written in the form scaled length : real length, where **scaled length** is the length on the diagram.

For example, a scale ratio of 1 : 100 means that the real lengths are 100 times larger than the lengths on the diagram.

Map scales

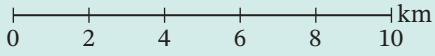
Map scales are often expressed in the same form as ratios. A scale of 1 cm : 1 km means that 1 cm on the map represents an actual distance of 1 km.

Example 7

Simplify each map scale.

a 1 cm : 1 km

b



Solution

a 1 cm : 1 km = 1 cm : 1000 m — 1 km = 1000 m

= 1 cm : 100 000 cm — 1 m = 100 cm

= 1 : 100 000

b The length of the scale from 0 to 10 on the diagram is 5 cm.

So 5 cm on the map represents 10 km of actual distance.

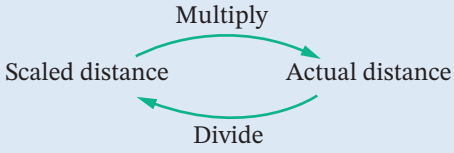
Scale = 5 cm : 10 km

= 5 cm : 10 × 1000 × 100 cm — Convert 10 km to cm.

= 5 cm : 1 000 000 cm

= 1 : 200 000 — Simplifying the ratio.

Map scales



Example 8

A map has a scale of 1 : 25 000.

a What is the actual distance if the scaled distance is 4 cm?

b What is the scaled distance if the actual distance is 3.5 km?

Solution

a Scaled distance = 4 cm

Actual distance = 4 × 25 000 cm

= 100 000 cm

= 1000 m — 1 m = 100 cm

= 1 km — 1 km = 1000 m

b Actual distance = 3.5 km

= 3500 m — 1 km = 1000 m

= 350 000 cm — 1 m = 100 cm

Scaled distance = 350 000 cm ÷ 25 000

= 14 cm

Scale drawings

Scale drawings

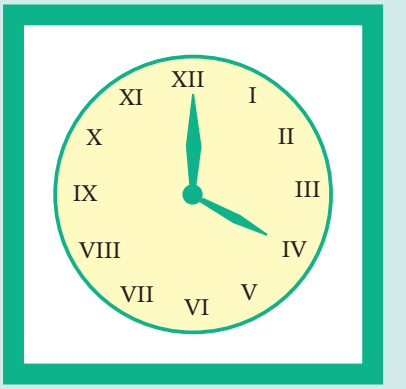
WS

Scale drawings

Scale drawings

Example 9

This diagram of a clock is drawn to a scale of 1 : 6. Measure its length and calculate its actual length.



Scale 1 : 6

Solution

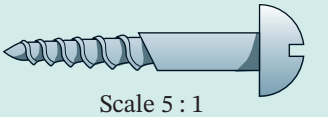
Scaled length = 5 cm by measurement

Actual length = 5 cm × 6

= 30 cm

Example 10

This drawing of a screw is drawn to a scale of 5 : 1. Find its actual length.



Scale 5 : 1

Solution

A scale of 5 : 1 means that the real screw is 5 times **smaller** than the one drawn.

Scaled length = 4 cm by measurement

Actual length = 4 cm ÷ 5

= 0.8 cm

9780170453141

EXERCISE 11.03 ANSWERS ON P. 578

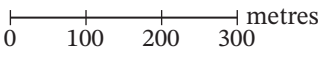
Scale maps and plans U F PS R C

1 Simplify each map scale. R C

EXAMPLE 7

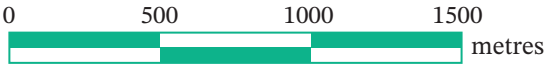
a 1 cm : 5 km **b** 1 mm : 1 m **c** 1 cm : 500 km **d** 1 cm : 25 km

e



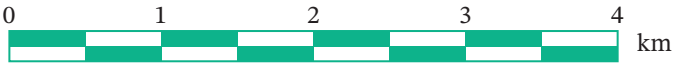
f

g

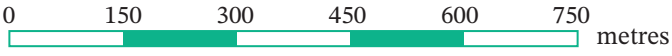


h

i



j



2 A map has a scale of 1 : 50 000. What distance is represented by 64 mm on the map? Select the correct answer **A**, **B**, **C** or **D**. R C

EXAMPLE 8

A 0.32 km **B** 3.2 km **C** 32 km **D** 320 km

3 A street map uses a scale of 1 cm : 200 m. PS R C

a Simplify this ratio.

b Find the actual distance, in kilometres, represented by each scaled distance.

i 7 cm **ii** 9.5 cm **iii** 12.4 cm

c Find the scaled distance, in centimetres, used to represent each actual distance.

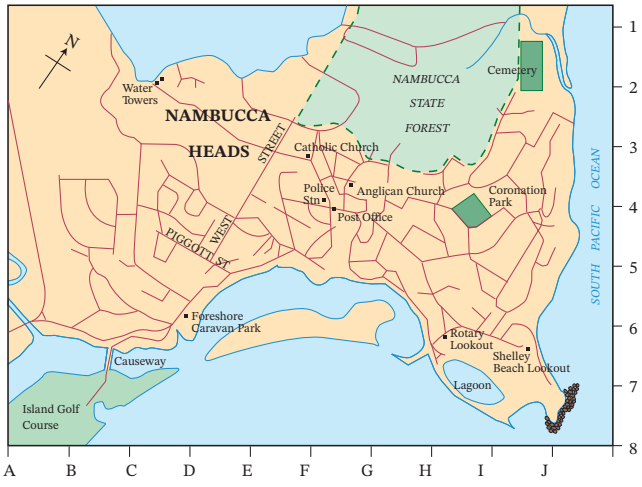
i 18 km **ii** 1500 m **iii** 9.6 km

4 On a map using a scale of 1 : 10 000 000, the world's longest river, the Nile in Egypt, is the length of an average shoe lace (66.7 cm). How many kilometres long is the River Nile? PS R C

5 The town of Gilgandra is 66 km north of Dubbo. On a map with a scale of 1 : 100 000, what is the scaled distance between the 2 towns? PS R C

6 Lord Howe Island is 2.8 km wide. How long would its scaled width be on a map with a scale of 1 : 50 000? PS R C

7 This map of Nambucca Heads has a scale of 1 : 40 000. PS R C



a Find, in metres, the distance between:

- **i** the Water Towers (C2) and the Catholic Church (F3)
- **ii** the Anglican Church (G4) and the centre of Coronation Park (I4)
- **iii** Rotary Lookout (H6) and Shelley Beach Lookout (J6)
- **iv** the post office (F4) and the Foreshore Caravan Park (D6)

b Find the length of:

- **i** West Street (E4)
- **ii** Piggott Street (D5)

c How long is the lagoon (I7)?

d What are the dimensions of the cemetery (J2)?

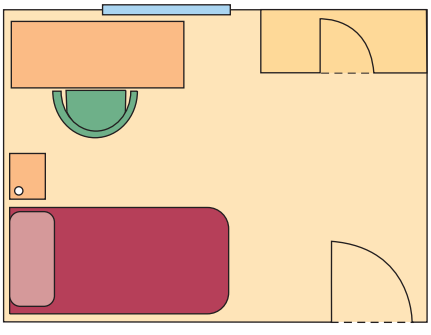
e How long is the causeway leading to the Island Golf Course (B7)?

f To train for a fun run, Merridy decides to run 8 km 3 times a week. What distance will this be on the map in centimetres? Outline a possible course for her training run, starting and finishing at the Foreshore Caravan Park (D6).

EXAMPLE 9

8 This is a scale plan of a bedroom. R C
By measurement and calculation, find in metres the actual:

a length of the bedroom
b width of the doorway (in cm)
c length of the bed
d length of the window
e length of the table
f area of the bedroom



Scale: 1 : 70

Foundation Standard Complex

9780170453141

9 Measure the length of each scaled-down image below, then use the scale ratio to calculate its actual length in centimetres (metres for the house). R C

a Fish 1 : 3

Shutterstock.com/Elena Blokhina

b House 1 : 300

iStock.com/pamspix

c Pen 1 : 4

Shutterstock.com/Pakhnyushchy

d Tennis racquet 1 : 16

Shutterstock.com/Gearstd

10 This house plan is drawn to a scale of 1 : 140. PS

Measure and calculate to the nearest 0.1 m: R C

a the length of the main bedroom

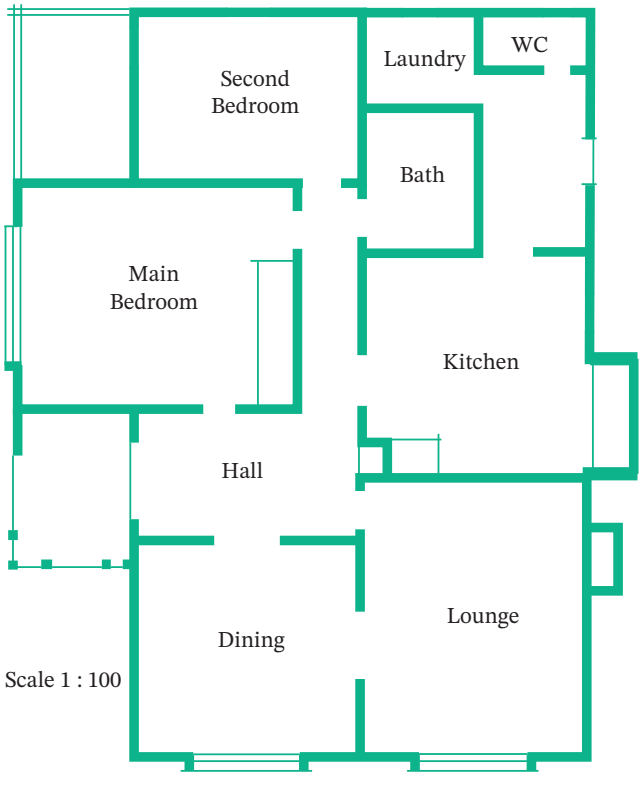
b the length of the window in that room

c the length of the laundry

d the area of the bathroom

e the longer side of the lounge room

f the area of the dining room



Foundation | Standard | Complex

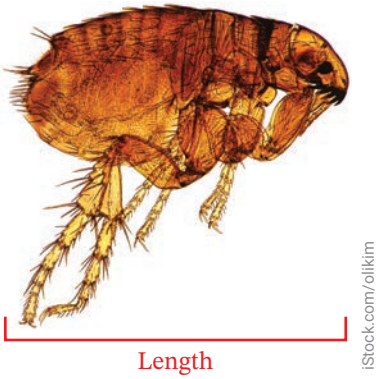
EXAMPLE 10

11 An electronics engineer designs a mobile phone SIM card using a diagram with a scale of 100 : 1. If the scaled drawing is 80 cm long, what is its actual length in millimetres? Select **A**, **B**, **C** or **D**. R C

A 80 **B** 8 **C** 0.8 **D** 0.08

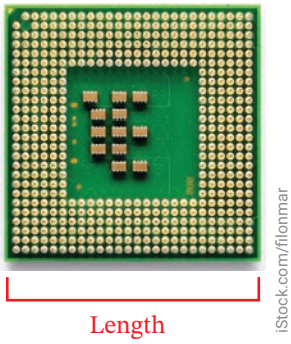
12 Measure the length of each magnified image below, then use the scale ratio to calculate its actual length in millimetres. R C

a Flea 100 : 1



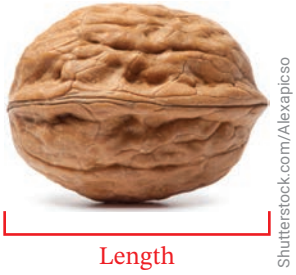
iStock.com/olikim

b Microchip 3 : 1



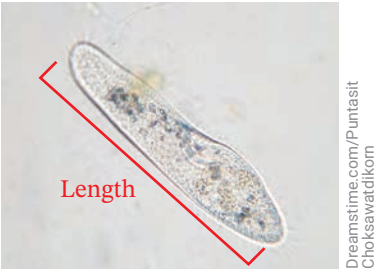
iStock.com/filonmar

c Nut 4 : 3



Shutterstock.com/Alexapicso

d Bacterium 100 : 1



Dreamstime.com/Puntasit Choksawatdikorn

Investigation

Scale drawings

1. Measure the dimensions of your bedroom and the dimensions of the items of furniture in it.
2. Using a scale of 1 : 100, draw a scale diagram of your bedroom on graph paper.
3. Draw scale diagrams of each piece of furniture on another piece of graph paper, then cut them out.
4. Rearrange the furniture in your bedroom on the scale diagram to see which arrangement you prefer best.

Foundation Standard Complex

9780170453141

Mental skills 11: Maths without calculators ANSWERS ON P. 578

24-hour time

24-hour time	12-hour time	24-hour time	12-hour time
00:00	12 a.m. (midnight)	12:00	12 p.m. (midday)
01:00	1 a.m.	13:00	1 p.m.
02:00	2 a.m.	14:00	2 p.m.
03:00	3 a.m.	15:00	3 p.m.
04:00	4 a.m.	16:00	4 p.m.
05:00	5 a.m.	17:00	5 p.m.
06:00	6 a.m.	18:00	6 p.m.
07:00	7 a.m.	19:00	7 p.m.
08:00	8 a.m.	20:00	8 p.m.
09:00	9 a.m.	21:00	9 p.m.
10:00	10 a.m.	22:00	10 p.m.
11:00	11 a.m.	23:00	11 p.m.

To convert from **24-hour time** to 12-hour time:

- if it begins with '00', then it is the 12 a.m. (midnight) hour
- if it begins with '12', then it is the 12 p.m. (midday) hour
- if it is less than 12:00, then it is a.m. (morning)
- if it is 13:00 or more, then it is p.m. (afternoon/evening) time: subtract 12 from the hour.

1 Study each example.

a Convert 18:50 to 12-hour time.

18:00 > 13:00, so it is p.m. time, so subtract 12 from the hour.

$18 - 12 = 6$

18:50 = 6:50 p.m.

b Convert 04:30 to 12-hour time.

04:30 < 12:00, so it is a.m. time.

04:30 = 4:30 a.m.

c Convert 00:15 to 12-hour time.

00:15 begins with 00, so it is 12 a.m. time

00:15 = 12:15 a.m.

2 Now convert each time to 12-hour time.

a	08:45	**b**	13:20	**c**	17:50	**d**	00:17
e	21:05	**f**	18:32	**g**	11:15	**h**	02:38
i	14:40	**j**	03:20	**k**	16:55	**l**	23:31
m	01:08	**n**	10:18	**o**	20:00	**p**	06:43

To convert from 12-hour time to 24-hour time:

- if it is the 12 a.m. (midnight) hour, begin with '00'
- if it is 'a.m.' time or the 12 p.m. (midday) hour, write as is but make sure the hour has 2 digits (for example, 02, 09).
- if it is 1 p.m. or later, then add 12 to the hour.

3 Study each example.

a Convert 4:10 a.m. to 24-hour time.

It is 'a.m.' time, so write as a 4-digit number and rename 4 as 04.

4:10 a.m. = 04:10

b Convert 4:10 p.m. to 24-hour time.

It is after 1 p.m., so add 12 to the hour: 4 + 12 = 16

4:10 p.m. = 16:10

c Convert 12:47 a.m. to 24-hour time.

It is in the 12 a.m. (midnight) hour, so change the 12 to 00.

12:47 a.m. = 00:47

4 Now convert each time to 24-hour time.

a	6:35 p.m.	**b**	8:05 a.m.	**c**	11:45 a.m.	**d**	11:20 p.m.
e	2:21 a.m.	**f**	12:30 p.m.	**g**	3:48 p.m.	**h**	7:11 p.m.
i	9:08 a.m.	**j**	9:50 p.m.	**k**	12:42 a.m.	**l**	7:39 a.m.
m	1:59 a.m.	**n**	10:18 p.m.	**o**	10:46 a.m.	**p**	5:23 p.m.

11.04 Dividing a quantity in a given ratio

Shares in ratios

Applying ratios

Applying ratios

Elyse and Henry won a cash prize of $420 for winning an art competition, but instead of dividing the money evenly ($210 each), they decide to divide it in the ratio 3 : 4, so that Elyse receives 3 parts while Henry receives 4 parts. Henry receives more because he did more of the work and paid more when buying the materials for the artwork.

Shutterstock.com/Africa Studio

Problems involving dividing a quantity in a given ratio can be solved using the **unitary method** or **fraction method**.

Example 11

Divide a cash prize of \$420 between Elyse and Henry in the ratio 3 : 4.

Solution

Method 1: Unitary method

Total number of parts $= 3 + 4 = 7$

7 parts $= \$420$

1 part $= \$420 \div 7$

$= \$60$

Elyse share $(3 \text{ parts}) = 3 \times \$60$

$= \$180$

Henry's share $(4 \text{ parts}) = 4 \times \$60$

$= \$240$

So Elyse receives \$180 and Henry receives \$240.

Check: $\$180 + \$240 = \$420$

Method 2: Fraction method

Total number of parts $= 3 + 4 = 7$

$$\text{Elyse share } (3 \text{ parts}) = \frac{3}{7} \times \$420$$

$$= \$180$$

$$\text{Henry's share } (4 \text{ parts}) = \frac{4}{7} \times \$420$$

$$= \$240$$

Example 12

Nick, Hong and Rob agreed to divide the profits of their removalist business in the ratio 2 : 3 : 5. If their profit this year was \$45 000, find the size of each person's share of the profits.

Solution

Method 1: Unitary method

Total number of parts $= 2 + 3 + 5 = 10$

10 parts $= \$45\,000$

1 part $= \$45\,000 \div 10$

$= \$4500$

Nick's share $= 2 \times \$4500$

$= \$9000$

Hong's share $= 3 \times \$4500$

$= \$13\,500$

Rob's share $= 5 \times \$4500$

$= \$22\,500$

Method 2: Fraction method

Total number of parts $= 2 + 3 + 5 = 10$

$$\text{Nick's share} = \frac{2}{10} \times \$45\,000$$

$$= \$9000$$

$$\text{Hong's share} = \frac{3}{10} \times \$45\,000$$

$$= \$13\,500$$

$$\text{Rob's share} = \frac{5}{10} \times \$45\,000$$

$$= \$22\,500$$

$\therefore$ Nick, Hong and Rob receive \$9000, \$13 500 and \$22 500 respectively.

Check: $\$9000 + \$13\,500 + \$22\,500 = \$45\,000$

EXERCISE 11.04 ANSWERS ON P. 578

Dividing a quantity in a given ratio U F PS R

1 Find the total number of parts if the ratio is:

a 2 : 7 **b** 4 : 1 **c** 3 : 4 **d** 2 : 5 : 6

Foundation | Standard | Complex

EXAMPLE 11

2 Divide $500 in the ratio:

a 4 : 1 **b** 7 : 3

3 Phuong, Janelle and Ahmet bought a Lotto ticket for $12. They contributed $3, $3 and $6 respectively to the purchase price. They won $4000 and agree to split the winnings in the same ratio. PS R

a Simplify the ratio 3 : 3 : 6.

b How much prize money does each person get?

4 George and Amal share the weekly rent of $390 in the ratio 7 : 6. What is Amal's share?

5 Divide 450 kg in the ratio:

a 4 : 5 **b** 3 : 2

6 Divide 720 cm in the ratio:

a 1 : 3 : 5 **b** 5 : 3 : 4

EXAMPLE 12

7 Company directors Judy, Gas and Robert share the company profits in the ratio 5 : 3 : 3. Which of the following is the amount that Judy receives in a year when profits are $121 000? Select the correct answer **A**, **B**, **C** or **D**. PS R

A $11 000 **B** $24 000 **C** $33 000 **D** $55 000

8 In Year 8, the ratio of boys to girls is 4 : 5. If there are 225 students in Year 8, find how many girls there are. PS

9 In Year 9, the ratio of boys to girls is 3 : 2. If there are 125 students in Year 9, how many more boys than girls are there? PS R

10 Adam needs to make 800 g of short-crust pastry. Flour and butter are needed in the ratio 3 : 1. How much flour is needed? PS R

11 A company posts 1386 letters in a week. The ratio of local to overseas letters is 2 : 7. How many overseas letters are sent in a week?

12 A truck carries fruit and vegetable boxes in the ratio 5 : 7. If it carries a total mass of 7.5 tonnes, what mass of vegetables does it carry? Select **A**, **B**, **C** or **D**. PS R

A 0.625 t **B** 3.125 t **C** 4.375 t **D** 6.873 t

13 An alloy of mass 176 kg is made from copper and zinc in the ratio 5 : 6. Find the mass of copper in the alloy.

14 At a school, the ratio of students who speak a second language to students who speak only English is 5 : 8. If there are 923 students at the school, how many students speak only English?

15 A 20 m cable is cut into 3 sections in the ratio 2 : 3 : 5. Find the length of each section.

16 When making mortar, sand and concrete is mixed in the ratio 6 : 1. If we need 280 kg of mortar, how much sand will we need? PS R

17 In a study of 225 000 people, it was found that the ratio of right-handed people to left-handed people was 13 : 2. PS R

a How many left-handed people were there?

b How many more right-handed people than left-handed people were there?

18 Angus earns twice as much as Catriona. If the sum of their wages is $210 000, how much does each earn? R

Rates 11.05

WS Rates

While a ratio compares 2 or more quantities measured in the same units, a **rate** compares 2 quantities measured in **different units**.

A rate shows how one quantity changes with another quantity. We write a rate using a '/' symbol in the form 'something *per* something else'. For example:

- the price of petrol is stated in cents per litre, or c/L
- your heart beats at a rate measured in beats per minute, or beats/min
- the speed of a car is measured in kilometres per hour, or km/h.

The word 'per' means 'for each' so we express a rate '*per* single unit'. For instance, travelling at a rate of 50 km/h means travelling 50 km in *each* hour.

Example 13

Write each statement as a simplified rate.

a A factory produces 87 cars in 3 hours

b Ham costs $50 for 8 kg

Solution

a The production rate would be expressed in cars per hour.

$$\text{Production rate} = \frac{87 \text{ cars}}{3 \text{ hours}}$$
$$= 29 \text{ cars/hour}$$

We can write a rate as a fraction: divide the number of cars by the number of hours

b The cost would be expressed in dollars per kilogram.

$$\text{Cost} = \frac{\$50}{8\text{kg}}$$
$$= \$6.25/\text{kg}$$

Divide the number of dollars by the number of kilograms

EXERCISE 11.05 ANSWERS ON P. 578

Rates U F R C

1 Write the units suitable for each rate below, in the form _____/_____. R C

a typing speed
b heart rate
c cost of a mobile phone call
d cost of bananas
e a person's wage
f a runner's speed
g population growth
h the cost of water
i population density of a country

EXAMPLE 13

2 Write each statement as a simplified rate. C

a 51 sheep in 3 hours
b $10.75 for 2.5 kg
c 208 students for 8 teachers
d 136 points in 4 games
e 546 words in 6 minutes
f 34 articles in 4 hours
g 72 cars in 14 days
h 5040 boxes in 8 hours
i 259 metres in 7 seconds
j 46 000 bottles in 50 hours
k 7944 revolutions in 6 minutes
l $175 for 5 hours
m 448 km in 8 hours
n $16.50 for 6 kg
o 114 runs in 24 overs
p 243 km using 30 litres
q $126 for 12 hours
r 2520 kg for 60 hectares

3 The cost of sending a 5.5 kg parcel to Malaysia is $88. What is the postage rate? Select the correct answer **A**, **B**, **C** or **D**. C

A $0.34/kg **B** $16/kg **C** $0.07/kg **D** $484/kg

4 In your own words, explain what is meant by each rate. C

a a speed of 100 km/h
b a traffic flow of 150 cars/h
c petrol consumption of 10.3 L/100 km
d a farmer keeping 60 sheep/hectare

5 A lift should carry no more than 1600 kg or 20 people. What is this weight allowance, in kg/person? C

6 A pulp mill clears 12 600 hectares of forest in 7 years. At what rate in hectares/year does the mill clear the forest? C

7 The cost of 53 litres of petrol is $73.67. Express this cost in c/L. C

8 A complaints hotline took 2190 calls in one year. Calculate the number of calls per month. C

Best buys

11.06

When shopping, it is important to compare the prices of different brands or sizes of items and calculate which is the **best buy** ('best value for money'). The biggest container does not always provide the best value. This can be done by comparing the **unit price** (cost of one item or unit) of each brand or size and choosing the cheapest one. A unit could be one gram or one millilitre.

Unit pricing

11.06

Best buys puzzle

Unit price

Unit price = cost ÷ number of items or units

Supermarkets are required by law to display unit prices to allow you to compare brands or sizes of items. If you look carefully at the price tags on their shelves, you will notice unit prices displayed in small print.

Example 14

Which brand of baked beans is the better buy?

$4.60 $1.65

Solution

Calculating the unit price (cost per gram) for each brand:

Bean There = $4.60 ÷ 500 = $0.0092 / g

Mr Beanz = $1.65 ÷ 200 = $0.00825 / g

Mr Beanz has the lower unit price, so it is the better buy.

EXERCISE 11.06 ANSWERS ON P. 579

Best buys U F PS R C

EXAMPLE 14

1 Find the better buy for each pair of items. PS R C

a A 2 kg box of sultanas for $8.85 or a 1 kg box for $4.65

b 6 notepads for $15.50 or 8 notepads for $20

c 45 g chips for $2.10 or 150 g for $6.50

d 2 tubs of yoghurt for $1.24 or 7 tubs for $4.30

e 3 kg of corn flour for $5.85 or 500 g of corn flour for $1

f 600 mL bottle of fruit juice for $3.20 or a 2.25 L carton for $8.05

Foundation Standard Complex

2 Michael purchased 400 g of ham for $3.59, while Kim purchased 300 g for $2.54. Who had the better buy? PS R C

3 Which size of Fruit Bix cereal is the best buy? PS R C

$4.75 **$3.49** **$2.51**

4 Happy Tam cat food can be purchased in 4 different packages.

Pack 1: 24 × 250 g cans for $39.99 Pack 2: 12 × 300 g cans for $24.99

Pack 3: 9 × 400 g cans for $25.99 Pack 4: 6 × 1 kg cans for $38.50

Order these packs from best to worst buy. Select the correct answer **A**, **B**, **C** or **D**. PS R C

A 4, 2, 1, 3 **B** 3, 2, 1, 4 **C** 4, 1, 2, 3 **D** 2, 1, 3, 4

5 For each item, find which size is the best value for money. PS R C

a

375 g

$1.90

Alamy Stock Photo/Oliver Hoffmann

750 g

$3.90

Shutterstock.com/Bahadir Yeniceri

b

2 L

$3.25

Shutterstock.com/Marek Tr

375 mL × 6

$3.85

Shutterstock.com/Gts

c

440 g

$2.21

Smart Media/Jalna

735 g

$2.78

Smart Media/Jalna

d

235 g

$4.20

175 g

$3.20

115 g

$1.80

Shutterstock.com/Lipowski Milan

Foundation Standard Complex

9780170453141

6 For each item, which size gives the best value for money? PS R C

		Small	Medium	Large
a	Washing powder	450 g for $3.99	600 g for $5.15	1 kg for $8.95
b	Margarine	350 g for $4.15	500 g for $5.99	750 g for $8.50
c	Ice cream	500 mL for $1.39	750 mL for $2.30	2 L for $5.99
d	Peas	400 g for $2.05	500 g for $2.49	600 g for $2.50

Rate problems 11.07

Problems involving rates can usually be solved by multiplying or dividing.

Rate problems
Rate problems
Ratios and rates review
Rate problems
Rate problems 2

Solving rate problems

- Write the units of the rate x/y as a fraction: $\frac{x}{y}$
- To find the quantity in the numerator, x, **multiply** by the rate.
- To find the quantity in the denominator, y, **divide** by the rate.

Example 15

Lucas types 55 words per minute. How many words can he type in 20 minutes?

Solution

The units of the rate expressed as a fraction is $\frac{\text{words}}{\text{min}}$.

To find the number of words (the numerator), **multiply** by the rate.

$$\text{Number of words} = 20 \times 55$$
$$= 1100$$

No. of minutes × words typed per minute

Example 16

A factory makes pens at the rate of 50 pens per minute.

a How many hours and minutes will it take to produce 10 000 pens?

b How many pens are produced in an 8-hour day at the factory?

Solution

The units of the rate expressed as a fraction are $\frac{\text{pens}}{\text{min}}$.

a To find the number of minutes (the denominator), **divide** by the rate.

How many times 50 divides into 10 000.

$$\begin{aligned}\text{Time taken} &= 10\,000 \div 50 \\ &= 200 \text{ minutes} \\ &= \frac{200}{60} \text{ hours} \\ &= 3 \text{ h } 20 \text{ min}\end{aligned}$$

b To find the number of pens (the numerator), **multiply** by the rate.

$$\begin{aligned}\text{No. of pens in one hour} &= 60 \times 50 \\ &= 3000\end{aligned}$$

1 h = 60 min

No. of mins × pens per min

$$\begin{aligned}\text{No. of pens in 8 hours} &= 8 \times 3000 \\ &= 24\,000\end{aligned}$$

EXERCISE 11.07 ANSWERS ON P. 579

Rate problems U F PS R C

EXAMPLE 15

1 Marisol is paid $17.80 per hour. How much will she earn if she works 38 hours in a week?

2 A cricket batsman scores at a rate of 32 runs per innings. How many runs will he score in 5 innings?

EXAMPLE 16

3 A car uses 14 litres of petrol to travel 147 kilometres. PS R

a Write this as a rate in km/L.

b How far can the car travel on 20 litres of petrol?

4 A farmer can graze 16 sheep per hectare. If he has 21 hectares set aside for sheep, how many sheep can he graze?

5 A tap drips water at a rate of 18 mL/h. How much water would be wasted in one day? PS R

6 An aeroplane can carry a total of 450 passengers per flight. How many flights would it take to carry 2700 passengers? PS R

7 The Wong family needs to buy new carpet for the family home. The carpet costs $125/m and the carpet layers charge $480 to lay it. How much will it cost to carpet the house if the Wongs need 28 metres of carpet? PS R

8 A farmer uses fertiliser at a rate of 28 kg/ha. How many hectares can she cover if she has 200 kg of fertiliser? PS R

Foundation Standard Complex

9780170453141

9 Tatiana is paid $17.50/hour to babysit. PS R

a How much does she earn for babysitting for 4 hours?

b How long did she babysit to earn $43.75?

10 A plane travelled at 900 km/h. How far did it travel in 20 minutes? PS R

11 **a** Petrol costs $1.35/L. If Rico had $20 in his pocket, how much petrol could he buy (correct to the nearest 0.1 litre)?

b If Rico's car can travel 9 km on one litre of petrol, how far can he travel on the petrol he bought with $20? PS R

12 Smokers lose approximately 3% of their lung capacity per year. If Ella with 100% lung capacity starts smoking at 20 years of age, at what age will she have 25% lung capacity? Select the correct answer **A**, **B**, **C** or **D**. PS R

A 75 **B** 28 **C** 45 **D** 33

13 The temperature in Mittagong at 7 a.m. is 8°C. If the temperature rises at a rate of 3°C/h, find: PS R

a the temperature at 10 a.m. and at 2 p.m.

b the time at which the temperature will be 23°C.

14 Keira and Xander take turns mowing a rectangular lawn 60 m long and 40 m wide. PS R

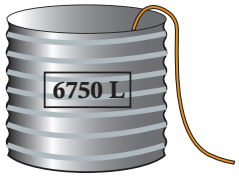
a Find the area of the lawn.

b When Keira cuts the grass, she does it in one hour using an old lawn mower. What is her mowing rate in m^2/min?

c Xander uses a new lawn mower and it takes him 40 minutes. What is his mowing rate in m^2/min?

d How long will it take them to mow the lawn if they mowed together?

15 Jayden is filling this tank with a pipe that pumps water at 1.25 litres per second.



How long will it take to fill the tank: PS R C

a in seconds? **b** in minutes? **c** in hours?

16 Mikayla and Jesinta started their holiday on a full tank of petrol. The reading on the odometer (in km) was

0	3	4	5	6	8

When the tank became empty, the reading was

0	3	5	2	1	8

Petrol cost $1.54/litre and they needed to pay $73.92 to fill the tank. PS R

a How many kilometres did they travel on a full tank of petrol?

b How much petrol is there in a full tank?

c How far can their car travel on 1 L of petrol? Answer to the nearest 0.1 km.

11.08 Speed

WS Speed

WS What's my speed?

Speed

Rates: Triangle method

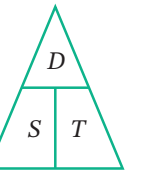
Speed is a rate that compares the distance travelled with the time taken. Average speed is calculated by dividing the distance travelled by the time taken.

Speed

$$\text{Average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

Speed can be measured in kilometres/hour (km/h) or metres/second (m/s).

The relationship between distance, speed and time can be remembered using this triangle.



If we cover the quantity we are looking for, the rest of the diagram tells us what to do.

- To find the speed, cover the S and we are left with $\frac{D}{T}$, so speed = distance ÷ time
- To find the distance, cover the D and we are left with $S \times T$, so distance = speed × time
- To find the time, cover the T and we are left with $\frac{D}{S}$, so time = distance ÷ speed

Example 17

A bullet train travels 320 km in 1 hour and 20 minutes.

a Calculate its average speed.

b How long will it take to travel 1000 km?

c How far will it travel in 5 hours?

Solution

a $\text{Average speed} = \frac{\text{distance}}{\text{time}}$

$= \frac{320 \text{ km}}{1 \text{ h } 20 \text{ min}}$

$= \frac{320 \text{ km}}{1\frac{1}{3} \text{ h}}$

$= 240 \text{ km/h}$

$20 \text{ min} = \frac{20}{60} \text{ h} = \frac{1}{3} \text{ h}$

b $\text{Time} = \frac{\text{distance}}{\text{speed}}$

$= \frac{1000}{240} \text{ h}$

$= 4\frac{1}{6} \text{ h}$

$= 4 \text{ h } 10 \text{ min}$

By the speed triangle, or because we divide by the rate to find the h in $\frac{\text{km}}{\text{h}}$.

Press °′″ or DMS on the calculator.

c Distance = speed × time
= 240 × 5
= 1200 km

By the speed triangle, or because we multiply by the rate to find the km in $\frac{\text{km}}{\text{h}}$.

EXERCISE 11.08 ANSWERS ON P. 579

Speed U F PS R C

EXAMPLE 17

1 Find the average speed in km/h for each statement.

a A horse rider travels a distance of 15 km in 3 hours
b A jet travels 2400 km in 5 hours
c A bushwalker walks 25 km in 5 hours
d A cyclist rides 85 km in 5 hours
e A motorbike travels 250 km in 2.5 hours
f A car travels 280 km in 3.5 hours
g A truck travels 390 km in 3 hours and 15 minutes
h A car travels 90 km in 45 minutes
i A motorbike on the race track travels 250 km in 1 hour and 15 minutes
j A boat travels 15 km in 1 hour and 40 minutes
k An athlete runs 200 m in 20 seconds
l A kangaroo travels 1.5 km in 15 minutes

2 Find the average speed in m/s for each statement.

a An athlete runs 200 m in 20 seconds
b A swimmer swims 100 m in 64 seconds
c A bird flies 348 m in 6 seconds
d A cyclist travels 960 m in 2 minutes
e A swimmer swims 1500 m in 16 minutes and 40 seconds

3 Find the distance travelled for each statement.

a A car travels for 8 hours at an average speed of 90 km/h.
b A bushwalker travels for 7 hours and 30 minutes at an average speed of 4 km/h.
c A truck travels for 14 hours at an average speed of 95 km/h.

4 Majid can walk at a speed of 6 km/h. How far can he walk in 30 minutes?

5 A boat travels 24 km in 90 minutes. What is its average speed? Select the correct answer **A**, **B**, **C** or **D**.

A 12 km/h **B** 16 km/h **C** 18 km/h **D** 36 km/h

6 Peter walked to school in 15 minutes, a distance of 1500 metres. Find his speed in: R C

a metres per minute **b** kilometres per hour

Foundation Standard Complex

7 Mrs Hassam lives 20 km from the nearest railway station and it takes her 30 minutes to drive there in her car. Find her average speed in km/h.

8 A racing car travels at an average speed of 210 km/h for 2 hours and 20 minutes. How far did it travel? Select **A**, **B**, **C** or **D**. PS R

A 90 km **B** 294 km **C** 462 km **D** 490 km

9 A flywheel rotates at a rate of 2400 revolutions per minute. How many revolutions does it make in 30 seconds? R

10 How long does it take a motor scooter to travel 60 km at a speed of 40 km/h? R

11 There are other units for measuring speed, such as the **knot** and the **mach.** Find what these special terms mean and where they are used. C

12 A bus travels at 75 km/h for 5 hours, and then travels a further distance of 200 km in 4 hours. Find the average speed for the whole journey, correct to one decimal place. PS R

13 A car travels for 3 hours at 60 km/h and then travels a further distance of 100 km at 50 km/h. What is the average speed for the trip? PS R

14 Kieran swims at a speed of 1.85 m/s. What would be his time (to 2 decimal places) for a 100 metre sprint? PS R

15 Nia runs 200 metres in 24 seconds. How far will she run in one minute at the same rate? PS R

Did you know?

Running speeds

The current world records for some of the Olympics running events are shown below, along with the equivalent speed in km/h.

Event	World record	Equivalent speed
Mens		
100 m	9.58 s	37.58 km/h
200 m	19.19 s	37.52 km/h
400 m	43.03 s	33.47 km/h
800 m	1 min 40.91 s	28.54 km/h
1500 m	3 mins 26 s	26.21 km/h
4 × 100 m relay	36.84 s	39.09 km/h
Womens		
100 m	10.49 s	34.52 km/h
200 m	21.34 s	33.74 km/h
400 m	47.6 s	30.25 km/h
800 m	1 min 53.28 s	25.42 km/h
1500 m	3 mins 50.07 s	23.47 km/h
4 × 100 m relay	40.82 s	35.28 km/h

Shutterstock.com/Maxisport

What do you notice about the speeds as the length of the race increases?
Why would the speeds for the 4 × 100 m relays be faster than the speeds for 400 m?

Foundation Standard Complex

Technology

Travelling distances and times

Visit a map website such as Google Maps or WhereIs for this investigation to examine travelling distances and times between 2 locations.
Aidan lives near the Wyong Hill Reserve in NSW and is travelling to the Tuggerah shopping centre to see a movie.

1 Use the website to locate both Wyong Hill Reserve and Tuggerah shopping centre, then find the travelling distance and time for Aidan's trip if he is going by car.

2 Find the travelling distance and time for Aidan's trip if he is travelling on foot (walking).

3 How much further would you have to travel if you were going from the Wyong Hill Reserve to the shops by car instead of walking there?

4 Would you recommend that Aidan travel by car or on foot for the trip? Why?

5 a Calculate the average speed of the car for the trip.

b Why do you think this average speed is slower than the normal speed limit of 60 km/h?

6 Aidan is meeting Alinta at Tuggerah to see a movie. Alinta lives in Berkeley Vale. Find the travelling distance and time for Alinta's trip if she is travelling by car.

7 If Alinta's actual driving time was 5 minutes, what was her average speed?

8 If Aidan's actual speed was 80 km/h, how many minutes and seconds will his trip take?

9 So will Aidan or Alinta arrive at Tuggerah first? By how many minutes and seconds?

Travel graphs 11.09

A **travel graph** or **distance–time graph** is a line graph that describes a journey, by comparing distance (on the vertical axis) with time (on the horizontal axis). The slope or steepness of the graph indicates the speed.

The hare and the tortoise


Jane's diary


Travel graphs

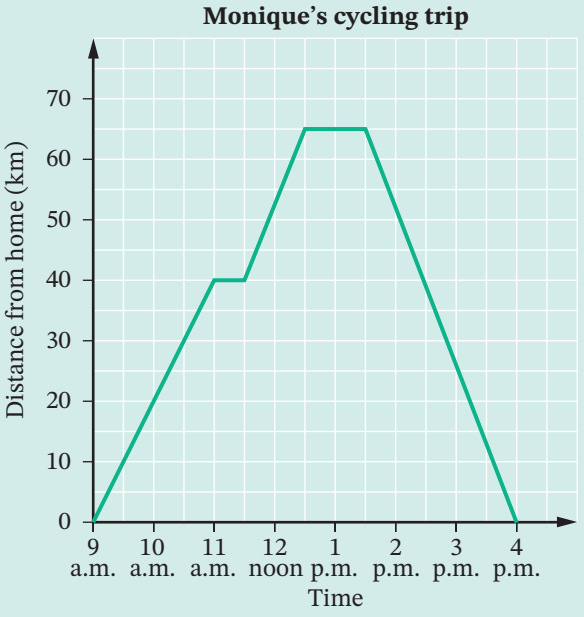
Travel graphs

On a **travel graph**:

- a horizontal (flat) section on the graph indicates a stop (the traveller is stationary)
- the steeper the line, the greater the speed (more distance covered in less time)
- a section going down, towards the right, indicates a change in direction or that the traveller is returning towards the start.

Example 18

This graph shows Monique's cycling trip.



a At what time did Monique leave home?

b When was Monique's first stop? How far from home was she?

c Find her average speed over the first 2 hours.

d What time was it when Monique began her journey home?

e How far did she travel all together?

f Find her average speed during the trip home.

g For how long did Monique stop altogether during the trip?

Solution

a Monique left home at 9 a.m.

At the start of the graph, when distance = 0.

Where the graph is flat, the distance from home does not change, which means that Monique has stopped

b Monique first stopped at 11 a.m., 40 km from home. This is where the graph is flat.

c Distance = 40 km, time = 2 hours

$$\text{Average speed} = \frac{40 \text{ km}}{2 \text{ h}} = 20 \text{ km/h}$$

d Monique started returning home at 1:30 p.m. This is where the graph points downward.

e Monique travelled 65 km, then returned home.

Total distance = 2×65 km = 130 km

f Distance = 65 km, time = $2\frac{1}{2}$ hours

$$\text{Average speed} = \frac{65 \text{ km}}{2\frac{1}{2} \text{ h}} = 26 \text{ km / h}$$

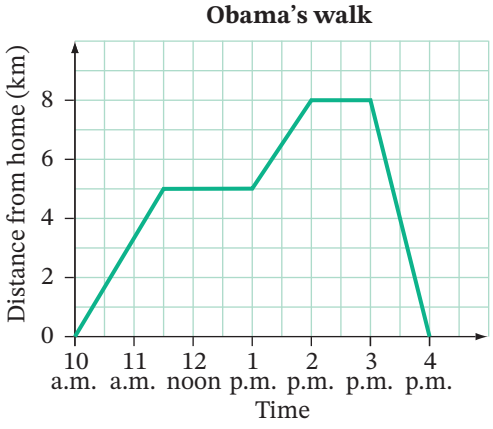
g First stop: $\frac{1}{2}$ hour. Second stop: 1 hour

Total stopping time = $\frac{1}{2} + 1 = 1\frac{1}{2}$ hours

EXERCISE 11.09 ANSWERS ON P. 579

Travel graphs U F PS R C

1 This travel graph shows Obama's return trip to his friend Joe's house. R C



a How long did it take Obama to walk to Joe's house?

b How far is Joe's house from Obama's house?

c Find Obama's average speed:

i before his first stop

ii after his first stop

d How is a higher speed shown on the graph?

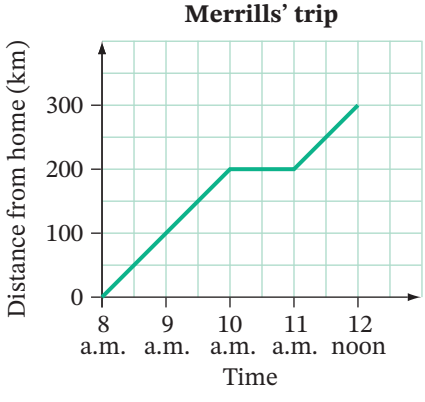
e What was the total distance that Obama travelled?

f Between what times does Obama stop on his walk?

g When did Obama start his trip home?

h How long did it take him to walk home?

2 Merrill drives from Sydney to Canberra, stopping to visit friends in Goulburn. R C



a How far is Canberra from Sydney?

b How long does the trip take?

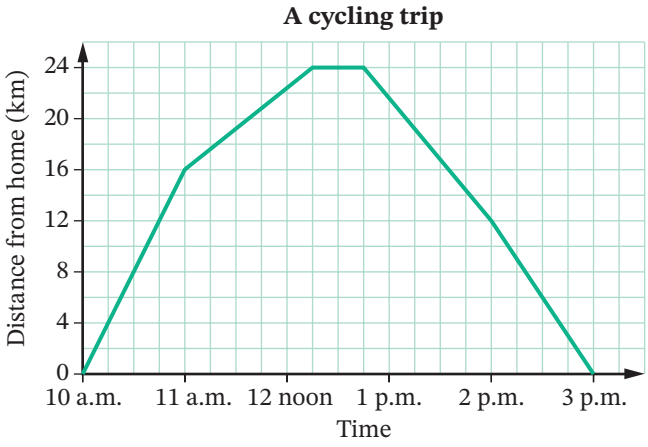
c For how long does Merrill stop at Goulburn?

d Find her average speed for the journey (excluding stops).

e How far is it from Goulburn to Canberra?

f When does Merrill travel faster: before or after Goulburn?

3 This graph shows a cyclist's day trip. R C



a At what time did the speed of the cyclist

i increase? **ii** decrease?

b When did the cyclist start to return home?

c How far did the cyclist travel altogether on this day?

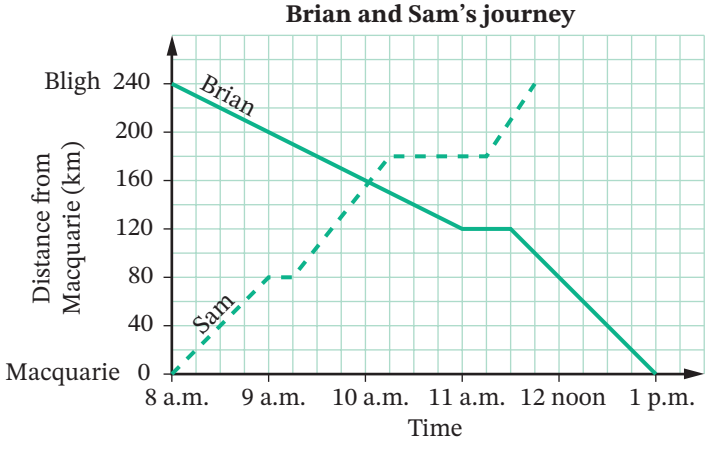
d How long did the cyclist spend 'on the road'?

e Find the cyclist's average speed for:

i the first hour **ii** 11 a.m. to 12:15 p.m.

iii 12:45 p.m. to 2 p.m. **iv** the entire day

4 Brian travels from Bligh to Macquarie, while Sam travels from Macquarie to Bligh. R C



a How far is it between the 2 towns?

b Who is travelling faster? How can you tell?

c How far is Brian from Macquarie at 11 a.m.?

d How far is Sam from Macquarie at 11 a.m.?

Foundation Standard Complex

9780170453141

e At what time do Brian and Sam pass each other? How far are they from Macquarie when they pass?

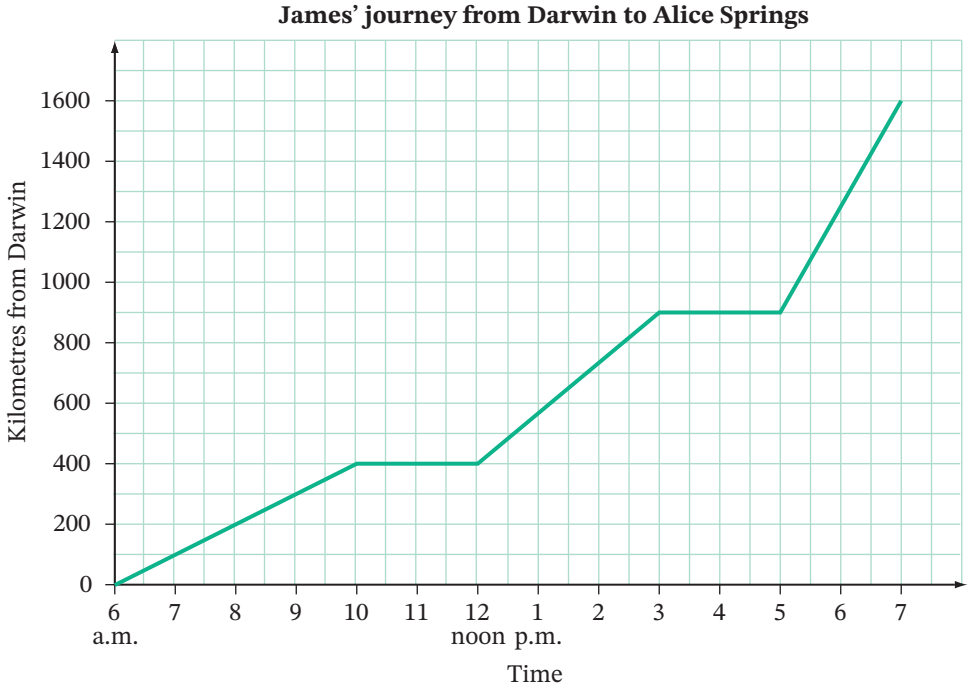
f Is Sam travelling faster before 9 a.m. or after 9:15 a.m.? How does the graph show this?

g Calculate Brian's average speed before he stops.

h For how long did Sam stop altogether on the trip? Select **A**, **B**, **C** or **D**.

A 60 minutes **B** 75 minutes **C** 5 minutes **D** 90 minutes

5 This graph illustrates James' trip from Darwin to Alice Springs. PS R C



a How far is Alice Springs from Darwin?

b When did James arrive in Alice Springs?

c What was James' average speed in the last 2 hours?

d Which of the following statements is false? Select **A**, **B**, **C** or **D**.

A James stopped for 4 hours altogether.

B James was travelling fastest in the last 2 hours.

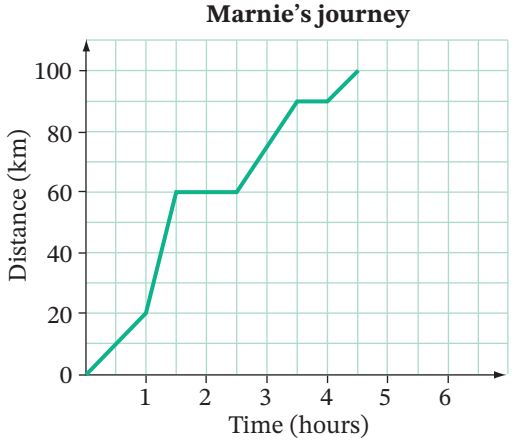
C James' speed for the first 4 hours was 100 km/h.

D James' average speed for the whole trip was 120 km/h.

e Samantha leaves Darwin one hour after James and travels at a constant speed of 125 km/h towards Alice Springs. Copy the graph and add Samantha's journey to it.

f Find the approximate time when Samantha overtakes James.

6 This travel graph shows Marnie's cycling journey. Write a story about her ride, based on the information in the graph. C



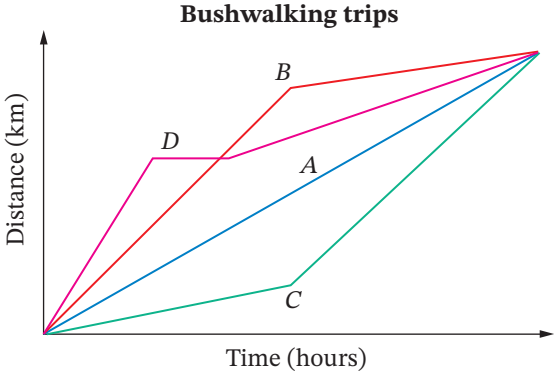
7 Match each bushwalker described below with the correct travel graph. R C

a Santosh maintained the same speed all day.

b Michelle was fast at first, but slowed down.

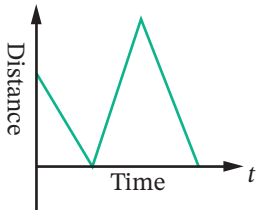
c Tahlia was the fastest, but then got slower after stopping for lunch.

d Jim was slow at first, but picked up speed.

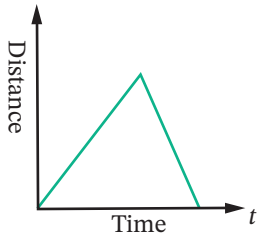


8 Which one of these graphs could **not** be a travel graph? Why not? R C

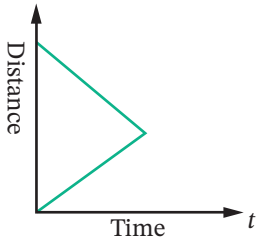
a



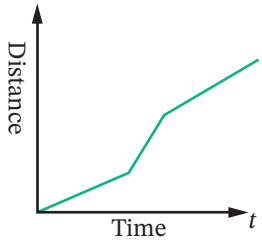
b



c



d



Foundation Standard Complex

9780170453141

Sketching informal graphs 11.10

While **line graphs** are useful for describing relationships and changes between variables, in most real-life situations, the graphs are more likely to be informal and involve **curves** rather than straight lines.

Example 19

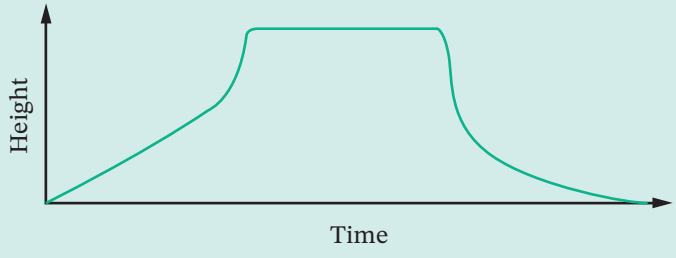
Draw a graph to represent a bath's water level over time.

- Jacob switches on the tap and the water level gradually rises.
- He switches off the tap, gets into the bath and the water level quickly rises.
- Jacob stays in the bath for a while before climbing out, reducing the water level again.
- He unplugs the bath and it drains completely: the water level decreasing quickly at first, then slowly towards the end.

Solution

The horizontal axis should represent Time.

The vertical axis should represent Height of water.



EXERCISE 11.10 ANSWERS ON P. 580

Sketching informal graphs U F PS R C

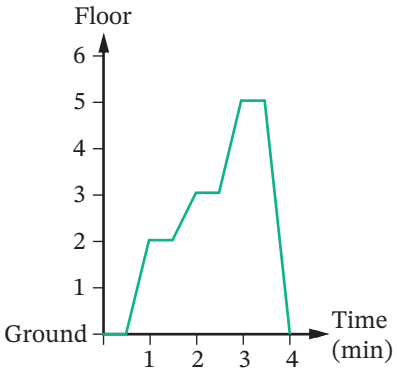
EXAMPLE 19

1 Sketch a graph of the noise level of this classroom. PS R C

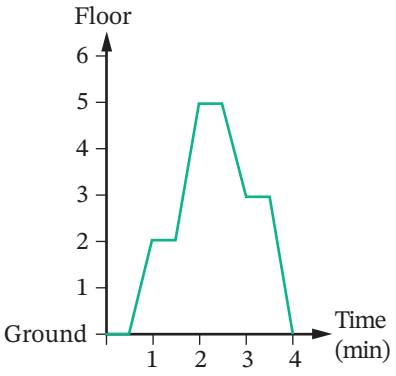
- The students enter the classroom and the noise level increases.
- They settle down and work quietly.
- There are small group discussions and then the teacher talks.
- Towards the end of the lesson the noise level increases.
- Then the teacher speaks about the homework for the night and the class is dismissed.

2 The lift in a 6-storey building started at the ground floor, went to the 2nd floor, then the 5th floor, then the 3rd floor, before returning to ground floor. Which graph represents this situation? Select the correct answer **A**, **B**, **C** or **D**. R C

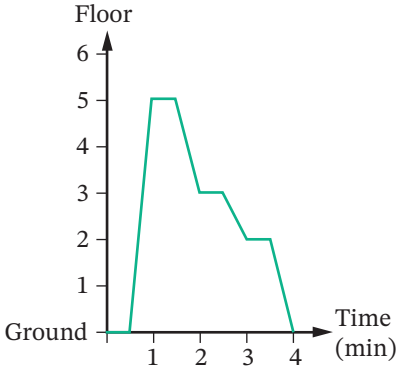
A



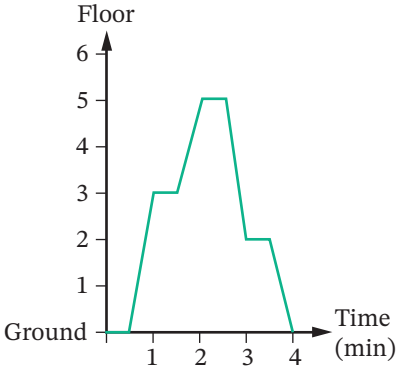
B



C

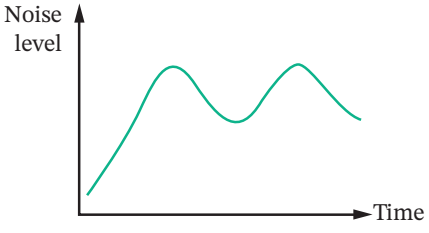


D

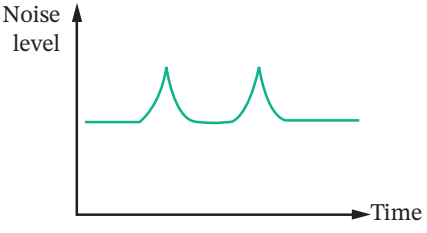


3 Match each graph of noise level to the Year 8 class described. R C

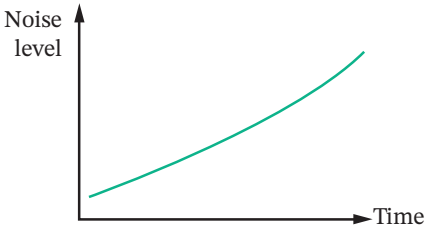
a



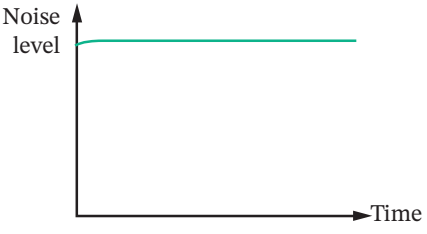
b



c



d

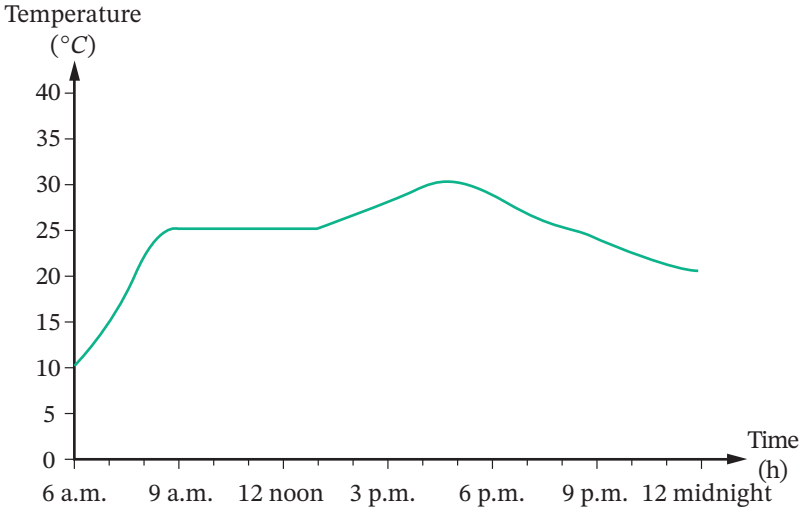


Foundation Standard Complex

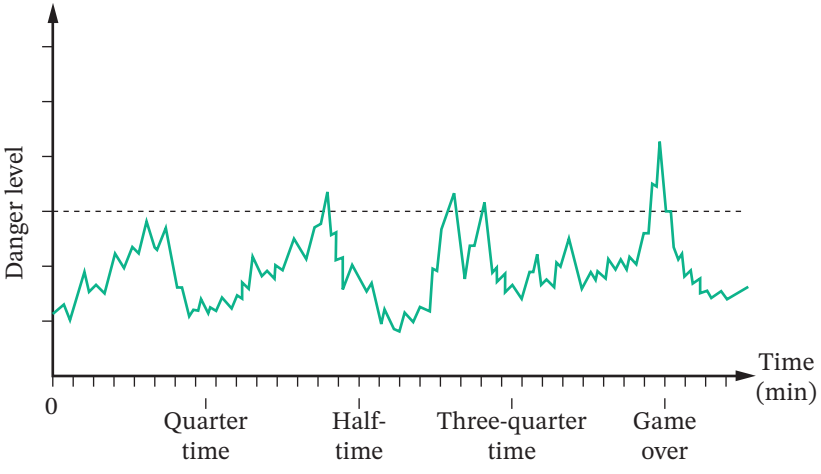
9780170453141

- 8 Green is constantly noisy.
- 8 Yellow is quiet until the teacher leaves the room.
- 8 Brown is regularly told to be quiet by their teacher.
- 8 Red just gets louder and louder.

4 Write a story to describe the changes in temperature over a day as shown on this graph. R C



5 Grandad likes watching basketball, but during a match his level of excitement (measured by his heart rate) can reach dangerous levels, as shown by the graph below. R C



a Describe Grandad's excitement level in the first quarter.

b How many times does he become too excited during the match?

c What happens to his excitement level after the match?

d Describe what might have happened in the final quarter to make him so excited.

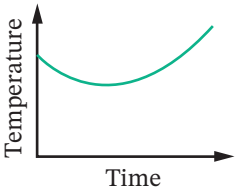
6 A triathlete has this training program for a marathon:

- Start at 5 a.m., run 12 km in 2 hours, rest $\frac{1}{2}$ hour.
- Run a further 8 km in the next hour, rest $\frac{1}{2}$ hour.
- Pick up bike and cycle home, arriving at 10 a.m.

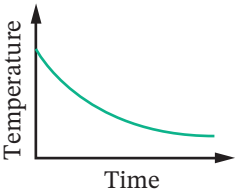
Draw the graph of this training session. PS R C

7 A bowl of soup sits on the kitchen bench cooling. At first it loses heat quickly, but as time passes it loses heat more slowly until it reaches room temperature. Which graph below best illustrates this? Select **A**, **B**, **C** or **D**. R C

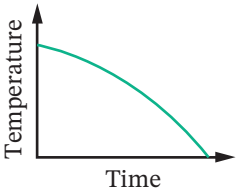
A



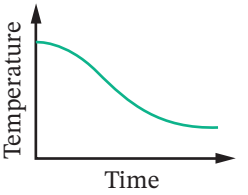
B



C



D



8 Sketch a graph to represent each situation. PS R C

a The temperature in your town over a 24-hour period.

b The volume of petrol in a car. It is filled up, then runs for a while, stops for some time and then continues the trip.

c The height of a plane travelling from Sydney to London with a refuelling stop in Dubai.

d The number of cans of drink in a vending machine if it is filled in the morning and in the afternoon.

e Your hunger level over a day during your waking hours.

11.11 Time differences

Time differences

Units of time

Example 20

What is the difference in time between 8:35 a.m. and 3:10 p.m.?

Foundation Standard Complex

9780170453141

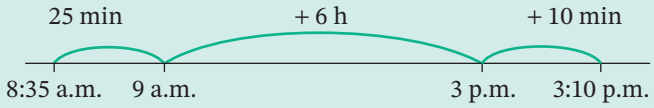
Solution

Method 1

From 8:35 a.m. to
9 a.m. = 25 minutes

From 9 a.m. to
3 p.m. = 6 hours

From 3 p.m. to
3:10 p.m. = 10 minutes



Total time difference = 6 h + 25 min + 10 min
= 6 h 35 min

Method 2

Convert to 24-hour time first, then use the calculator's °’” or DMS key to subtract the times.

Time difference = 3:10 p.m. − 8:35 a.m.
= 15:10 – 08:35
= 6 h 35 min

15 °’” 10 °’” − 8 °’” 35 °’” =.

Example 21

Find 7 h 5 min − 3 h 24 min.

Solution

$7\text{ h }5\text{ min} - 3\text{ h }24\text{ min} = (7-3)\text{h} + (5-24)\text{min}$
$= 4\text{ h} + (-19)\text{min}$
$= 3\text{ h }(60-19)\text{min}$
$= 3\text{ h }41\text{ min}$

OR On a calculator, enter 7 °’” 5 °’” − 3 °’” 24 =

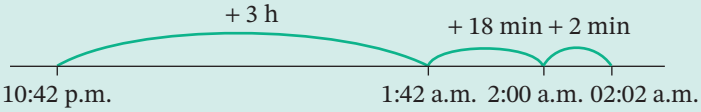
Example 22

What is the time 3 hours and 20 minutes after 10:42 p.m.?

Solution

3 hours after 10:42 p.m.
is 1:42 a.m.

20 minutes after
1:42 a.m. is 2:02 a.m.



EXERCISE 11.11 ANSWERS ON P. 580

Time differences U F PS R C

EXAMPLE 20

1 What is the difference in time between 11:42 a.m. and 2:13 p.m.? Select the correct answer **A**, **B**, **C** or **D**.

A 2 h 31 min **B** 3 h 55 min **C** 9 h 29 min **D** 11 h 55 min

2 Calculate the time difference between:

a 6:15 p.m. and 8:10 p.m.
b 11:16 a.m. and 12:06 p.m.
c 4:10 a.m. and 8:55 a.m.
d 11:25 p.m. and 3:20 a.m.
e 07:25 and 13:10
f 21:20 and 08:15
g 4:10 a.m. and 12:15 p.m.
h 09:40 and 13:10
i 12:45 and 17:25

EXAMPLE 21

3 Simplify each expression.

a 2 h 15 min + 4 h 32 min
b 3 h 25 min + 8 h 27 min
c 6 h 42 min − 3 h 13 min
d 12 h 37 min − 5 h 6 min
e 7 h 12 min + 5 h 18 min
f 1 h 42 min + 6 h 27 min
g 15 h 57 min − 9 h 48 min
h 6 h 2 min − 4 h 17 min
i 9 h 37 min + 2 h 52 min
j 4 h 49 min + 7 h 18 min
k 8 h 18 min − 3 h 27 min
l 5 h 31 min − 3 h 48 min

4 A film starts at 3:14 p.m. and ends at 5:09 p.m. How long is the film?

5 This part of a timetable is a schedule for a bus travelling between Sydney and Wagga Wagga. PS R C

Sydney to Wagga Wagga		Wagga Wagga to Sydney	
Sydney	2:30 p.m.	Wagga Wagga	7:15 a.m.
Strathfield	3:00 p.m.	Gundagai	8:25 a.m.
Yagoona	3:20 p.m.	Jugiong	8:54 a.m.
Liverpool	3:45 p.m.	Yass	9:41 a.m.
Mittagong	4:40 p.m.	Goulburn*	10:41 a.m.
Goulburn*	5:40 p.m.	Mittagong	12:10 p.m.
Yass	7:10 p.m.	Liverpool	1:05 p.m.
Jugiong	7:55 p.m.	Yagoona	1:20 p.m.
Gundagai	8:20 p.m.	Strathfield	1:35 p.m.
Wagga Wagga	9:30 p.m.	Sydney	2:05 p.m.

* 30 minute meal stop at Goulburn

a How long does the trip from Sydney to Wagga Wagga take?
b How long would the trip take without a meal break?
c Ali joins the return bus at Jugiong and gets off at Liverpool. How long is his trip?
d Find the time taken from Liverpool to Sydney, and from Sydney to Liverpool on the return trip. Suggest a reason for the difference.

Foundation Standard Complex

e At what time does the bus from Wagga Wagga arrive in Goulburn?

f Where is the return bus at 1:35 p.m.?

g Renee is waiting at Yagoona at 2:45 p.m. for the bus to Mittagong. How long will she have to wait before the bus arrives and when will she reach Mittagong?

EXAMPLE 22

11.11

6 What time will it be:

a 6 hours after 2 p.m.?

b 3 hours after 10 a.m.?

c 20 minutes after 7:15 p.m.?

d 2 hours 32 minutes after 10:45 a.m.?

e 3 hours 29 minutes after 10:35 p.m.?

f 5 hours after 9:32 a.m.?

g 9 hours after 6:17 p.m.?

h 55 minutes after 3:30 p.m.?

i $4\frac{1}{4}$ hours after 4:30 a.m.?

j 5 hours and 25 minutes after 9:45 a.m.?

7 A car rally began at 8:20 a.m. Here are some of the cars and the times they ran. Write the cars in their order of finishing and the time each crossed the finishing line. R C

Toyota 6:21 (6 h 21 min) Volvo 5:23 Ford 5:44

Nissan 6:01 Subaru 5:59 Peugeot 5:42

8 This is part of the ferry timetable for Woy Woy to Empire Bay. PS R C

MONDAY TO FRIDAY					
FERRY DEPARTS FROM WOY WOY					
DEPARTS	SARATOGA	DAVISTOWN			ARRIVES
Woy Woy	Veterans Hall	Lintern St.	Central (RSL)	Pine Av.	Empire Bay
6:35 a.m.	6:45 a.m.	6:50 a.m.	7:00 a.m.	–	–
7:45 a.m.	7:55 a.m.	8:00 a.m.	8:10 a.m.	8:10 a.m.	8:15 a.m.
9:00 a.m.	9:10 a.m.	9:15 a.m.	9:25 a.m.	9:25 a.m.	9:30 a.m.
10:45 a.m.	10:55 a.m.	11:00 a.m.	11:10 a.m.	11:10 a.m.	11:15 a.m.
12:30 p.m.	12:40 p.m.	12:45 p.m.	12:55 p.m.	12:55 p.m.	1:00 p.m.
1:50 p.m.	2:00 p.m.	2:05 p.m.	2:15 p.m.	2:15 p.m.	2:20 p.m.
3:30 p.m.	3:40 p.m.	3:45 p.m.	–	–	–
4:50 p.m.	5:00 p.m.	5:05 p.m.	5:15 p.m.	–	–
5:50 p.m.	6:00 p.m.	6:05 p.m.	6:15 p.m.	–	–
6:50 p.m.	7:00 p.m.	7:05 p.m.	7:15 p.m.	7:15 p.m.	7:20 p.m.

a How many trips from Woy Woy arrive at Empire Bay each weekday?

b If Elise catches the 7:45 a.m. ferry from Woy Woy, at what time will she arrive at Empire Bay?

c If Toby catches the 2:05 p.m. ferry from Lintern St, where will he be at 2:15 p.m.?

d Adele needs to be at Central (RSL) before 10 a.m. What is the latest ferry she can catch from Saratoga to be there on time?

e How long does it take to travel from Saratoga to Empire Bay?

f At what time does the last ferry leave Woy Woy in the evening?

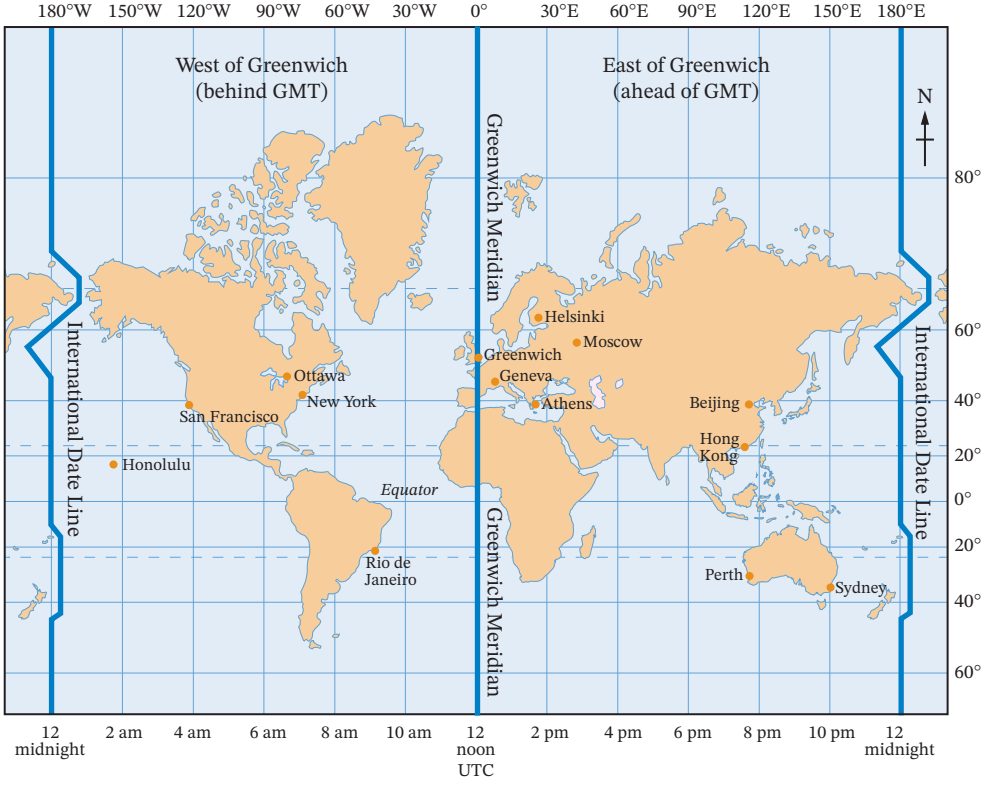
g Suppose a new ferry service departs Woy Woy at 11:15 a.m. What time should it arrive at Pine Avenue?

11.12 World time zones

WS World time zones

WS Australian times

The world is divided into 24 hourly **time zones**. Time is the same throughout each zone. The centre of each time zone is a meridian of longitude (an imaginary line running from the North Pole to the South Pole). Each hourly time zone covers 15° of longitude.



The map above shows how times around the world are related. All time is measured in relation to the time at the Greenwich Observatory (in London), either ahead of or behind **UTC (Coordinated Universal Time)**, also known as **Greenwich Mean Time (GMT)**. Greenwich is pronounced 'Grennitch'. Time zones in Australia are ahead of UTC because Australia is east of Greenwich. Time zones in the USA are behind UTC because the USA is west of Greenwich.

Example 23

For each country, use the map to determine whether it is ahead of or behind UTC.

a South Africa **b** Canada **c** Chile **d** China

Solution

a On the map, South Africa is to the right (east) of the Greenwich Meridian.
South Africa is ahead of UTC.

b Canada is in North America, to the left (west) of the Greenwich Meridian.
Canada is behind UTC.

c Chile is in South America, to the left (west) of the Greenwich Meridian.
Chile is behind UTC.

d China is in Asia, to the right (east) of the Greenwich Meridian.
China is ahead of UTC.

EXERCISE 11.12 ANSWERS ON P. 580

World time zones U F PS R C

EXAMPLE 23

1 Use the map above to determine whether each city is ahead of or behind UTC. R

a Sydney **b** San Francisco **c** Rio de Janeiro **d** Perth
e Beijing **f** Honolulu **g** Moscow **h** Athens
i Hong Kong **j** Helsinki **k** New York **l** Ottawa

2 Find the time in each city when it is 12 noon in Greenwich.

a Sydney **b** Perth **c** New York **d** Beijing
e San Francisco **f** Honolulu **g** Moscow **h** Geneva

3 What is the time difference between:

a Sydney and Perth? **b** Sydney and Beijing?
c Sydney and Honolulu? **d** Sydney and Moscow?
e Sydney and New York? **f** Perth and Beijing?
g San Francisco and New York? **h** Honolulu and Moscow?
i Geneva and Perth? **j** San Francisco and Geneva?

4 If it is 9 p.m. in Sydney, what is the time in:

a London? **b** Perth? **c** New York? **d** Beijing?
e San Francisco? **f** Honolulu? **g** Moscow? **h** Geneva?

5 A cricket match being played in India is telecast live at 3:30 p.m. Sydney time.
What is the local time of the cricket match if Sydney's time is $4\frac{1}{2}$ hours ahead of India's? PS R

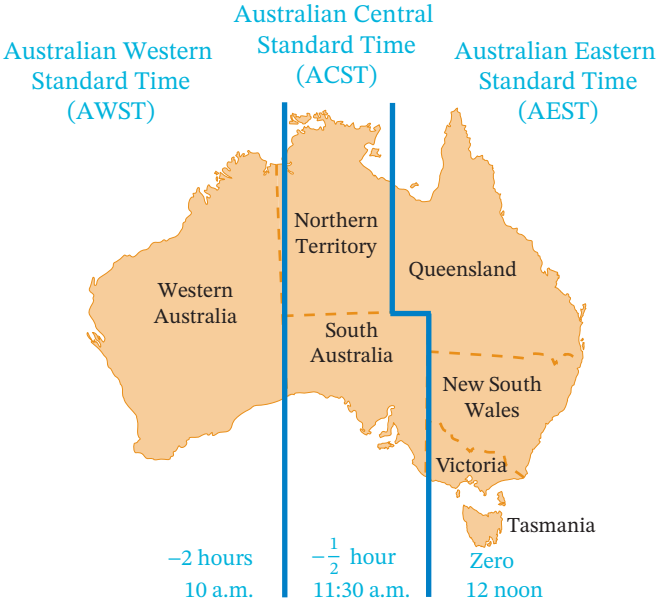
6 Sabiha, in Melbourne, wants to video call her cousin Habib in Turkey. The time in Turkey is 7 hours behind the time in Melbourne. At what time should Sabiha call to catch Habib when it is 1 p.m. in Turkey? PS R

7 Sydney is 2 hours behind Auckland. A plane leaves Auckland at 4 p.m. and takes 3 hours to fly to Sydney. What is the local time in Brisbane when the plane lands? Select the correct answer **A**, **B**, **C** or **D**. PS R

A 3 p.m. **B** 5 p.m. **C** 7 p.m. **D** 9 p.m.

8 Find out what happens if you cross the International Date Line (IDL). Why isn't the IDL straight? R C

9 This map shows the 3 time zones for Australia.



State whether each city is ahead of, behind or has the same time as Adelaide (SA).

a Canberra **b** Hobart **c** Darwin
d Perth **e** Hervey Bay (Qld) **f** Broome (WA)
g Griffith (NSW) **h** Alice Springs (NT) **i** Cairns (Qld)

10 What is the time difference between:

a Sydney and Darwin? **b** Brisbane and Perth?
c Adelaide and Hobart? **d** Melbourne and Adelaide?
e Hobart and Perth? **f** Brisbane and Canberra?

11 If it is 11 a.m. in Sydney, what time is it in:

a Melbourne? **b** Adelaide? **c** Perth?
d Darwin? **e** Hobart? **f** Canberra?

Foundation Standard Complex

9780170453141

12 If it is 8:30 p.m. in Adelaide, what time is it in:

a Melbourne? **b** Sydney? **c** Perth?

d Darwin? **e** Hobart? **f** Brisbane?

13 a Joe flies from Sydney to Perth, taking 4 hours. If he leaves Sydney at 1 p.m., at what time does he land in Perth? Give your answer as Perth local time.

b When Joe flies home, he leaves Perth at 1 p.m. At what time does he land in Sydney? Give your answer as Sydney local time. PS R

14 a Find out when daylight saving begins and ends.

b Why do we have daylight saving?

c How does daylight saving affect the different time zones?

d If it is 6 p.m. in Western Australia (not on daylight saving), what time is it in New South Wales on Eastern Standard Daylight Saving Time? PS R C

Investigation

World trip

Plan a trip around the world with at least 3 stopovers (for example, Tokyo, Hanoi, Cairo). Use airline timetables so you can give details of departures, arrivals and the length of each flight. Does it matter if you head east or west when you start? What effect does the International Date Line have on your trip?

Power plus ANSWERS ON P. 580

1 Australia's annual birth rate in 2021 was approximately 12.7 per 1000. Given that its population then was 26 200 000, approximately how many babies were born in Australia in 2021?

2 Singapore is a small island, but it has a population of 5 780 000, making it the 2nd most densely populated country in the world. Its population density is 8210 persons/km^2.

a What is the area of Singapore, to the nearest square km?

b Australia is the 3rd least-densely populated country in the world, at a rate of only 3.4 persons/km^2 and an area of 7 682 300 km^2. If Australia was as densely populated as Singapore, what would its population be?

3 A spider moves at 1 cm/s. If the spider is in the back left-hand corner of your classroom, find how long (in minutes) it will take to reach:

a the nearest person **b** you **c** the teacher's desk

4 Convert each speed to km/h. Round your answers to 2 decimal places.

a An African cheetah runs at 27 m/s.

b A German peregrine falcon dives at 97 m/s.

c A Tanzanian snake travels at 3.3 m/s.

d A racing cyclist rides at 23 m/s.

5 Work out a formula for converting speed expressed as x m/s to y km/h.

CHAPTER 11 REVIEW

Language of maths

Applying ratios and rates

Time

best buy	daylight saving	distance	divide
equivalent	International Date Line	km/h	map
per (/)	plan	rate	ratio
scaled length	scale ratio	simplify	speed
stationary	term	time zone	travel graph
unitary method	unit price	UTC (Coordinated Universal Time)	

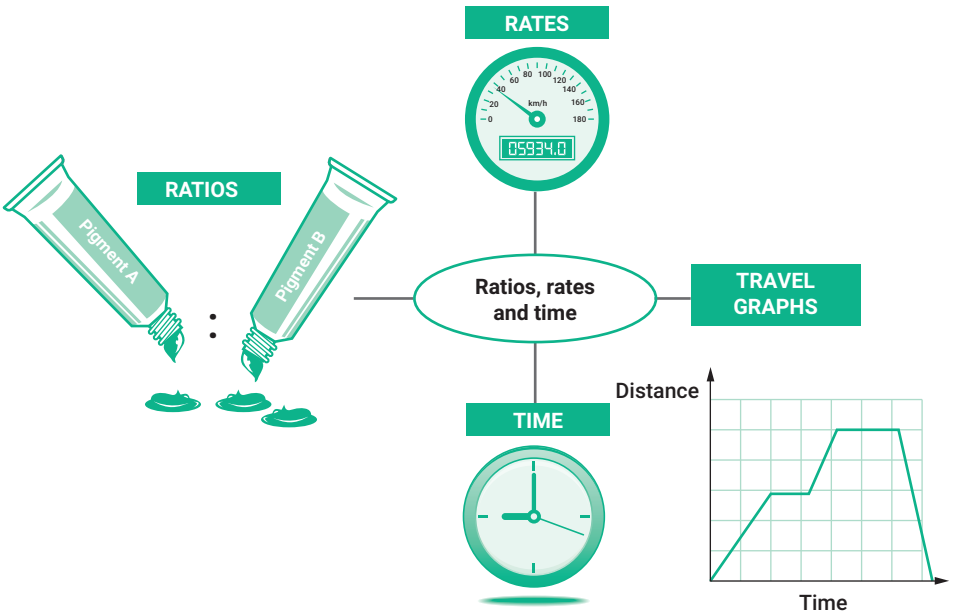
1. When comparing the prices and sizes of items to find the **best buy**, do we look for the highest or lowest **unit price**?
2. What type of measurement compares quantities of different types, expressed using 2 units?
3. What is meant by the **scale ratio** of a map or plan?
4. What does an **average speed** of 65 km/h actually mean?
5. How is a change in speed shown on a travel graph?
6. In which country is the UTC or GMT time zone?

Topic summary

Mind map: Ratios, rates and time

- Give examples of situations where ratios, rates and time are used.
- What did you learn in this chapter?
- What did you find the most difficult about this topic? Discuss any problems with your teacher or with a friend.

Print (or copy) and complete this mind map of the topic, adding detail to its branches and using pictures, symbols and colour where needed. Ask your teacher to check your work.



9780170453141

TEST YOURSELF 11

ANSWERS ON P. 580

1 Copy and complete each pair of equivalent ratios. 11.01

a $1 : 3 = 4 : \_\_\_\_$ **b** $2 : 5 = 6 : \_\_\_\_$ **c** $3 : 7 = \_\_\_\_ : 21$

d $4 : 9 = \_\_\_\_ : 45$ **e** $0.5 : 0.8 = 2 : \_\_\_\_$ **f** $3 : 4 : 5 = \_\_\_\_ : 20 : \_\_\_\_$

2 Simplify each ratio. 11.01

a 12 : 21 **b** 25 : 75 **c** 6 : 36

d 25 : 45 **e** 18 : 6 : 24 **f** 5 : 25 : 100

g $\frac{1}{3} : \frac{1}{2}$ **h** $\frac{3}{4} : \frac{9}{16}$ **i** $1\frac{1}{2} : 2\frac{1}{2}$

j 0.98 : 0.245 **k** 1.5 : 6 **l** 91 : 5.6

m 5 km : 200 metres **n** 20 kg : 3600 g **o** \$25 : \$4.25

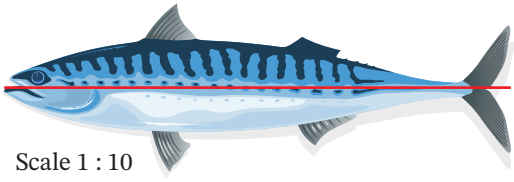
p 18 months: 4 years **q** 10 days: 5 weeks **r** 8 h : 3 days

3 **a** The ratio of girls to boys in Year 8 is 4 : 3. If there are 75 boys in Year 8, find how many girls there are. 11.02

b Adam and Eve invested in a business in the ratio 5 : 7. If Eve invested \$63 000, how much did Adam invest?

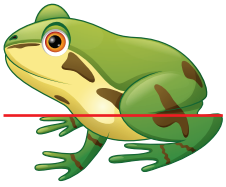
4 Measure the length of each scale drawing below, and then use the ratio to work out the actual length of the object correct to the nearest centimetre. 11.03

a Fish



Scale 1 : 10

b Frog



Scale 1 : 4

5 On a tourist map of Sydney, the scale is given by 0 ——— 500 m. 11.03

a Write this scale as a simplified ratio.

b Find the actual distance between the following places given the scaled distance.

i Circular Quay station to the Opera House (2.5 cm)

ii Pyrmont Bridge to Parliament House (4.4 cm)

c Find the scaled distance between the following places given the actual distance.

i Art Gallery of NSW to Sydney Tower (875 m)

ii Circular Quay station to Central station (2.5 km)

6 Ellen and Portia share the weekly rent of \$420 on their apartment in the ratio 4 : 3. How much does Ellen pay? Select the correct answer **A**, **B**, **C** or **D**. 11.04

A \$105 **B** \$240 **C** \$180 **D** \$210

7 Write each statement as a rate in simplified form. 11.05

a \$10.50 for 3 kg **b** 220 km in 2 hours

c \$56.40 for 4 hours **d** 260 runs in 50 overs

Foundation | Standard | Complex

11.06

8 For each pair, determine which is the better buy.

a A 1 kg box of biscuits for $5.60 or a 700 g carton for $4.00.

b A 350 g can of soup for $4.20 or a 550 g can for $7.15.

c A 1.5 L bottle of lemonade for $2.45 or a 375 mL can for $0.70.

d 3 × 40 g chocolate bars for $2.36 or a 500 g chocolate bar for $9.

11.07

9 **a** Mince is $3.99/kg. How much does 5 kg of mince cost?

b Tiwa earns $18.70/h. How much is she paid for 38 hours work?

c How many litres of petrol can you buy with $40 if petrol costs $1.35/L? Answer to the nearest 0.1 L.

d Fertiliser is used at 20 kg/ha. How many hectares can be covered with 144 kg of fertiliser?

11.08

10 Find the speed, in km/h, of a cyclist who travels a distance of 45 km in 2 hours and 15 minutes.

11.08

11 Find the distance covered by a truck that travels for 5 hours and 30 minutes at an average speed of 45 km/h.

11.09

12 Keith and Kent decided to go bushwalking. This travel graph shows their walk.

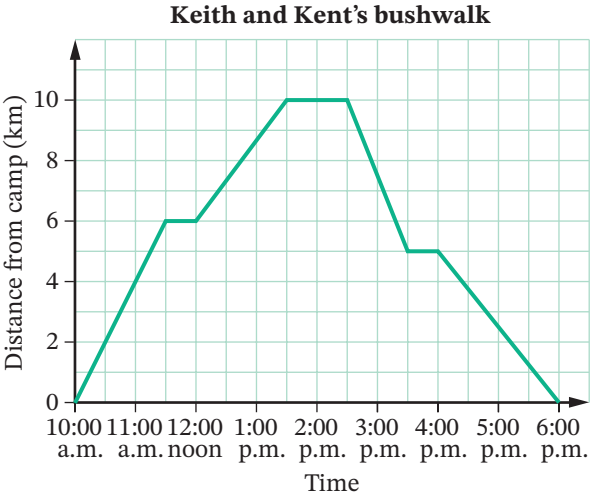
a How far did they travel from camp?

b How many stops did they make?

c Find their average speed between their first and second stops.

d How long did it take them to return home?

e Between what times were they walking the fastest?



11.10

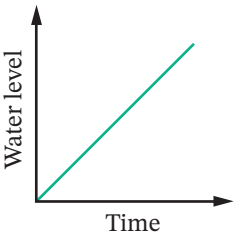
13 Match each description to its correct graph.

a The water level of the bath stayed constant at 50 cm.

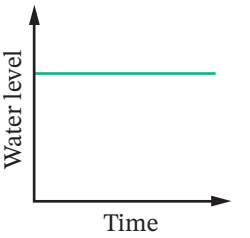
b The bath was filled at a steady rate. The tap was turned off to let the hot bathwater cool. The rest of the bath was filled with cold water.

c The bath was filled with warm water at a steady rate.

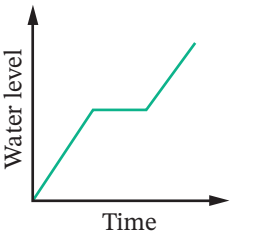
A



B



C



Foundation Standard Complex

9780170453141

14 Draw a graph to represent the following story. 'The weight of the baby elephant increased quickly at first, but then slowed down to a steady rate.' 11.10

15 What is the time: 11.11

a 3 hours and 20 minutes after 8:05 p.m.?

b 4 hours and 45 minutes before 11:15 p.m.?

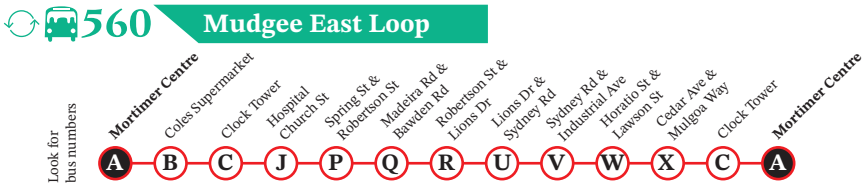
16 Calculate the time difference between: 11.11

a 10:10 a.m. and 6:40 p.m.

b 12:05 p.m. and 3:20 a.m.

c 12:30 and 23:20

17 A section of a bus timetable is shown. 11.11



Weekdays (Monday to Friday)

am	**560**	10.02	10.03	10.04	10.08	10.11	10.13	10.16	10.10	10.20	10.22	10.23	10.27	10.30
	560	11.40	11.41	11.42	11.46	11.49	11.51	11.54	11.56	11.58	12.00	12.01	12.05	12.08
pm	**560**	2.39	2.40	2.41	2.45	2.48	2.50	2.53	2.55	2.57	2.59	3.00	3.04	3.07
	560	4.15	4.16	4.17	4.21	4.24	4.26	4.29	4.31	4.33	4.35	4.36	4.40	4.43

a What do you think the shaded area represents?

b How many bus services run each day?

c How long is the journey from the Mortimer Centre to Robertson St/Lions Dr?

d Tom catches the bus from Spring St at 2:48 p.m. Where does the bus stop after 11 minutes?

e Mary needs to meet a friend at the Clock Tower at 3:10 p.m. Which is the latest bus she can catch from Madeira Rd to be there on time?

18 Use the world map on page 480 to find the time difference between: 11.12

a Sydney and Athens

b Sydney and Hong Kong

c Perth and Honolulu

d San Francisco and Helsinki

19 An international hockey match in Holland is played at 3:30 p.m. local time. At what time should Shegufta wake up to watch the game live on TV in Sydney if Sydney's time is 8 hours ahead of Holland's? 11.12