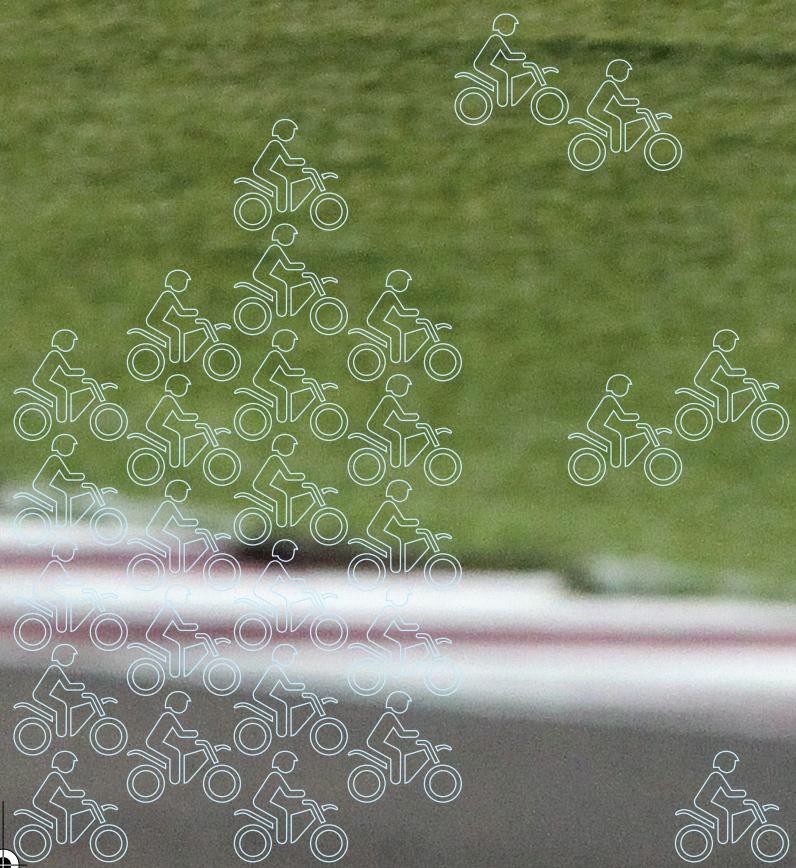


6



Measurement

6

Hat trick at Qatar. In 2009, 23-year-old Australian Casey Stoner won the Moto GP in Qatar for the third season in a row.

The 22-lap race was postponed because torrential rain made it impossible to see far enough ahead on the twists and turns with the floodlights reflecting off the wet track.

Casey won the race with a comfortable 7.771 second lead over Valentino Rossi. Riding his 800 cc Ducati, he reached speeds of up to 324.7 km/h on the 1.068 km main straight.

In 2007, Casey won his first World Motor Cycle Grand Prix (Moto GP) title, aged just 21. He was the 2008 Young Australian of the Year.

In 2010, Casey won his fourth straight Australian Moto GP at Phillip Island. He led all the way and crossed the line 8.598 seconds clear of Jorge Lorenzo.

Forum

In swimming and running races, times are measured to 0.01 s. In this fraction of time the swimmer or runner covers about 2 cm. How far would a motorcyclist travel in this time? Why are times for Grand Prix and Moto GP races measured to 0.001 s?

Casey Stoner rides an 800 cc motor bike. What does the 'cc' stand for?

Do you think a knowledge of maths would help you become a good Moto GP racer?

Why learn this?

Measurement helps us keep records, whether it be the height of a growing child or the volume of water in a dam. Good measurement skills are useful in many practical ways. They help a carpenter to work out how much wood is needed to construct a cupboard, enable a painter to calculate the volume of paint required to paint a room and allow a gardener to determine the area of lawn to be planted or fertilised.

After completing this chapter you will be able to:

- choose appropriate units for measuring and convert between them
- estimate common measurements using standard units
- calculate the perimeter of different shapes
- calculate the area of different shapes made up of rectangles and triangles
- calculate the volume of prisms.

Recall 6

Prepare for this chapter by attempting the following questions. If you have difficulty with a question, go to Pearson Places and download the Recall Worksheet from Pearson Reader.

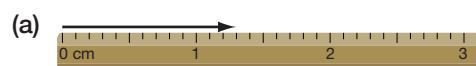
1 Calculate the following.

- | | | |
|-----------------------------|----------------------|-------------------------|
| (a) $3.4 + 6.8 + 4.2 + 2.1$ | (b) $45.6 - 5.28$ | (c) $54 + 11.3 - 26.04$ |
| (d) 6×4.2 | (e) 9.2×6.1 | (f) 18.96×1000 |
| (g) $2780 \div 100$ | (h) $3 \div 10$ | (i) $45.9 \div 1000$ |

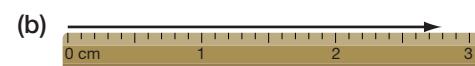


2 State the length of the arrow shown on each ruler:

(i) in millimetres

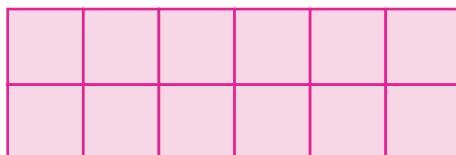


(ii) in centimetres.



3 This rectangle is made up of centimetre squares. Calculate:

- (a) the perimeter in cm
(b) the area in cm^2 .



4 Copy and complete the following conversions.

- | | | |
|--|--|---|
| (a) $2 \text{ km} = \underline{\hspace{1cm}}$ m | (b) $30 \text{ mm} = \underline{\hspace{1cm}}$ cm | (c) $5 \text{ m} = \underline{\hspace{1cm}}$ cm |
| (d) $1500 \text{ g} = \underline{\hspace{1cm}}$ kg | (e) $4 \text{ L} = \underline{\hspace{1cm}}$ mL | (f) $20 \text{ kg} = \underline{\hspace{1cm}}$ g |
| (g) $250 \text{ mL} = \underline{\hspace{1cm}}$ L | (h) $1.75 \text{ m} = \underline{\hspace{1cm}}$ mm | (i) $500 \text{ g} = \underline{\hspace{1cm}}$ kg |



5 How many sugar cubes are in the stack shown here?



Key Words

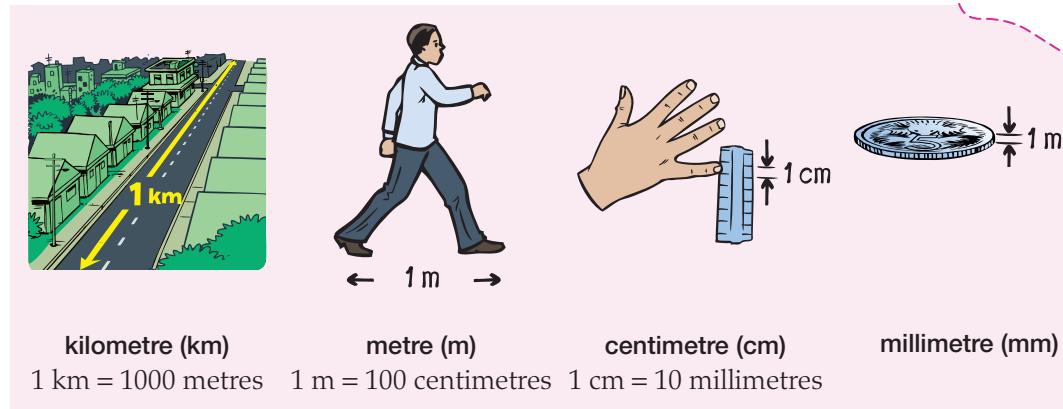
area	height	metric	perpendicular
base	kilometre	millimetre	rectangular prism
centimetre	length	parallelogram	volume
composite shape	metre	perimeter	width

Units of length

6.1

The system of measurement used in Australia up until 1970 was the imperial, or British system, which uses units of length such as inches, feet, yards, miles, chains and furlongs. In this system, it is awkward to convert between the different units.

In the 17th century, French scientists created another system of measurement, known as the **metric** system. All lengths in the metric system are derived from dividing or multiplying a standard length, the '**metre**', by powers of 10 (10, 100, 1000, ...). This makes it easier to convert between lengths. The metric system was introduced into Australia in 1970. The metric units of **length** used most often are:



In the 1100s, King Henry I of England decreed that the distance from the tip of his nose to the end of his finger would be called a 'yard'. This unit of length was then used for nearly 900 years!



When estimating lengths, it helps to be able to picture the size of each unit of length, or compare the object in question to a 'reference' measurement.

Worked Example 1

WE1

Use the reference measurement to help you estimate:

- the length
 - the height
- of this motor home.



Thinking

- Look at the reference measurement. Estimate how many times this length would need to be used to match the length of the motor home.
- Again, estimate how many times the length of the reference measurement would need to be used to match the height of the motor home.

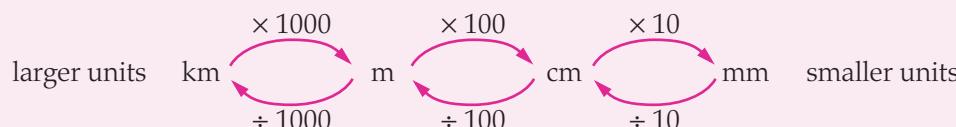
Working

- The motor home is approximately 5 m long.
- The motor home is about 3 m high.

6.1

Converting units of length

The ease with which we can convert between units is the great advantage of the metric system. Converting between metric units of length is made easy because we only ever need to multiply or divide by powers of 10 to change to different units.



To convert from a *larger* unit to a *smaller* unit, we *multiply*.

To convert from a *smaller* unit to a *larger* unit we *divide*.

The conversion table above shows that when converting from kilometres to metres, we multiply by 1000. When converting from centimetres to metres, we divide by 100. To convert from kilometres to centimetres we multiply by 1000, then by 100.

Worked Example 2

WE2

Copy and complete the following conversions.

(a) $62.4 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

(b) $87.5 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

Thinking

- (a) Larger unit to smaller unit, so multiply.
There are 1000 m in 1 km, so multiply by 1000.

- (b) Smaller unit to larger unit, so divide.
There are 100 cm in 1 m, so divide by 100.

Working

$$\begin{aligned} (a) \quad & 62.4 \text{ km} \\ &= 62.4 \times 1000 \text{ m} \\ &= 62400 \text{ m} \end{aligned}$$

$$\begin{aligned} (b) \quad & 87.5 \text{ cm} \\ &= 87.5 \div 100 \text{ m} \\ &= 0.875 \text{ m} \end{aligned}$$

Worked Example 3

WE3

Copy and complete the following conversions.

(a) $8.7 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

(b) $530 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

Thinking

- (a) 1 Larger unit to smaller unit, so multiply.
First, multiply by 100 to convert m to cm.
- 2 Then, multiply by 10 to convert cm to mm.

- (b) 1 Smaller unit to larger unit, so divide.
First, divide by 100 to convert cm to m.
- 2 Then, divide by 1000 to convert m to km.

Working

$$\begin{aligned} (a) \quad & 8.7 \text{ m} \\ &= 8.7 \times 100 \text{ cm} \\ &= 870 \text{ cm} \\ &= 870 \times 10 \text{ mm} \\ &= 8700 \text{ mm} \end{aligned}$$

$$\begin{aligned} (b) \quad & 530 \text{ cm} \\ &= 530 \div 100 \text{ m} \\ &= 5.3 \text{ m} \\ &= 5.3 \div 1000 \text{ km} \\ &= 0.0053 \text{ km} \end{aligned}$$



6.1

Notice that in part (a) of Worked Example 3, we multiply by 100, then by 10. This is equivalent to multiplying by 1000. In part (b) we divide by 100, then by 1000. This is equivalent to dividing by 100 000.

6.1 Units of length

Navigator

Q1, Q2 Column 1, Q3 Column 1,
Q4, Q5, Q7, Q8, Q9, Q10, Q11,
Q13, Q15, Q16, Q18

Q1, Q2 Column 2, Q3 Column 2,
Q5, Q6, Q7, Q8, Q9, Q11, Q12,
Q13, Q14, Q15, Q16, Q18

Q1, Q2 Column 3, Q3 Column 3,
Q5, Q6, Q7, Q8, Q9, Q10, Q11,
Q12, Q13, Q14, Q15, Q16, Q17,
Q18

Answers
page 658

Fluency

- 1 Use the reference measurement to help you estimate the following.

(a)



The length of this car.

(b)



The adult giraffe's height.

(c)



The height of the tallest part of this building.

(d)



The length of this mantis fly.

WE1

- 2 Copy and complete the following conversions.

(a) $5 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

(b) $3.6 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

(c) $0.008 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

(d) $65 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

(e) $0.55 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

(f) $1.2 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

(g) $2.9 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$

(h) $6.1 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$

(i) $0.35 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$

(j) $90 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

(k) $0.3 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

(l) $3750 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

(m) $4200 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

(n) $570 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

(o) $9.2 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

(p) $80 \text{ mm} = \underline{\hspace{2cm}} \text{ cm}$

(q) $255 \text{ mm} = \underline{\hspace{2cm}} \text{ cm}$

(r) $1.8 \text{ mm} = \underline{\hspace{2cm}} \text{ cm}$

WE2

- 3 Copy and complete the following conversions.

(a) $3.2 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

(b) $4.95 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

(c) $9000 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

(d) $34500 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

(e) $0.003 \text{ km} = \underline{\hspace{2cm}} \text{ cm}$

(f) $560 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$

(g) $97 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$

(h) $0.342 \text{ km} = \underline{\hspace{2cm}} \text{ mm}$

(i) $7800 \text{ mm} = \underline{\hspace{2cm}} \text{ km}$

(j) $1.92 \text{ km} = \underline{\hspace{2cm}} \text{ cm}$

(k) $2400 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

(l) $0.89 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

WE3

6.1

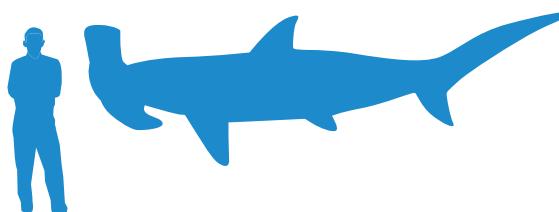
- 4 State which metric unit would be most appropriate for measuring:
- (a) the length of your foot
 - (b) the distance from Sydney to Melbourne
 - (c) the distance around an athletics track
 - (d) the length of a shoelace
 - (e) the distance run in a marathon
 - (f) the length of your bed.
- 5 (a) Which of the following gives the best estimate of the distance across a suburban street?
- | | | | |
|----------------|--------------|---------------|---------------|
| A 50 cm | B 5 m | C 50 m | D 5 km |
|----------------|--------------|---------------|---------------|
- (b) Which of the following gives the best estimate of the length of a mouse's tail?
- | | | | |
|-----------------|---------------|----------------|-----------------|
| A 0.1 cm | B 1 cm | C 10 cm | D 100 cm |
|-----------------|---------------|----------------|-----------------|
- (c) The diameter of a 20 cent coin is about:
- | | | | |
|-----------------|-----------------|----------------|-----------------|
| A 2.8 mm | B 2.8 cm | C 2.8 m | D 2.8 km |
|-----------------|-----------------|----------------|-----------------|
- (d) The length of a ball-point pen could be:
- | | | | |
|----------------|----------------|----------------|---------------|
| A 15 mm | B 50 mm | C 15 cm | D 15 m |
|----------------|----------------|----------------|---------------|
- 6 Place the lengths below in order from smallest to largest, by first converting them to a common unit.
- (a) 0.4 m, 4000 mm, 4 cm, 0.04 km
 - (b) 3.2 km, 360 m, 290 000 cm, 3100 m
 - (c) 71.4 m, 0.64 km, 5600 cm, 820 000 mm
 - (d) 0.9 cm, 90 mm, 0.095 m, 0.0089 km

Understanding

- 7 At the Beijing Olympics in 2008, Australia's Steve Hooker won a gold medal and broke the Olympic record in the men's pole vault, clearing the bar at 596 centimetres. How many metres is this?
- 8 Situated on Heard Island, Big Ben is Australia's only active volcano. Its summit is 2745 m above sea level. What is its height in kilometres?
- 9 The average man is 1.8 metres tall. Use the diagram to estimate the length of the hammerhead shark.



- 10 The bird-eating spider of South America has a body length of 89 mm and a leg span of 254 mm. Write these measurements in centimetres.



- 11 A giant jellyfish was once measured at 2290 mm across and 36 000 mm long. Convert these dimensions to metres.
- 12 Claire is building a desk and she wants it to be wide enough so that she can fit the length of two A4 sheets across it. If the length of an A4 sheet is 298 mm, how wide does Claire's desk have to be in millimetres? What is this length in centimetres?



Jellyfish have no bones, no heart and no brain.



Reasoning

- 13 The direct distance 'as the crow flies' between Melbourne and Adelaide is about 800 km. Estimate the direct distance between:



- (a) Canberra and Brisbane
- (b) Adelaide and Perth
- (c) Sydney and Darwin.

- 14 One of the fastest growing plants in the world is the bamboo plant. Its stem can grow 300 mm a day. If, on Monday morning, a bamboo plant was one metre tall, and it grew 300 mm every day, how tall will it be on Saturday morning? Write the answer in metres.



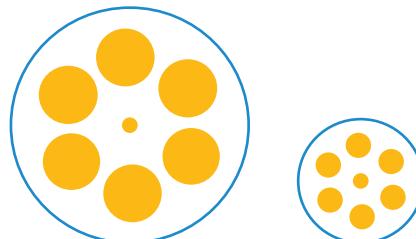
6.1

- 15 (a) Guess the answer to each of the following, then use your ruler to help you decide.

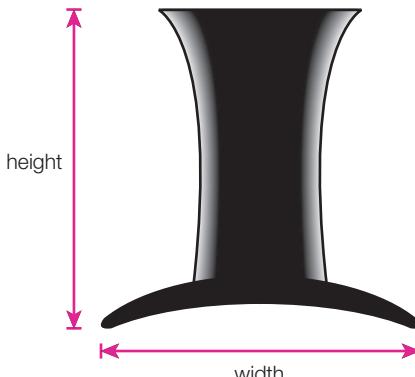
(i) Which horizontal line is longer?



(ii) Which diagram has the larger central circle?



(iii) Which is longer, the height of the hat, or its width?



- (b) Explain each illusion or effect above and why you think it happens.

Open-ended

- 16 A builder jotted down the measurements needed for a door.

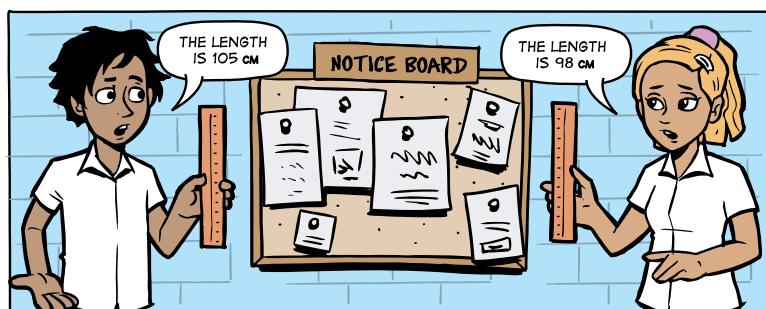
height of door	2032 mm
width of door	821 mm

Why did the builder write these measurements using millimetres instead of cm or m?

- 17 The following are mistakes made by a student when converting units. For each, explain what mistake has been made and write the correct answer.

- (a) $27 \text{ m} = 0.27 \text{ cm}$ \times (b) $765 \text{ mm} = 7.65 \text{ cm}$ \times
 (c) $3800 \text{ m} = 3.08 \text{ km}$ \times (d) $1356 \text{ cm} = 1.356 \text{ m}$ \times

- 18 Two students have been asked to measure the length of the school notice board.



Suggest possible reasons for the difference in their answers.

Perimeter

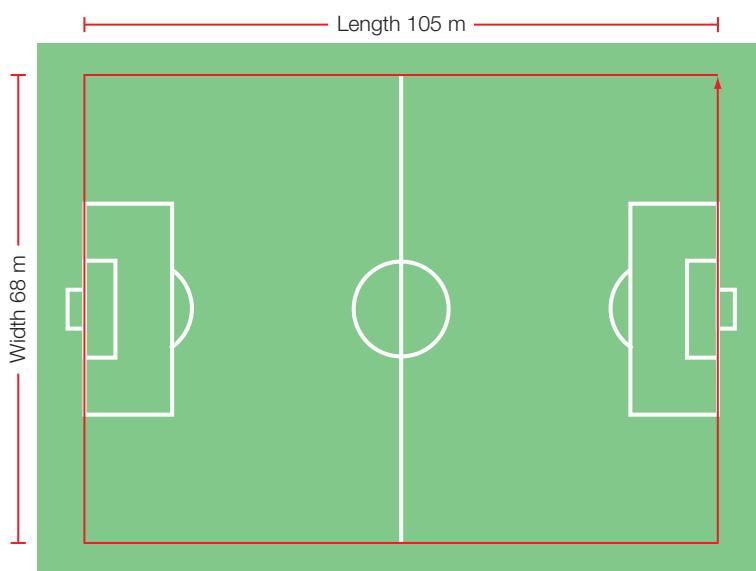
6.2

Perimeter is the distance along the boundary of a shape.

The word perimeter comes from two Greek words: *peri*, meaning ‘around’ and *metron*, meaning ‘measure’.

Here are some examples:

- A frame goes along the perimeter of a picture.
- A fence is built along the perimeter of a property.
- A soccer pitch has a boundary line marked along its perimeter (shown here in red).



To find the perimeter of a shape, we simply add up the lengths of the sides (first making sure they are all in the same units).

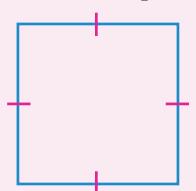
For example, the perimeter of this soccer pitch is $105 + 68 + 105 + 68 = 346$ m.

Because the pitch is rectangular in shape, it has 2 pairs of equal sides: 2 lengths and 2 widths.

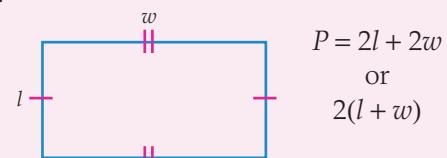
We can use this to write the perimeter of the pitch as $P = 2 \times 105 + 2 \times 68$ m. If we let the pronumerals l and w represent the length and the width, we can write a formula for the perimeter of a rectangle: $P = 2l + 2w$. This formula can also be written as $P = 2(l + w)$: Add the length and the width, then multiply by 2.

A square has 4 equal sides. If we use l to represent the length of each side, we can write the perimeter as: $P = l + l + l + l$. A shorter way to write this is $P = 4l$.

To find the perimeter of a square or a rectangle:



$$P = 4l$$



$$P = 2(l + w)$$

or

 $2(l + w)$

Sides that are marked in the same way (with the same number of small dashes) have the same length.

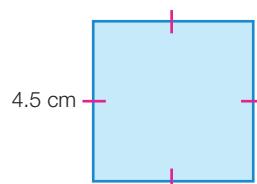
6.2

Worked Example 4

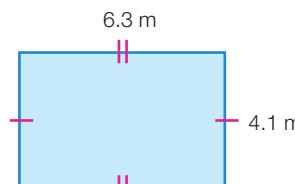
WE4

Find the perimeter of each of these shapes.

(a)



(b)



Thinking

- (a) 1 Write down the formula for the perimeter of a square.
 2 Substitute the side length into the formula.
 3 Evaluate, writing the answer with the correct units.

- (b) 1 Write down the formula for the perimeter of a rectangle.
 2 Substitute the side lengths into the formula.
 3 Evaluate, writing the answer with the correct units.

Working

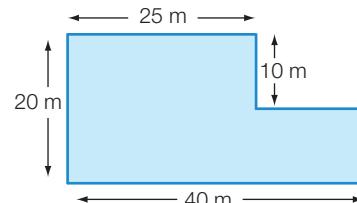
$$\begin{aligned}(a) \quad P &= 4l \\ &= 4 \times 4.5 \\ &= 18 \text{ cm}\end{aligned}$$

$$\begin{aligned}(b) \quad P &= 2l + 2w \\ &= 2 \times 6.3 + 2 \times 4.1 \\ &= 12.6 + 8.2 \\ &= 20.8 \text{ m}\end{aligned}$$

Worked Example 5

WE5

Calculate the perimeter of the shape below.

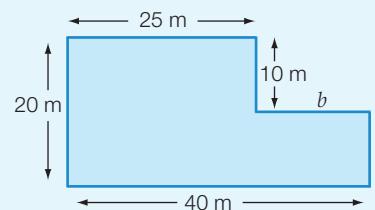


Thinking

- 1 First, find the lengths of the unmarked sides. Label them a and b , then use the given lengths to find them.

- 2 Add up the lengths of all the sides.

Working



$$\begin{aligned}a &= 20 \text{ m} - 10 \text{ m} \\ &= 10 \text{ m}\end{aligned}$$

$$\begin{aligned}b &= 40 \text{ m} - 25 \text{ m} \\ &= 15 \text{ m}\end{aligned}$$

$$\begin{aligned}P &= 10 + 25 + 20 + 40 + 10 + 15 \\ &= 120 \text{ m}\end{aligned}$$

6.2 Perimeter

Navigator

Q1, Q2, Q3, Q4, Q5, Q6, Q8, Q9, Q12

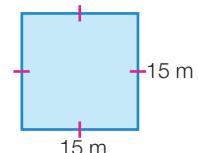
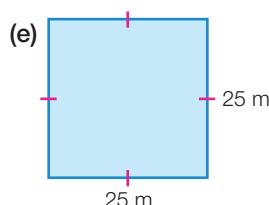
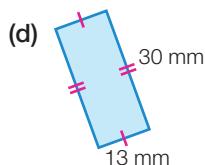
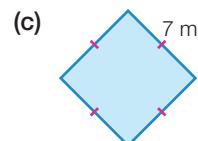
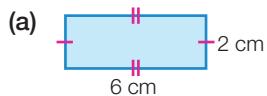
Q1, Q2, Q3, Q4, Q6, Q7, Q8, Q9, Q11, Q12

Q1 (a)–(c), Q2 (a)–(c), Q3, Q4, Q6, Q7, Q8, Q9, Q10, Q11, Q12

Answers
page 658

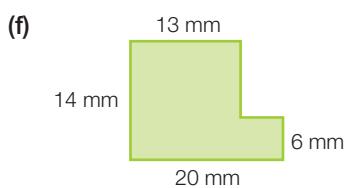
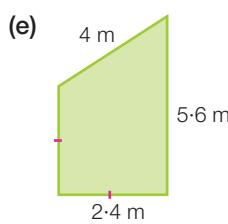
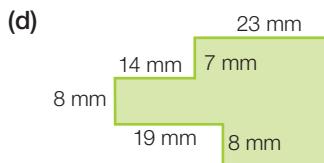
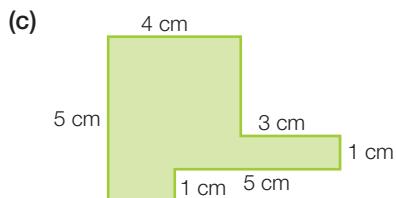
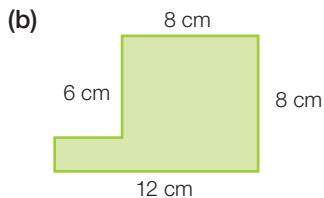
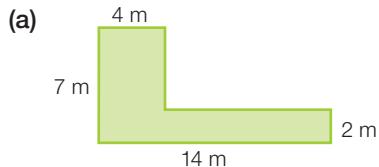
Fluency

- 1 Find the perimeter of each of these shapes.



WE4

- 2 Calculate the perimeter of the shapes below.



WE5

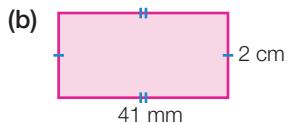
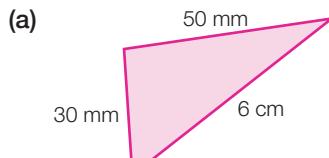
- 3 (a) The perimeter of a rectangle with a length of 25 cm and a width of 10 cm is:

A 35 cm B 45 cm C 70 cm D 250 cm

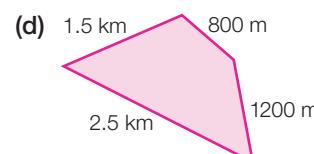
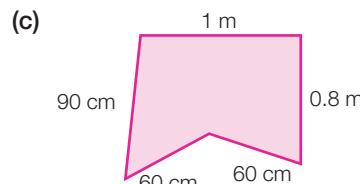
- (b) The perimeter of a square of side length 460 mm is:

A 18.4 m B 9.2 m C 1.84 m D 0.92 m

- 4 Calculate the perimeter of each of the following, first converting side lengths to the smaller unit when necessary.

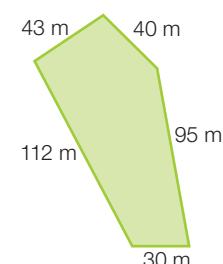


6.2



Understanding

- 5 A yacht sails three straight legs of a course which form a triangle. The length of the legs are 2.5 km, 1.7 km and 3.9 km. What distance does the yacht sail to complete the course?
- 6 A group of phys. ed. students run around the perimeter of a court in their gymnasium, which is rectangular and has dimensions 38 m by 16 m. What distance will they run if they complete 6 laps?
- 7 Juan wishes to run two strands of wire around his property to mark its boundary. A plan of the property is shown on the right. If he can buy the necessary wire for 60 cents per metre, how much will the wire cost him?
- 8 Estimate the perimeter of each of the following objects.
 - (a) a 30 cm ruler
 - (b) your desk
 - (c) a basketball court
 - (d) your school's boundary fence.



Drawing a diagram can help.



Reasoning

- 9 If the perimeter of a rectangle is 240 mm and its width is 20 mm, then its length is:
 - A 100 mm
 - B 110 mm
 - C 120 mm
 - D 220 mm
- 10 The local swimming pool is rectangular, with dimensions of 25 m by 12 m. If it has a 1 m wide rectangular path around its perimeter, what is the distance along the outer edge of the path?

Open-ended

- 11 The length and width of a rectangle are both whole numbers in centimetres. Write down some possible dimensions if its perimeter is 84 cm.
- 12 "I am holding a picture of a shape with a perimeter of 16 cm" the teacher said, "but it is not a rectangle nor a triangle". Draw two possible examples of the shape the teacher may be holding.

Outside the Square Problem solving

Ram's rulers

Ram is planning a woodwork model and needs to draw a line 6 cm long. He has been using as rulers two straight pieces of wood with no markings, but he knows their lengths are 10 cm and 8 cm. How can he use these pieces of wood to measure a 6 cm line?



Strategy options

- Guess and check.
- Work backwards.
- Make a model.



Area

Before laying tiles on a bathroom floor, the tiler would first need to find the **area** of the floor so that he or she will know how many tiles to buy.

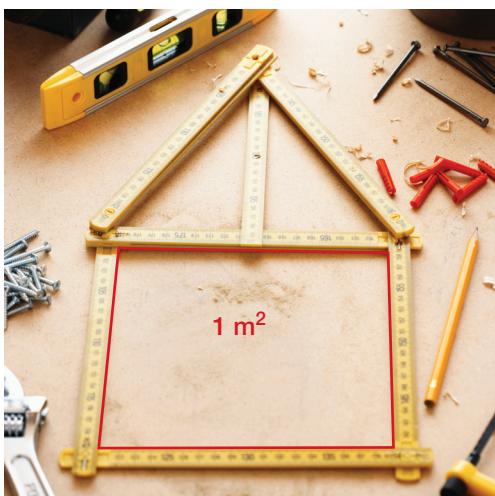
Area is the amount of surface inside a plane (flat) shape. It is measured in 'square' units. When we calculate the area of a shape we are finding the number of squares that can fit inside the shape.



Units of area

□

A square millimetre, mm^2 (actual size)
(1 mm length \times 1 mm width = 1 mm^2)



A square metre, m^2
(1 m length \times 1 m width = 1 m^2)

We can say the names of square units, such as 1 cm^2 , in two ways: '1 centimetre squared' or '1 square centimetre'.



A square centimetre, cm^2 (actual size)
(1 cm length \times 1 cm width = 1 cm^2)



A square kilometre, km^2
(1 km length \times 1 km width = 1 km^2)

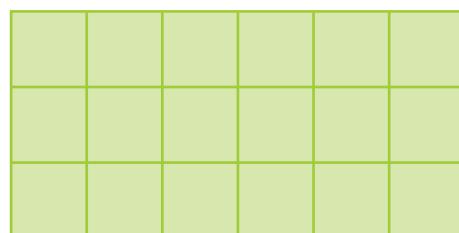
Area of a rectangle

Consider this rectangle of length 6 cm and width 3 cm.

The rectangle contains 3 rows of 6 squares. Its area is equal to $3 \text{ cm} \times 6 \text{ cm} = 18 \text{ cm}^2$.

The area (A) of a rectangle is equal to its length (l) multiplied by its width (w), or $A = l \times w$.

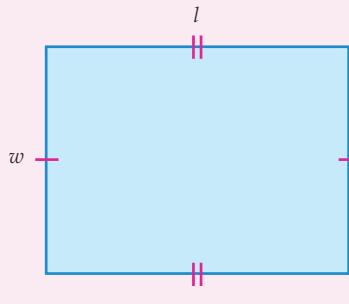
This formula can be written as $A = lw$.



6.3

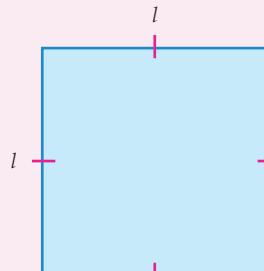
The length and width of a square are equal, so the area of a square can be found using the formula $A = l \times w$, or $A = l^2$.

Area of a rectangle



$$A = lw$$

Area of a square



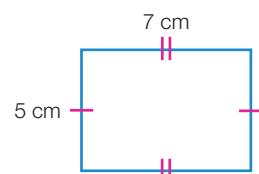
$$A = l^2$$

Worked Example 6

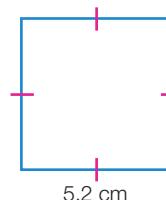
WE6

Calculate the area of the following shapes.

(a)



(b)



Thinking

- (a) 1 Write the formula for the area of a rectangle.
2 Identify l and w , and substitute their values into the formula.
3 Evaluate, writing the answer with the correct units.

- (b) 1 Write the formula for the area of a square.
2 Identify l and substitute its value into the formula.
3 Evaluate, writing the answer with the correct units.

Working

- (a) $A = lw$
 $A = 7 \times 5$
 $A = 35 \text{ cm}^2$
- (b) $A = l^2$
 $A = 5.2 \times 5.2$
 $A = 27.04 \text{ cm}^2$



6.3 Area

Navigator

Q1, Q2, Q3 (a), Q4, Q5, Q6, Q7, Q8, Q11, Q12, Q13, Q16, Q17, Q18, Q22, Q23

Q1 (a)–(f), Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q10, Q11, Q12, Q13, Q15, Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23

Q1 (g)–(l), Q2, Q3 (b), Q4, Q5, Q6, Q7, Q9, Q10, Q11, Q12, Q14, Q15, Q16, Q17, Q19, Q20, Q21, Q22, Q23

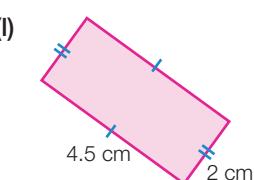
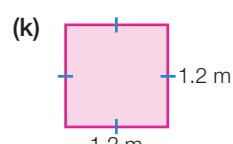
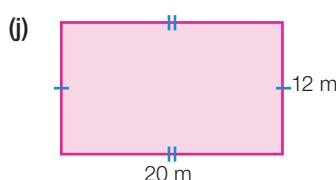
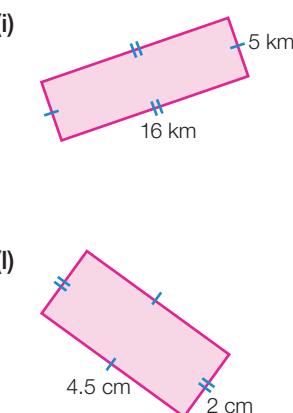
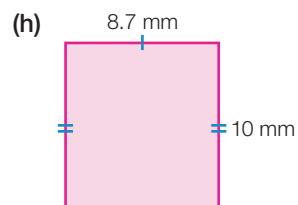
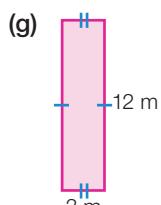
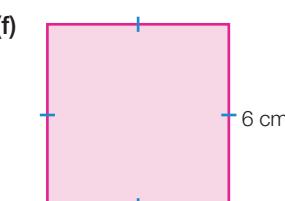
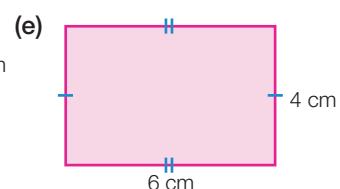
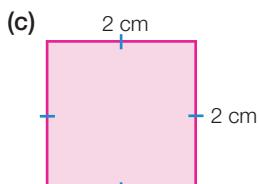
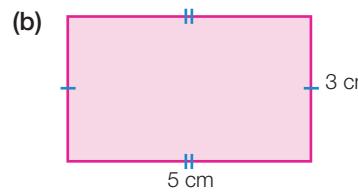
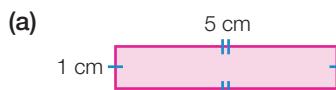
**Answers
page 659**

Equipment required: A calculator may be used for Questions 11–15

Fluency

- 1 Calculate the area of the following shapes.

W.E.6



- 2 State which of the units of area— mm^2 , cm^2 , m^2 or km^2 —would be most suitable for measuring the area of:

- | | |
|------------------------------|-------------------------------|
| (a) a sheet of writing paper | (b) your little toe-nail |
| (c) a pizza | (d) a house block |
| (e) a football oval | (f) Tasmania |
| (g) a small watch face | (h) the floor of a classroom. |

- 3 (a) A rectangle that has twelve rows of three square centimetres has an area of:

A 15 cm^2 B 30 cm^2 C 36 cm^2 D 72 cm^2

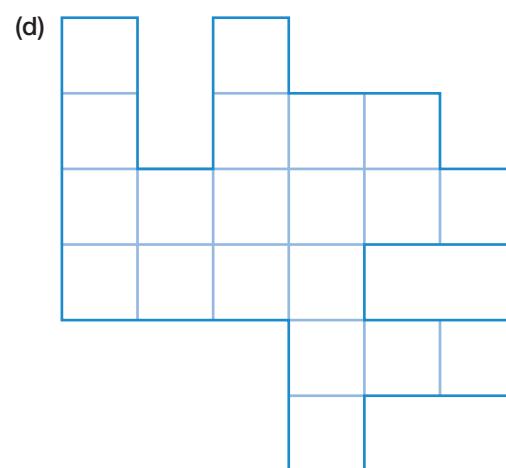
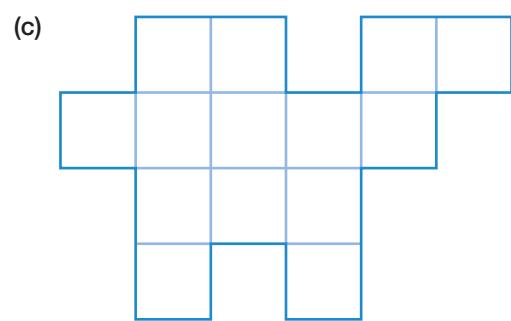
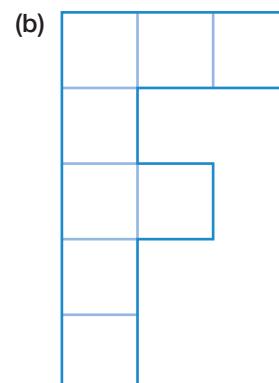
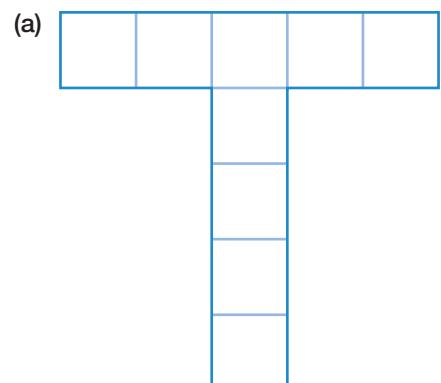
- (b) If the area of a rectangle is 24 cm^2 and its width is 10 mm , then its length is:

A 2.4 mm B 2.4 cm C 11 cm D 24 cm

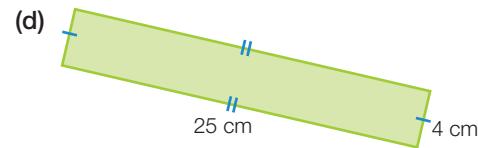
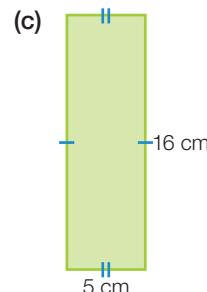
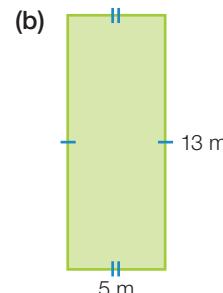
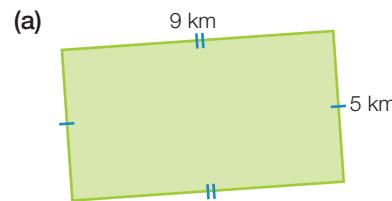


6.3

- 4 The following shapes have been drawn on centimetre grid paper. Find (i) the perimeter and (ii) the area of each one.



- 5 Find (i) the perimeter and (ii) the area of each shape below.



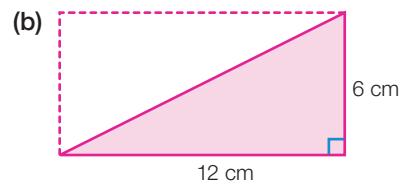
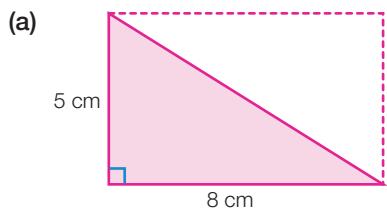
Convert all measurements to the same unit before finding the area.



Understanding

- 6 Find the area in km^2 of a rectangle of length 3 km and width 800 m.
- 7 What is the area in cm^2 of a rectangle of length 450 mm and width 70 cm?
- 8 Find the width of a rectangle with length 7 cm and area 28 cm^2 .
- 9 Find the length of a rectangle with width 2.6 m and area 13.52 m^2 .

- 10 Find the area of each of the following triangles by first considering a rectangle.



- 11 The Ray family is installing solar power to their house. There will be 6 panels attached to their roof, each with dimensions of $2.4 \text{ m} \times 2.1 \text{ m}$.

- (a) What is the area of each solar panel?
- (b) What is the total area of the solar panels?
- (c) If the solar panels generate a maximum of 6.5 kilowatt hours (kWh) of energy per square metre each day, how much energy could the Ray family's new solar system produce in a day?



- 12 Guy wishes to sow a lawn in a rectangular section of his yard, which is 8.5 m long and 6.9 m wide.

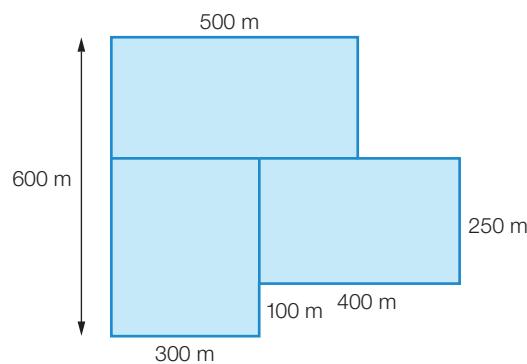
- (a) How many grams of lawn seed will he need to use if the recommended seed coverage is 60 grams per square metre?
- (b) What length of wood would Guy need to purchase to create a timber border for the section?

- 13 A builder wishes to estimate the number of bricks required to build a wall 4.2 m wide and 2.6 m high. If 1 square metre of brick wall contains 48 bricks, how many bricks are needed?

- 14 Jasmin decided to make a 45 cm square pillow for her study chair. One piece of fabric will be required for the front of the pillow, and one for the back. Each piece of fabric will need an extra 1 cm on all edges for the front and back to be sewn together. What area of fabric will Jasmin need to make the pillow?

- 15 A farmer wants to create three separate rectangular paddocks on his farm, as shown in the diagram.

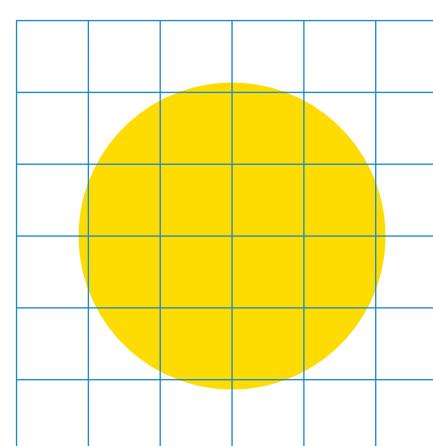
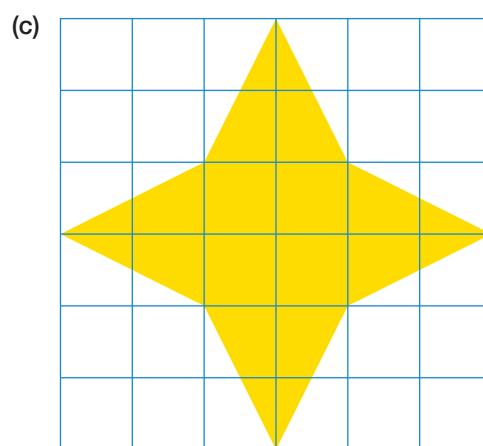
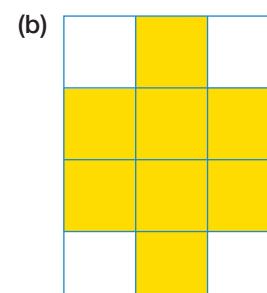
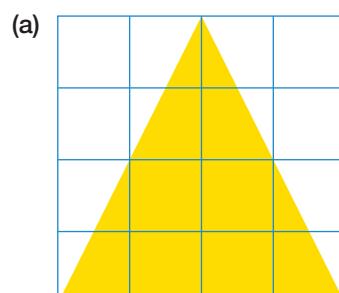
- (a) Find the area of the three paddocks using the plan provided.
- (b) To sow his paddocks, the farmer needs to spread 60 g of seed for every square metre. How many kilograms of seed will he need?
- (c) What is the total length of fencing needed to surround each of the three paddocks?



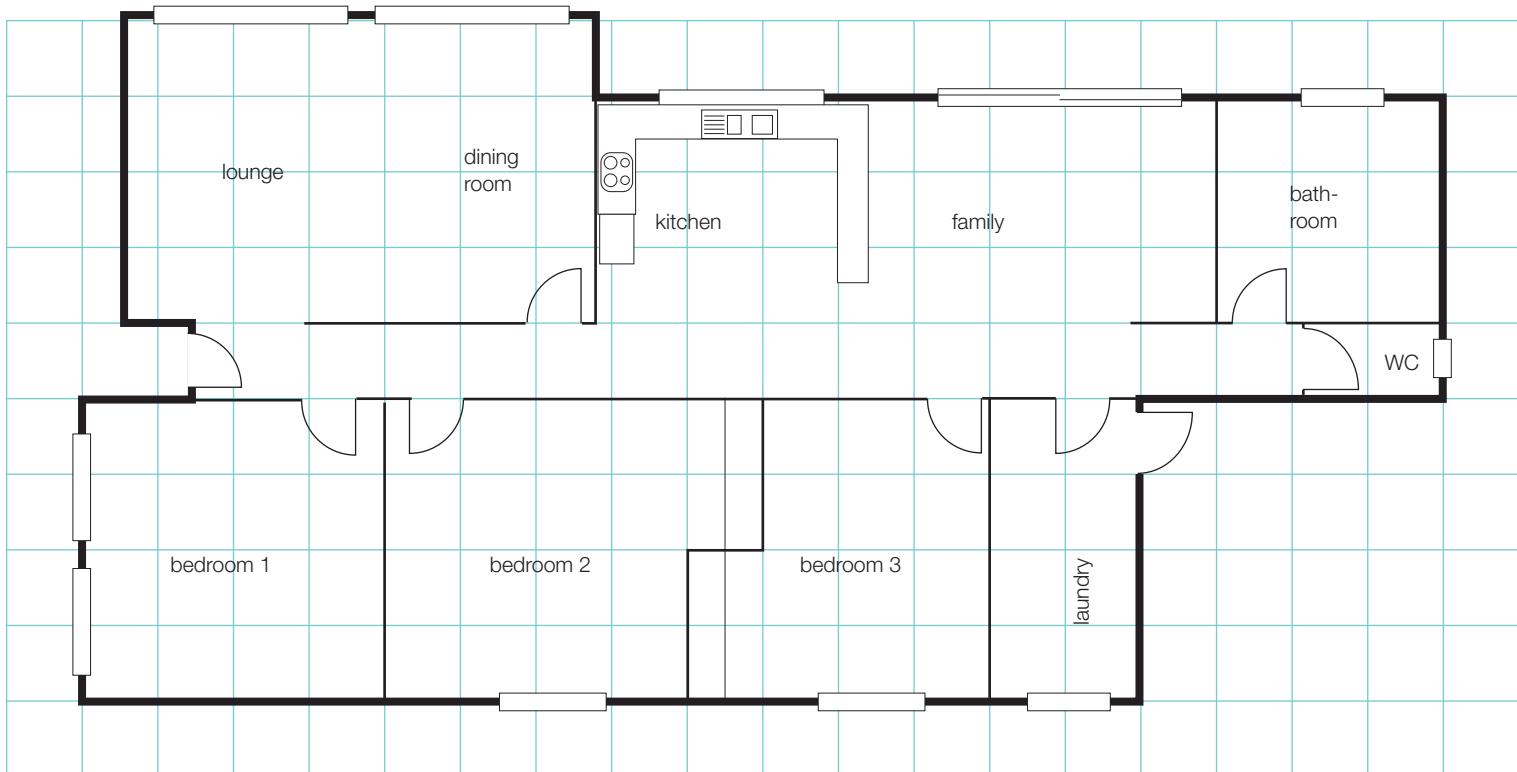
6.3

Reasoning

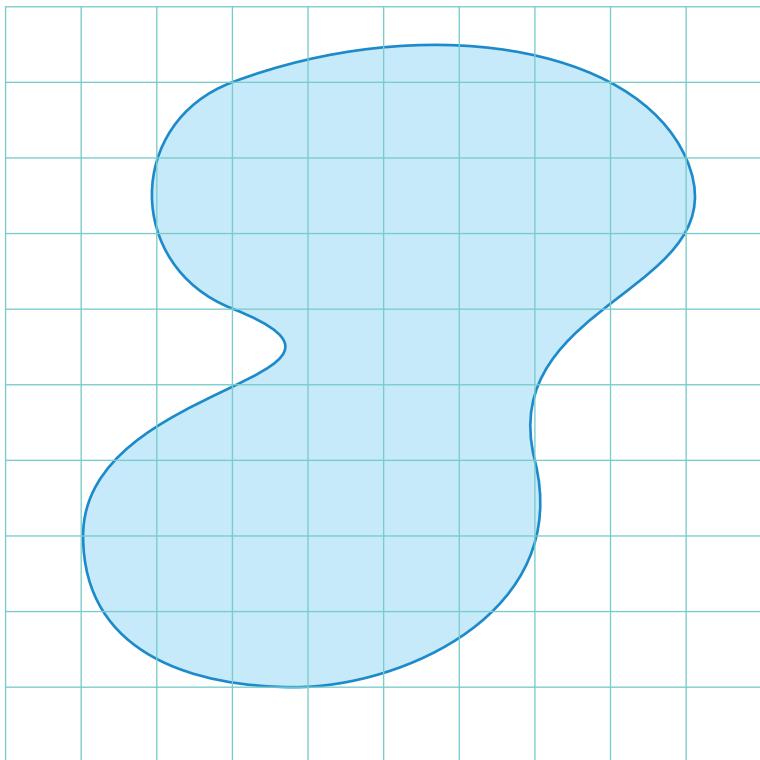
- 16 The following shapes have been drawn on centimetre grid paper. Find the shaded area in each case.



- 17 (a) Use the grid to estimate the area covered by the floor plan of this house. The squares on the plan below represent square metres.



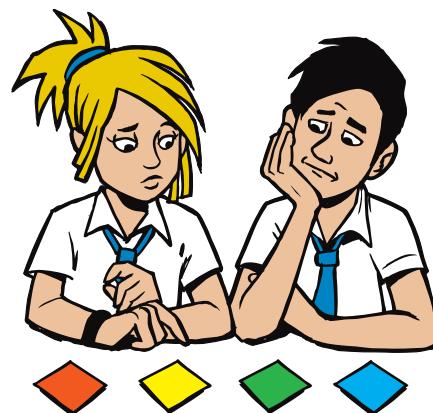
- (b) Use the grid to estimate the area of the lake. The squares on the grid represent square kilometres.



- 18 Write down all the possible whole number dimensions of a rectangle with an area of 20 cm^2 .
- 19 Find the length and width of a rectangular room whose area is 60 m^2 and perimeter is 34 m .

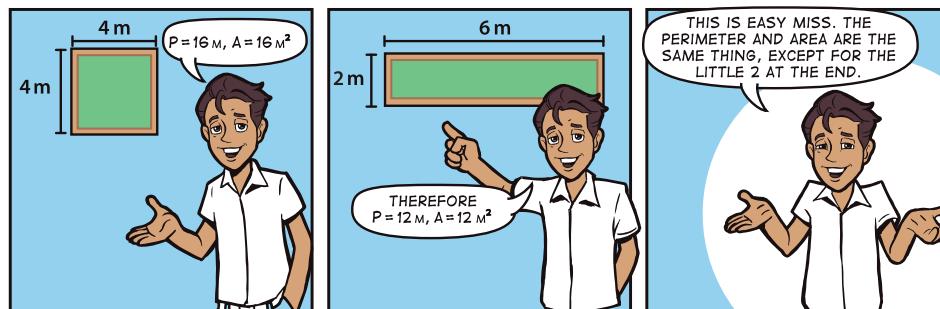
Open-ended

- 20 Ethan and Magda were asked to each make a shape using four 1 cm^2 squares, and then find the perimeter of their shapes. Ethan said the perimeter of his shape was 10 cm , whereas Magda said her shape had a perimeter of only 8 cm . Could they both be right? Draw what their shapes may have looked like.
- 21 Peta made a blanket for her newborn baby Mia's cot. The blanket has an area of 2.4 m^2 . What might the perimeter of the blanket be?



6.3

22



- (a) One of Sam's calculations is not right. What has he done wrong?
 (b) How would you explain the difference between area and perimeter to Sam?
 (c) What is meant by the 'little 2' and why must it be written on the answers for area?
- 23 List three materials that are sold by the square metre.

Outside the Square Game

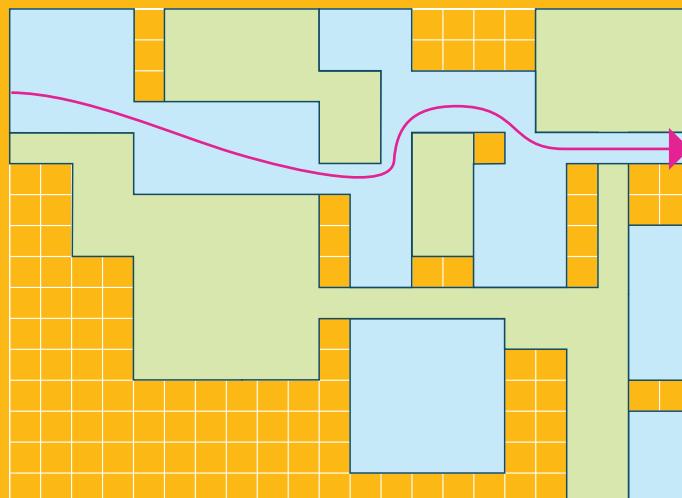
Blaze a trail

Equipment required: 2 brains, A4 graph (or grid) paper, 2 dice, 2 different coloured pens or pencils

There are jungles in the world that have never been crossed. The race is on to be the first to blaze a trail.

How to win:

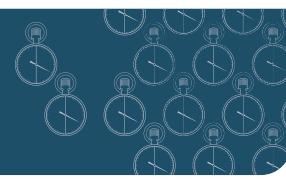
Create an unbroken path from one side of the jungle (graph paper) to the other. Your opponent will be trying to block you, and be the first to achieve this feat for themselves.



How to play:

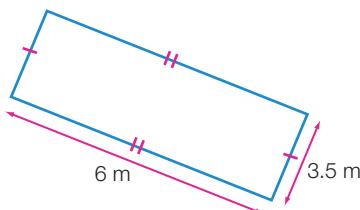
- 1 Each player has a different coloured pencil or pen. Players take it in turn to roll the dice.
- 2 The two numbers rolled represent the size of the block to colour in, one for length and one for width. The player may choose which die will be used for width and which will represent length. The block coloured must be a rectangle or a square.
- 3 A player may place their block anywhere on the graph paper; however, blocks cannot overlap with another block, or go off the graph. If the numbers rolled cannot make a rectangle that will fit on the grid, the player does not place a block for that turn.

Half-time 6

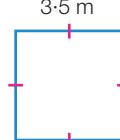


- 1 Find (i) the perimeter and (ii) the area of the following shapes.

(a)



(b)

**Ex. 6.2, 6.3**

- 2 Complete the following conversions.

(a) $45 \text{ cm} = \underline{\hspace{2cm}}$ m

(b) $0.015 \text{ km} = \underline{\hspace{2cm}}$ m

(c) $307 \text{ m} = \underline{\hspace{2cm}}$ km

(d) $0.6 \text{ km} = \underline{\hspace{2cm}}$ cm

(e) $196\,000 \text{ m} = \underline{\hspace{2cm}}$ km

(f) $2640 \text{ cm} = \underline{\hspace{2cm}}$ km

Ex. 6.1

- 3 A garden bed is 5.2 m long and 3 m wide.

(a) How much fertiliser will be required to cover the garden bed, if the recommended amount is 0.75 kg per square metre?

(b) What length of wooden fencing will be needed to surround the bed?

- 4 Which unit of area— mm^2 , cm^2 , m^2 or km^2 —would be the most appropriate for measuring the area of:

(a) a soccer field

(b) a postage stamp

(c) a table placemat

(d) a national park?

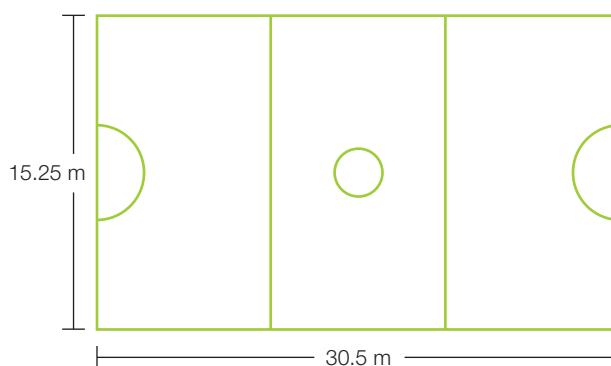
- 5 A rectangle has a perimeter of 26 cm and an area of 30 cm^2 . What are its dimensions (length and width)?

- 6 A netball court is 30.5 m long and 15.25 m wide.

(a) At training, players complete five laps around the boundary of the court. How many metres is this?

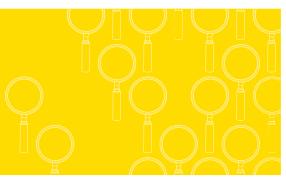
(b) Calculate the area of the court.

(c) The player in the position of 'goal attack' is allowed to move around in two-thirds of the court's area. Calculate this area, correct to one decimal place.

**Ex. 6.3****Ex. 6.3****Ex. 6.2, 6.3**



Investigation



Paddocks

Equipment required:
1 brain, graph paper

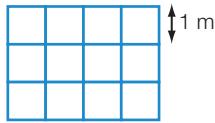
The Big Question

A farmer is planning to fence off an area of 400 m^2 for the calves on his property. What dimensions (length and width) would give the paddock an area that is cheapest to fence?



Engage

- 1 Shapes with the same area can have different perimeters. Each of the rectangles below has been made using 12 squares. Each square has a side length of 1 m.



- (a) Copy and complete the table below for the three rectangles.

Dimensions of shape	Area (m^2)	Perimeter (m)
1×12		
2×6		
3×4		

- (b) Which of the rectangles above has the shortest perimeter?
(c) Why would the farmer be interested in having the shortest perimeter?

Explore

- 2 List all possible pairs of whole number dimensions that would give a paddock with an area of exactly 400 m^2 .

Strategy options

- Draw a diagram.
- Test all possible combinations.

- 3 (a) Select three of the paddocks you think are most suitable for containing the calves. Draw the three paddocks on graph paper, showing their dimensions. To show their relative sizes, use a scale of 1 cm on page = 5 m in real life.

- (b) Find the perimeter of each of the three paddocks.

- 4 Use the following information to complete the table on the following page and calculate the total cost of the fencing for each paddock.

Fencing wire: Each fence has five strands of wire. Each strand goes all the way around the fence. The wire costs 85¢ per metre.

Corner posts: The paddocks will need a large post at each corner, each costing \$40.

Standard posts: There must be a post at least every 5 m along a section of fence. If the distance between the corner posts is longer than 5 m, a standard post is placed along the fence. Mark where the standard posts will be required on the diagrams of each of your paddocks, and count the number needed for each paddock. Each standard post costs \$15.



This table will help you to calculate the total cost of constructing each paddock. Copy the table and complete the columns for each of your three paddocks.

Paddock	Dimensions	Perimeter	Metres of fencing wire needed	Cost of fencing wire	No. of corner posts needed	Cost of corner posts	No. of standard posts needed	Cost of standard posts	Total cost
Paddock 1									
Paddock 2									
Paddock 3									

Explain

- 5 What happens to the perimeter of a paddock as it gets longer in length and shorter in width? Try to explain why this is. The 12 m^2 rectangles you used in Question 1 may help.

Elaborate

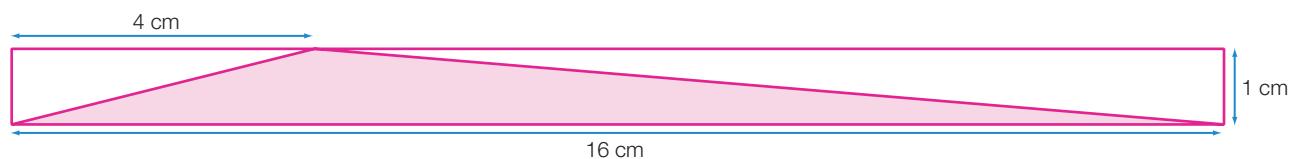
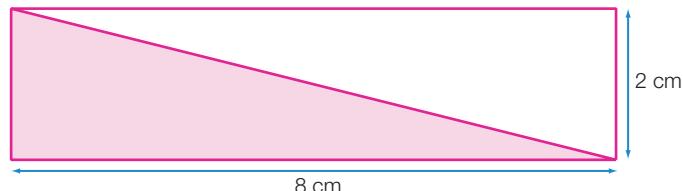
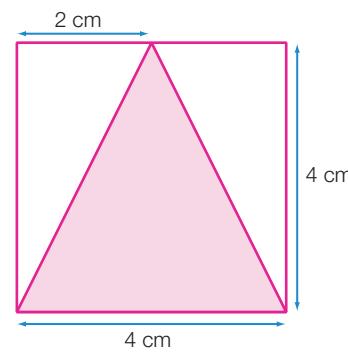
- 6 Answer the Big Question by stating which of the three paddocks you think the farmer should choose, giving reasons for your choice.

Evaluate

- 7 (a) What information did you discover from the rectangles in Question 1 that could be used to determine the dimensions of a larger paddock with the shortest perimeter?
 (b) Why did you select the three paddocks that you did?
 (c) Cost is one consideration when designing paddocks. What are other considerations that the farmer would need to take into account?

Extend

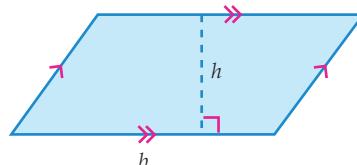
- 8 Investigate the perimeter and the area of other shapes by looking at the triangles below. Each triangle has an area of 8 cm^2 .
- (a) Copy them onto graph paper using the actual measurements given in the diagrams. Then measure the perimeter of each triangle with a ruler.
- (b) Which triangle has the shortest perimeter? Is this what you expected? Explain.



6.4

Area of a parallelogram

A **parallelogram** is a four-sided shape that has two pairs of parallel sides. The pairs of parallel sides are marked by $>$ and $>>$ symbols. The parallelogram has a **base**, b , and a **height**, h , which is **perpendicular** to the base. Perpendicular means ‘at right angles to’. This is shown by the symbol for the right angle \perp .



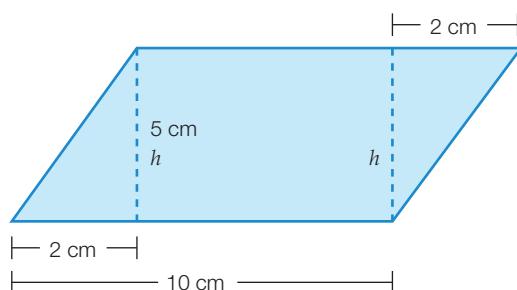
Developing a formula for area



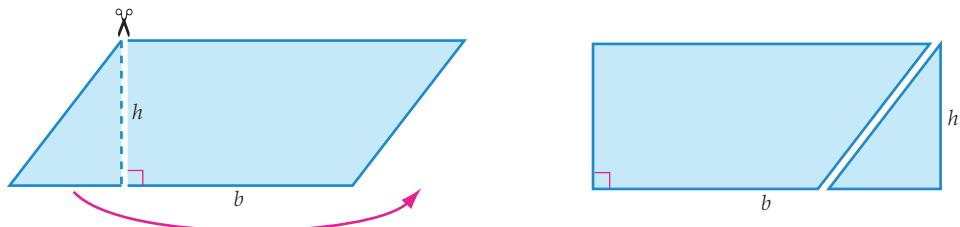
We can find a formula for calculating the area of a parallelogram by cutting and rearranging it into a familiar shape—a rectangle.

Construct a parallelogram by ruling a horizontal line 10 cm long and labelling it b . At one end of the line, and 2 cm in from the other end, measure two perpendicular heights of 5 cm. Mark them with dotted lines and label them h . Use the marked heights to rule a second 10 cm line parallel to the first. Make sure that this line starts 2 cm in from one end, and extends 2 cm past the other end of the first line.

If you have done this accurately, the two shorter, sloping sides of the parallelogram will also be parallel when you rule them in.



Transform your parallelogram into a rectangle by cutting down one of the dotted lines marking the height and rearranging the two pieces formed into a rectangle, as shown below.



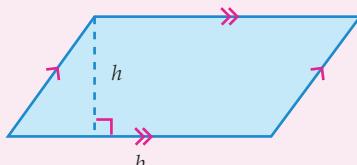
The base and height of the parallelogram become the length and width of a rectangle, and so we can multiply them together to find the area.

Area of a parallelogram

Multiply the base (b) by its perpendicular height (h).

$$A = bh$$

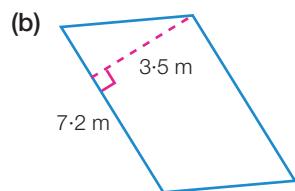
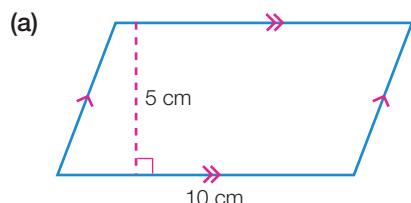
Sides that are marked with the same number of > symbols are parallel.



Worked Example 7

WE7

Find the area of each of the following parallelograms.



Thinking

Working

- (a) 1 Write the formula for the area of a parallelogram.
2 Identify b and h , and substitute their values into the formula.
3 Evaluate, writing the answer with the correct units.

(a) $A = bh$
 $A = 10 \times 5$
 $A = 50 \text{ cm}^2$

- (b) 1 Write the formula for the area of a parallelogram.
2 Identify b and h , and substitute their values into the formula.
3 Evaluate, writing the answer with the correct units.

(b) $A = bh$
 $A = 7.2 \times 3.5$
 $A = 25.2 \text{ m}^2$

6.4

6.4 Area of a parallelogram

Navigator

**Answers
page 659**

Q1, Q2, Q3, Q4, Q6, Q7, Q8,
Q10

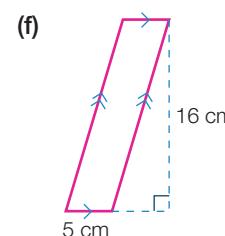
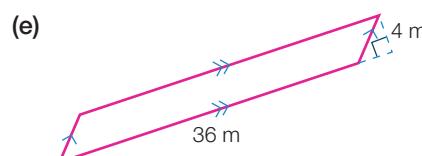
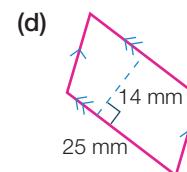
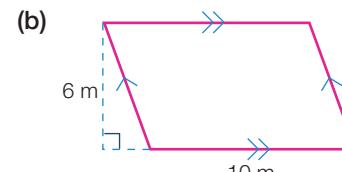
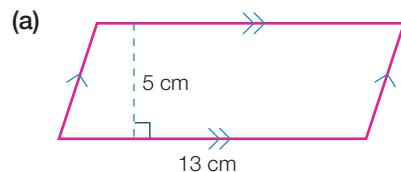
Q1 (c)–(f), Q2, Q3, Q4, Q5, Q6,
Q7, Q8, Q9, Q10

Q1 (e)–(f), Q2, Q3, Q4, Q5, Q7,
Q8, Q9, Q10, Q11

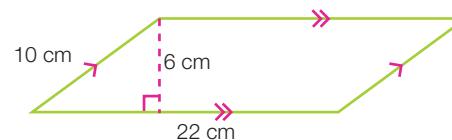
Fluency

WE7

- 1 Find the area of each of the following parallelograms.

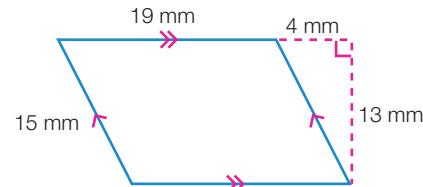


- 2 (a) Find the area of this parallelogram, in cm^2 :
(b) Find the perimeter, in cm.



- 3 (a) The height of this parallelogram is:

- A 4 mm B 13 mm
C 15 mm D 19 mm



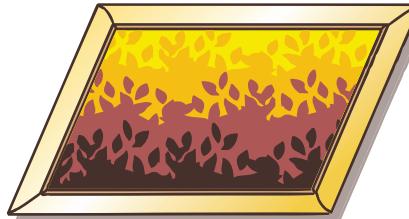
- (b) A parallelogram with a base length of 14 m, a sloping side length of 5 m and a height of 4 m has an area of:

- A 20 m^2 B 28 m^2 C 56 m^2 D 70 m^2

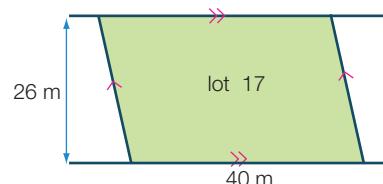
Understanding

- 4 A parallelogram with a base length of 12 cm has an area of 90 cm^2 . What is the height of the parallelogram?

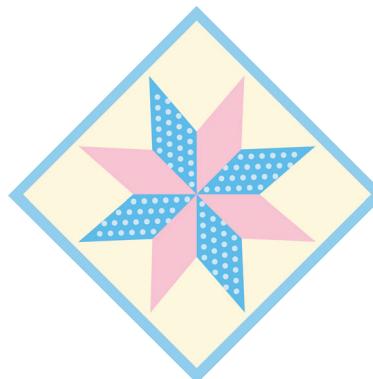
- 5 The picture frame shown has a height of 15 cm and encloses an area of 300 cm^2 . What is the base length of the picture frame?



- 6 A block of land appears on a council map as shown. Calculate its area in square metres.

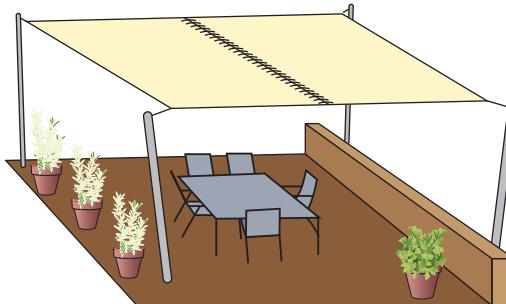


- 7 (a) How many identical parallelograms are shown in the quilt pattern below? (Ignore the different colours.)
 (b) If a single parallelogram has a base length of 8.5 cm and a height of 6.5 cm, calculate the area of material required for all of the parallelograms on the quilt.



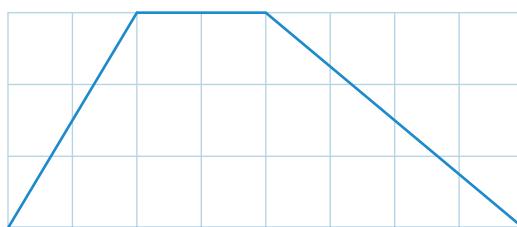
Reasoning

- 8 Two parallelogram-shaped shade sails are sewn together to provide shade for a courtyard, as shown. Each parallelogram has a base length of 4 m and a height of 2.5 m.



- (a) At midday when the Sun is directly overhead, what area of shade will the shade sails provide?
 (b) Show another way that the shade sails could be sewn together. Would this provide the same area of midday shade? Explain.

- 9 (a) Copy the trapezium and show the position of the cuts and the transformations required to form a rectangle.
 (b) Calculate the area of the trapezium if one grid square = 1 cm^2 .



Open-ended

- 10 State the dimensions (base and height) of three parallelograms that have an area of 32 cm^2 .
- 11 Four identical parallelograms are placed together to form a larger parallelogram.
 (a) Show how this can be done.
 (b) State two possible dimensions of the smaller parallelogram, so that the larger parallelogram has an area of less than 100 cm^2 .

6.5

Area of triangles and composite shapes

Area of a triangle

How do you find the area of a triangle? When faced with a new problem, mathematicians often try to use what they already know to solve it.

To find the area of a triangle, we will use a shape we already know how to find the area of: the rectangle. Can triangles be 'rearranged' to form rectangles?



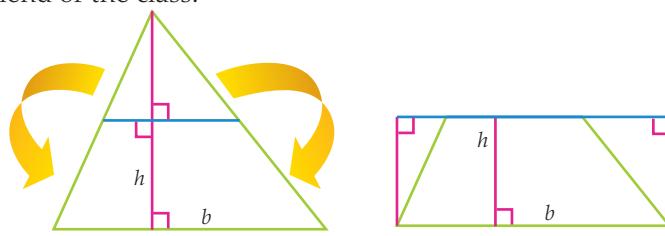
<p>1 Use a ruler and a pencil to draw a triangle. So it is easy to work with, the side lengths should be at least 10 cm long. Label one side as the base, b.</p>	<p>2 Rule a line from the apex (the point at the top) of the triangle to the base. The line should be perpendicular (at an angle of 90°) to the base. Label this line h, the height of the triangle.</p>
<p>3 Mark a point half-way up this line and use it to rule a line parallel to the base.</p>	<p>4 Cut along these two inside lines to create four pieces.</p>

Now:

- Use the four pieces to form a rectangle.
- Reform the triangle.
- Keep moving between the rectangle and the triangle until you are able to do it easily.
- What is the simplest way to move from the triangle to the rectangle? Write down the steps involved, then share them with a friend or the class.

Did you find that the simplest way was to rotate the two top pieces until they touched the bottom two?

We can find the area of the rectangle formed by finding the length and the width and multiplying them.





The length of the rectangle is the length of the base of the triangle, b .

The width of the rectangle is half the height of the triangle, $\frac{1}{2}h$, or $\frac{h}{2}$. (Can you see why? Look back at the instructions for step 3.)

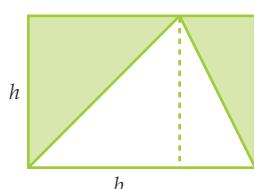
So, instead of writing $A = \text{length} \times \text{width}$, we can write:

$A = b \times \frac{h}{2}$, or $A = \frac{bh}{2}$ for the area of the rectangle, which is also the area of our original triangle.

This rule will work for all triangles. You can check this by repeating steps 1–4 with differently shaped triangles, then rearranging them into rectangles.

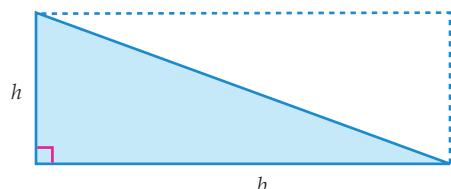
Another way of looking at it

Another way of showing that the area of a triangle is equal to $\frac{bh}{2}$ is to draw a rectangle around the triangle, touching the points of the triangle, like this:

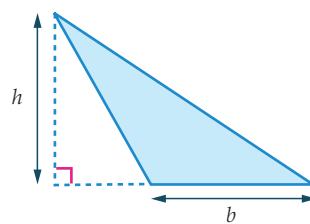


The area of this rectangle is $b \times h$, or bh . We can see by using symmetry that the two smaller, shaded triangles together are equal to the original, unshaded triangle. This means that the original triangle occupies half the area of the rectangle, or $\frac{bh}{2}$.

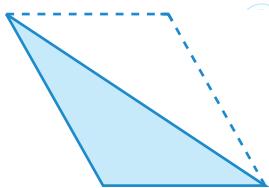
It is easy to see that the area of a triangle is half the area of the enclosing rectangle if you consider a right-angled triangle.



For some triangles, such as this one, the perpendicular height is measured outside of the triangle. We can find the height by extending the base, then drawing a perpendicular line from this extension to the opposite vertex. These triangles also follow the rule $A = \frac{bh}{2}$.



We can draw another identical triangle to form an enclosing parallelogram.

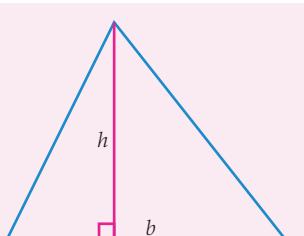


The area of the parallelogram is bh .

One triangle forms half of the parallelogram, so its area is $\frac{bh}{2}$.

The area of a triangle is equal to half of the product of the base and the perpendicular height.

$$A = \frac{bh}{2}$$

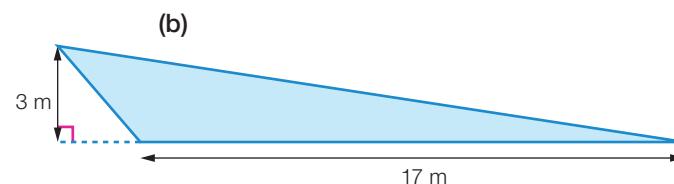
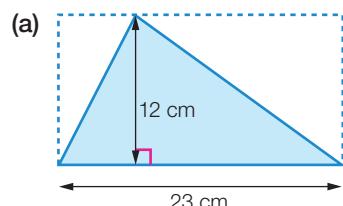


6.5

Worked Example 8

WE8

Calculate the area of the following triangles.



Thinking

- (a) 1 Write the formula for the area of a triangle.
- 2 Identify b and h , and substitute their values into the formula.
- 3 Evaluate, writing the answer with the correct units.

Working

$$(a) A = \frac{bh}{2}$$

$$A = \frac{23 \times 12}{2}$$

$$A = 138 \text{ cm}^2$$

- (b) 1 Write the formula for the area of a triangle.
- 2 Identify b and h , and substitute their values into the formula.
- 3 Evaluate, writing the answer with the correct units.

$$(b) A = \frac{bh}{2}$$

$$A = \frac{17 \times 3}{2}$$

$$A = 25.5 \text{ m}^2$$

Composite shapes

A **composite shape** is a shape that is made by combining two or more shapes, such as rectangles, squares, parallelograms and triangles. Examples of composite shapes are shown below.

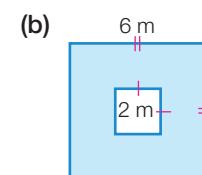
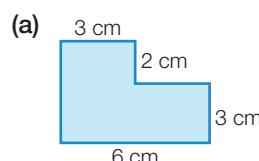


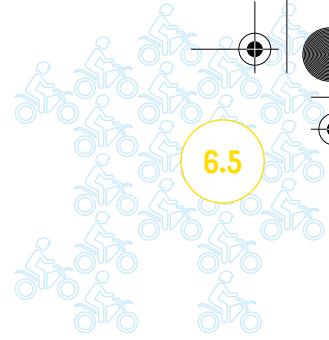
To find the area of a composite shape we divide it up into shapes that we can find the area of, then add or subtract the area of each individual shape.

Worked Example 9

WE9

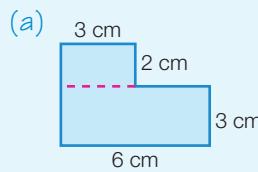
Calculate the shaded area of the following composite shapes.



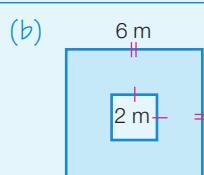
**Thinking**

- (a) 1 Split the composite shape into recognisable shapes. (This may be done in different ways.)
- 2 Write the area of the composite shape as the sum of the areas of the individual shapes.
- 3 Calculate each of the smaller areas.
- 4 Perform the addition by writing the answer with the appropriate units.

- (b) 1 Write the area of the composite shape as the area of the larger shape minus the area of the smaller shape.

Working

$$\begin{aligned} \text{Total area} &= \boxed{\quad} + \boxed{\quad} \\ &= L \times W + l \times w \\ &= 3 \times 2 + 6 \times 3 \\ &= 6 + 18 \\ &= 24 \text{ cm}^2 \end{aligned}$$



$$\begin{aligned} \text{Total area} &= \boxed{\quad} - \boxed{\quad} \\ &= L^2 - l^2 \\ &= 6^2 - 2^2 \\ &= 36 - 4 \\ &= 32 \text{ m}^2 \end{aligned}$$

Note that when we have two of the same type of shape, we use capital letters (L, W) for the dimensions of the larger shape and lower case letters (l, w) for the dimensions of the smaller shape. This is demonstrated in Worked Example 9.

6.5 Area of triangles and composite shapes

Navigator

Q1, Q2 (a)–(f), Q3, Q4, Q6, Q7, Q9, Q11, Q13

Q1 Columns 2 & 3, Q2, Q3, Q5, Q6, Q7, Q8 (a) & (b), Q9, Q10, Q11, Q13

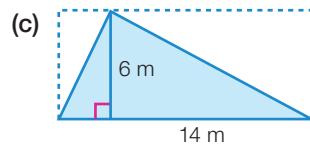
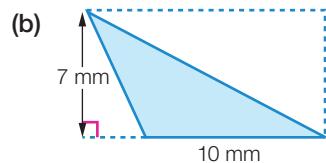
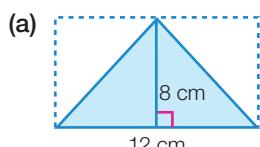
Q1 Column 3, Q2, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14

**Answers
page 660**

Equipment required: A calculator may be used for Questions 2, 4, 6, 8 and 9

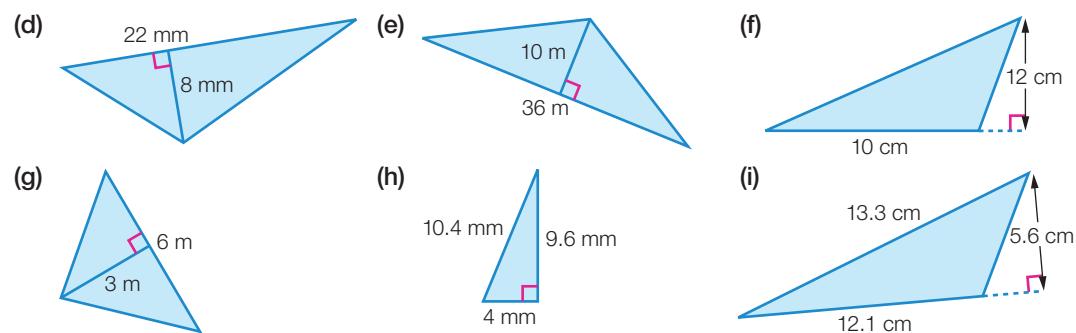
Fluency

- 1 Calculate the area of the following triangles.



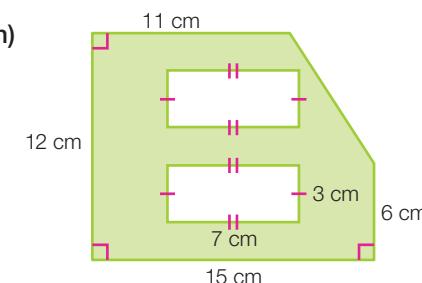
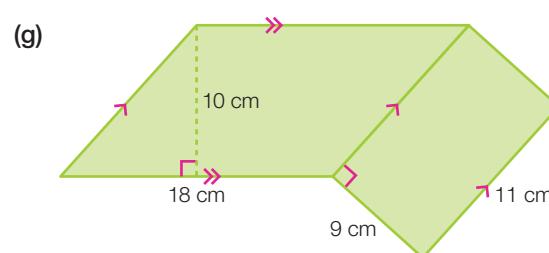
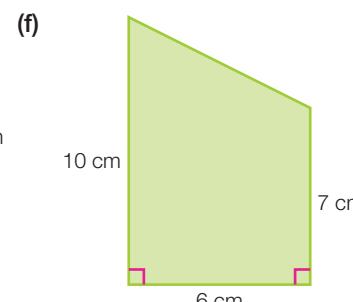
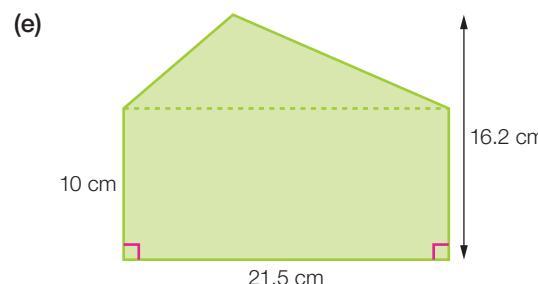
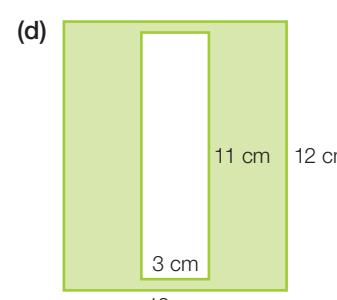
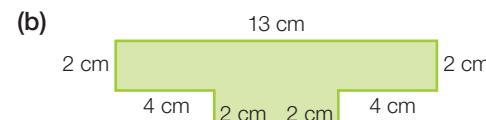
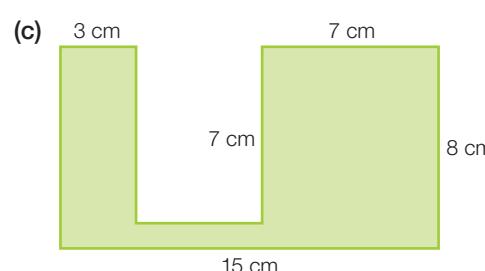
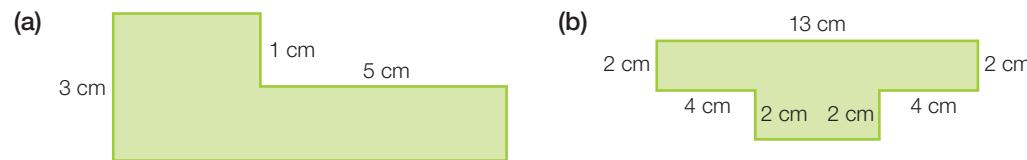
WE8

6.5



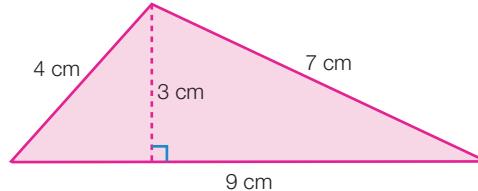
2 Calculate the shaded area of the following composite shapes.

WE9



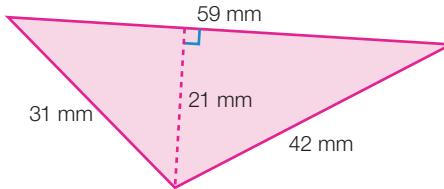
3 (a) In the diagram, the height of the triangle is:

- A 3 cm
- B 4 cm
- C 7 cm
- D 23 cm



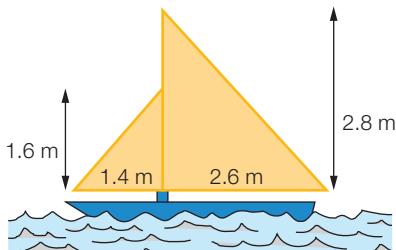
- (b) The base length of the triangle is:

- A 21 mm
- B 31 mm
- C 42 mm
- D 59 mm

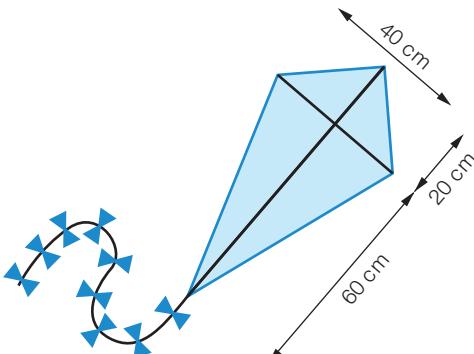


Understanding

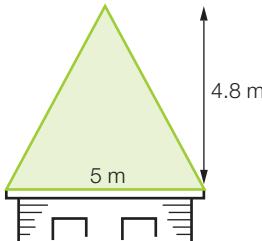
- 4 Find the total area of the sails on this yacht.



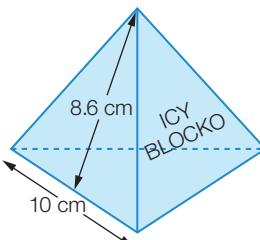
- 5 Find the area of paper required to build the kite shown.



- 6 The label on a tin of paint claims the contents will cover 4 square metres. How many tins would be needed to paint the triangular roof section pictured?

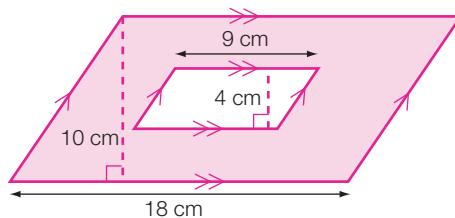


- 7 Find the total area of the four identical triangular faces of the container of frozen drink (a Tetrapak) shown.

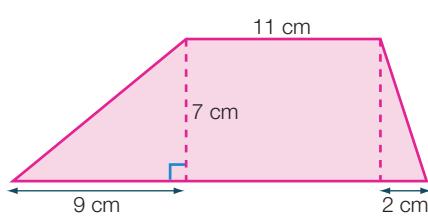


- 8 Find the area of each of the following composite shapes.

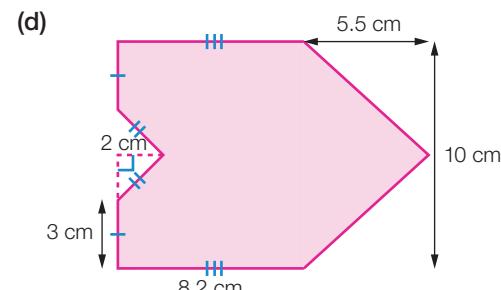
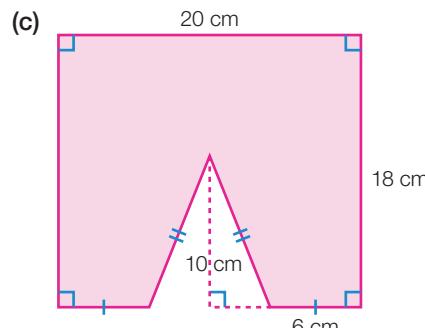
(a)



(b)



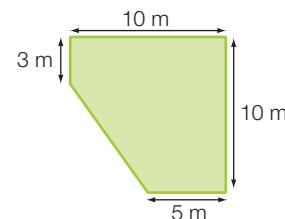
6.5



- 9 Terry is having a doorway put in one of the walls of his house.
- If the wall is 5 m long and 2.4 m high, and the doorway measures 0.82 m by 2 m, what area of wall will remain after the doorway is completed?
 - The architraves go along the sides and top of the doorway. What length of architraves is needed?
 - Terry installs a door in the doorway, and paints two coats of varnish on both sides of the door. If 1 litre of varnish covers 4 square metres, how many litres of varnish did Terry use?

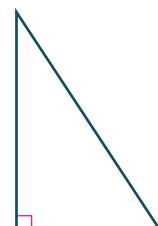
Reasoning

- 10 Describe a method for finding the area of the composite shape shown without splitting it up into known shapes. Use your method to find the answer.



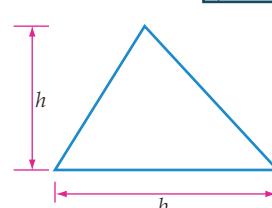
- 11 This triangle can be cut into two pieces to form a rectangle.

- Describe exactly where and how to make the cut.
- Use a diagram to show how the two pieces fit together to make a rectangle.



- 12 This triangle can be cut into four pieces to form a rectangle.

- Describe exactly where and how to make the cuts.
- Use a diagram to show how the four pieces fit together to make a rectangle.



Open-ended

- 13 A triangle has an area of 36 cm^2 . Give two possible combinations for the triangle's base and height.

- 14 The difference in area between a rectangle and a triangle is 12 cm^2 . Draw a possible example of the pair, showing their dimensions.



Volume

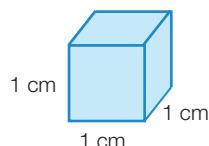
6.6

A box is a three-dimensional (3D) object, which means it has length, width and height. The amount of space inside a box (if it is empty) is its **volume**.

Volume is the amount of space occupied by a 3D object. Volume is measured in 'cube' units. When we calculate volume, we are finding the number of cubes inside the object.

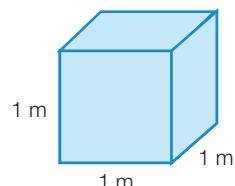
We can measure the volume of an object by counting or calculating the number of cubic centimetres that would fit inside it. A cubic centimetre (cm^3) is a cube with a length, width and height of 1 cm. The volume of larger objects may be measured in cubic metres (m^3)—a cube with length, width and height of 1 m.

A cubic centimetre



$$1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm} = 1 \text{ cm}^3$$

A cubic metre



$$1 \text{ m} \times 1 \text{ m} \times 1 \text{ m} = 1 \text{ m}^3$$

Note that this cube is not drawn to scale.



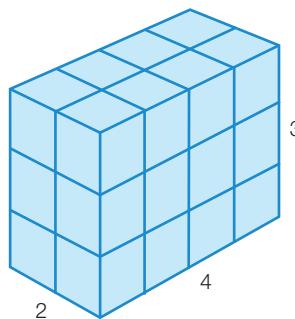
mm^3	cm^3	m^3
The volume of a red head on a match is about 4 mm^3 .	The volume of a die is about 1 cm^3 .	The volume of a standard dishwasher is just over 1 m^3 .

The symbol, ' cm^3 ', can be said in two ways: 'cubic centimetres' or 'centimetres cubed'.

A **rectangular prism** is made up of layers of cubes. Each layer has the same rectangular shape, meaning that there is the same number of cubes in each layer.

The volume of a prism can be found by finding the number of cubes on the bottom face (or top face, if that is easier to see) and then multiplying this by how many layers of cubes there are.

The rectangular prism shown here has 8 cm cubes on its top face, and 3 layers of cubes. Its volume is $8 \times 3 = 24 \text{ cm}^3$.

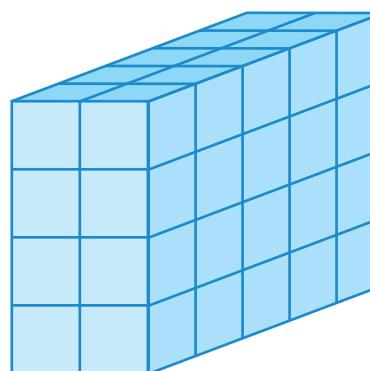


6.6

Worked Example 10

We 10

How many cubic centimetres are there in the following rectangular prism? (Each small cube represents 1 cm^3 .)



Thinking

- Find the number of squares on the top face of the prism.
- Find the height of the prism.
- Work out the total number of cubes.

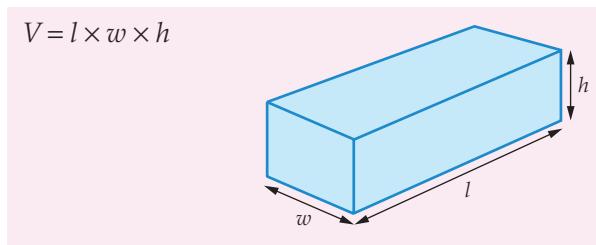
Working

There are 10 squares on the top face.

It is 4 units high.

$$\begin{aligned}10 \times 4 &= 40 \text{ cubes} \\&= 40 \text{ cm}^3\end{aligned}$$

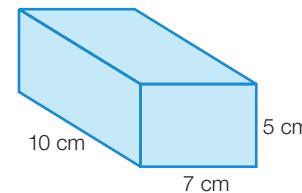
The number of cubes showing on the top or bottom face of a rectangular prism is the same as the area of that rectangular face. Instead of counting the number of cubes in the top or bottom face, we can multiply the length by the width to get the area of the face ($A = l \times w$). We then multiply by the number of layers of cubes. So, to find the volume of a rectangular prism, we multiply the length, width and height values together.



Worked Example 11

We 11

Find the volume of the following rectangular prism in cm^3 .



Thinking

- State the formula for calculating the volume of rectangular prisms.
- Substitute the values for l , w and h into the formula and evaluate.

Working

$$V = lwh$$

$$\begin{aligned}V &= 10 \times 7 \times 5 \\&= 350 \text{ cm}^3\end{aligned}$$

6.6 Volume

Navigator

Q1, Q2, Q3, Q6 Column 1, Q7, Q9, Q10, Q12, Q13

Q1, Q2, Q4, Q5, Q6 Columns 1 & 2, Q7, Q9, Q10, Q11, Q12, Q13

Q1, Q2, Q4, Q5, Q6 Columns 2 & 3, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14

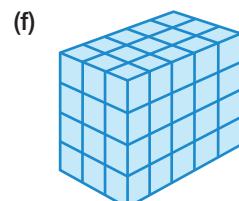
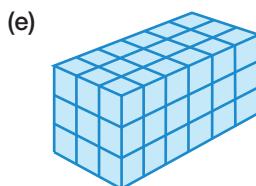
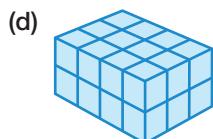
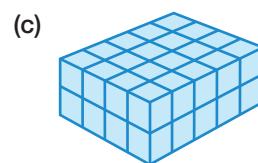
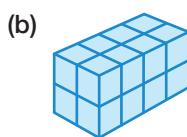
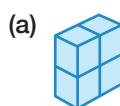
Answers
page 660

Equipment required: A calculator may be used for Questions 7–9, 11 and 14

Fluency

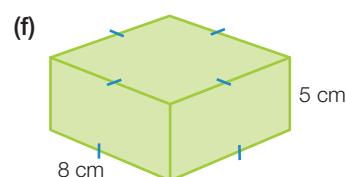
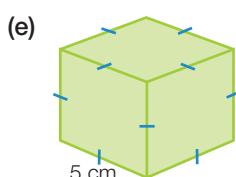
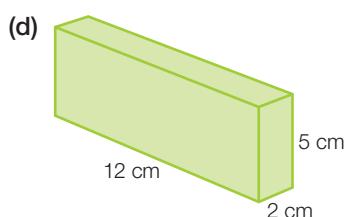
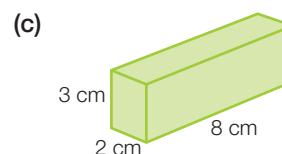
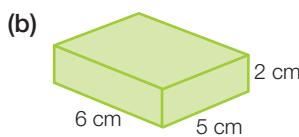
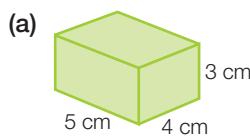
- 1 How many cubic centimetres are there in the following rectangular prisms? (Each small cube represents 1 cm^3 .)

We 10



- 2 Find the volume of the following rectangular prisms in cm^3 .

We 11



- 3 A room is 3 m long, 2 m wide and 2 m high. What is its volume in metres cubed?
 4 A pocket dictionary has a cover 12 cm long and 9 cm wide and is 2 cm thick. Find the volume of this book.

- 5 Choose the correct answer for each of the following rectangular prisms.

- (a) Length = 20 cm; width = 10 cm; height = 5 cm. The volume is:

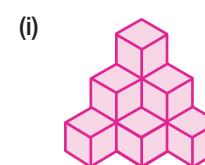
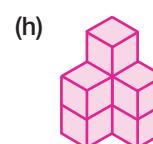
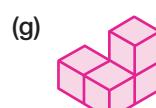
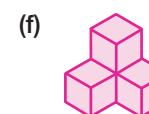
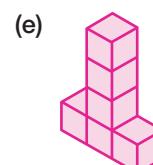
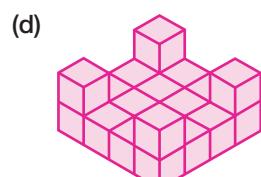
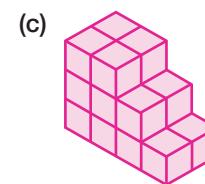
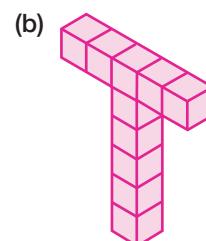
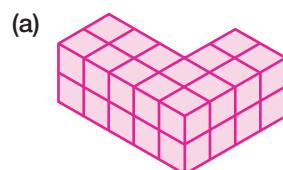
A 35 cm^3 B 100 cm^3 C 700 cm^3 D 1000 cm^3

- (b) Length = 3 m; width = 75 cm; height = 50 cm. The volume is:

A 11.25 m^3 B 112.5 cm^3 C 11250 cm^3 D 1125000 cm^3

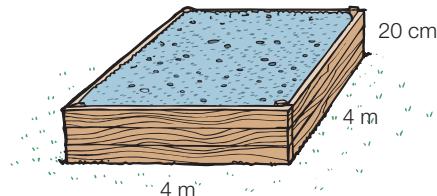
6.6

- 6 Find the volume of each of these compound solids by counting the number of centimetre cubes.



Understanding

- 7 A water tank is to be placed on a wooden box filled with gravel to keep it level. How much gravel is needed, in m^3 , to fill the base shown?



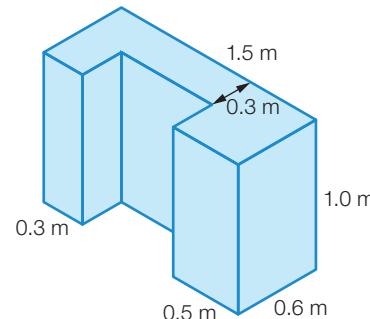
- 8 If a cake in the shape of a rectangular prism is 20 cm long, 15 cm wide and 6 cm thick when baked, what will its volume be after it is iced all over (including the bottom) with a layer of icing 0.5 cm thick?



Divide the solid into rectangular prisms.



- 9 Lachlan has finished the brickwork for his backyard barbecue, shown below. Find the volume of bricks used in building the barbecue.



Reasoning

- 10 A large toy box is completely full of identical wooden blocks which are 10 cm long, 6 cm wide and 4 cm in height. How many blocks can fit inside the toy box, if the dimensions of the toy box are: length 40 cm, width 30 cm and height 20 cm?
- 11 A rectangular prism has a volume of 216 cm^3 . It is twice as long as it is wide, and its height is 3 cm. Find its length.

Open-ended

- 12 A rectangular prism is made from 30 one-centimetre cubes. Give possible values for the length, width and height of the prism.
- 13 At a school fair, a game involves guessing the number of jelly beans in a container. The person with the closest guess will win all the jelly beans.
 - (a) How many jelly beans do you think are in the jar?
 - (b) How did you make an accurate estimate of the number of jelly beans in the jar?
 - (c) If the jelly beans were the same volume but cube-shaped, would more or fewer jelly beans fit in the jar?
- 14 A small cube is placed inside a large cube of volume 64 cm^3 . Give three possible side lengths of the smaller cube and calculate the volume of empty space inside the large cube.



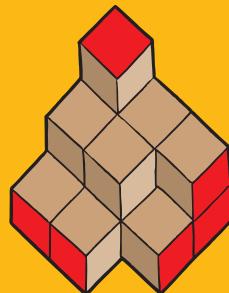
Outside the Square

Problem solving

The red cube

A new water fountain is being constructed as a display for a shopping centre. The water will run smoothly over a large red cube. Construction has started, as shown on the right. How many of the remaining cubes will need one face painted? Two faces painted? Three faces painted?

In the completed water feature, how many cubes will have one, two and three faces painted?



Strategy options

- Have I seen a similar problem?
- Make a model.

Mathspace

City Mission



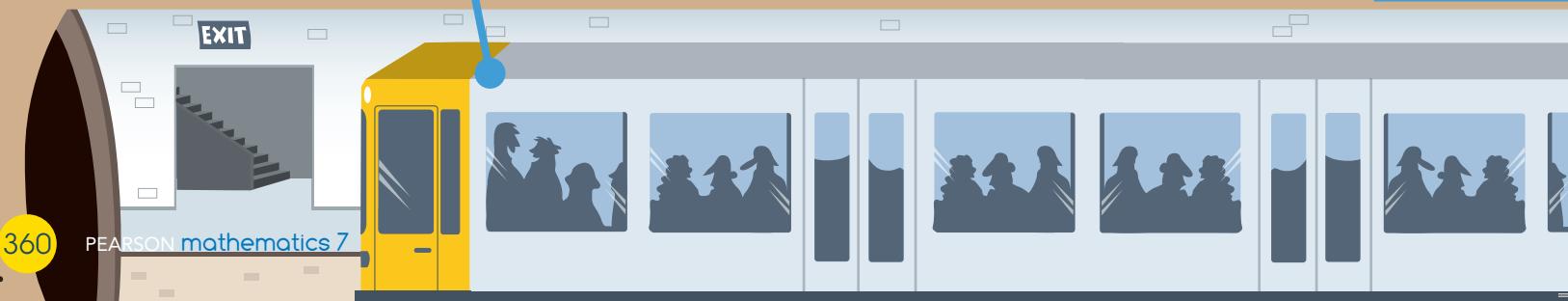
Code X, the evil code-breaking master, is on a spree through the city's streets, decoding top secret information that is giving him access to all of the city's finances, gold and valuables. Your mission is to answer the questions he has left on different devices at various locations around the city, starting at the police station. Answering the questions correctly will spell the access code to his computer files and give you the location of the next clue. The path taken will lead you to Code X's hideout. Can you break the code before he escapes?

The length of this single carriage train could be:
Y 0.07 km (go to police station)
Z 200 m (go to train map)
A 2000 cm (go to library)
B 1200 mm (go to bank)

- The volume of air that can fit inside this telephone booth is:
K $12\ 800 \text{ m}^3$ (go to newspaper stand)
L 6400 m^3 (go to library)
M 360 m^3 (go to police station)
N 1.28 m^3 (go to train map)

The length of this train line is:
R 4.6 km (go to train carriage)
S 3.8 km (go to L'Hotel)
T 42 km (go to museum)
U 52 km (go to telephone booth)

- 0.67 km is equal to:
N 6700 cm (go to Pop's Pizza)
O 670 m (go to telephone booth)
P 6.7 m (go to library)
Q 0.0067 m (go to train carriage)



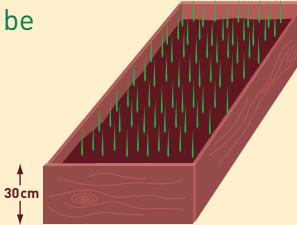


LANDSCAPE GARDENING

Landscape gardening involves designing and creating outside spaces, such as the area around a house or building, and public parks. There are many DIY magazines and TV shows transforming the average backyard into a haven of 'outdoor rooms', lights, waterfalls and vegetable gardens. Before a garden can be transformed, a detailed design is drawn on grid or graph paper.

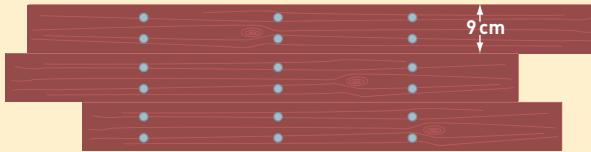
- 1 (a)** Why is it helpful to draw the design on a grid?
- (b)** The scale at the top of the grid states that 1 cm on the page represents 1 m in real life. What real life distance would 1 mm represent? At the top of the following page is a design used to transform an Australian backyard. Refer to the plan when answering Questions 2–8.
- 2** What is the total area of the backyard (not including the house)?
- 3** The lawn will be sown by seed. 30 g of grass seed is needed to cover each square metre.
 - (a)** What is the area to be covered in grass?
 - (b)** How much grass seed will you need to buy? Give your answer in kilograms.
- 4** The path that extends from the shed to and around the vegie garden will be paved with bricks. The base dimensions of one brick are 20 cm × 10 cm. Calculate:
 - (a)** How many bricks will cover each square metre?
 - (b)** What is the total number of bricks required to complete the path?

- 5** The vegetable garden will be constructed out of timber sleepers with a height of 30 cm. The box needs to be filled with a mixture of soil and compost.

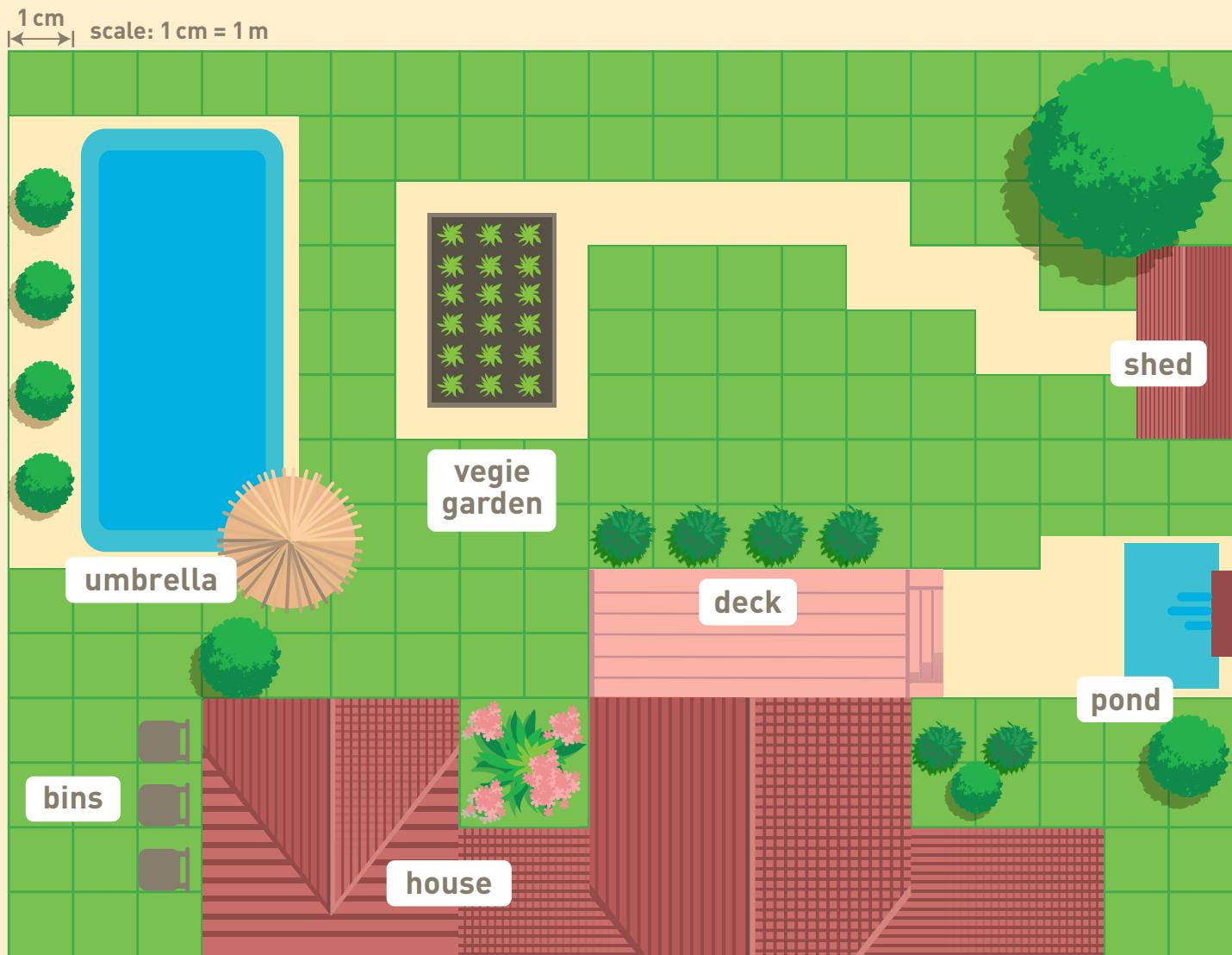


- (a)** What is the total length of the timber sleepers needed to make the vegetable garden box?
- (b)** Find the area of the topsoil of the vegetable garden.
- (c)** What volume of soil mixture will be needed to fill the box to the top?

- 6** The deck will be made using hardwood boards that are 9 cm wide. Decking boards are sold in different lengths and then cut to size.



- (a)** What area is to be decked? (Include the step in your calculations.)
- (b)** How many boards are needed to cover a width of one metre?
- (c)** What length of decking will need to be bought to make the deck?



An important consideration when designing a backyard is cost. A detailed budget needs to be completed before the project can begin.

7 Using the figures you have calculated in Questions 2–6, copy and complete the budget below.

Item	Number of items required or area to cover (m^2)	Cost	Total cost of each item
Grass seed		\$8.95 per 1 kg box	
Bricks		\$0.80 each	
Timber sleepers		\$12 per metre	
Soil mixture		\$42 per m^3	
Decking		\$4.50 per metre	
Total cost \$			

8 What other costs in making this backyard have not been included in the above budget?

Research

Design your own 'ideal' backyard. Make a scale drawing of it using similar symbols as above. Consider aspects such as space, cost, slope of the land, water restrictions, pets and your family's needs.



Investigation

Equipment required: 1 brain, (2 brains may be used for Question 2), centimetre cubes (optional), graph paper or isometric dot paper



Blocks of chocolate

The dimensions of a Cadbury Cherry Ripe® chocolate bar are shown below.

The surface area of a chocolate bar is the combined area of the top, bottom and all four sides. It is the area that is covered in chocolate.

The smaller the surface area of a chocolate bar, the less packaging will be required to wrap around it.



The Big Question

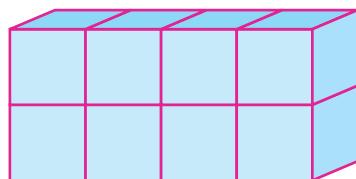
What is the smallest possible surface area for a Cadbury Cherry Ripe® that has a volume of 36 cm^3 ?

Engage

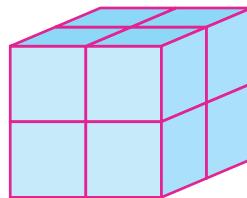
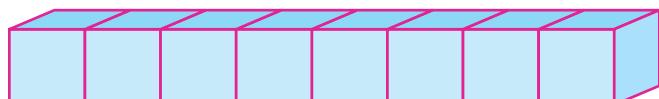
Chocolate comes in blocks that resemble rectangular prisms. The volume of a rectangular prism can be calculated using the formula: Volume = length \times width \times height. If the volume is known to be 8 cm^3 and we want to find the possible dimensions for the rectangular prism, we need to find three numbers that multiply to give 8:

For example: $8 \text{ cm}^3 = 4 \times 2 \times 1$

These dimensions give the following rectangular prism.



These eight cubes can be arranged to make two other rectangular prisms:



- 1 The surface area of a rectangular prism can be found by counting or calculating the number of squares on the surface of each face (including the bottom) and adding them together. The surface area of a rectangular prism with length 4 cm, width 1 cm and height 2 cm is shown in the table below.

Dimensions	
	$4 \text{ cm} \times 2 \text{ cm} \times 1 \text{ cm}$
Area of front and back	
	$8 + 8 = 16$
Area of top and bottom	
	$4 + 4 = 8$
Area of sides	
	$2 + 2 = 4$
Total surface area	
	$16 + 8 + 4 = 28 \text{ cm}^2$



- Calculate the surface area of the other two rectangular prisms with volume 8 cm^3 . If you have centimetre cubes, use them to help you.
- All three rectangular prisms have a volume of 8 cm^3 . What are the dimensions of the one with the smallest surface area?
- Draw the actual Cherry Ripe® bar as a rectangular prism on graph paper or dot paper.
- What is the surface area of the Cherry Ripe®?

Explore

- 2** The volume of the Cherry Ripe® shown is $12 \times 3 \times 1 = 36 \text{ cm}^3$.
- Other whole number dimensions of a rectangular prism will give a volume of 36 cm^3 . List all the different combinations of whole numbers that will make this statement true.
- $36 \text{ cm}^3 = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$
- 

A factor tree can help find three numbers that will multiply together to equal 36.

 **Strategy options**

 - Make a table.
 - Have I seen a similar problem?
 - Make a model.
- Choose the three sets of dimensions from the list you compiled in (a) that you think will have the least surface area. Draw three chocolate bars with the chosen dimensions on graph paper or dot paper.
 - Copy and complete the table below to find the total surface area of the three prisms:

Dimensions of chocolate bar	Area of front and back	Area of top and bottom	Area of sides	Total surface area

Explain

- Use your results from Question 2 to answer the Big Question. Include dimensions of the bar and its surface area in your answer.
- How much less packaging would this new bar require, compared to the current one?

Elaborate

- Explain how you can predict which dimensions of a rectangular prism will have the smallest surface area.
- Write a statement that explains how you would find the dimensions that give the smallest surface area for a rectangular prism.

Evaluate

- Describe, using a step-by-step method, the approach you used to solve this problem. Did you use any of the information you found in Question 1?
- Can this problem be solved another way? What other methods or shortcuts could be used when approaching problems like this one?
- Why do you believe current chocolate bars are the shape they are? Do you think that chocolate companies may consider changing the dimensions of chocolate bars? List some advantages and disadvantages of doing this.

Extend

- Construct a model of your alternative Cherry Ripe® chocolate bar that has the smallest surface area. Design the packaging and then fold it into a rectangular prism.
- Prepare a report for the Cadbury Schweppes company on the size, dimensions and packaging of your new Cherry Ripe® chocolate bar. Your report should include:
 - the dimensions and surface area of your newly designed Cherry Ripe®
 - environmental reasons for reducing the amount of packaging used for individual chocolate bars
 - financial reasons for reducing the amount of packaging used for individual chocolate bars
 - an example of what your new Cherry Ripe® will look like (your design).

Challenge 6

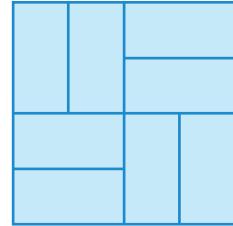


1 If a \$2 coin is about 2 mm thick, how much is a kilometre-high stack of \$2 coins worth?

2 The perimeter of this square paddock is 800 m. It is divided into eight identical paddocks as shown.

The perimeter, in metres, of each of the eight smaller paddocks is:

- A 150 B 200
C 300 D 400



3 The weight limit for a lift is 1500 kilograms. The average weight of the people in the lift is 80 kilograms. If the combined weight of the people is 100 kilograms over the limit, how many people are in the lift?

- A 13 B 16 C 17 D 20

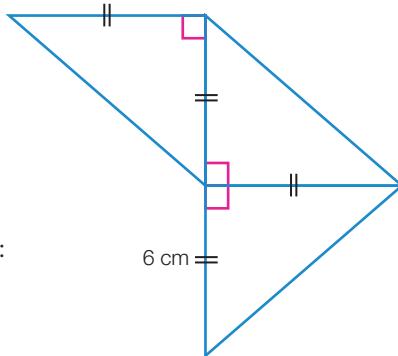
4 When a square piece of paper is folded in half vertically, the resulting rectangle has a perimeter of 39 cm. Find the area of the original sheet of paper, in square centimetres.

5 A rectangular area on a wall measuring 7 units by 3 units is covered with 7 rectangular tiles measuring 1 unit by 3 units. In how many ways can this be done?



6 The area of the entire figure shown is:

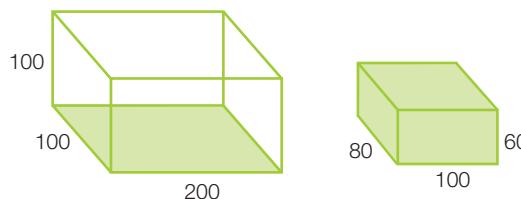
- A 36 cm^2 B 54 cm^2
C 72 cm^2 D 108 cm^2



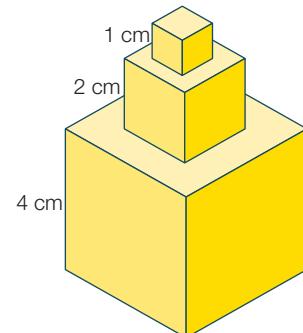
7 A rectangular sign has the dimensions 10 m by 16 m. If a square advertisement to be painted on it must have a border at least 1.5 m wide, the area of the largest square advertisement that can be painted on the sign is:

- A 49 m^2 B 72.25 m^2
C 91 m^2 D 160 m^2

8 A fish tank has a base of 100 cm by 200 cm and a depth of 100 cm. A solid metal rectangular prism with dimensions 80 cm by 100 cm by 60 cm is placed in the tank and water is poured into the tank until it is level with the top of the metal prism. After the prism is carefully removed from the tank, the depth of the water remaining is measured. What are the three possible depths?



9 Three cubes are sitting on top of each other. The bottom cube has a side length of 4 cm, the cube on top of it has a side length of 2 cm and the very top cube has a side length of 1 cm. What is the visible area of the cube stack?



Chapter review 6

D.I.Y. Summary

Key Words

area	height	metric	perpendicular
base	kilometre	millimetre	rectangular prism
centimetre	length	parallelogram	volume
composite shape	metre	perimeter	width

Copy and complete the following using the words and phrases from this list, where appropriate, to write a summary for this chapter. A word or phrase may be used more than once.

- 1 _____ is the distance around the outside of a shape.
- 2 To calculate the _____ of a rectangle, you multiply the _____ by the width.
- 3 The area of a triangle is half the _____ multiplied by the perpendicular _____.
- 4 The _____ of a rectangular prism is found by multiplying the length, width and height together.
- 5 The system of measurement used in Australia is called the _____ system.
- 6 To find the area of a _____ we break it up into simpler shapes.
- 7 Multiplying the base length by the perpendicular height will find the area of a _____.

Fluency

- 1 (a) The height of an average house ceiling is approximately:

A 260 mm B 2.6 m C 0.26 km D 2600 m

Ex. 6.1

- (b) The length of a classroom desk is approximately:

A 18 cm B 280 mm C 180 cm D 180 m

- 2 Copy and complete the following length conversions.

(a) $45.9 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

(b) $58\,000 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

Ex. 6.1

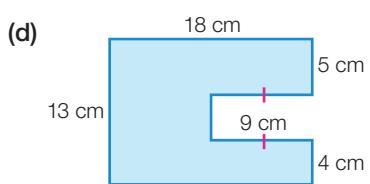
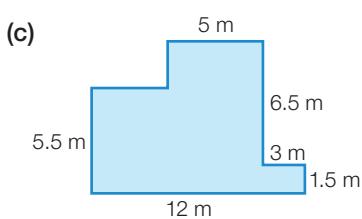
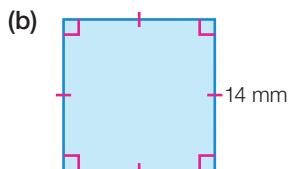
(c) $9.2 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

(d) $42 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

(e) $980 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

(f) $0.006\,73 \text{ km} = \underline{\hspace{2cm}} \text{ mm}$

- 3 Find the (i) perimeter and (ii) area of each of the following shapes.



Ex. 6.2

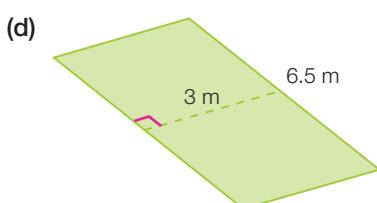
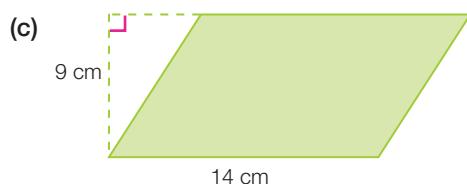
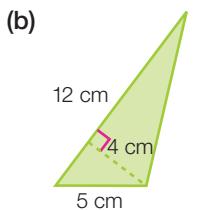
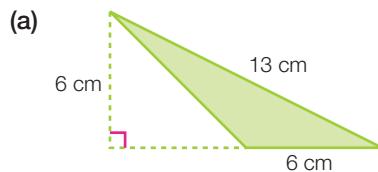
Ex. 6.3

Ex. 6.5

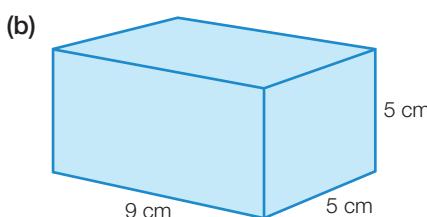
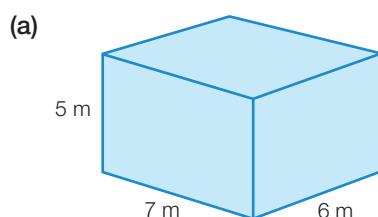
- 4 Find the perimeter and area of a squash court 9.75 m long and 6.4 m wide.

Ex. 6.2, 6.3

- 5 Find the area of each of the following shapes.



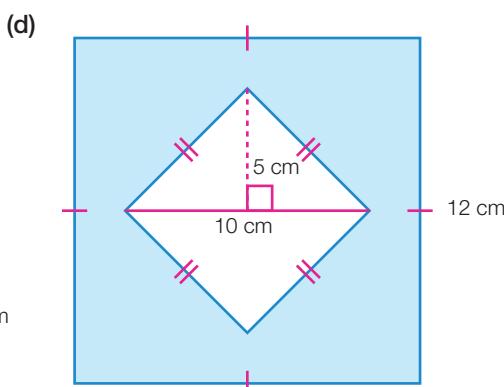
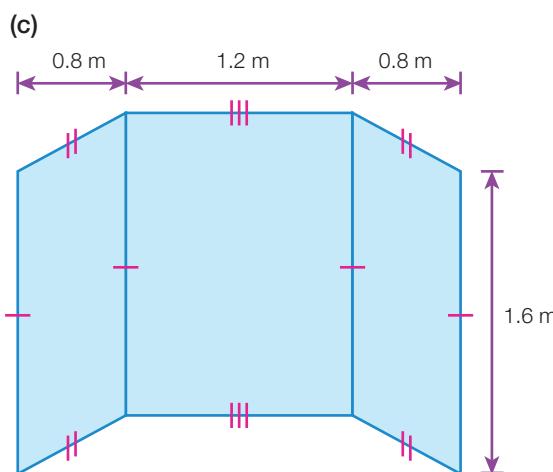
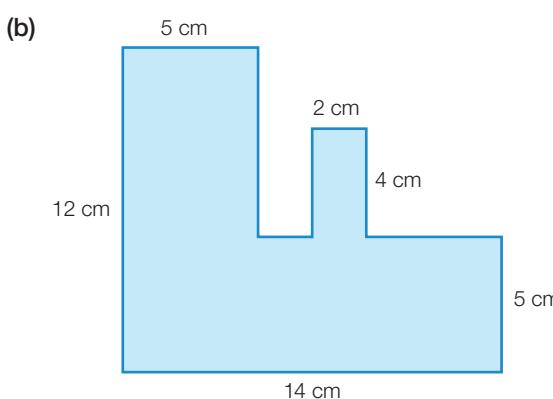
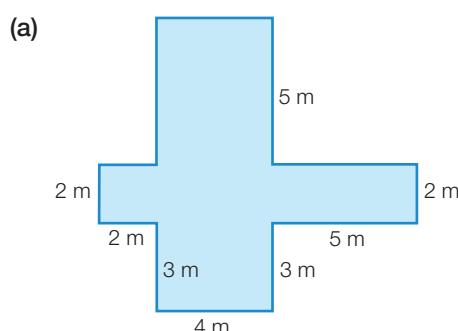
- 6 Determine the volume of the following solids.



Ex. 6.6

Understanding

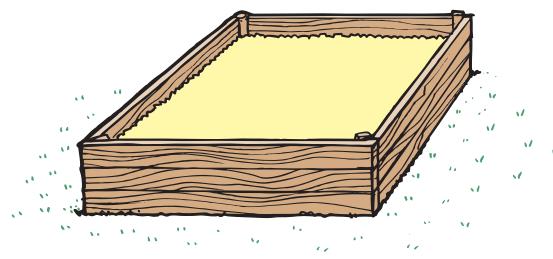
- 7 Find the area of each composite shape below.



- 8 A carpenter calculates that the length of timber she requires to make a book case is 4850 mm.
- How many metres is this?
 - If timber costs \$6 per metre at the hardware store, how much will she pay?
- 9 Robbie is tiling the floor of his bathroom, which is a rectangle measuring 3 m by 2.5 m.
- Write these measurements in centimetres, then calculate the area of the floor in square centimetres.
 - Robbie is using square tiles that have a side length of 25 cm. Calculate the number of tiles needed to cover the floor.
 - If the tiles cost 80 cents each, calculate how much Robbie will pay for the required number of tiles.

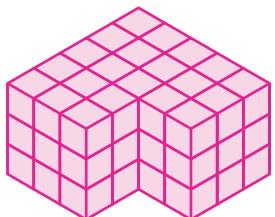


- 10 Theresa is constructing a sand pit for her children. She has created a rectangular wooden box that is 2 m long, 1.5 m wide and 0.3 m high.
- Calculate the perimeter of the box.
 - Calculate the volume of the box.
 - If one cubic metre of sand costs \$15, calculate how much it will cost to fill the box to a depth of 25 cm with sand.

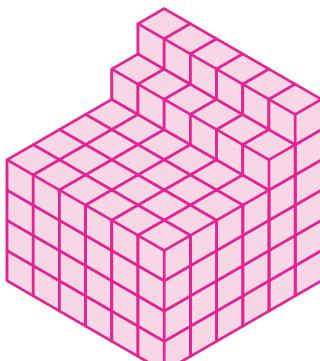


- 11 Tricia has obtained a quote of \$21 per square metre for her driveway to be resurfaced. If her driveway is rectangular and measures 12 m long and 3.2 m wide, what will the job cost her?
- 12 Determine the volume of each of the following solids. (The cubes are centimetre cubes.)

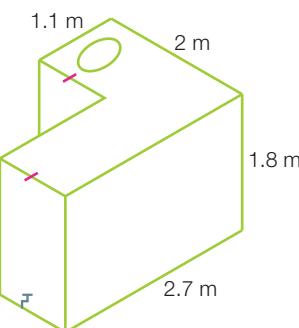
(a)



(b)

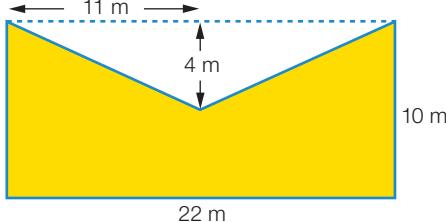


- 13 Cameron has had a water tank specially made to fit the side of his house. Calculate the volume of the tank, in cubic metres.



Reasoning

- 14 What is the perimeter of a square with an area of 25 cm^2 ?
- 15 What is the area of a rectangle with a perimeter of 32 cm and a length of 10 cm?
- 16 At right is a diagram of the available floor space (shaded) in an unoccupied car show-room. Calculate the area available for a display.

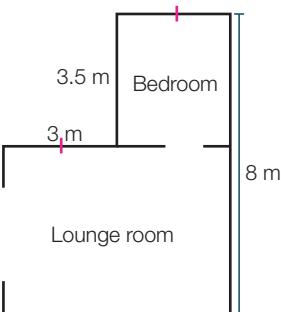


- 17 Five blocks of dimensions $3 \text{ cm} \times 5 \text{ cm} \times 6 \text{ cm}$ are placed in a toy box of length 40 cm, width 20 cm and height 9 cm. Find the volume of space left in the box.
- 18 Draw a diagram to help you explain:
- how to turn a parallelogram into a rectangle
 - how to turn a triangle into a rectangle.

NAPLAN practice 6

Numeracy: Non-calculator

- Which has the larger area: A rectangle with a length of 20 cm and a width of 15 cm, or a triangle with a base of 20 cm and a height of 15 cm?
- Li is having new carpet laid in the lounge room and bedroom of her apartment. What area is to be carpeted?



- What is the perimeter of a square that has an area of 100 cm^2 ?
- A rectangular picture frame has a perimeter of 80 centimetres. The frame has a length of 25 centimetres.

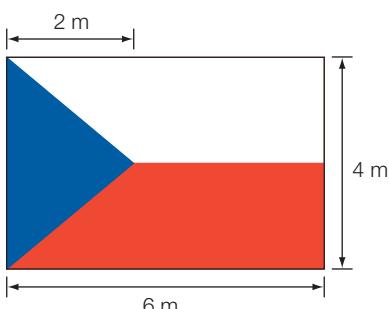
What is the width of the picture frame? _____ cm

Numeracy: Calculator allowed

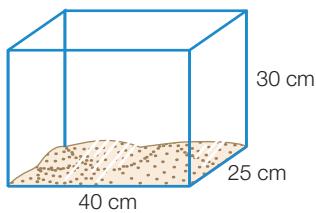
- The flag of the Czech Republic is shown here.

The line where the red and white sections meet is halfway up the flag. If the blue triangle has a height of 2 m, the area of the flag that is red is:

- A** 8 m^2 **B** 9 m^2
C 10 m^2 **D** 16 m^2



- A pack of playing cards is 2.6 cm high. If there are 52 cards in the pack, what is the thickness of each card?
 - The Hudson family have bought a new fish tank, requiring a 20 mm deep layer of pebbles on the bottom. Which volume of pebbles should they buy?
- A** 1000 cm^3 **B** 2000 cm^3
C 20000 cm^3 **D** 30000 cm^3
- Sanjay used identical cubes to build a rectangular prism. There were 18 cubes in its base. She used 54 cubes altogether. Which of these could be the dimensions of Sanjay's prism?
- A** $6 \times 3 \times 2$ **B** $3 \times 2 \times 9$ **C** $9 \times 3 \times 3$ **D** $6 \times 3 \times 9$



Mixed review



Fluency

1 Write the following in algebra.

- (a) Akash has n pencils in his pencil case. He takes 8 out and lends them to a friend.
How many pencils are in the case now?

Ex.5.1

- (b) k dollars is divided evenly among 6 people. How much money does each person receive?
(c) There are 50 matches in one box. How many matches are there in h boxes?

2 Arrange the following decimals in order from smallest to largest.

- (a) 2.3, 2.003, 2.33, 2.323, 2.302 (b) 0.089, 0.129, 0.091, 0.0909, 0.0199

Ex.4.1

3 Write the following as fractions or mixed numbers in simplest form.

- (a) 6 out of 24 students in the class have black hair.
(b) 5 full dozen egg cartons and 4 eggs in another carton.
(c) 25 minutes out of an hour.

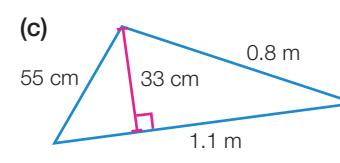
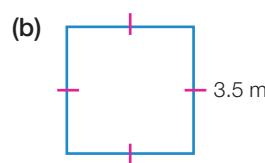
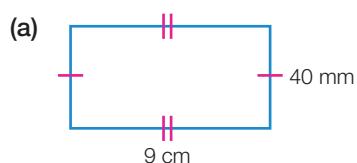
Ex.3.1

4 Write each of the following numbers as a product of their prime factors in index form.

- (a) 28 (b) 200 (c) 990

Ex.2.3

5 Find (i) the perimeter and (ii) the area of the following shapes, giving your answer in the larger unit where necessary.



Ex.6.2, 6.3, 6.5

6 Calculate:

- (a) $7 + 32 \div 4 \times 2$ (b) $(33 + 12) \div 3 + 19$ (c) $6 \times 9 \div 2 + 4$

Ex.1.5

7 Calculate the following, writing your answers in simplest form and as a mixed number, if appropriate.

- (a) $\frac{5}{6} \times \frac{4}{9}$ (b) $\frac{9}{10} \div \frac{7}{15}$ (c) $1\frac{3}{5} \times 2\frac{7}{8}$ (d) $4 \div \frac{2}{3}$

Ex.3.5, 3.6

8 Copy and complete the following conversions.

- (a) $6.09 \text{ km} = \underline{\hspace{2cm}} \text{ m}$ (b) $83 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$ (c) $5400 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

Ex.6.1

9 Calculate the following.

- (a) $-2 + 8$ (b) $14 - 17$ (c) $-15 + 3$ (d) $-5 - 6$
(e) $3 + (-9)$ (f) $-4 - (-1)$ (g) $11 - (-2)$ (h) $-7 - 10$

Ex.2.5–2.7

10 Use a mental or written strategy to calculate the following.

- (a) 28×43 (b) $990 \div 6$ (c) 57×4

Ex.1.1, 1.3

11 There are 8 red, 12 blue and 4 black jelly beans in a packet.

- (a) Write the ratio blue:red:black in simplest form.
(b) Write the number of red jelly beans as a percentage of the total, rounded to one decimal place.

Ex.4.9

12 Write the following decimals as fractions in simplest form.

(a) 0.23

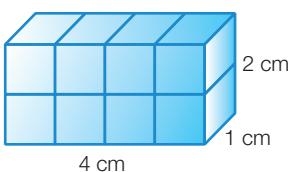
(b) 0.06

(c) 0.505

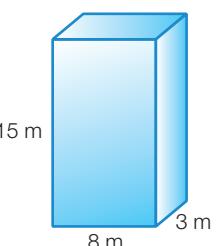
Ex. 4.3

13 Find the volume of the following rectangular prisms.

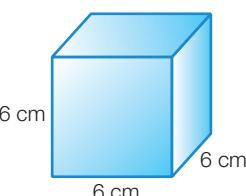
(a)



(b)



(c)

**Ex. 6.6**

14 Copy and complete the table using the rule $y = 3(x + 2)$.

x	0	2	3	6	10
y					

Ex. 5.4

15 Calculate:

(a) $4.67 + 8.8$

(b) $8.93 + 0.00635$

(c) $19.87 + 21.075$

Ex. 4.4

16 Calculate:

(a) $1.86 \div 600$

(b) $0.42 \div 1000$

(c) $10.605 \div 0.005$

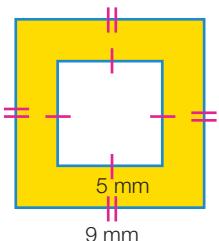
Ex. 4.6

Understanding

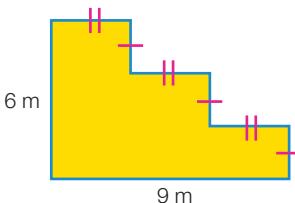
17 Joseph had \$578.97 in his bank account. After his pay was deposited, there was \$665.49. How much was Joseph's pay?

18 Find the area of the shaded regions.

(a)



(b)



19 Ben surveyed some Year 7 students to find out their favourite Australian animal. Here are his results:

Koala 8 students
Wombat 4 students

Bilby 6 students
Kangaroo 2 students

Write the preference for each animal (a) as a fraction in simplest terms, and (b) as a percentage of the total number of students.

Reasoning

20 Which is larger: 2^8 or 8^2 ?

21 The Hawkesbury Magpies were playing in the U14 football grand final. All goals were scored by three boys. Johan scored $\frac{1}{3}$ of the goals, Rihbi scored $\frac{1}{2}$ of the goals and Kyle scored the rest. If the Magpies scored 24 goals, how many goals were scored by Kyle?

22 A rectangle has a length 5 cm greater than its width and a perimeter of 42 cm. What are the dimensions of the rectangle?

23 At a shop I can buy three cans of soft drink for the same price as a hamburger. How much is one can of drink if I can buy one can and a hamburger for \$9?