

6



Measurement

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.

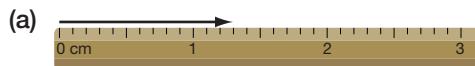


- | | | |
|-----------------------------|----------------------|-------------------------|
| (a) $3.4 + 6.8 + 4.2 + 2.1$ | (b) $45.6 - 5.28$ | (c) $54 + 11.3 - 26.04$ |
| (d) 6×4.2 | (e) 9.2×6.1 | (f) 18.96×1000 |
| (g) $2780 \div 100$ | (h) $3 \div 10$ | (i) $45.9 \div 1000$ |

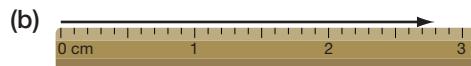
2 State the length of the arrow shown on each ruler:



(i) in millimetres



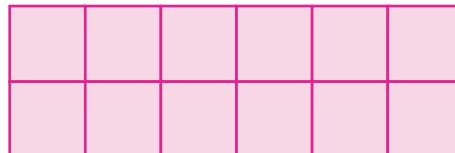
(ii) in centimetres.



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

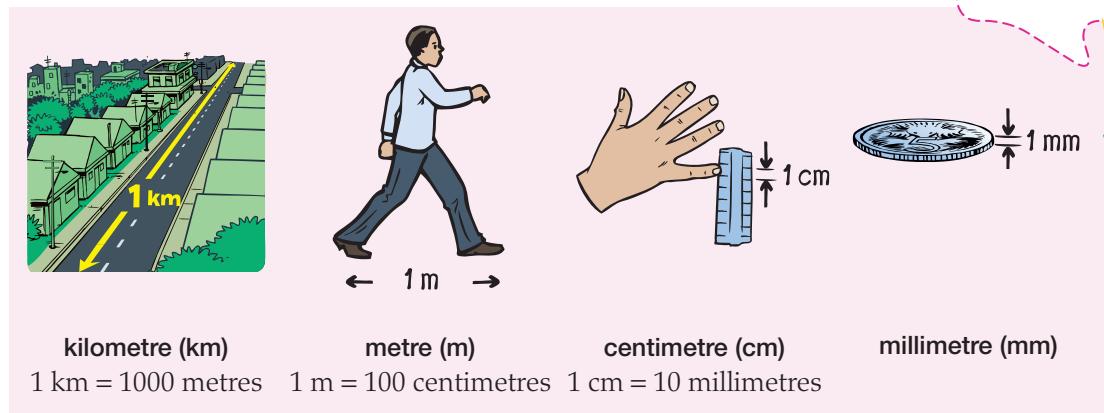
area	height	metric	perpendicular
base	kilometre	millimetre	rectangular prism
centimetre	length	parallelogram	volume
composite shape	metre	perimeter	width

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

WE 1

Use the reference measurement to help you estimate:

- (a) the length
(b) the height
of this motor home.



Thinking

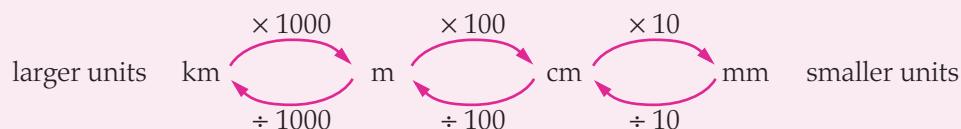
- (a) Look at the reference measurement. Estimate how many times this length would need to be used to match the length of the motor home.
- (b) Again, estimate how many times the length of the reference measurement would need to be used to match the height of the motor home.

Working

- (a) The motor home is approximately 5 m long.
- (b) The motor home is about 3 m high.

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

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

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

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
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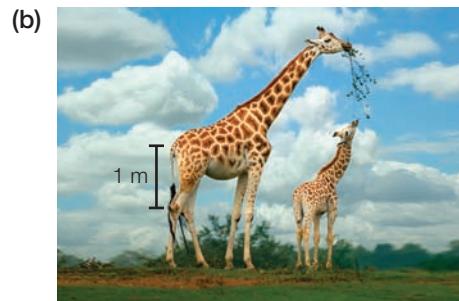
Fluency

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

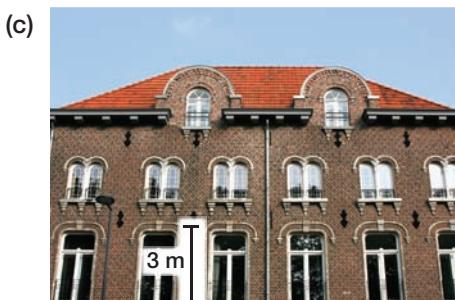
WE1



The length of this car.



The adult giraffe's height.



The height of the tallest part of this building.



The length of this mantis fly.

- 2 Copy and complete the following conversions.

WE2

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

- 3 Copy and complete the following conversions.

WE3

(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) $34\,500 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

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

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?

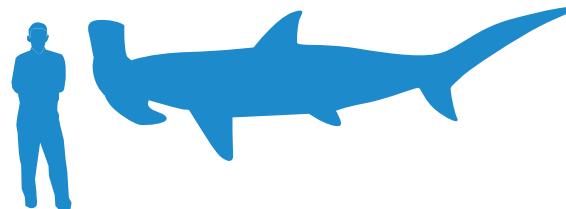
8 Situated on Heard Island, Big Ben is Australia's only active volcano. Its summit is 2745 m above sea level. What is its height in kilometres?

9 The average man is 1.8 metres tall. Use the diagram to estimate the length of the hammerhead shark.





- 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.





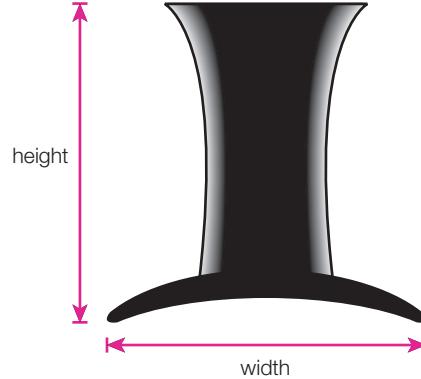
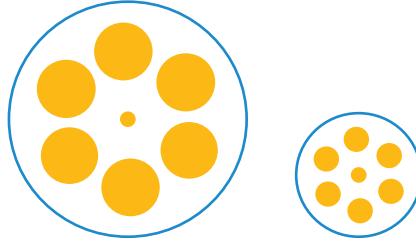
15 (a) Guess the answer to each of the following, then use your ruler to help you decide.

(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.

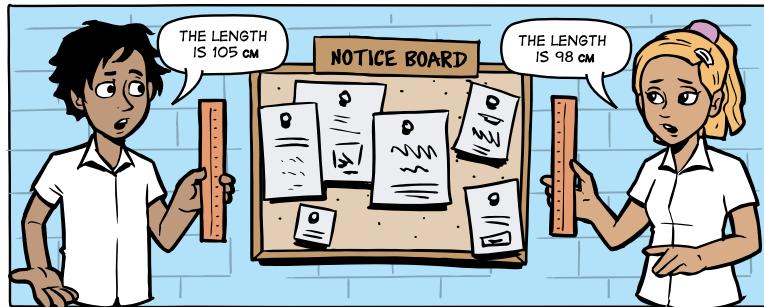
height of door	2032 mm
width of door	821 mm

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

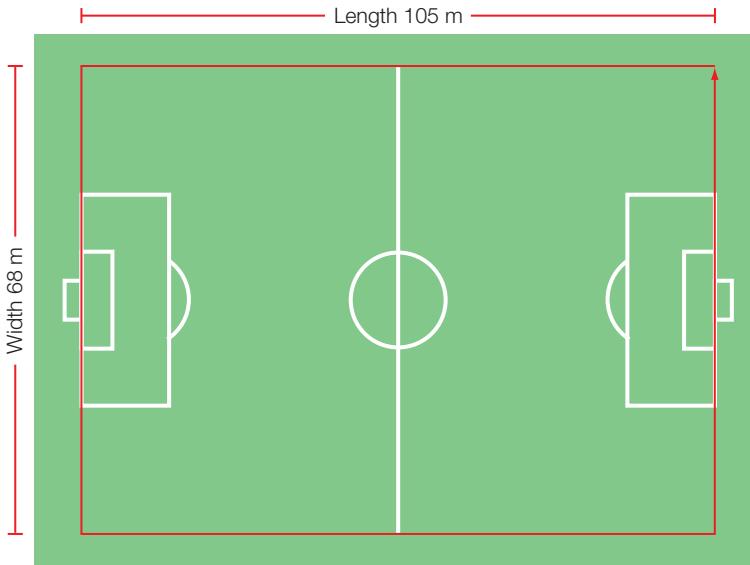
6.2

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).

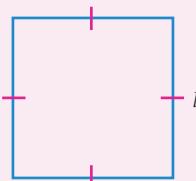
For example, the perimeter of this soccer pitch is $105 + 68 + 105 + 68 = 346$ m.

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

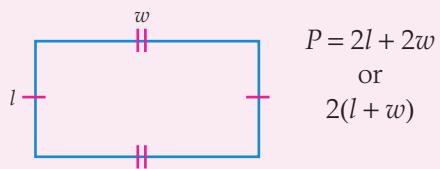
We can use this to write the perimeter of the pitch as $P = 2 \times 105 + 2 \times 68$ m. If we let the pronumerals l and w represent the length and the width, we can write a formula for the perimeter of a rectangle: $P = 2l + 2w$. This formula can also be written as $P = 2(l + w)$: Add the length and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



$$P = 4l$$



$$P = 2l + 2w$$

or

$$2(l + w)$$

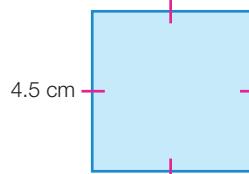
Sides that are marked in the same way (with the same number of small dashes) have the same length.

Worked Example 4

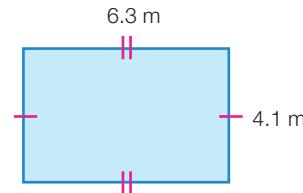
WE4

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.

Working

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

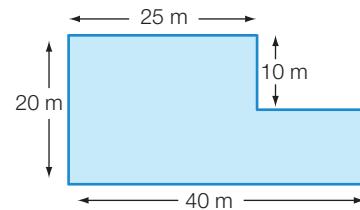
- (b) 1 Write down the formula for the perimeter of a rectangle.
- 2 Substitute the side lengths into the formula.
- 3 Evaluate, writing the answer with the correct units.

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

Worked Example 5

WE5

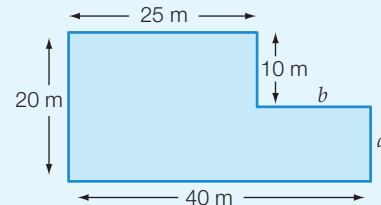
Calculate the perimeter of the shape below.



Thinking

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

Working



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

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

- 2 Add up the lengths of all the sides.

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

6.2 Perimeter

Navigator

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

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

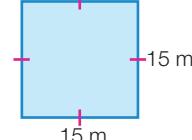
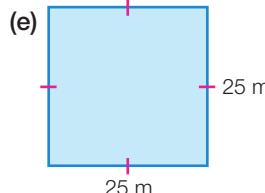
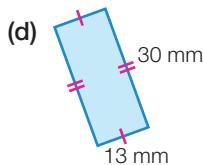
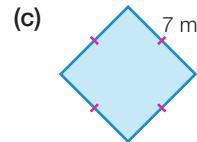
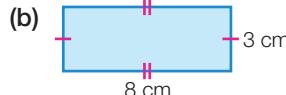
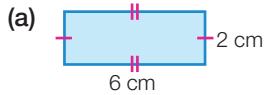
Q1 (a)–(c), Q2 (a)–(c), Q3, Q4,
Q6, Q7, Q8, Q9, Q10, Q11, Q12

**Answers
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WE4

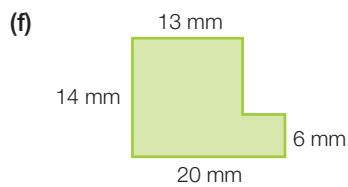
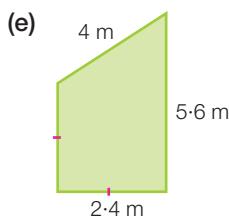
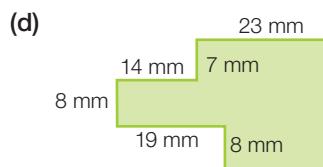
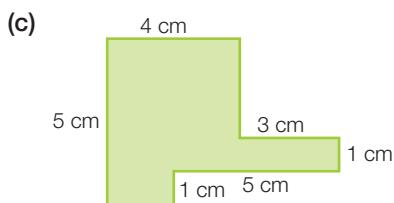
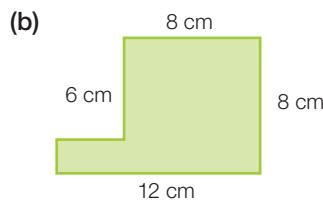
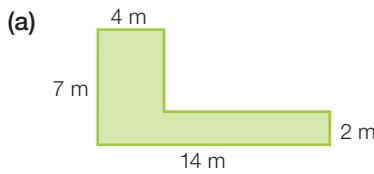
Fluency

- 1 Find the perimeter of each of these shapes.



- 2 Calculate the perimeter of the shapes below.

WE5



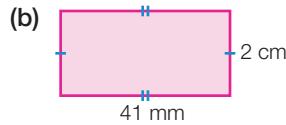
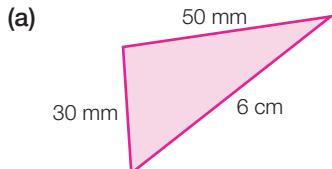
- 3 (a) The perimeter of a rectangle with a length of 25 cm and a width of 10 cm is:

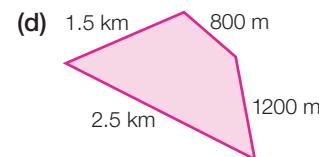
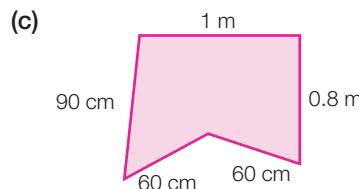
A 35 cm B 45 cm C 70 cm D 250 cm

- (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

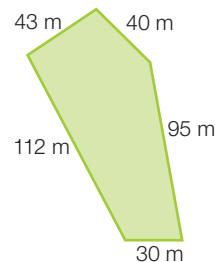
- 4 Calculate the perimeter of each of the following, first converting side lengths to the smaller unit when necessary.





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

6.3

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.

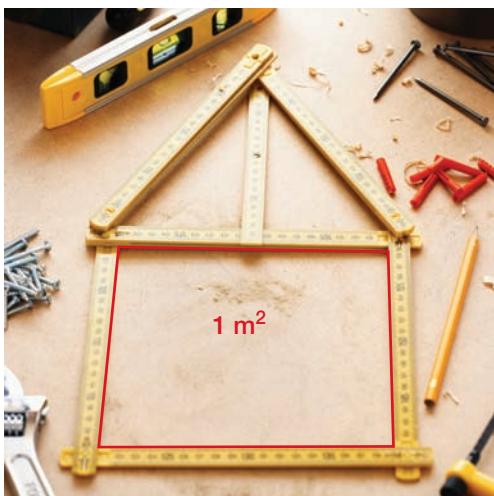
Area is the amount of surface inside a plane (flat) shape. It is measured in 'square' units. When we calculate the area of a shape we are finding the number of squares that can fit inside the shape.



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)

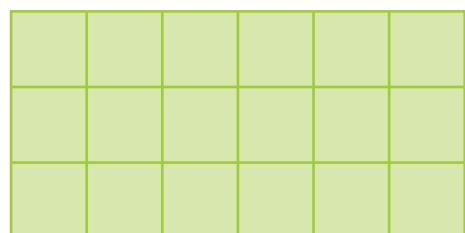
Area of a rectangle

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

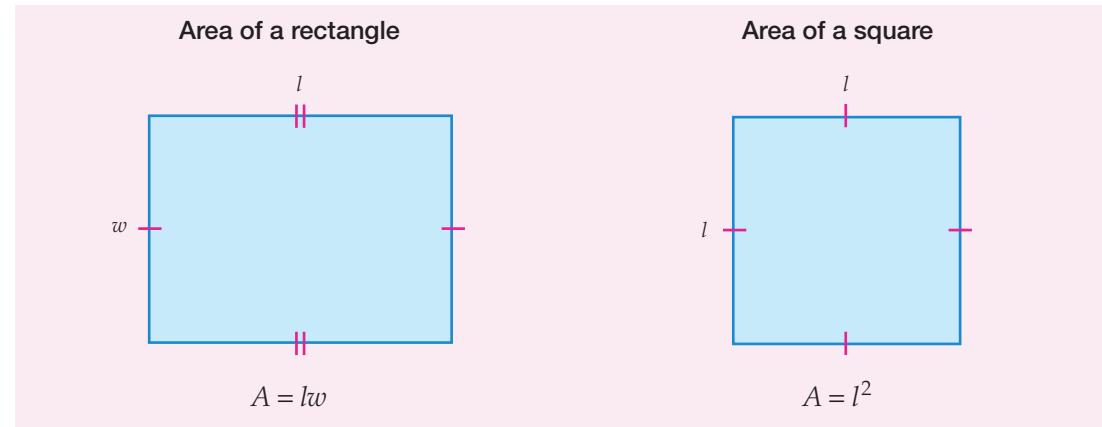
The rectangle contains 3 rows of 6 squares. Its area is equal to $3 \text{ cm} \times 6 \text{ cm} = 18 \text{ cm}^2$.

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 $A = lw$.



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

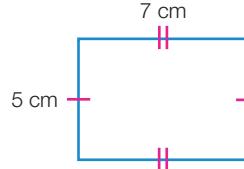


Worked Example 6

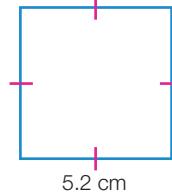
WE 6

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

$$\begin{aligned}
 (a) \quad & A = lw \\
 & A = 7 \times 5 \\
 & A = 35 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad & A = l^2 \\
 & A = 5.2 \times 5.2 \\
 & A = 27.04 \text{ cm}^2
 \end{aligned}$$

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

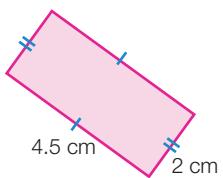
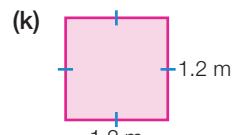
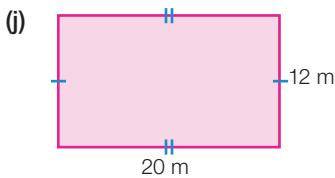
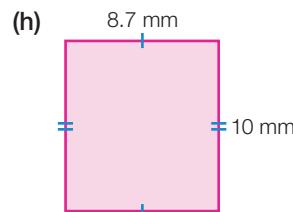
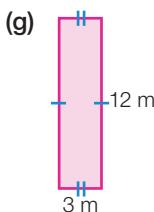
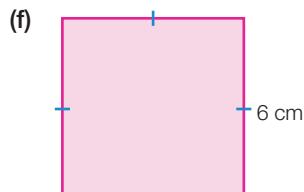
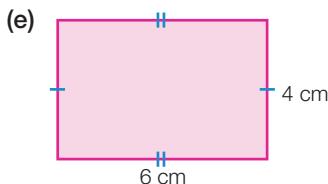
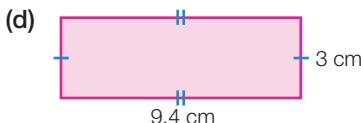
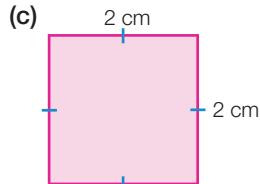
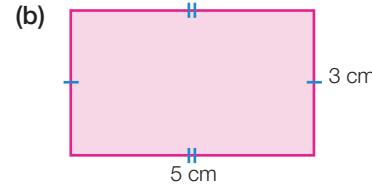
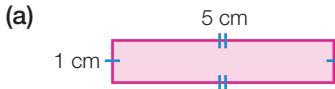
Answers
page 659

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

Fluency

- 1 Calculate the area of the following shapes.

WE6



- 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

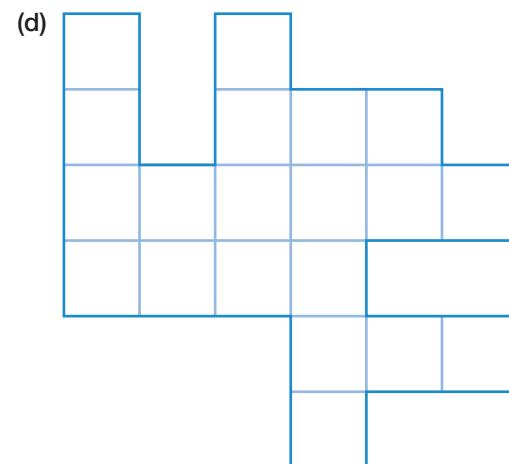
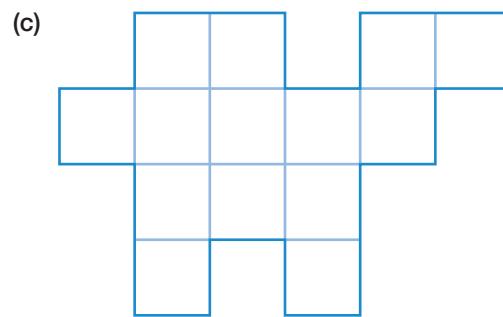
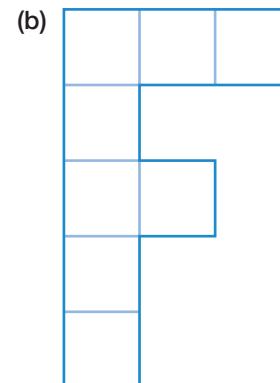
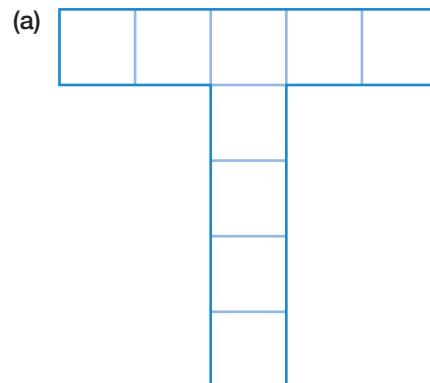
- (b) If the area of a rectangle is 24 cm^2 and its width is 10 mm, then its length is:

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

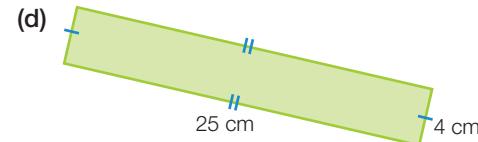
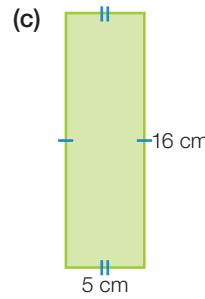
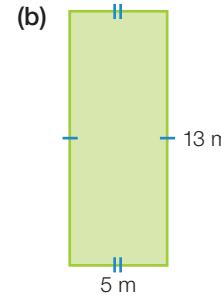
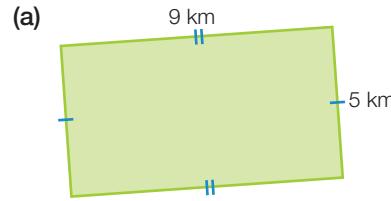




- 4 The following shapes have been drawn on centimetre grid paper. Find (i) the perimeter and (ii) the area of each one.



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



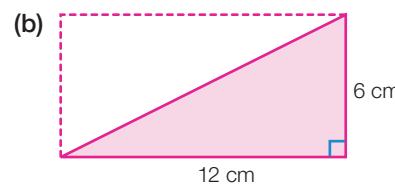
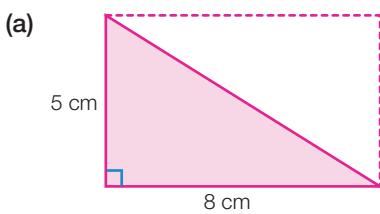
Convert all measurements to the same unit before finding the area.



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.

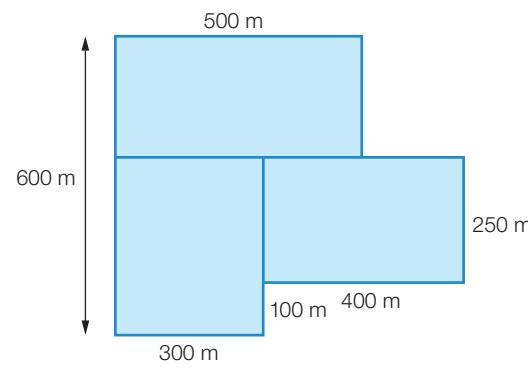
- (a) How many grams of lawn seed will he need to use if the recommended seed coverage is 60 grams per square metre?
- (b) What length of wood would Guy need to purchase to create a timber border for the section?

- 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?

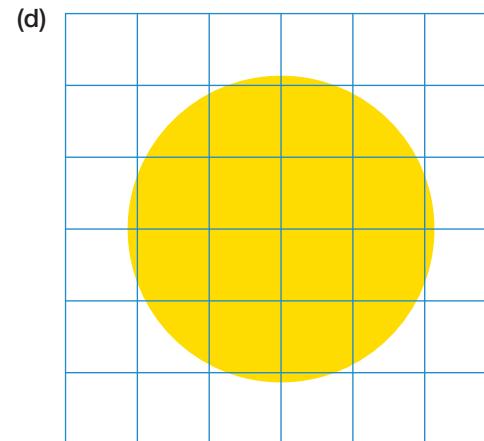
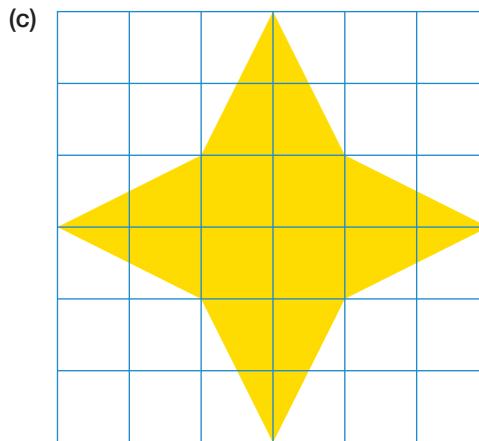
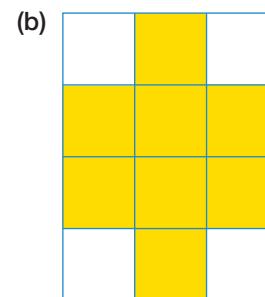
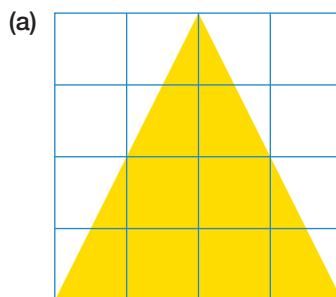
- 15 A farmer wants to create three separate rectangular paddocks on his farm, as shown in the diagram.

- (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?

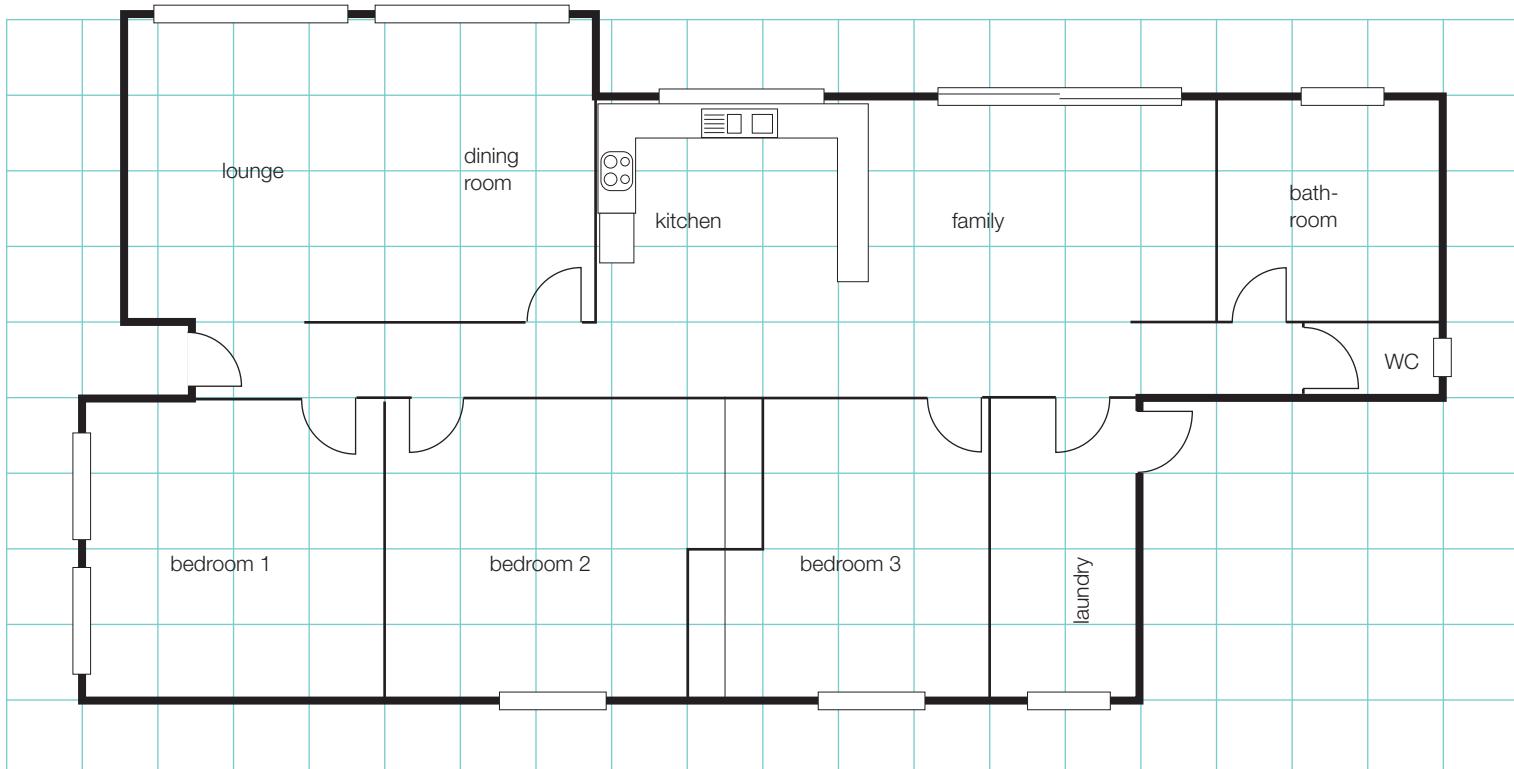


Reasoning

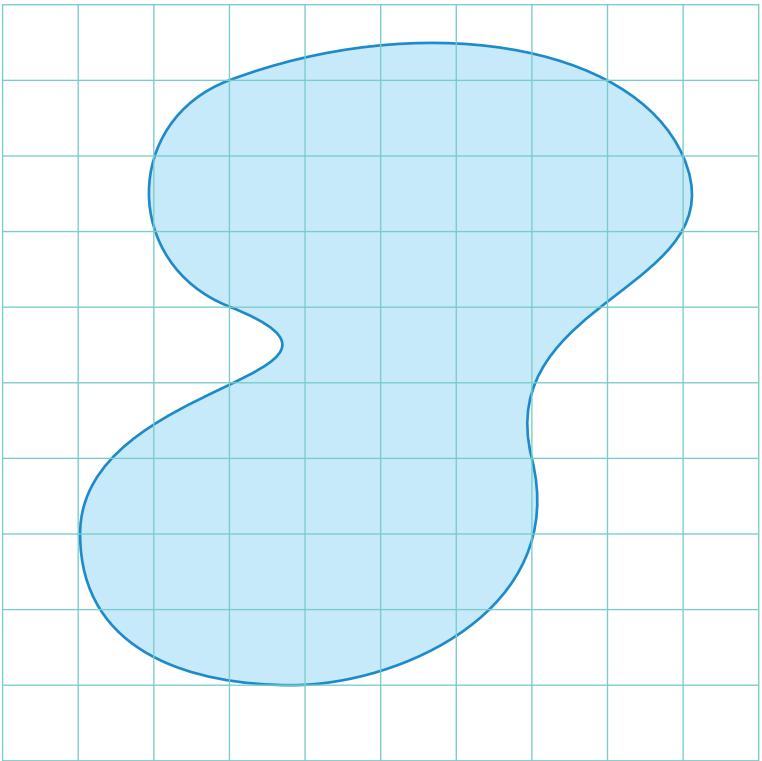
- 16 The following shapes have been drawn on centimetre grid paper. Find the shaded area in each case.



- 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.



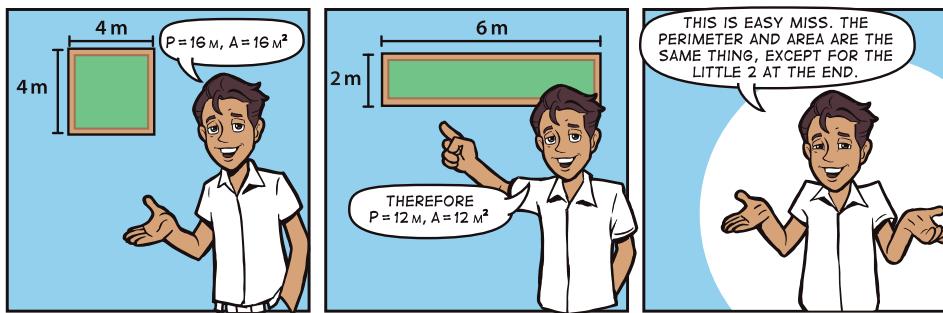
- 18 Write down all the possible whole number dimensions of a rectangle with an area of 20 cm^2 .
- 19 Find the length and width of a rectangular room whose area is 60 m^2 and perimeter is 34 m .

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?



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

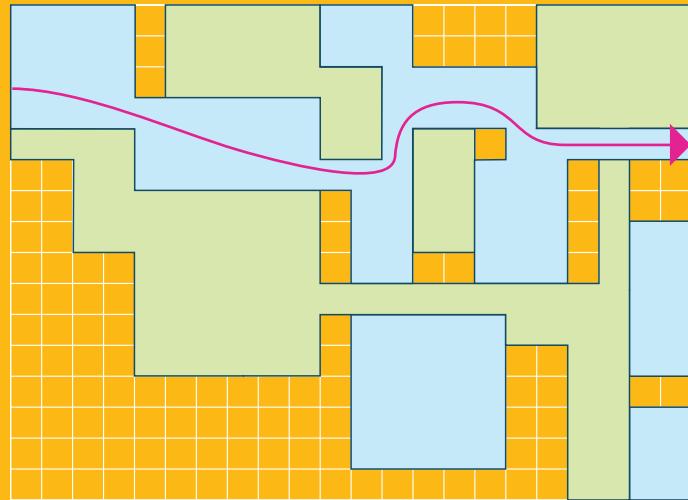
Blaze a trail

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.



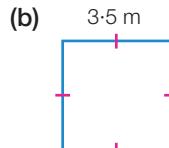
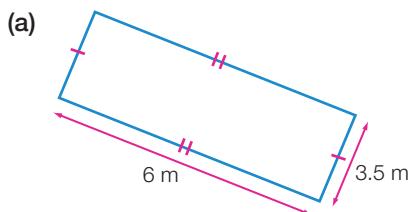
How to play:

- 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.



Ex. 6.2, 6.3

- 2 Complete the following conversions.

(a) $45 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$ (b) $0.015 \text{ km} = \underline{\hspace{2cm}} \text{ m}$ (c) $307 \text{ m} = \underline{\hspace{2cm}} \text{ km}$
 (d) $0.6 \text{ km} = \underline{\hspace{2cm}} \text{ cm}$ (e) $196\,000 \text{ m} = \underline{\hspace{2cm}} \text{ km}$ (f) $2640 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

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?

Ex. 6.2, 6.3

- (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?

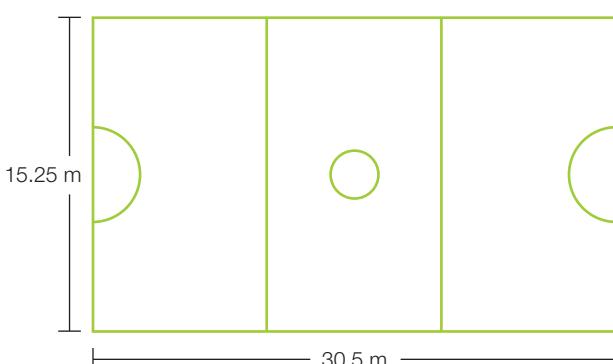
- 5 A rectangle has a perimeter of 26 cm and an area of 30 cm^2 . What are its dimensions (length and width)?

- 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