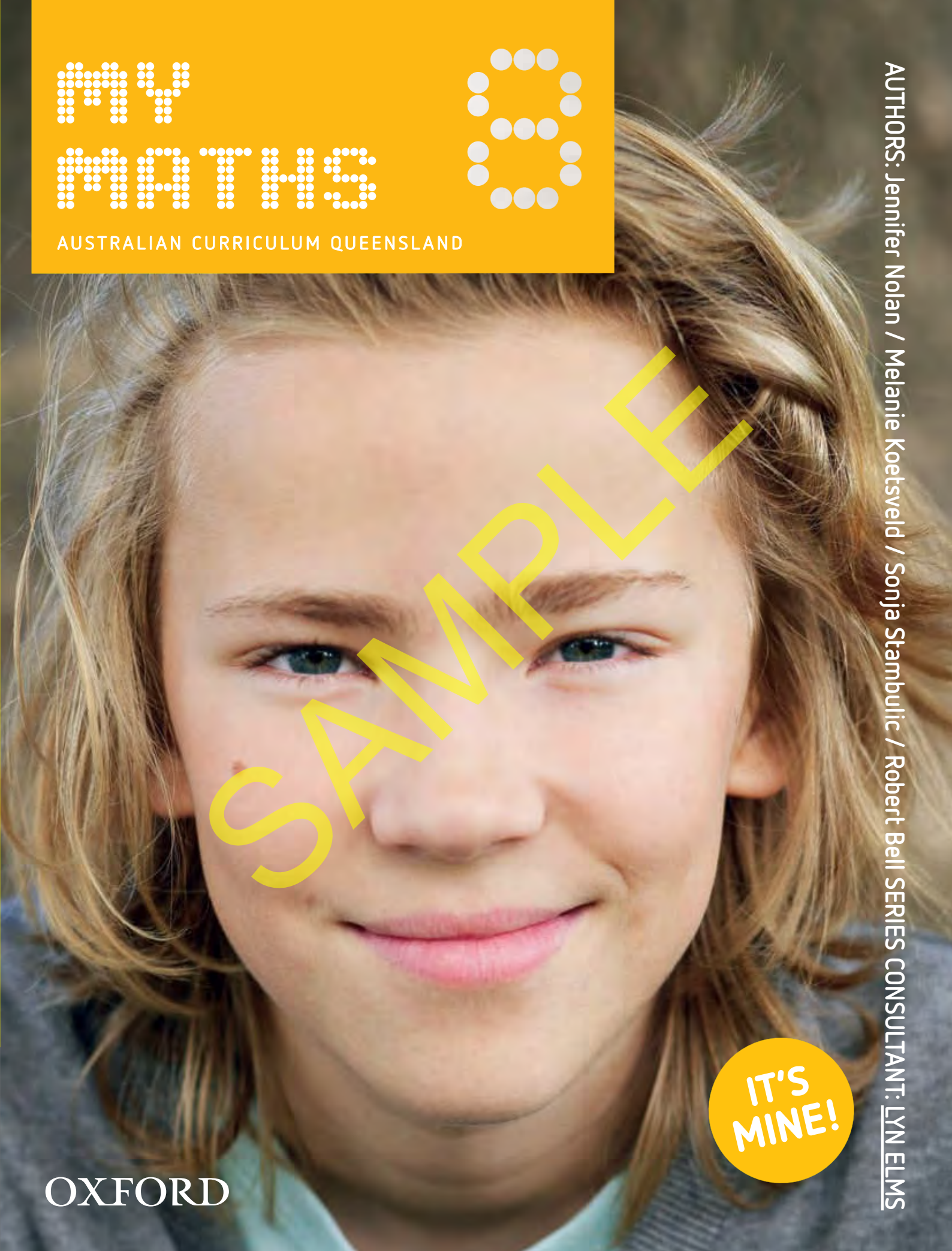
MY MATHS 8

AUSTRALIAN CURRICULUM QUEENSLAND



IT'S MINE!

AUTHORS: Jennifer Nolan / Melanie Koetsveld / Sonja Stambulic / Robert Bell SERIES CONSULTANT: LYN ELMS

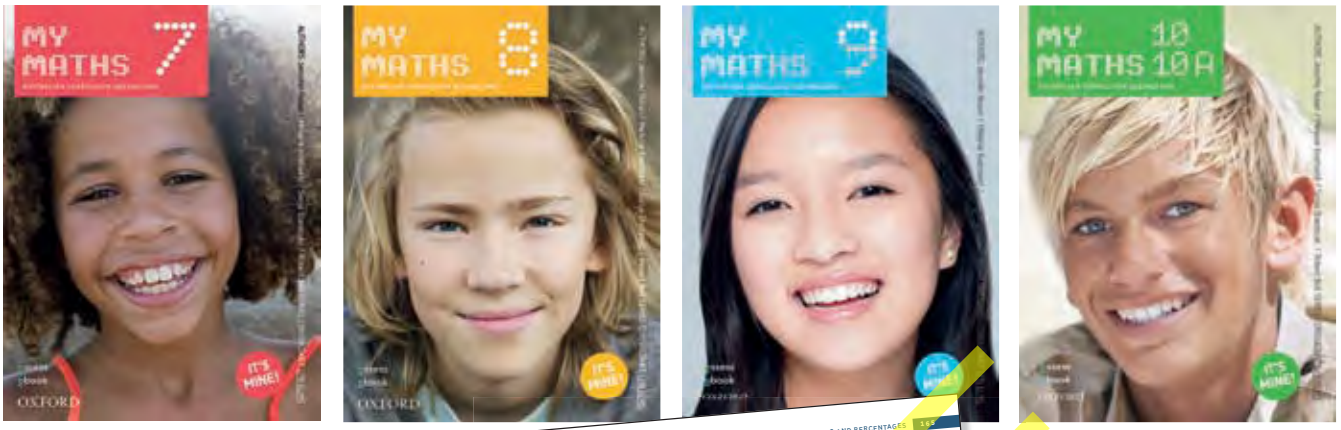
OXFORD

NUMBER AND ALGEBRA

MEASUREMENT AND GEOMETRY

STATISTICS AND PROBABILITY

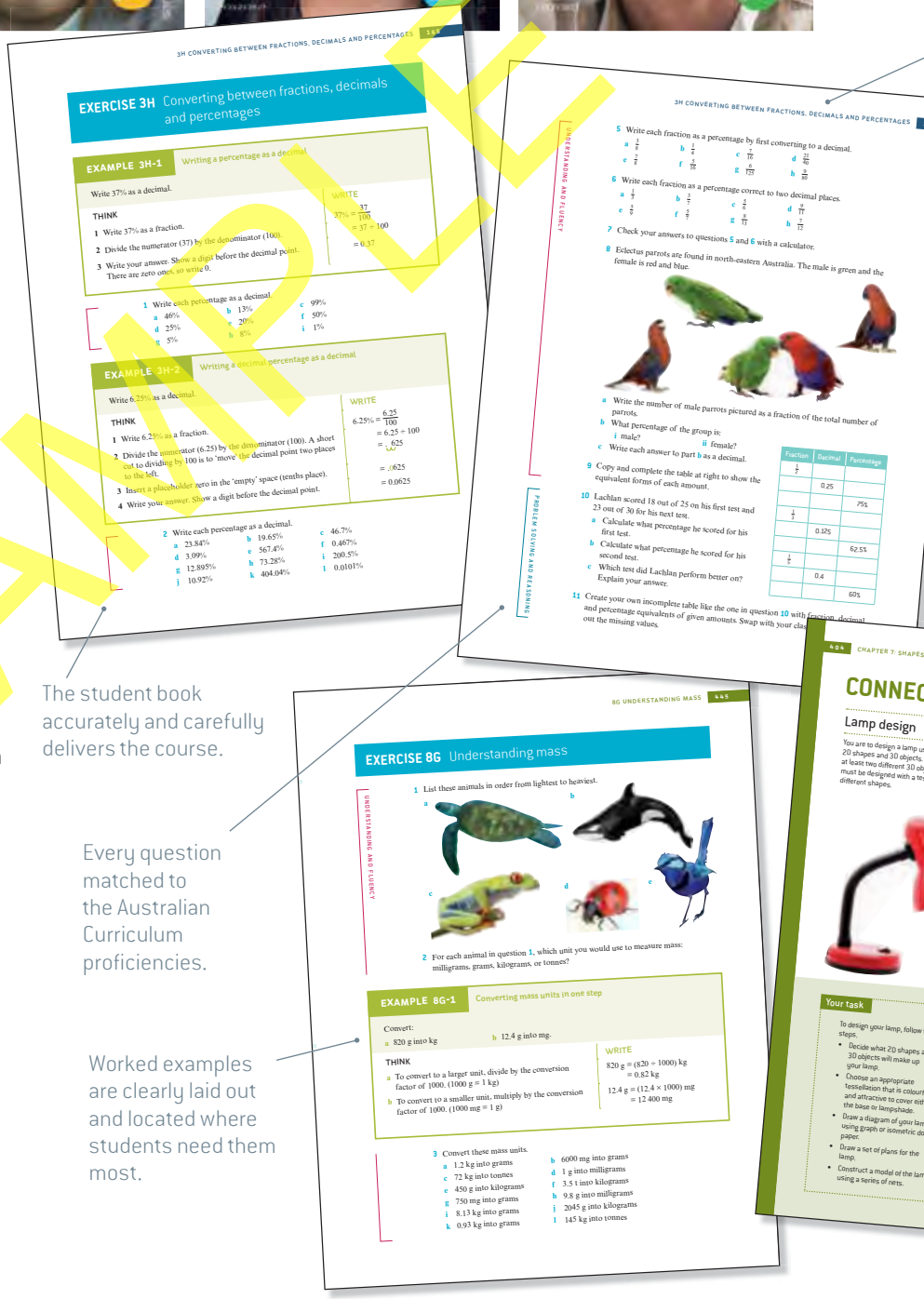
OXFORD MYMATHS FOR QUEENSLAND



Oxford MyMaths for Queensland has been specifically developed to support students wherever and whenever learning happens: in class, at home, with teacher direction or in independent study.

STUDENT BOOK + OBOOK/ASSESS

- Finely levelled exercises to ensure smooth progress
- Integrated worked examples – right where your students need them
- Learning organised around the 'big ideas' of mathematics
- Discovery, practice, thinking and problem-solving activities promote deep understanding
- A wealth of revision material to consolidate and prove learning
- Rich tasks to apply understanding
- Highly accessible and easy to navigate
- Comprehensive digital tutorials and guided examples to support independent progress



The student book accurately and carefully delivers the course.

Every question matched to the Australian Curriculum proficiencies.

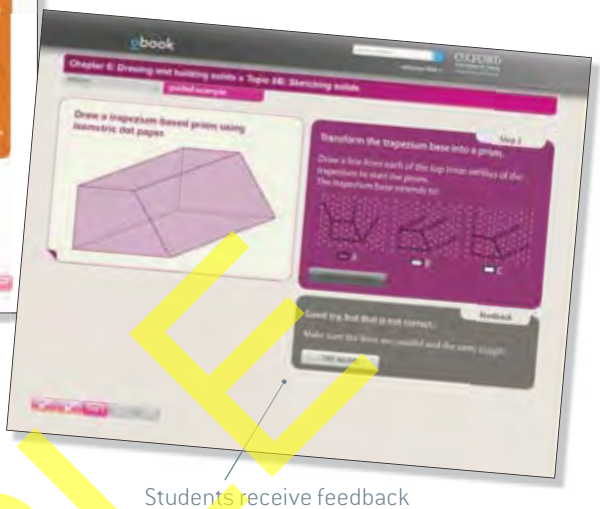
Worked examples are clearly laid out and located where students need them most.

24/7 LEARNING AND SUPPORT

E-tutors scaffold understanding of key concepts and build confidence.

Self-discovery opportunities for students through guided exploration.

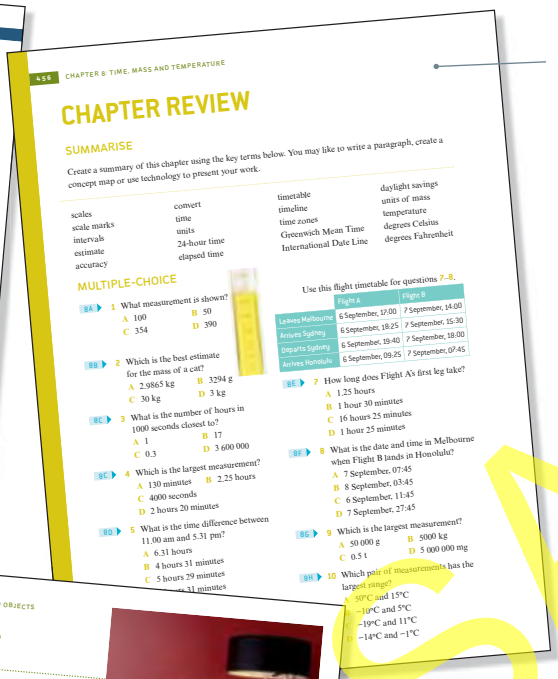
Guided examples support practice and fluency



Students receive feedback for incorrect responses

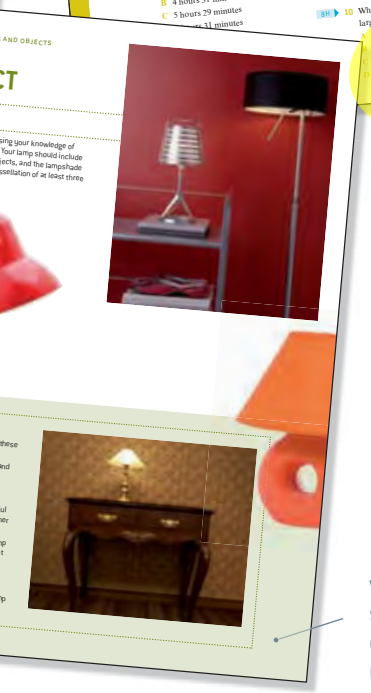
Finely levelled content enables students to progress with ease

Ample revision to consolidate understanding and prove that learning has happened



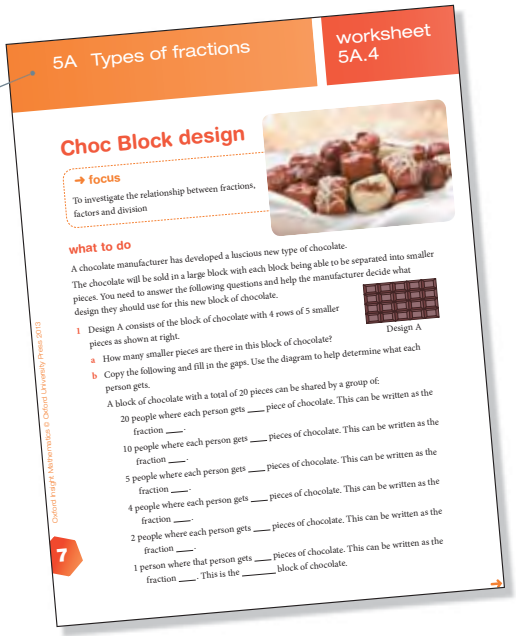
Optimise understanding and performance.

Personalised learning: tailor the very best learning experiences for all.



Rich tasks where students can demonstrate understanding

Intervention and extension worksheets supplied for every topic.

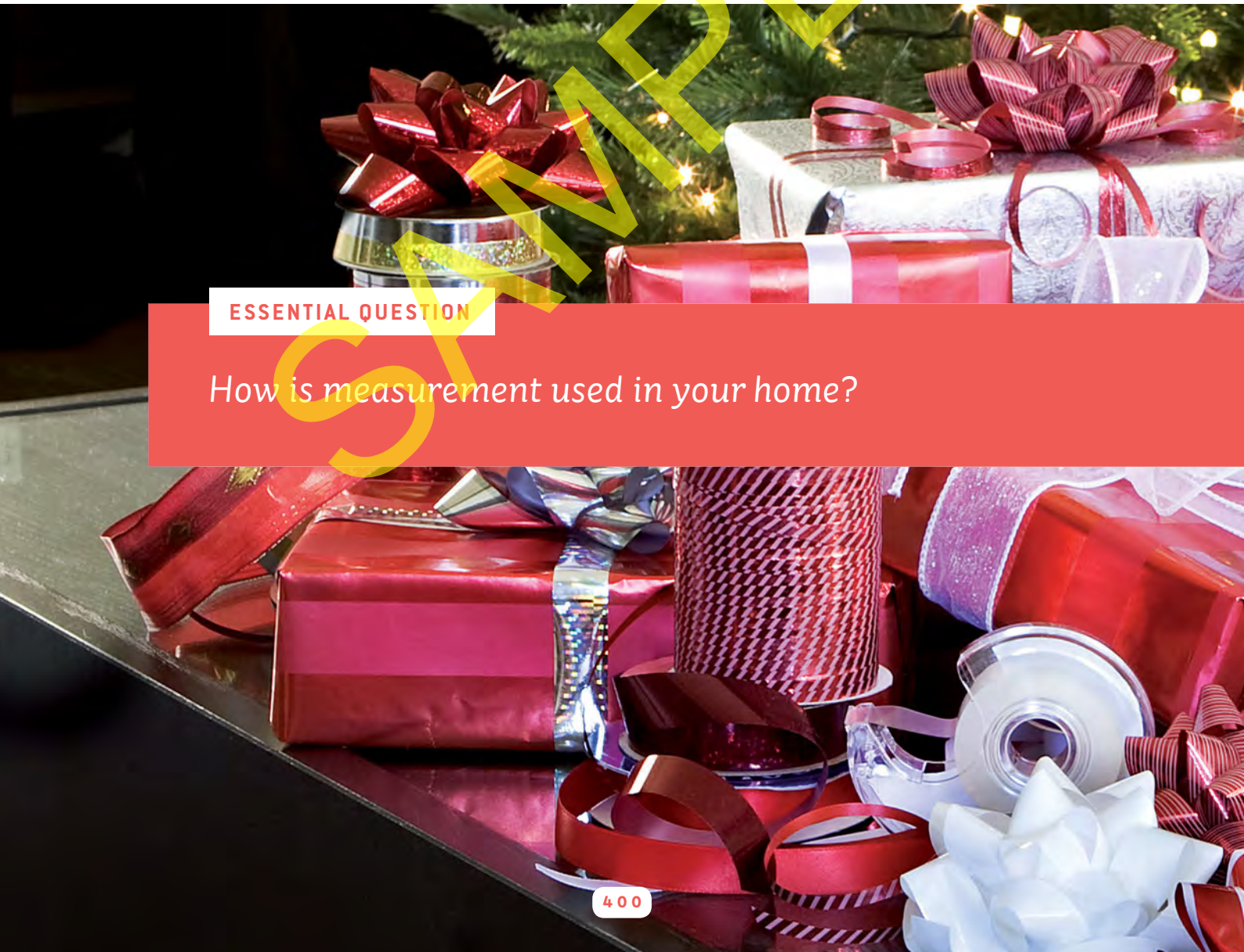


TEACHER QBOOK/ASSESS

Practical classroom resources and tools:

- Manage student differentiation
- Correct common misconceptions
- Assign work
- Set tests
- Monitor results
- Any device, anytime, anywhere.

8 MEASUREMENT



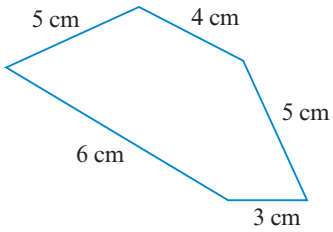
ESSENTIAL QUESTION

How is measurement used in your home?

Are you ready?

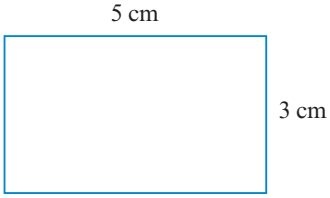
8A **1** How many millimetres long is a 15-cm ruler?

8A **2** What is the perimeter of this shape?

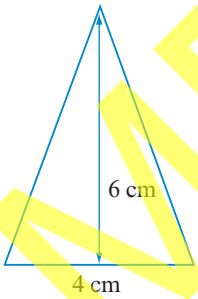


A 18 cm
B 1800 cm
C 20 cm
D 23 cm

8C **3** What is the area of this shape?



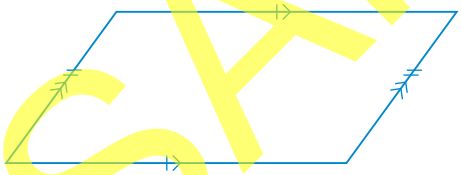
8C **4** What is the area of this triangle?



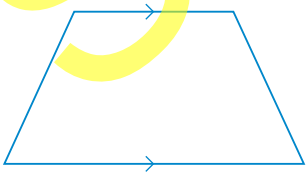
A 24 cm^2
B 12 cm^2
C 10 cm^2
D 2 cm^2

8D **5** Which shape is a rhombus?

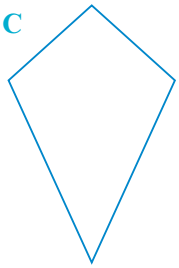
A



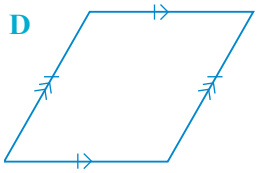
B



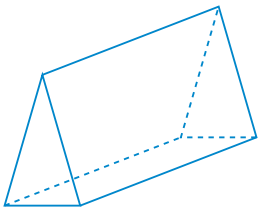
C



D

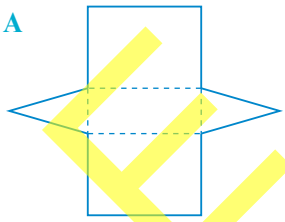


8F **6** How many faces does this object have?



8F **7** Which net matches the object in question **6**?

A



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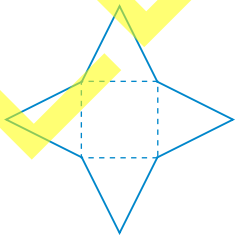

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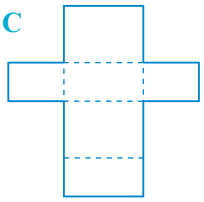
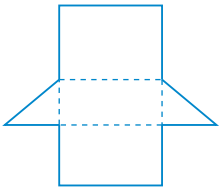
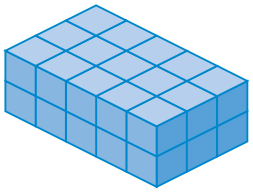


D



8G **8** What is the volume of this prism?



A 10 cm^3
B 15 cm^3
C 16 cm^3
D 30 cm^3

8H **9** How can you convert centimetres to metres?

A divide by 100 **B** multiply by 100
C multiply by 10 **D** divide by 10

8H **10** Which unit relates to area?

A mm^3 **B** cm
C m^3 **D** km^2

8A Length and perimeter

Start thinking!

When you think about measurement, two words you may know are **length** and **perimeter**.

1 What is the difference between length and perimeter?

Common units of length are millimetres (mm), centimetres (cm), metres (m) and kilometres (km).

2 Think of an object that you could measure both the length and perimeter of in:
i millimetres **ii** centimetres **iii** metres **iv** kilometres.

3 With a classmate, **estimate**:
a the length **b** the perimeter
of the table that you are sitting at now.

4 Why is it important to estimate?

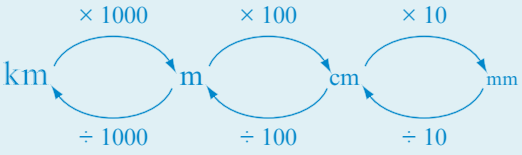
5 Choose a device to measure the table. Explain why your chosen device is better than either a 5-cm ruler or a trundle wheel.

6 Imagine your table is against a wall. How might you find the perimeter of the table without measuring the side that is against the wall?

7 Without moving the table, find both its length and its perimeter. How do these measurements compare to your estimate?

KEY IDEAS

- Common units of length are millimetres (mm), centimetres (cm), metres (m) and kilometres (km).
- You can convert between units of length by multiplying or dividing by the conversion factor.



- Perimeter is the distance around the outside edge of a 2D (two-dimensional) shape.
- To calculate perimeter, add the length measurements of each side together. Make sure that all measurements are in the same unit.
- Always estimate your answer first.

EXERCISE 8A Length and perimeter

EXAMPLE 8A-1 Converting units of length (one step)

Convert 46 cm into metres.

THINK

1 The length is being converted to a larger unit (centimetres into metres), so divide by the conversion factor.

2 The conversion factor from centimetres to metres is 100.

WRITE

46 cm = (46 ÷ 100) m
= 0.46 m

1 Convert:

- **a** 58 m into centimetres
- **b** 2.7 km into metres
- **c** 521 cm into metres
- **d** 398 m into kilometres
- **e** 1.2 cm into millimetres
- **f** 3987 m into kilometres
- **g** 423 mm into centimetres
- **h** 7 mm into centimetres

EXAMPLE 8A-2 Converting units of length (two steps)

Convert 1.23 m into millimetres.

THINK

1 First convert to centimetres by multiplying by 100. 1 m = 100 cm.

2 Complete the conversion to millimetres by multiplying by 10. 1 cm = 10 mm.

WRITE

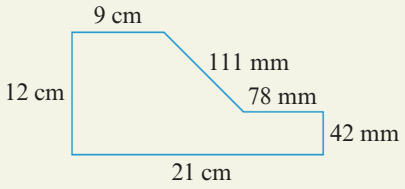
1.23 m = (1.23 × 100) cm
= 123 cm
= (123 × 10) mm
= 1230 mm

2 Convert:

- **a** 5.34 m into millimetres
- **b** 3.95 km into centimetres
- **c** 235 000 mm into metres
- **d** 145 000 000 mm into kilometres
- **e** 2368 cm into kilometres
- **f** 287 mm into metres
- **g** 1.934 km into centimetres
- **h** 0.91 km into millimetres

EXAMPLE 8A-3 Calculating perimeter

Calculate the perimeter of this shape in centimetres.



THINK

1. There are six sides to the shape so there are six lengths to be added.
2. Write all measurements in centimetres. Remember that 10 mm = 1 cm.
3. Add all the lengths and include the correct unit.

WRITE

perimeter = 9 cm + 111 mm + 78 mm + 42 mm + 21 cm + 12 cm

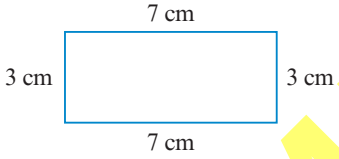
= 9 cm + 11.1 cm + 7.8 cm + 4.2 cm + 21 cm + 12 cm

= 65.1 cm

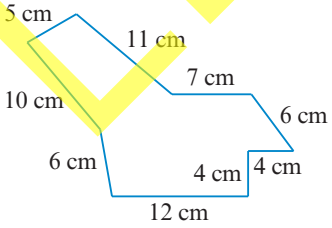
UNDERSTANDING AND FLUENCY

3 Calculate the perimeter of each shape.

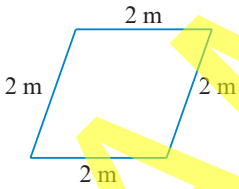
a



b



c



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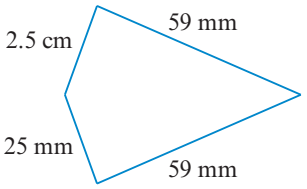
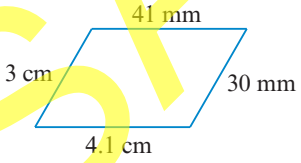
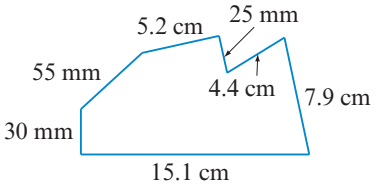


e



f



4 For each object, first estimate and then measure:

i the horizontal and vertical lengths

ii the perimeter.

a

b

c

5 Explain how you found the perimeters in question **4**.

UNDERSTANDING AND FLUENCY

6 Name the best unit to use to measure:

a the length of a basketball court

b the perimeter of Australia

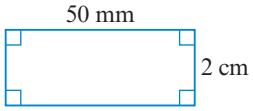
c the perimeter of an iPod

d the length of your textbook.

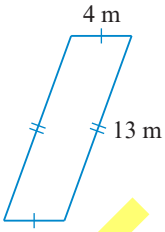
7 Name a device you could use to measure each object in question **6**.

8 Calculate the perimeter of each object.

a



b



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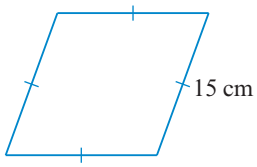

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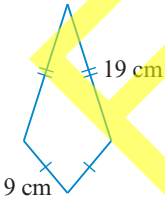

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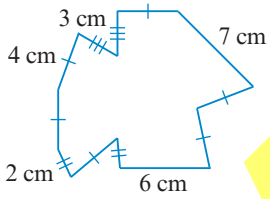

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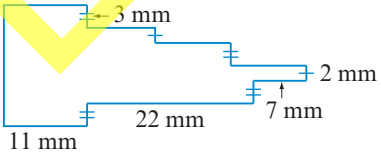


9 Calculate the perimeter of:

a a square with side length 4 cm

b a square with side length 1.2 km

c an equilateral triangle with side length 2.5 cm

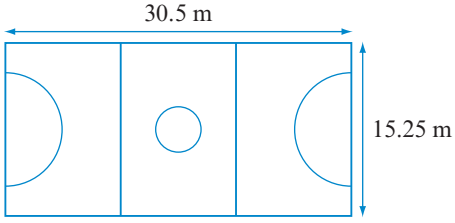
d a rhombus with base 15 mm.

e a rectangle with length 10 mm and width 15 mm

f a rectangle with length 6 m and width 1 m.

PROBLEM SOLVING AND REASONING

10 To warm up before a netball match, Jordan has the option of either running six laps around the netball court or four shuttle runs.



a How far is one lap around the netball court?

b How far is six laps around the netball court?

A shuttle run involves starting at the bottom of the court and running hard to the first third-line, back to the start, running to the second third-line and back to the start and finally up to the end of the court and back.

c How far is the first part of the shuttle run (to the first third-line and back)?

d What distance does a single shuttle run cover?

e How far is four shuttle runs?

f If you were Jordan, which warm up activity would you choose? Explain.

NOTE The **dimensions** of the court are 30.5 m by 15.25 m or 30.5 m × 15.25 m.

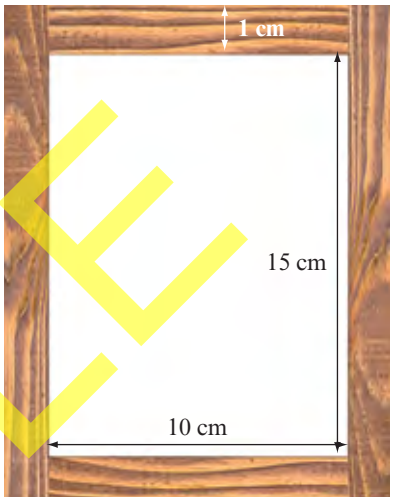
11 Trish makes earrings. One design is a rectangular jewel with wire wrapped around its perimeter twice. If the jewel is 4.5 cm long and 1.5 wide, how much wire (in metres) is used for 20 pairs of earrings?

12 A road has a white line painted on each edge, and a dashed line down the middle. If every 10 m section of the road has eight 650 mm long dashes down its centre, calculate the total length of paint required (in kilometres) for a 10 km road.

13 Alice wants to make some photo frames for a friend. She buys some wood to fit around the outside of a standard-sized photo.

a What is the perimeter of a standard-sized photo?

Alice wants the frame to be 1 cm wide, as shown in the image.



b Why is the length of wood needed greater than the perimeter of the photo?
(Hint: are the corner parts of the frame included in the photo perimeter?)

c What length of wood is needed?

d What is the perimeter around the photo frame? Why is this different from part **c**?

e Investigate how these results would change if:

- **i** the frame was 2 cm wide
- **ii** the frame was 3 cm wide
- **iii** the frame was for a 15 cm × 20 cm photo
- **iv** the frame was for a 20 cm × 25 cm photo.

Write a paragraph on your findings.

14 Alice packs the photo frames from question **13** into a gift box with the dimensions shown in the photo and wants to tie a ribbon around the present. Assuming that she will need a minimum of 60 cm of ribbon for the bow, how much ribbon will she need to buy in order to wrap the present as shown?

15 A square has a perimeter of 36 cm. What is its side length?

16 Give three possible sets of dimensions for a rectangle with perimeter 100 cm.

17 A rectangle has perimeter 60 m.

a What might its dimensions be?

b How many answers are possible for part **a**? Assume whole numbers only.

CHALLENGE

18 Make up your own question like question **17** and give it to a classmate to solve. How many possible whole-number answers are there?

19 A new television screen has a perimeter of 6.1 m. If it has a length of 1.9 m, find its width.

20 A rectangular pool is 12.5 m long and 4.7 m wide. What length of paving is required around the pool's edge if the pavers used are 50 cm wide?

21 For each special quadrilateral you met in chapter 7:

a draw a diagram labelling each side with a pronumeral (for example, a, b, h)

b use the diagram to write a formula that can be used to calculate its area.

22 Jackson takes on a scrapbooking project. He decides to cover the perimeter of every page in ribbon that is 2 cm wide. If there are 28 square sheets of paper that measure 25 cm in the book, find the length of ribbon (in metres) required to place ribbon around the edge of each page.

23 A rectangular vegetable garden has a perimeter of 28 m.

a Write down a possible set of dimensions for this garden.

A fence is to be placed 1 m from the edge around the vegetable garden to allow space for more vegetables.

b What length of fencing is required?

c What length of fencing would be required if the distance between the fencing and the edge of the garden was:

i 2 m?

ii 3 m?

d Can you see a pattern or rule that you could follow in order to find the length of fencing required, no matter how close or far from the edge it is placed?

e Repeat parts **a**–**d** using a different set of dimensions. Do your findings match the rule you found in part **d**? Explain.

Reflect

How is estimation important when measuring length and perimeter?

8B Circumference of a circle

Start thinking!

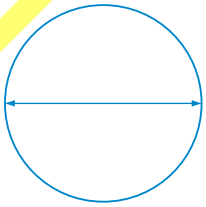
1 How would you measure the perimeter of a circle?

The perimeter of a circle is called its **circumference**.

2 Pair up with a classmate and get a ruler and a long piece of string or ribbon.

3 Copy this table, leaving space for at least five rows.

Object	Diameter (D)	Radius (r)	Circumference (C)	$\frac{C}{D}$



4 Either as a class or in your pairs collect at least five circular objects. Cylinders will work as well.

5 Choose one object. Measure across the width of the circle at its centre as shown here. This is called its **diameter**. Record this in your table. Be as accurate as possible.

The **radius** is the distance from the centre of the circle to its perimeter. It is exactly half the diameter.

6 What is the radius of the circular object you are measuring? Record this in your table.

7 Use your piece of string and ruler to measure the circumference of the circular object and record the measurement in your table.

8 Complete the last cell of your table, correct to two decimal places. What number do you obtain?

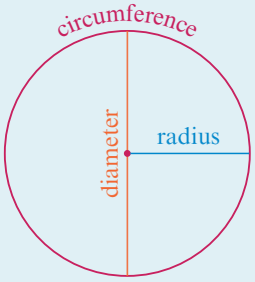
9 Repeat steps **5**–**8** for all your other circular objects. What do you find?

The ratio of the circumference to the diameter $\left(\frac{C}{D}\right)$ is equal to the irrational number **pi** (π), no matter what size a circle is. Remember that π cannot be written as an exact decimal number. Rounded to two decimal places, the value of π is approximately 3.14.

10 Why might the number you get each time not be close to π?

KEY IDEAS

- Circumference (C) is the perimeter of a circle.
- Diameter (D) is the width of a circle through its centre.
- Radius (r) is half the diameter.
- To find the circumference of a circle, multiply the diameter by π.
- $C = \pi D$ or $C = 2\pi r$.



EXERCISE 8B Circumference of a circle

For all questions in this topic, use π on your calculator and then round each answer to two decimal places.

EXAMPLE 8B-1 Finding diameter

Find the length of the diameter if a circle has a radius of 4 cm.

THINK

1 The diameter is twice the length of the radius. Multiply the radius by two.

2 Write your answer.

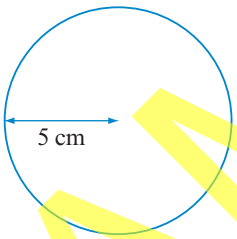
WRITE

$D = 2r$
$= 2 \times 4$ cm
$= 8$ cm

UNDERSTANDING AND FLUENCY

1 Find the length of the diameter of each circle.

a



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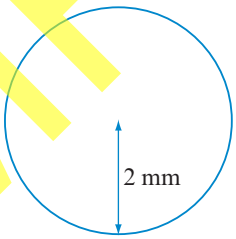
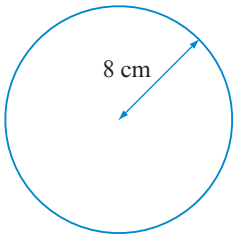


c



2 Find the length of the diameter if a circle has a radius of:

a 3 cm	b 6 m	c 70 mm
d 1.5 cm	e 111 mm	f 9 cm
g 12 mm	h 2.5 m	i 25 mm

EXAMPLE 8B-2 Finding radius

Find the length of the radius if a circle has a diameter of 12 cm.

THINK

1 The radius is half the size of the diameter. Divide the diameter by two.

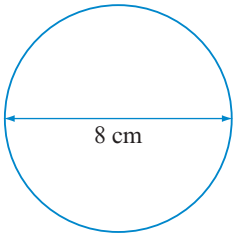
2 Write your answer.

WRITE

$r = \frac{D}{2}$
$= 12 \text{ cm} \div 2$
$= 6$ cm

3 Find the length of the radius of each circle.

a



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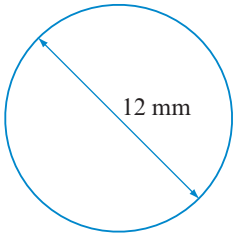

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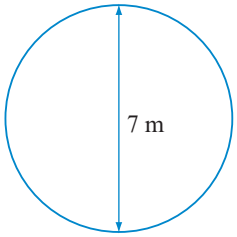
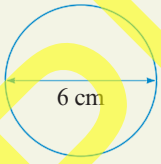


4 Find the length of the radius if a circle has a diameter of:

a 10 cm	**b** 4 m	**c** 6 mm
d 30 cm	**e** 5.6 mm	**f** 9 m
g 16 cm	**h** 5 m	**i** 24 cm

EXAMPLE 8B-3 Using the diameter to calculate circumference

Calculate the circumference of this circle, correct to two decimal places.



THINK

1. Identify which formula to use.
2. Substitute the measurement for diameter.
3. Calculate using π on your calculator.
4. Round to two decimal places and include the appropriate unit.

WRITE

$C = \pi D$

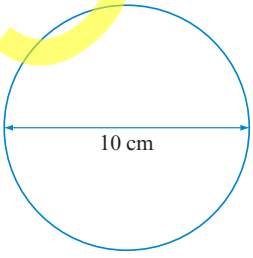
$= \pi \times 6$

$= 18.849\,555\,9\ldots$

$C = 18.85$ cm

5 Calculate the circumference of each circle.

a



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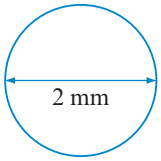

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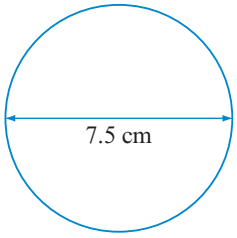
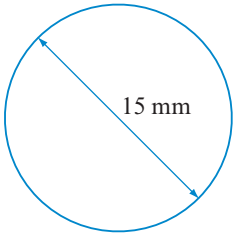


d



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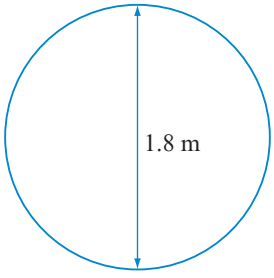

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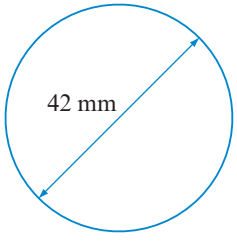
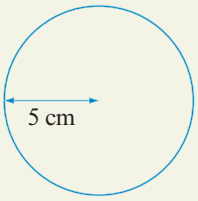


EXAMPLE 8B-4 Using the radius to calculate circumference

Calculate the circumference of this circle, correct to two decimal places.

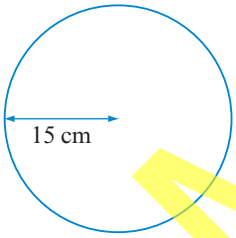


THINK	WRITE
1 Identify which formula to use.	$C = 2\pi r$
2 Substitute the measurement for radius.	$= 2 \times \pi \times 5$
3 Calculate using π on your calculator.	$= 31.415\,926\,5\ldots$
4 Round to two decimal places and include the appropriate unit.	$C = 31.42$ cm

UNDERSTANDING AND FLUENCY

6 Calculate the circumference of each circle.

a



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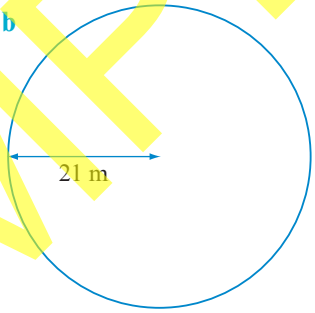
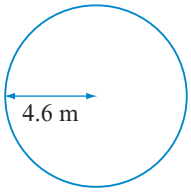


c



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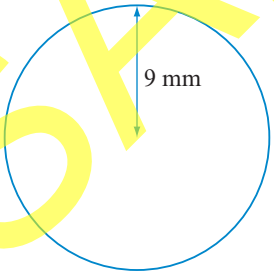

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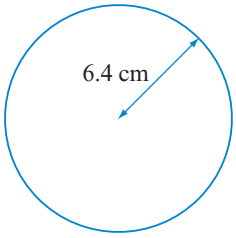

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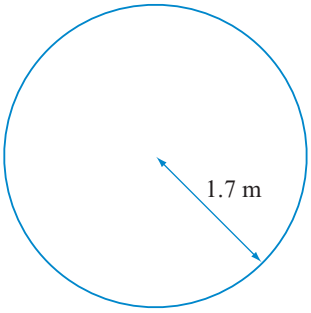
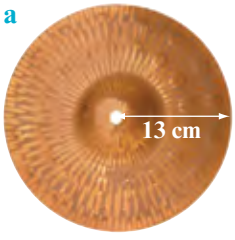


7 Calculate the circumference of each object.

a



b

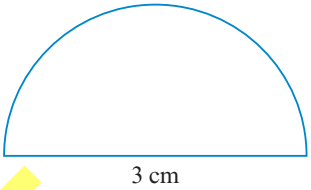
c

d

8 Find the circumference of a circle with:

a radius 1.2 m **b** diameter 2.5 cm **c** diameter 6.4 mm
d radius 0.4 cm **e** radius 19 cm **f** radius 13 mm
g diameter 0.75 m **h** diameter 27 cm **i** radius 82 km.

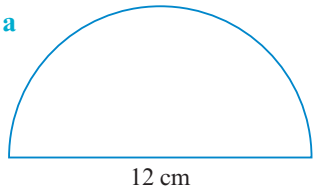
9 Look at this semicircle.



a How much of a circle is it?
b What would be the circumference if it was a full circle?
c Use your answers to parts **a** and **b** to find the length of the curved section of the semicircle.
d What is the perimeter of the semicircle?

10 Use your understanding of circumference to find the perimeter of each shape.

a



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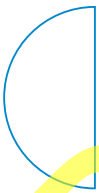

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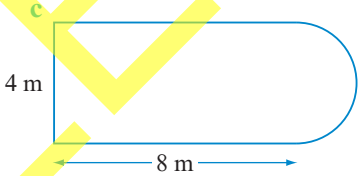

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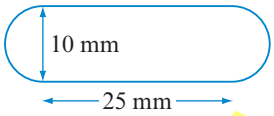

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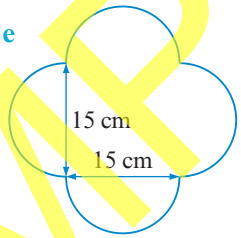

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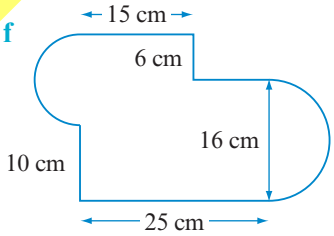


11 Elli bought Thomas a ring. She knows that his ring finger has a circumference of 60 mm. She buys him an S size ring, which has an inner diameter of 19.15 mm.

a Find the inner circumference of this ring. Do you think it will fit?

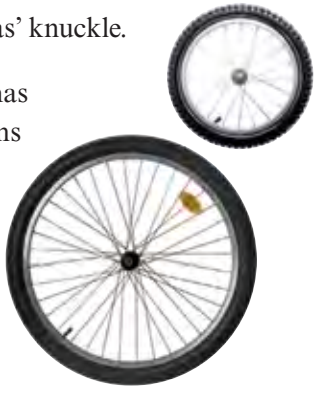
Elli gives the ring to Thomas and finds that it doesn't fit because it won't go over his knuckle. She tries both a T size ring (diameter of 19.56 mm), which is still slightly too small, and a U size ring (diameter of 19.96 mm), which is slightly too big.

b What size range must the circumference of Thomas' knuckle be in? (Hint: find the circumferences of both the T and U size rings.)

Elli discovers that these rings also come in half sizes.

c What would be the diameter of a ring size $T\frac{1}{2}$?
d If the ring is a perfect fit, find the circumference of Thomas' knuckle.

12 Jack goes for a bike ride with his younger sister Lily, but she has trouble keeping up. Jack gets frustrated but his mother explains that because Lily's bike is smaller, Lily has to work harder to go the same distance. If Jack's bike wheels have a diameter of 55 cm and Lily's have a diameter of 32 cm:



a find the circumference of their wheels
b find how many times each wheel turns to travel 1 km
c discuss whether Jack's mum is correct.

PROBLEM SOLVING AND REASONING

13 Lauren and Matt go for a ride on a merry-go-round. Lauren chooses a horse 5.4 m from the centre and Matt chooses a horse 4.1 m from the centre.

- **a** Do these lengths relate to diameter or radius? Explain.
- **b** Find how far they will each travel in one revolution of the merry-go-round.
- **c** If the merry-go-round rotates six times in a ride, find the difference in the distance Matt and Lauren travel.
- **d** Explain why, although Matt and Lauren are on the same ride, Lauren travels further than Matt.

14 For circles with these circumferences, find:

- **i** the diameter
- **ii** the radius.

a 314 cm **b** 6.28 m **c** 15.7 mm **d** 1.57 cm

15 Imagine you could tie a piece of string around the circumference of the Earth at the equator.

- **a** If Earth has a diameter at the equator of about 12 756 km, how much string would be needed?
- **b** If you added 1 m to the length of the piece of string, would you be able to:
  - **i** squeeze your pinkie finger under the string?
  - **ii** fit your hand under the string?
  - **iii** slide yourself under the piece of string?
  - **iv** crawl under the string?
  - **v** walk under the string?

Explain your answer.

CHALLENGE

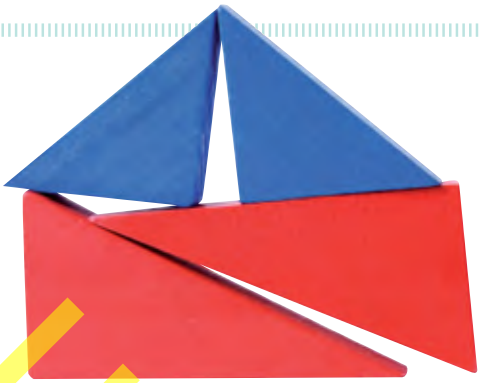
16 A local show has a new Ferris wheel. It has a radius of 54 m.

- **a** What is the diameter of the Ferris wheel?
- **b** If the Ferris wheel stands 5 m off the ground, how high would you be if you were at the top?
- **c** What is the circumference of the Ferris wheel?
- **d** How many carriages could fit on the Ferris wheel if each one was 1 m wide and there has to be at least 3 m between each carriage?
- **e** Use your answer from part **c** to calculate the distance between each carriage on the Ferris wheel.
- **f** If the owner wanted to fit 100 carriages onto the Ferris wheel, assuming a minimum distance of 3 m between each carriage, by how much would the radius of the Ferris wheel have to increase?
- **g** Are the details in this question realistic? Investigate and write a paragraph on your findings.

Reflect

What is π and how does it relate to radius, diameter and circumference?

8C Area of rectangles and triangles



Start thinking!

1 What is **area** and how is it different from length?

2 For the rectangle in figure A, what is:
- **a** the length (l)?
- **b** the **width** (w)?
- **c** the area (A)?

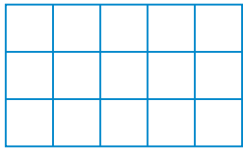


Figure A

3 How does figure A show that the formula for the area of a **rectangle** is $A = l \times w$ or $A = lw$?

Figure B shows the rectangle from figure A split into two identical triangles.

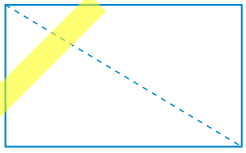


Figure B

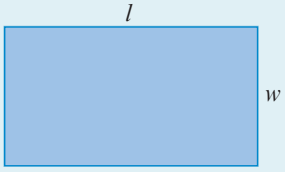
4 How does figure B show that the area of a **triangle** is exactly half that of a rectangle with the same dimensions?

5 How do the **base** (b) and **height** (h) of this triangle relate to the length and width of this rectangle?

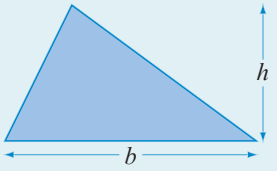
6 The formula for the area of a triangle is $A = \frac{1}{2} \times b \times h$ or $A = \frac{1}{2}bh$. How does this relate to the formula for the area of a rectangle?

KEY IDEAS

- Area (A) is the amount of space enclosed by a 2D shape.
- Common units of area measurement include square millimetres (mm^2), square centimetres (cm^2), square metres (m^2) and square kilometres (km^2).



- To find the area of a rectangle, multiply its length (l) by its width (w).
  $A = lw$
- To find the area of a triangle, multiply its base (b) by its height (h) then divide by 2.
  $A = \frac{1}{2}bh$

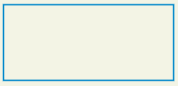


NOTE The base and height of a triangle must be **perpendicular** to each other.

EXERCISE 8C Area of rectangles and triangles

EXAMPLE 8C-1 Calculating area of a rectangle

Calculate the area of this rectangle.

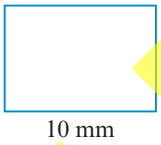


THINK	WRITE
1 Write the formula.	$A = l \times w$
2 Identify l and w. Write the length in centimetres so that both l and w are in the same units.	$l = 45$ mm $= 4.5$ cm $w = 2$ cm
3 Substitute the values for l and w into the formula.	$A = 4.5 \times 2$
4 Calculate the result and include the appropriate unit.	$= 9$ cm^2

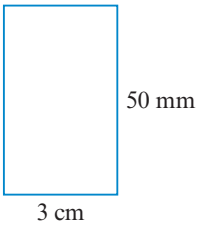
UNDERSTANDING AND FLUENCY

1 Calculate the area of each rectangle.

a



b



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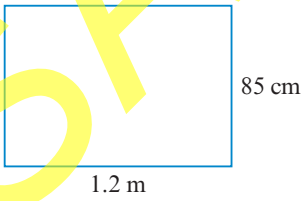

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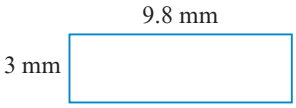
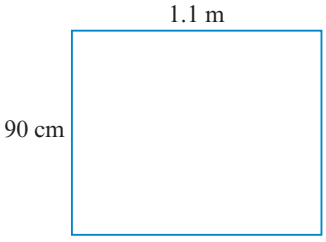


e



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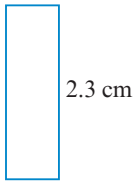
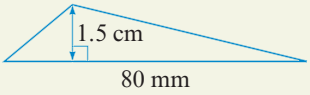


EXAMPLE 8C-2 Calculating area of a triangle

Calculate the area of this triangle.

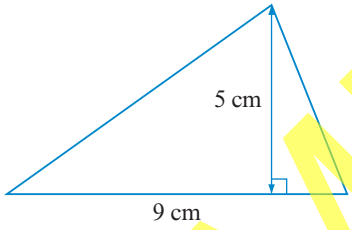


THINK	WRITE
1 Write the formula.	$A = \frac{1}{2}bh$
2 Identify b and h. Write the base in centimetres so that both b and h are in the same units.	$b = 80 \text{ mm} = 8 \text{ cm}$ $h = 1.5 \text{ cm}$
3 Substitute the values for b and h into the formula.	$A = \frac{1}{2} \times 8 \times 1.5$
4 Calculate the result and include the appropriate unit.	$= 6 \text{ cm}^2$

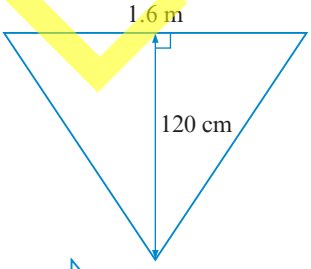
UNDERSTANDING AND FLUENCY

2 Calculate the area of each triangle.

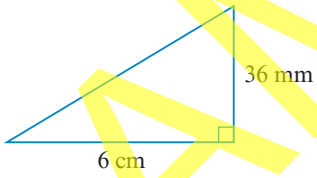
a



b



c



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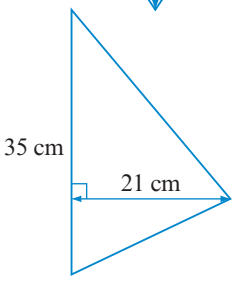

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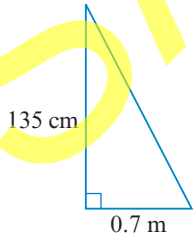

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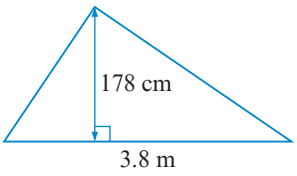


3 Calculate the area of each shape.

- **a** a rectangle with length 35 mm, width 4 cm
- **b** a rectangle with length 12 mm, width 17 cm
- **c** a triangle with base 15 mm, height 2 cm
- **d** a square with length 7.2 mm
- **e** a triangle with base 25 cm, height 10 mm
- **f** a triangle with base 8 cm, height 42 mm
- **g** a square with base 19 cm

h a rectangle with base 4.2 cm, height 11 mm

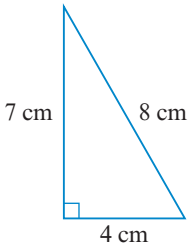
i a triangle with base 0.7 m, height 49 cm

4 How much material is needed to make the multi-coloured umbrella shown?

5 A classmate attempted question **4** and after using 68.5 cm as the height of each triangle, obtained an answer of 8768 cm^2. Can you explain where they went wrong?

6 Calculate the area of each shape.

a



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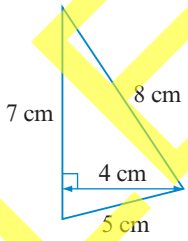

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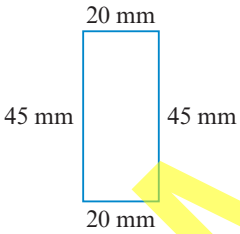

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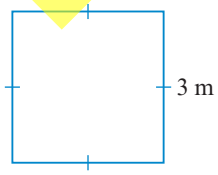

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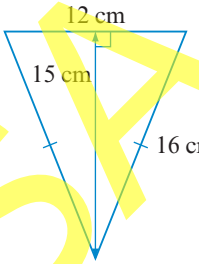

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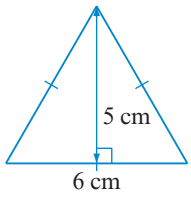
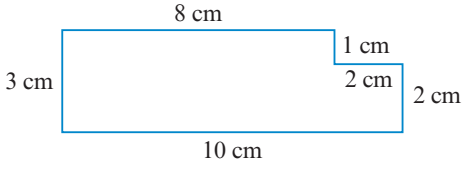


7 Two classmates were arguing about the dimensions of the rectangle in question **6c**.
Juan said that the length was the longest side and therefore it was 45 mm.
Erica said it was the horizontal length and therefore it was 20 mm.
Can you explain how they are both wrong and both right?

8 You can use your understanding of areas of rectangles and triangles to find the area of **composite shapes**.



a Copy this figure and draw a line on it splitting it into two rectangles.

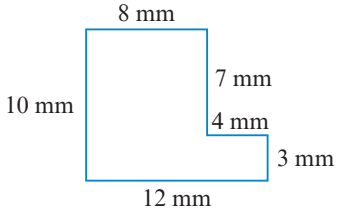
b Find the area of each rectangle and hence the area of the entire shape.

c Is there another way you could have done this?
Draw another diagram to show how it could be done.

UNDERSTANDING AND FLUENCY

9 Find the area of each shape.

a



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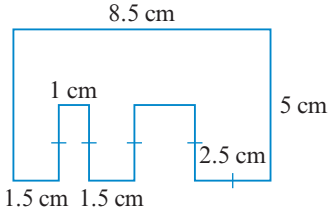

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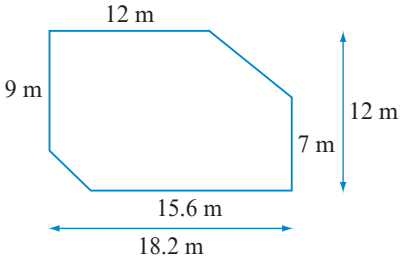

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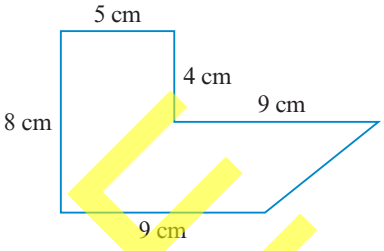

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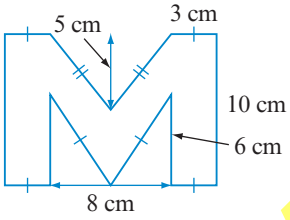

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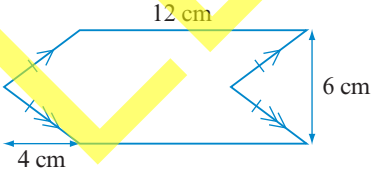
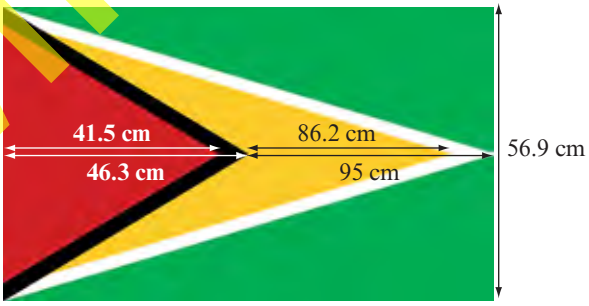
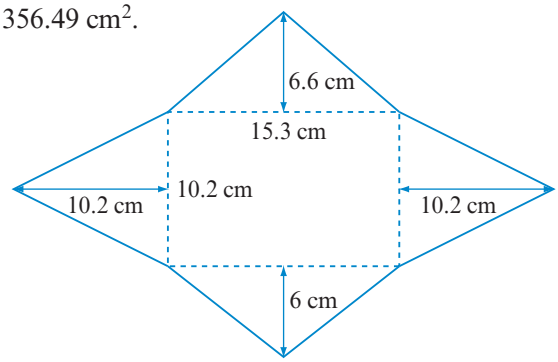


PROBLEM SOLVING AND REASONING

10 Guyana's flag consists of numerous coloured triangles. Use the measurements to find the area of each coloured section.



11 This envelope template has an area of 356.49 cm^2.



a Use your understanding of areas of rectangles and triangles to prove this area measurement is correct.

b Create your own envelope (using rectangles and triangles) that has a total area of:

i less than 300 cm^2

ii between 300 cm^2 and 400 cm^2

iii more than 400 cm^2.

What did you change each time?

PROBLEM SOLVING AND REASONING

12 A rectangle has an area of 68 cm^2. Draw three possible rectangles that fit this description, labelling length and width on each one.

13 A rectangle has an area of 20 cm^2 and a length of 4 cm. Find its width and explain why there is only one rectangle that you can draw that fits this description.

14 A triangle has an area of 32 mm^2.

a Draw three possible triangles that fit this description, labelling base and height on each one.

Suppose that this triangle has a base of 8 mm.

b What would its height be?

c Draw two possible triangles that fit this description, labelling base and height on each one.

d Explain why there are many triangles that fit this description.

15 A rectangle has an area of 56 m^2.

a State three possible sets of dimensions.

b Find the perimeter of each possible rectangle.

16 A rectangle has a perimeter of 48 cm. Find three possible areas this rectangle could have.

17 A square has an area of 64 mm^2. Draw this square, stating its dimensions, its perimeter and why there is only one square that matches this description.

18 A wooden frame is to go around a rectangular mirror with an area of 3600 cm^2.

a If the mirror has a length of 90 cm, what is its width?

b What area of wood is required if the frame is to be 5 cm wide? (Hint: draw a picture to help you with your calculations.)

CHALLENGE

19 Mohammed is making a rectangular vegetable garden and has 24 m of fencing to put around the garden.

a List three possible sets of dimensions and corresponding areas for the garden.

b What is the maximum area that you can find using 24 m of fencing? What shape is this?

Mohammed realises he can enclose a bigger area if he puts the garden against the shed wall and only has to fence three sides of the garden.

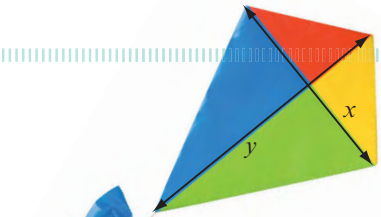
c List another three possible sets of dimensions and corresponding areas for the veggie garden if one side is against the shed wall.

d What is the maximum area that you can find now using 24 m of fencing for three sides? What shape is this? How does this relate to your answer to part **b**?

Reflect

How are the dimensions and area of a triangle related to the dimensions and area of a rectangle?

8D Area of other quadrilaterals



Start thinking!

You can use your understanding of the area of a rectangle to find the area of other **quadrilaterals**.

1 Match each description to a **parallelogram**, **rhombus** or **kite**.
- **a** Opposite sides parallel, all sides equal, opposite angles equal.
- **b** Two pairs of sides equal in length.
- **c** Opposite sides parallel and equal in length, opposite angles equal in size.

2 Look at the parallelogram shown in figure A.
- **a** What do b and h stand for?
- **b** How might you cut and rearrange this parallelogram so it forms a rectangle?
- **c** Use the formula for area of a rectangle to show the formula for area of a parallelogram is $A = b \times h$ or $A = bh$.

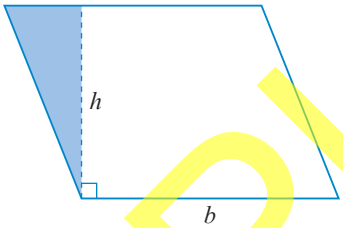


Figure A

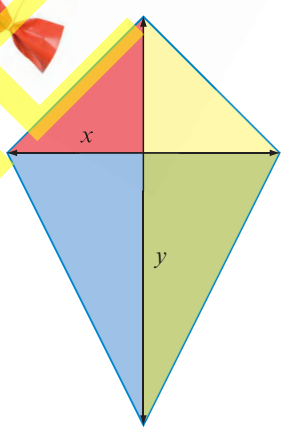
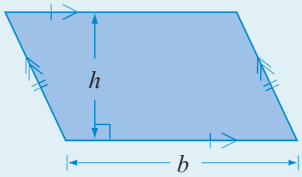


Figure B

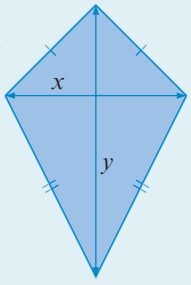
3 Look at the kite in figure B. The diagonals are marked inside the kite and labelled x and y.
- **a** Copy and cut out the kite twice. Cut one of these copies along its diagonal lines.
- **b** Rearrange all the parts so that you form a rectangle.
- **c** How do the diagonals of the kite relate to the length and width of the rectangle?
- **d** How many copies of the kite make up this rectangle?
- **e** Use the formula for the area of a rectangle to show that the formula for the area of a kite is $A = \frac{1}{2} \times x \times y$ or $A = \frac{1}{2}xy$.

KEY IDEAS

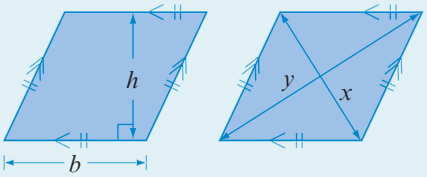
- The formula for the area of a parallelogram is $A = bh$



- The formula for the area of a kite is $A = \frac{1}{2}xy$



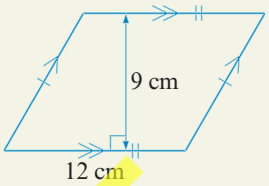
- The formula for the area of a rhombus is $A = bh$ or $A = \frac{1}{2}xy$



EXERCISE 8D Area of other quadrilaterals

EXAMPLE 8D-1 Calculating area of a parallelogram

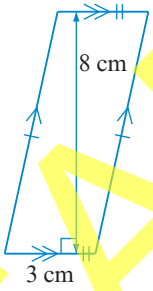
Calculate the area of this parallelogram.



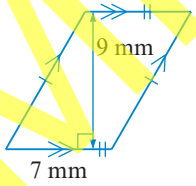
THINK	WRITE
1 Write the formula.	$A = bh$
2 Identify b and h.	$b = 12$ cm, $h = 9$ cm
3 Substitute the values for b and h into the formula.	$A = 12 \times 9$
4 Calculate the result and include the appropriate unit.	$= 108$ cm^2

1 Calculate the area of each parallelogram.

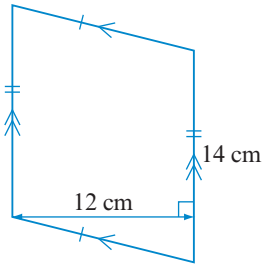
a



b

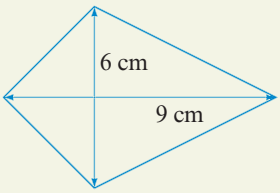


c



EXAMPLE 8D-2 Calculating area of a kite

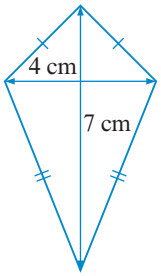
Calculate the area of this kite.



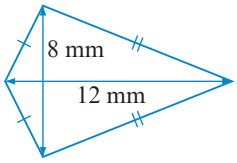
THINK	WRITE
1 Write the formula.	$A = \frac{1}{2}xy$
2 Identify x and y.	$x = 6$ cm, $y = 9$ cm
3 Substitute the values for x and y into the formula.	$A = \frac{1}{2} \times 6 \times 9$
4 Calculate the result and include the appropriate unit.	$= 27$ cm^2

2 Calculate the area of each kite.

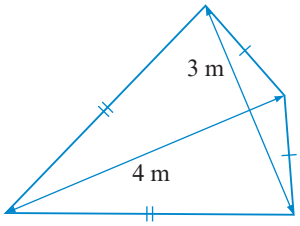
a



b

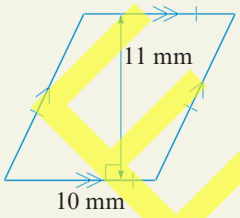


c



EXAMPLE 8D-3 Calculating area of a rhombus

Calculate the area of this rhombus.

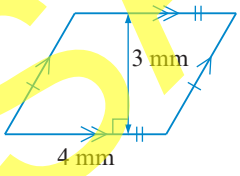


THINK	WRITE
1 A rhombus is both a parallelogram and a kite. As the base and height are given, write the formula for a parallelogram.	$A = bh$
2 Identify b and h.	$b = 10$ mm, $h = 11$ mm
3 Substitute the values for b and h into the formula.	$A = 10 \times 11$
4 Calculate the result and include the appropriate unit.	$= 110$ mm^2

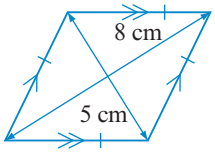
UNDERSTANDING AND FLUENCY

3 Calculate the area of each rhombus.

a



b



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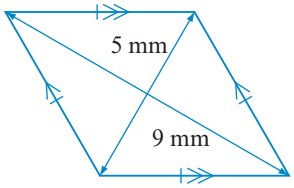
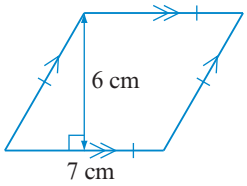


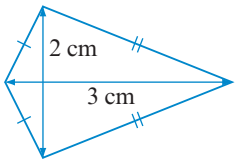
4 For each shape:

- **i** identify if it is a parallelogram, rhombus or kite
- **ii** write the formula to find its area
- **iii** calculate its area.

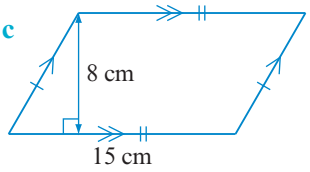
a



b

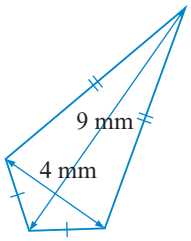


c



UNDERSTANDING AND FLUENCY

d



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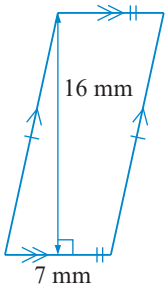

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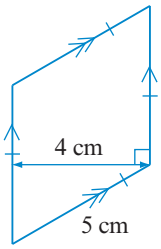
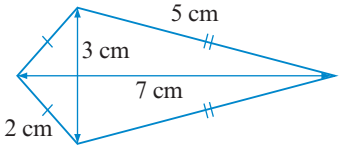


5 Calculate the area of each quadrilateral.

a



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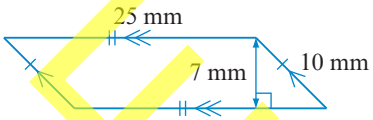

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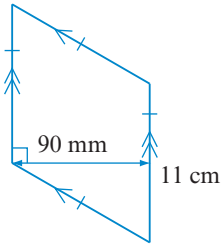

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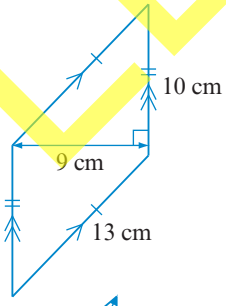

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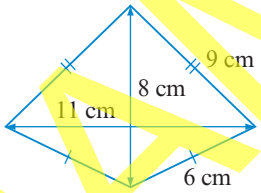

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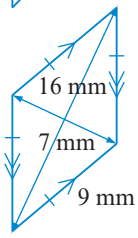


PROBLEM SOLVING AND REASONING

6 Tim's uncle has an old road sign he wants painted on both sides.

a If the sign is 0.7 m tall and 0.7 m wide, find the total area Tim will have to paint if he uses three coats of paint.

Tim's uncle likes the results so much he asks Tim to paint another 20 road signs.

b What is the total area Tim will paint for 20 road signs? Remember they need three coats on both sides.

c How much will it cost to paint the signs if a litre of paint costs $8.99 and covers 15 m^2?

d If Tim is paid $150, find how much money Tim will make after deducting the cost of the paint.

7 Amanda wants to make some kites. She decides to make two types, a large blue kite and a smaller red kite.

- **a** The blue kite needs to be at most 95 cm long and 65 cm wide. What is the largest area it can be?
- **b** The red kite can have a maximum area of 400 cm^2. If the kite is 40 cm long, how wide must it be?

8 The area of a kite can be found by relating it to a parallelogram.

- **a** Draw a kite, using dotted lines for the diagonals.
- **b** Cut the kite in half along one of the diagonals.
- **c** Rearrange these two pieces so that they form a parallelogram.
- **d** What is the formula for the area of a parallelogram?
- **e** One of the diagonals relates to the base of the parallelogram. Which one?
- **f** Half of one of the diagonals relates to the height of the parallelogram. Which one?
- **g** Explain how this method also gives the formula for the area of a kite as $A = \frac{1}{2}xy$.

9 Consider this building in Hamburg.

- **a** What shape is it?
- **b** If the glass section is 21 m tall and 86 m long, what is the area of this entire section?
- **c** Is every window equal in area? Explain.
- **d** How might you calculate the area of every window? Explain.

10 Use the Internet or another resource to investigate the use of quadrilaterals, especially parallelograms, rhombuses and kites, in art and architecture.

11 The area of a parallelogram is 40 cm^2.

- **a** Draw three possible parallelograms that fit this description, labelling base and height.
- **b** Why is this more difficult than if it was a rectangle?

12 A rhombus has an area of 24 mm^2.

- **a** Draw two possible rhombuses that fit this description, labelling base and height.
- **b** Find the perimeter of these two rhombuses.
- **c** Explain why the area of a rhombus can never be a square number unless the shape is a square (remember that a square is a special type of rhombus).

13 Draw three possible kites that have an area of 36 m^2, labelling the appropriate dimensions.

CHALLENGE

14 Write your own open-ended questions about the areas of quadrilaterals and swap them with a classmate. What strategies can you use to solve these problems?

15 The special quadrilateral that has not been covered yet is the **trapezium**. Look at the trapezium in figure A.

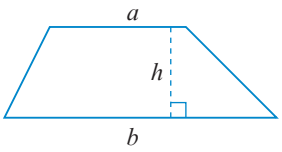


Figure A

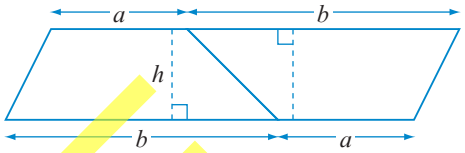


Figure B

a Copy and cut out this trapezium twice. Label the copies as shown in figure A.

b Rotate one of these trapeziums and join it up to the first trapezium as shown in figure B.

c What shape does this now form?

d What is the formula for the area of a parallelogram?

e The height of the trapeziums corresponds to the height of the parallelogram. What part of the parallelogram does the sum of the trapezium lengths $(a + b)$ correspond to?

The formula for the area of this parallelogram is $A = (a + b) \times h$, where $a + b$ is the base.

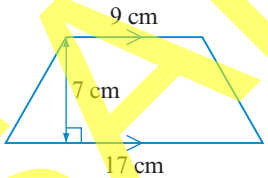
f How many trapeziums make up this parallelogram?

g Explain how this shows that the formula for the area of a trapezium is $A = \frac{1}{2}(a + b) \times h$ or $A = \frac{1}{2}(a + b)h$.

h If $a = 4$, $b = 9$ and $h = 3$, find the area of the trapezium shown in figure A.

16 Find the area of each trapezium using the formula $A = \frac{1}{2}(a + b)h$.

a



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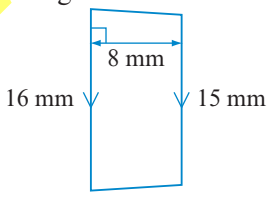

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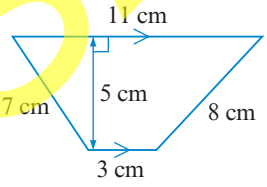
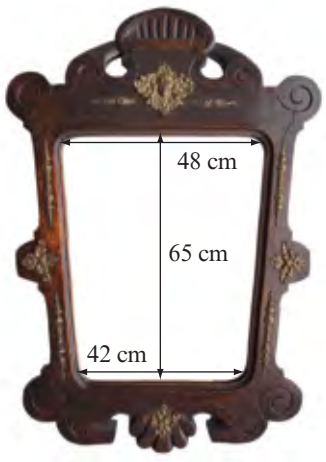


17 Find the cost of fitting the frame on the right with a mirror if your local hardware store charges \$0.25 per cm^2 for mirror glass.



18 The formula for the area of a trapezium can also be developed by cutting a trapezium in half and joining the two pieces to form another parallelogram. Draw a trapezium and cut it out to show how this might be done.

Reflect

How is the formula for the area of a rectangle useful when finding the formulas for the areas of other quadrilaterals?

8E Area of a circle

Start thinking!

1 If the circumference of a circle is $C = 2\pi r$, what would be the formula for a *half* circumference of a circle?

2 Draw a circle that has a radius of 5 cm and shade half of it in colour, as shown in figure A.

3 How does your answer to question **1** relate to figure A?

A **sector** is a slice of a circle that starts from the centre of the circle.

4 How many sectors does the slice of lime shown above have?

5 Divide your circle from question **2** into 16 equal sectors so you have eight coloured sectors and eight non-coloured sectors.

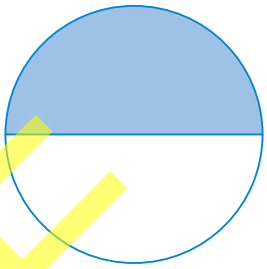


Figure A

6 Cut these up and arrange them as shown in figure B.

7 What shape does this form? Draw the quadrilateral and label its base and height.

8 What is the formula for the area of this shape?

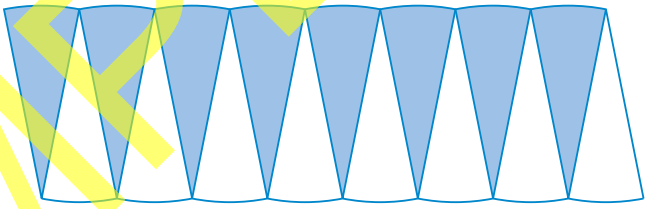


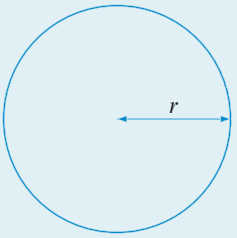
Figure B

9 Measure the base and height of the shape you formed and calculate the area.

10 If the height of your parallelogram is the same as the radius (r) of the circle and the base of the parallelogram is πr, explain why the formula for the area of a circle is $A = \pi r^2$.

KEY IDEAS

- The formula for the area of a circle with radius r is $A = \pi r^2$.
- If you are given the diameter, find the radius before using the formula.

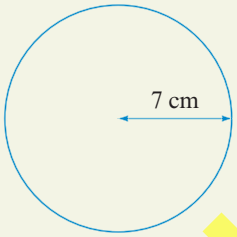


EXERCISE 8E Area of a circle

For all questions in this topic, use π on your calculator and then round each answer to two decimal places.

EXAMPLE 8E-1 Calculating area of a circle, given radius

Calculate the area of this circle.

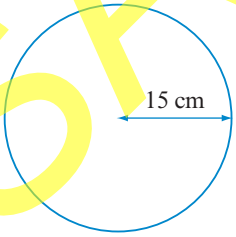


THINK	WRITE
1 Write the formula.	$A = \pi r^2$
2 Identify r and substitute it into the formula.	$= \pi \times 7^2$
3 Calculate the result using π on your calculator.	$= 153.938\,040\,0\ldots$
4 Round to two decimal places and include the appropriate unit.	$A = 153.94\ \text{cm}^2$

UNDERSTANDING AND FLUENCY

1 Calculate the area of each circle.

a



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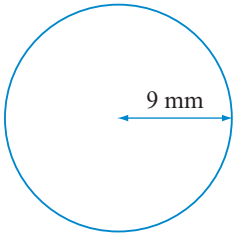

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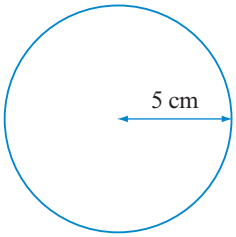
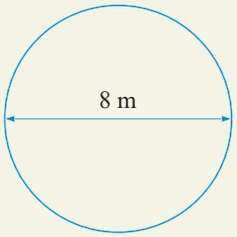


EXAMPLE 8E-2 Calculating area of a circle, given diameter

Calculate the area of this circle.

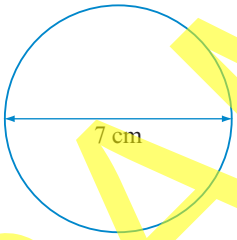


THINK	WRITE
1 Write the formula.	$A = \pi r^2$
2 Identify the radius (half the diameter).	$r = D \div 2$ $= 8 \div 2$ $= 4$ m
3 Substitute the value for r into the formula.	$A = \pi \times 4^2$
4 Calculate the result using π on your calculator.	$= 50.265\,482\ldots$
5 Round to two decimal places and include the appropriate unit.	$A = 50.27$ m^2

UNDERSTANDING AND FLUENCY

2 Calculate the area of each circle.

a



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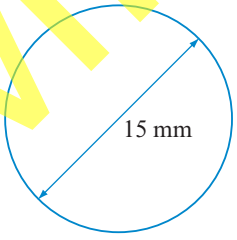

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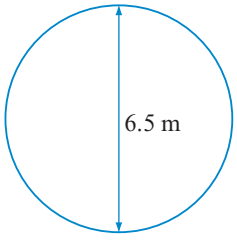
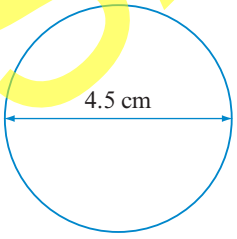


3 Calculate the area of each circle.

a



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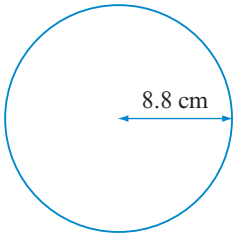

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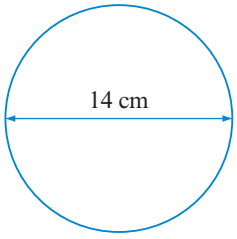

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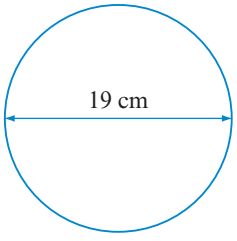

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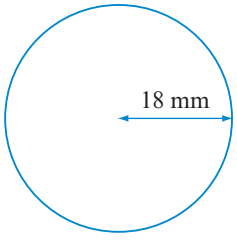

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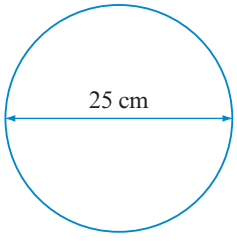
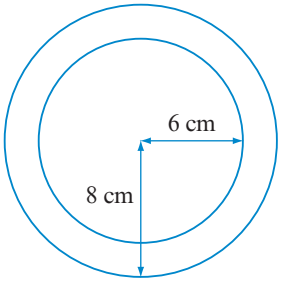


4 Calculate the area of a circle with:

a radius 5 cm
b diameter 7.5 m
c diameter 15 mm
d radius 29 mm
e radius 0.8 m
f diameter 0.42 cm

5 You can subtract the area of one circle from another to find the area of a ring. Another name for a ring is an **annulus**. Find the area for each annulus.

a



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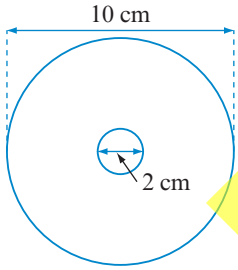

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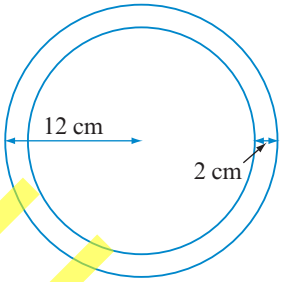
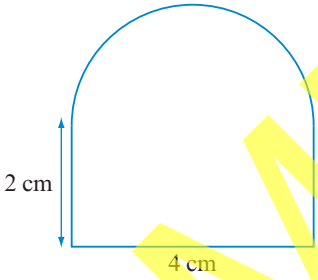


6 Use your understanding of area of a circle to find the area of each composite shape.

a



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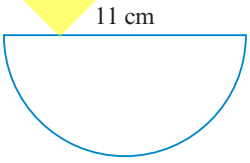

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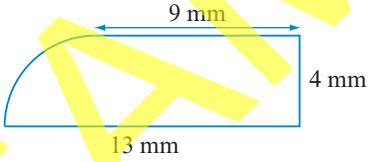

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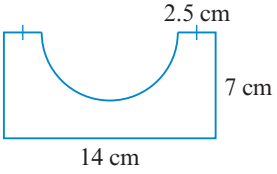

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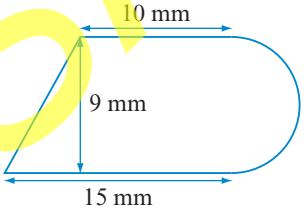

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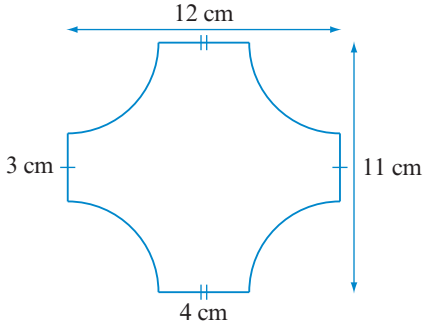
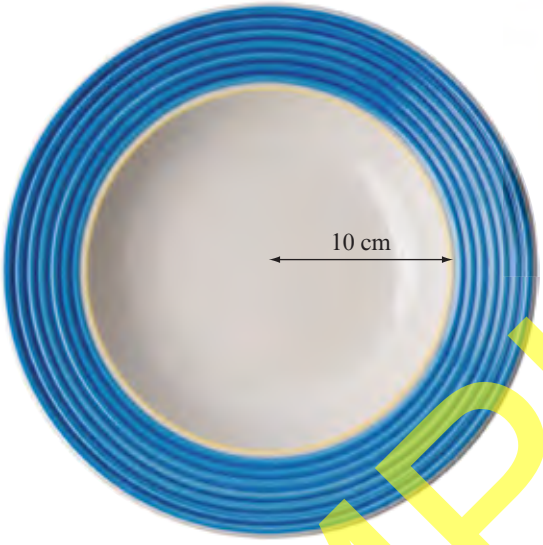


7 Anika wants to make a circular placemat. How much material will she need if the placemat has a diameter of 55 cm?

8 A sprinkler sprays a stream of water 7.5 m long around in a circle. What is the total area covered by the sprinkler?

9 What is the largest pancake that could be cooked in this frying pan, if its base has a diameter of 24 cm?

10 Adrian wants to cook a pancake using the frying pan from question **9** and place it on this plate.



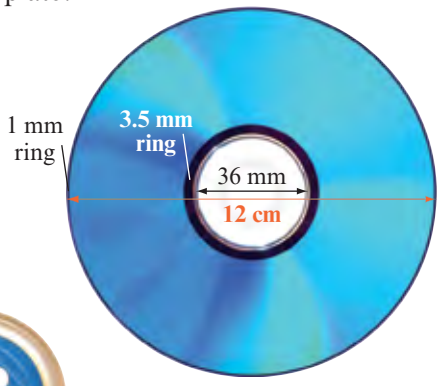
a What is the maximum area a pancake could have if it had to fit on the white section of this plate and the white section has a radius of 10 cm?

b To make a pancake the size you found in part **a**, what distance should be between the edges of the pancake and the side of the frying pan?

c What is the entire area of the plate if it has a diameter of 30 cm?

d What is the area of the painted section of the plate?

11 A DVD has a diameter of 12 cm and an inner (non-recordable) circle of diameter 36 mm. There is a 1 mm gap between the edge of the DVD and where the recording starts, and there is an additional 3.5 mm ring that cannot be recorded onto. What is the recordable area of the DVD?



12 What is the total area that this button covers if it has a diameter of 20 mm and each hole has a radius of 1.5 mm?

13 Design your own button. Draw and label its dimensions, stating the area that it will have.

14 It is possible to find the radius of a circle if you know its area.

a Explain why the formula to find the radius of a circle is $r = \sqrt{\frac{A}{\pi}}$.

b Why might it be easier to find the length of the radius if the area has π in it? Support your answer by finding the radius of a circle that has an area of:

i 16 **ii** 16π.

c What mistakes might people make when trying to find the radius of a circle using this formula?

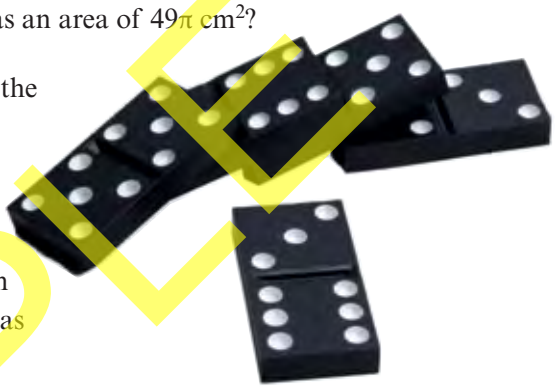
15 Find the radius of a circle which has an area of:

a 9π cm^2 **b** 25π cm^2 **c** 100 cm^2 **d** 65 cm^2.

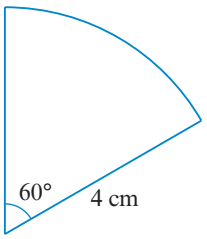
16 What is the diameter of a circle that has an area of 49π cm^2?

CHALLENGE

17 What percentage of the top surface of the pieces in a domino set is painted white (i.e. to show the dots)? You will need to research the number and type of tiles found in a domino set. Assume an individual domino piece is 44 mm in length, 22 mm in width and each dot has diameter 4 mm.



18 You can use knowledge of angles to calculate the area of a sector. Look at the sector shown here.



a What is the angle at the vertex of the sector?

b How many degrees in a circle?

c Use your answers to parts **a** and **b** to write the angle for this sector as a fraction of a circle.

d What is the radius of this sector?

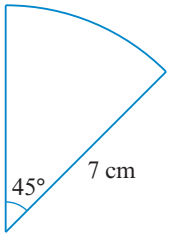
e What would be the area of the circle if it was complete?

f Use your answers to parts **c** and **e** to find the area of the sector.

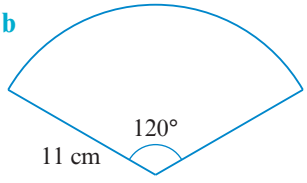
g Explain why this works to a classmate.

19 Calculate the area of each sector.

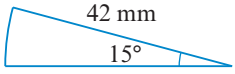
a



b



c



20 How could you use your understanding of sectors to find the areas of the composite shapes in question **6**.

Reflect

Why is π important when working with circles?

8F Surface area

Start thinking!

1 How are figures A and B related?

2 Draw nets for figures C and D.

3 How are the three nets similar and how are they different?

4 A face has been labelled on each object.
What shape is Face 1 for the:

a **rectangular prism**?

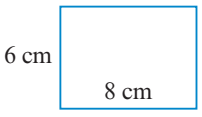
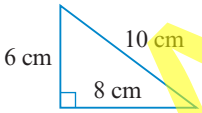
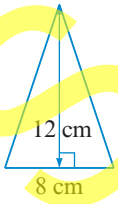
b **triangular prism**?

c **square-based pyramid**?

5 Label this 'Face 1' on each of your nets.

6 Label the remaining faces on each of your nets.

7 Copy and complete this table.
The first face for each object has been done for you.

	Face 1	Face 2	Face 3	Face 4	Face 5	Face 6
Rectangular prism						
Triangular prism						
Square-based pyramid						

8 How would you use the information in the table to calculate the **total surface area** of each object?

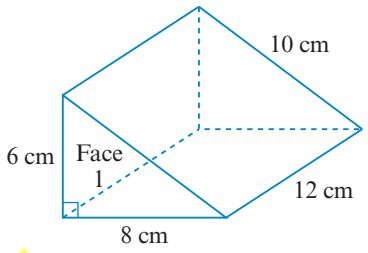


Figure A

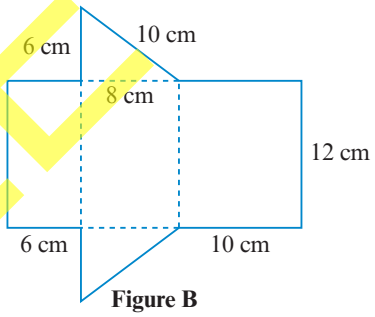


Figure B

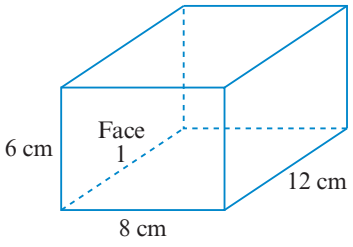


Figure C

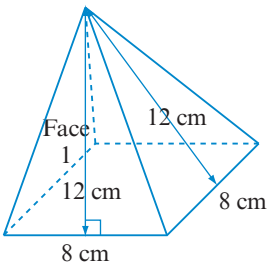


Figure D

KEY IDEAS

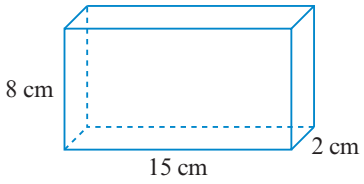
- The total surface area (TSA) of a 3D object is the total area of the outer surface of the object.
- The TSA of a prism is the sum of the areas of each face of the prism.
- Using the net of an object makes the faces easier to identify.

EXERCISE 8F Surface area

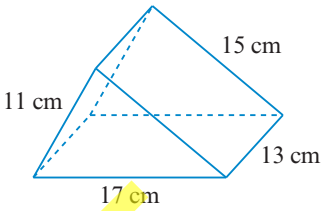
UNDERSTANDING AND FLUENCY

1 Draw each face for these prisms.

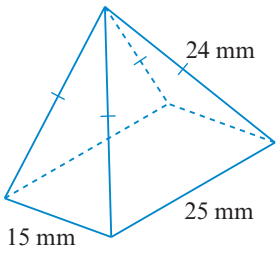
a



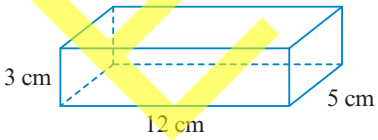
b



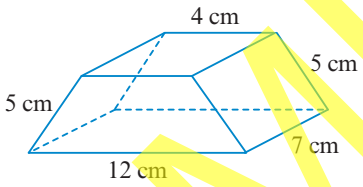
c



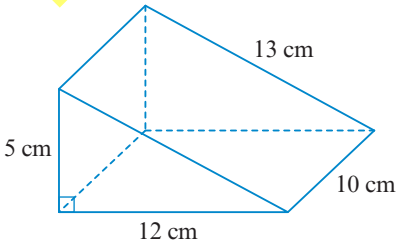
d



e

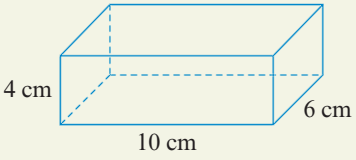


f



EXAMPLE 8F-1 Calculating surface area of a rectangular prism

Calculate the surface area of this rectangular prism.



THINK

1. Identify the faces (three pairs of identical rectangles).
2. Calculate the area of each face.
3. Add the areas together and include the appropriate unit.

WRITE

TSA = 4 cm × 10 cm + 4 cm × 10 cm + 10 cm × 6 cm + 10 cm × 6 cm + 4 cm × 6 cm + 4 cm × 6 cm

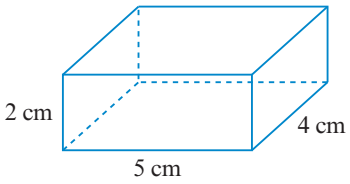
= 40 cm^2 + 40 cm^2 + 60 cm^2 + 60 cm^2 + 24 cm^2 + 24 cm^2

= 248 cm^2

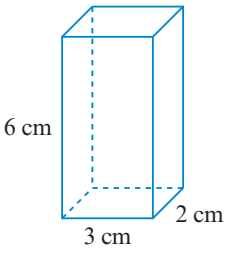
UNDERSTANDING AND FLUENCY

2 Calculate the surface area of each rectangular prism.

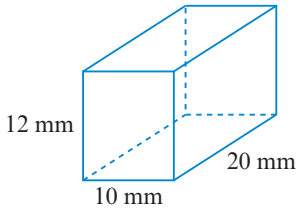
a



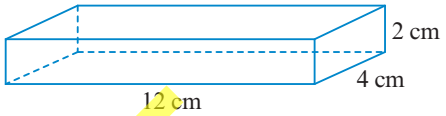
b



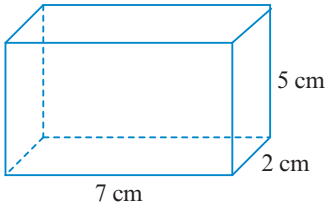
c



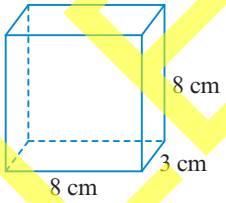
d



e

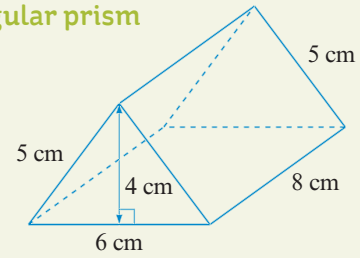


f



EXAMPLE 8F-2 Calculating surface area of a triangular prism

Calculate the surface area of this triangular prism.



THINK

1. Identify the faces (two identical triangles and three rectangles).
2. Calculate the area of each face.
3. Add the areas together and include the appropriate unit.

WRITE

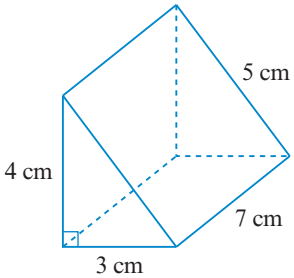
$\text{TSA} = \frac{1}{2} \times 6\text{ cm} \times 4\text{ cm} + \frac{1}{2} \times 6\text{ cm} \times 4\text{ cm} + 5\text{ cm} \times 8\text{ cm} + 6\text{ cm} \times 8\text{ cm} + 5\text{ cm} \times 8\text{ cm}$

$= 12\text{ cm}^2 + 12\text{ cm}^2 + 40\text{ cm}^2 + 48\text{ cm}^2 + 40\text{ cm}^2$

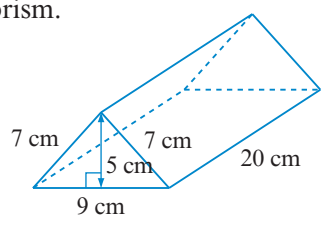
$= 152\text{ cm}^2$

3 Calculate the surface area of each triangular prism.

a

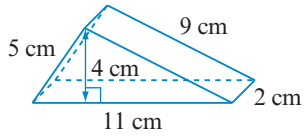


b

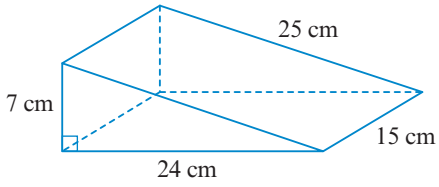


UNDERSTANDING AND FLUENCY

c



d



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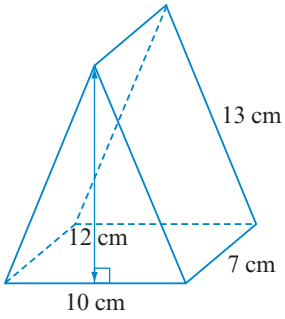
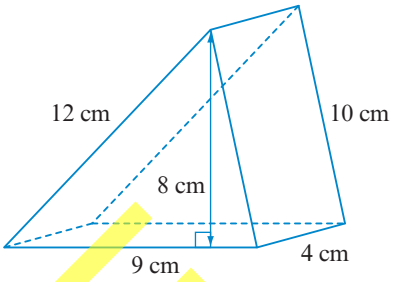
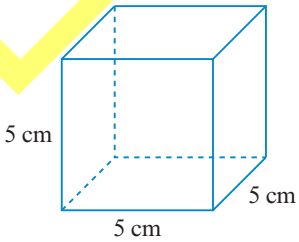


f



4 A friend wanted to calculate the surface area of this cube. She wrote her working as:

TSA = 5 cm × 5 cm + 5 cm × 5 cm + 5 cm × 5 cm + 5 cm × 5 cm + 5 cm × 5 cm + 5 cm × 5 cm.



a What is the surface area of this cube?

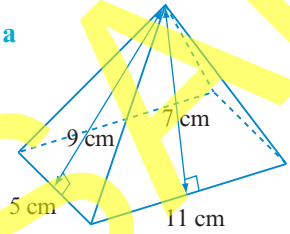
b Is there a shortcut for finding the surface area of a cube? Explain it to a classmate.

5 Calculate the surface area of a cube that has a side length of:

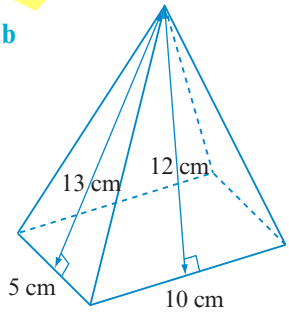
a 4 cm **b** 6 m **c** 12 mm **d** 20 cm.

6 Calculate the surface area of each **pyramid**. Is there a shortcut?

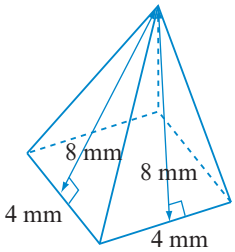
a



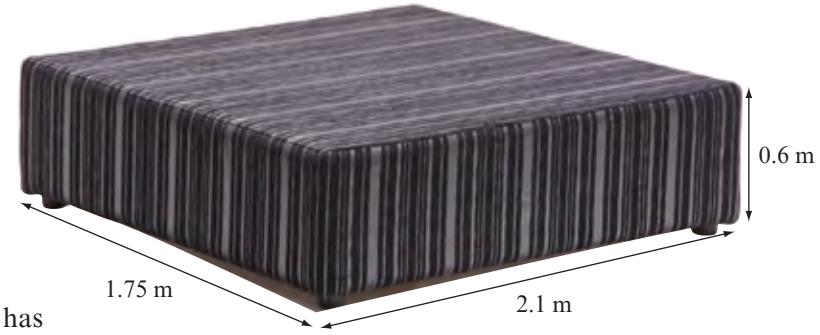
b



c



7 Jess wants to make a fitted sheet for the new mattress she bought. Assuming that the mattress is a rectangular prism, what is the minimum amount of material that she will need to buy in order to make the fitted sheet? (Hint: the sheet has to cover the sides and top of the mattress.)



8 Thanh makes a box for his mother in woodwork and needs to cover it in contact inside and out.

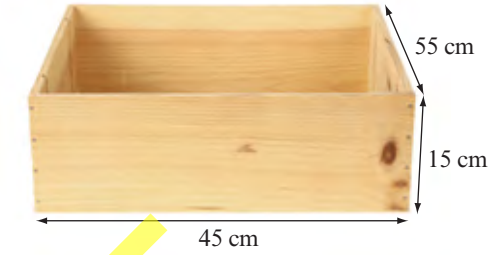
a How many faces will Thanh need to cover?

b Why is there more to cover than if it was just a closed box

Thanh decides to cover it in blue contact on the outer surface and white contact on the inner surface.

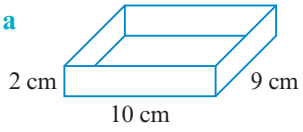
c Calculate how much blue contact and white contact Thanh will need. Ignore the thickness of the wood.

d What is the total surface area that Thanh will cover in contact?

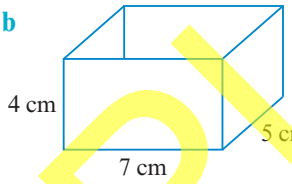


9 Calculate the total surface area for each open box.

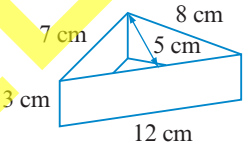
a



b



c

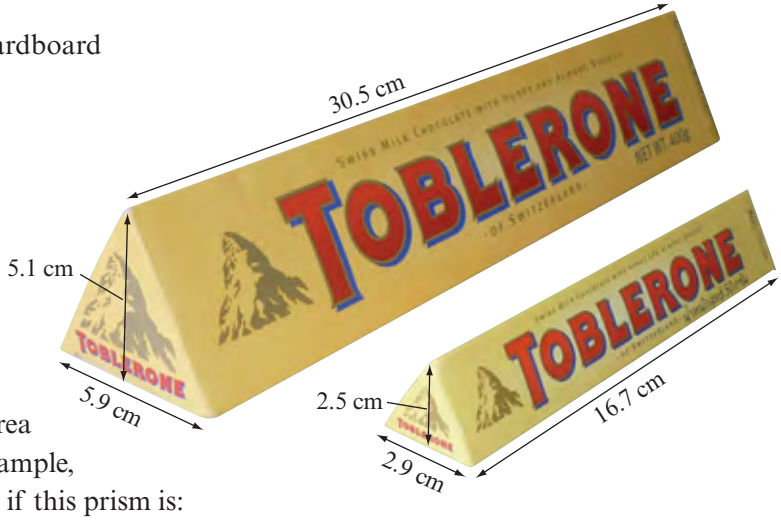


10 Recalculate the surface area for each object in question **9** if you only consider the outer surface area.

11 If a pool measures 18 m by 11 m by 2 m, and it costs $5 per square metre to paint, how much will it cost to paint the interior of the swimming pool?

12 Aaron wants to make his own tent. He decides on a simple triangular prism design. If he wants the tent to be 1 m tall, 2 m wide, 3 m long with a slanted edge of 1.41 m, how much material will he need? (Include material for the floor of the tent.)

13 Find the difference in cardboard needed for a small block of Toblerone compared to a large block of Toblerone. (Hint: assume the ends of each Toblerone are equilateral triangles.)



14 A prism has a surface area of 600 cm^2. Draw an example, labelling its dimensions, if this prism is:

a a cube

b a rectangular prism

c a triangular prism.

PROBLEM SOLVING AND REASONING

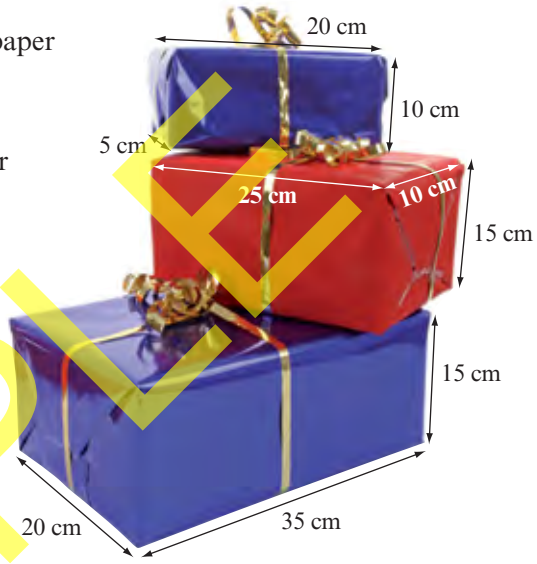
15 Why is there only one option for question **14** part **a**?

16 For each special quadrilateral:

- **a** draw a prism that uses the quadrilateral as the base
- **b** label your drawing with appropriate dimensions; for example, height, width, length, etc.
- **c** find the total surface area for your prism
- **d** swap with a classmate, check your answers and discuss any differences.

17 **a** Find the minimum amount of blue paper and red paper to wrap these gifts.

b Why would you need more than the minimum amount of wrapping paper to cover these gifts?



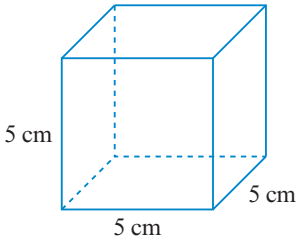
18 How much contact is needed to protect the cover of this textbook? Assume that you cover the spine and both sides of the front and back of the book.

19 How would you calculate the surface area of a tetrahedron?

20 What mistakes are common when finding the surface area of an object?

CHALLENGE

21 Consider the cube from question **4**, shown here.



- **a** What is its surface area?
- **b** What is the surface area if two of these cubes are stacked, one on top of the other?
- **c** What is the surface area if there is a stack of:
  - **i** three cubes?
  - **ii** four cubes?
  - **iii** five cubes?
- **d** Is there a pattern? Describe a shortcut to calculate the surface area of a stack of 17 cubes.
- **e** Would this pattern still work with a different sized cube? Investigate using a cube with different dimensions.

22 How would you calculate the surface area of a cylinder?

Reflect

When could knowledge of surface area be useful?

8G Volume of prisms

Start thinking!

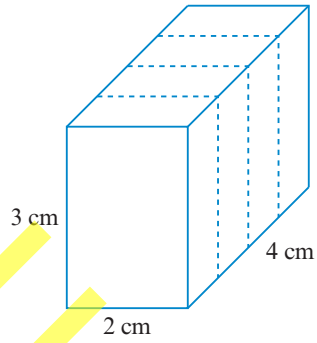


Figure A

1 What type of prism is shown in figure A?

2 What is the shape of its cross section? Does it matter where you 'slice' the prism to obtain the cross section?

This cross section is also known as the **base** of the prism.

3 If the base is the front face, what is the length of the dimension that is at right angles to this face?

This length is called the **height** of the prism.

4 Does it matter that the 'height' is not a vertical length and the base is not a horizontal face of the prism?

The **volume** (V) of a prism is found by multiplying the area of the base (A) by the height (H).

Volume = area of base × height

$V = A \times$ _____

or $V =$ _____

5 Copy and complete the formula for volume of a prism at right.

6 Use the formula to show the volume in figure A is 24 cm^3.

7 Does it matter which face is the base? Show another way of working out the volume using the bottom face as the base this time. Do you obtain the same answer?

8 What type of prism is shown in figure B? (Hint: what shape is its cross section?)

9 What is the area of its base? (Hint: this is the area of the cross section.)

10 What is its height?

11 Use the formula to calculate its volume.

12 Could a different face of the prism be used as the base? Explain.

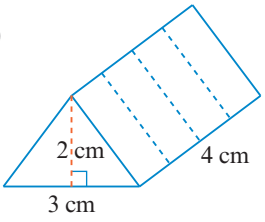


Figure B

KEY IDEAS

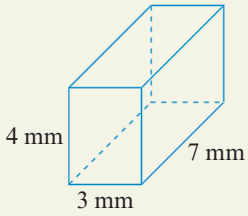
- Volume is the amount of space a 3D object occupies.
- Common units of volume are cubic millimetres (mm^3), cubic centimetres (cm^3) and cubic metres (m^3).
- A rectangular prism has a rectangle for its base.
- A triangular prism has a triangle for its base.
- To find the volume (V) of any prism, use the formula $V = AH$, where A is the area of the base and H is the height of the prism. The base and height of a prism must be perpendicular (at right angles) to each other.
- The volume of other 3D objects such as cylinders can also be found using the formula $V = AH$.

NOTE We use H for height of a prism so that it is not confused with h for height of a triangle or parallelogram.

EXERCISE 8G Volume of prisms

EXAMPLE 8G-1 Calculating volume of a rectangular prism

Calculate the volume of this prism.

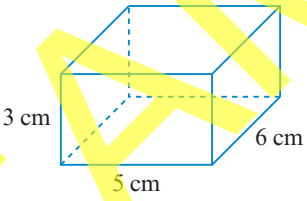


THINK	WRITE
1 Write the formula.	$V = AH$ $= l \times w \times H$
2 Choose the front face as the base. Identify the shape (rectangle) so appropriate area formula is used ($A = lw$).	
3 Identify l, w and H and check they are in the same units.	$l = 3$ mm, $w = 4$ mm, $H = 7$ mm
4 Substitute the values into the formula and calculate the result. Include the appropriate unit.	$V = 3 \times 4 \times 7$ $= 84$ mm^3

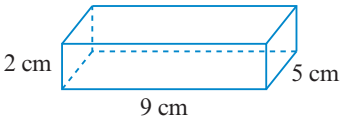
UNDERSTANDING AND FLUENCY

1 Calculate the volume of each rectangular prism.

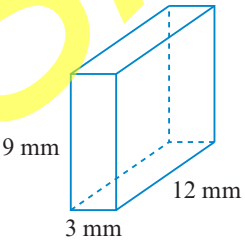
a



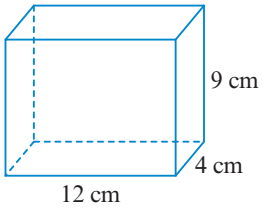
b



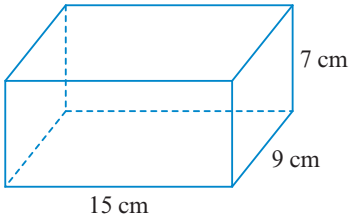
c



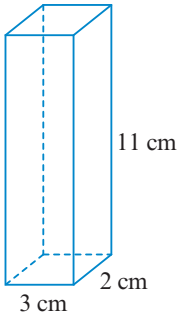
d



e

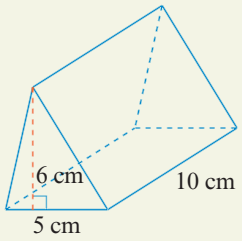


f



EXAMPLE 8G-2 Calculating volume of a triangular prism

Calculate the volume of this prism.



THINK

1. Write the formula.
2. Choose front face as base. Identify the shape (triangle) so appropriate area formula is used ($A = \frac{1}{2}bh$).
3. Identify b, h and H and check they are in the same units.
4. Substitute the values into the formula and calculate the result. Include the appropriate unit.

WRITE

$V = AH$

$= \frac{1}{2} \times b \times h \times H$

$b = 5$ cm, $h = 6$ cm, $H = 10$ cm

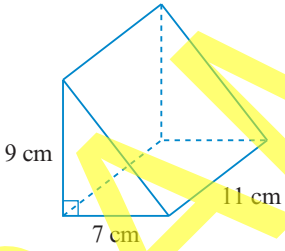
$V = \frac{1}{2} \times 5 \times 6 \times 10$

$= 150$ cm^3

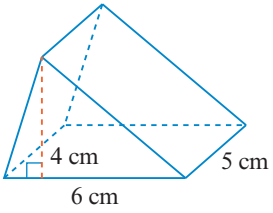
UNDERSTANDING AND FLUENCY

2 Calculate the volume of each triangular prism.

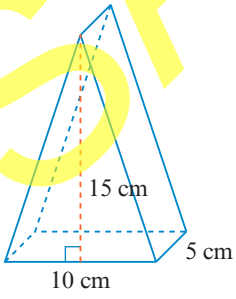
a



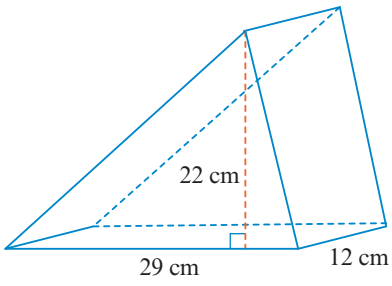
b



c



d



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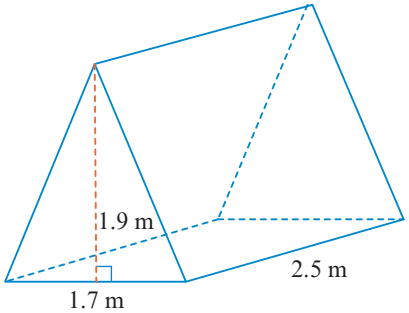

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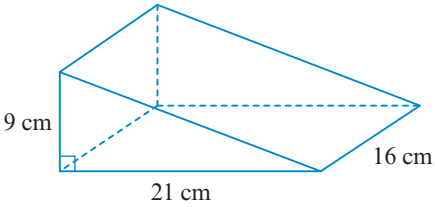


3 Calculate the volume of each prism.

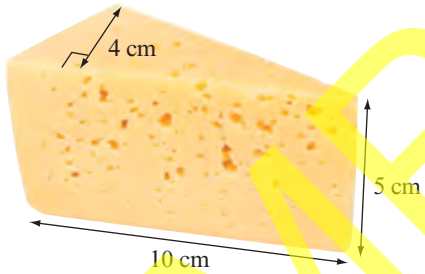
- **a** rectangular prism 2.5 cm long, 4.5 cm wide and 6 cm high
- **b** triangular prism 9 mm high, 3.5 mm wide and with 12 mm base
- **c** rectangular prism 7 m long, 2 m wide and 11 m high
- **d** triangular prism 5.5 mm high, 8 mm wide and with 1.5 mm base
- **e** triangular prism 16 cm high, 5 cm wide and with 12 cm base
- **f** rectangular prism 11.5 mm long, 18 mm wide and 7 mm high

4 Calculate the volume of each object.

a

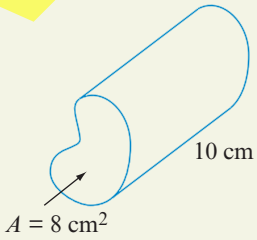
b

c



EXAMPLE 8G-3 Calculating volume of an object

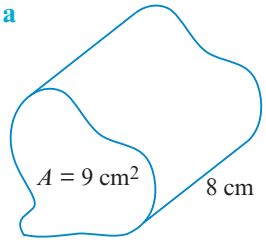
Calculate the volume of this object.



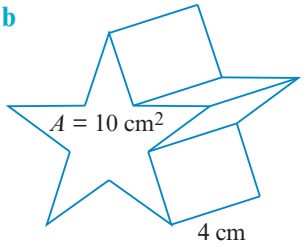
THINK	WRITE
1 Write the formula. This object is not a prism but the same formula can be used.	$V = AH$
2 Identify the shape of the base (irregular). Its area is given.	$A = 8\ \text{cm}^2$
3 Identify H and check its unit is centimetres.	$H = 10\ \text{cm}$
4 Substitute the values into the formula and calculate the result. Include the appropriate unit.	$V = 8 \times 10$ $= 80\ \text{cm}^3$

5 Calculate the volume of each object. The base area is shown.

a



b



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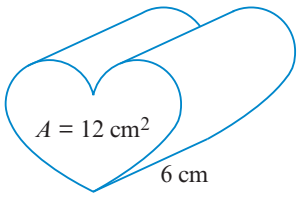
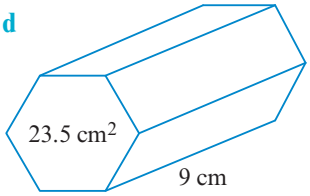


d



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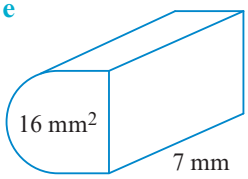

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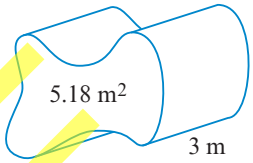
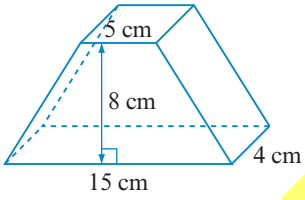
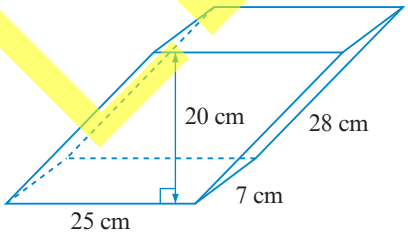


6 Use the formula $V = AH$ to calculate the volume of each object.

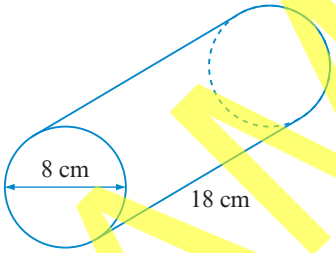
a



b



c



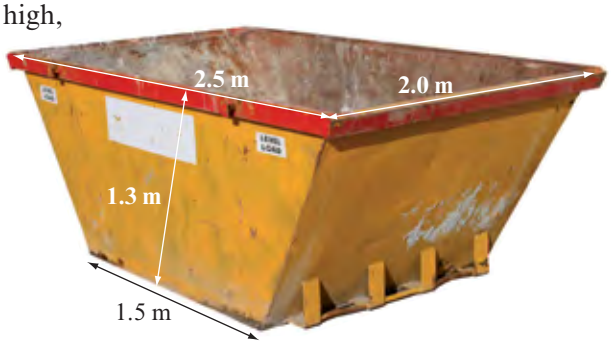
7 A tissue box is 21 cm long, 11.4 cm wide and 12.3 cm tall.

a What is its volume?

b If each tissue laid flat in the box is 1 mm high, how many tissues would it fit?

8 Explain why the volume of any irregular prism can be found by using the formula $V = AH$.

9 A skip has the dimensions shown. Calculate its volume in cubic metres.



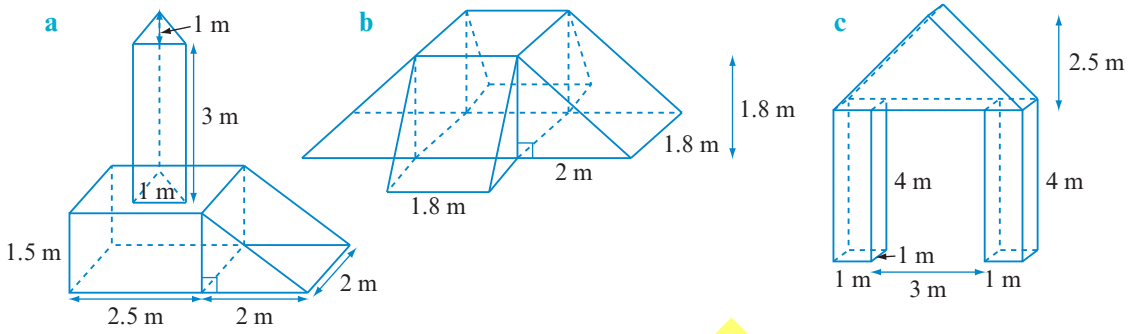
10 A new kind of insulation is to be fitted in the roof of a house. It is measured in cubic metres rather than square metres because it fills the entire roof (normally insulation is just a thick layer). The roof is in the form of a triangular prism. If the roof is 2 m high, 9 m wide and 14 m long, calculate:

a how much insulation is needed (in cubic metres)

b how much it will cost if the insulation costs $30 per cubic metre.

PROBLEM SOLVING AND REASONING

11 Andrew likes to make geometric sculptures. If his materials cost $2 per cubic metre, calculate how much it costs him to produce each sculpture.



12 Mel decides she wants one of the sculptures from question **11**. She can't decide which one, but it needs to be as light as possible.
Use the information at right to recommend which sculpture Mel should buy.

Sculpture a: weighs 3 kg per cubic metre
Sculpture b: weighs 2 kg per cubic metre
Sculpture c: weighs 2.5 kg per cubic metre

13 A rectangular prism has a square base with sides that measure 5 cm. If the prism has a volume of 100 cm^3, what is its length?

14 A triangular prism must be 20 cm long and have a volume of 400 cm^3.

a What area must the triangle face be?

b If the triangle face must be exactly 10 cm high, what is the base measurement?

c If the triangle face must be less than 10 cm high, what are three possible sets of dimensions (base and height) of the triangle face?

15 If you were to fit yourself into a cardboard box, what would be:

a the smallest possible set of dimensions for this box?

b the smallest possible volume it could have?

16 A rectangular prism has a volume of 500 cm^3. List three possible sets of dimensions.

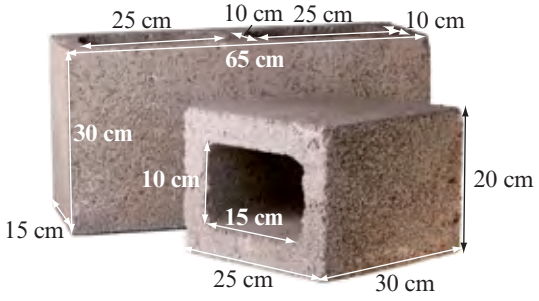
17 A triangular prism has a volume of 500 cm^3.

a List three possible sets of dimensions.

b Draw these three examples. Try to use different shaped triangles for each one.

18 What common mistakes do people make when finding the volume of a prism?

19 Find the volume of concrete needed to make these two blocks at right.



20 Julia found the answer to question **19** to be 44 250 cm^3. Explain where Julia went wrong and help her find the correct answer.

CHALLENGE

Reflect

How is the volume of a prism related to its base?

8H Area and volume conversions

Start thinking!

1 **a** What are the dimensions of figure A?
b How many square centimetres in figure A?

2 **a** What are the dimensions of figure B?
b How many square millimetres in figure B?
c Is this area the same or different from figure A?
d Explain why, even though there are 10 mm in 1 cm, there are 100 mm^2 in 1 cm^2.

3 **a** Draw another square and label its sides with '1 m'.
b Use this square to explain why, even though there are 100 cm in 1 m, there are 10 000 cm^2 in 1 m^2.

4 **a** How many cubic centimetres in figure C?
b Copy and relabel figure C in millimetres.
c Explain why, even though there are 10 mm in 1 cm, there are 1000 mm^3 in 1 cm^3.

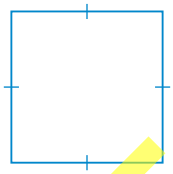


Figure A

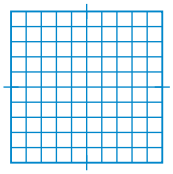


Figure B

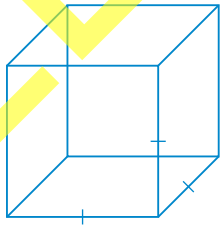
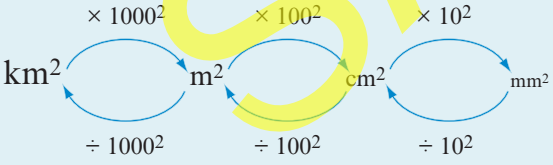


Figure C

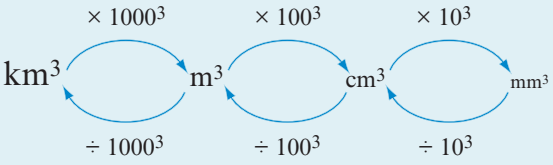
KEY IDEAS

- When converting between units of area, you multiply/divide by the square of the conversion factor.



For example, as 1 cm = 10 mm:
1 cm × 1 cm = 1 cm^2
10 mm × 10 mm = 100 mm^2
so 1 cm^2 = 100 mm^2 or 10^2 mm^2

- When converting between units of volume, you multiply/divide by the cube of the conversion factor.



For example, as 1 m = 100 cm:
1 m × 1 m × 1 m = 1 m^3
100 cm × 100 cm × 100 cm = 1 000 000 cm^3
so 1 m^3 = 1 000 000 cm^3 or 100^3 cm^3

- **Capacity** is the amount of fluid that a container can hold.
- Common units for capacity are millilitres (mL), litres (L), kilolitres (kL) and megalitres (ML).

EXERCISE 8H Area and volume conversions

UNDERSTANDING AND FLUENCY

1 Copy and complete:

a To convert between centimetres and millimetres the conversion factor is 10.
To convert between cm^2 and mm^2 the conversion factor is
$10^2 = 10 \times 10 =$ _____
To convert between cm^3 and mm^3 the conversion factor is
$10^3 = 10 \times 10 \times 10 =$ _____

b To convert between metres and centimetres the conversion factor is 100.
To convert between m^2 and cm^2 the conversion factor is
$100^2 = 100 \times 100 =$ _____
To convert between m^3 and cm^3 the conversion factor is
$100\_ =$ ___ × ___ × ___ = _____

c To convert between kilometres and metres the conversion factor is 1000.
To convert between km^2 and m^2 the conversion factor is
$1000\_ = 1000 \times 1000 =$ _____
To convert between km^3 and m^3 the conversion factor is
$1000\_ =$ ___ × ___ × ___ = _____

2 Copy and complete these conversion statements. The first one has been done for you.

a 6 cm^2 into $mm^2 = (6 \times 10^2)$ $mm^2 = (6 \times 100)$ $mm^2 = 600$ mm^2

b 4 m^2 into $cm^2 = (4 \times 100^2)$ $cm^2 = (4 \times$ _____$)$ $cm^2 =$ _____ cm^2

c 900 mm^2 into $cm^2 = (900 \div 10^2)$ $cm^2 = (900 \div$ _____$)$ $cm^2 =$ _____ cm^2

d 5 cm^3 into $mm^3 = (5 \times 10^3)$ $mm^3 = (5 \times 1000)$ $mm^3 =$ _____ mm^3

e 7 m^3 into $cm^3 = (7 \times 100^3)$ $cm^3 = (7 \times$ _____$)$ $cm^3 =$ _____ cm^3

f 2000 mm^3 into $cm^3 = (2000 \div 10^3)$ $cm^3 = (2000 \div$ _____$)$ $cm^3 =$ _____ cm^3

EXAMPLE 8H-1 Converting to a smaller area unit

Convert 3.8 cm^2 into mm^2.

THINK	WRITE
1 1 cm = 10 mm so 1 $cm^2 = 10^2$ mm^2. Multiply by conversion factor (10^2) to convert to a smaller unit.	3.8 cm^2 $= (3.8 \times 10^2)$ mm^2
2 Calculate 10^2. ($10 \times 10 = 100$)	$= (3.8 \times 100)$ mm^2
3 Complete the multiplication.	$= 380$ mm^2

3 Convert each measurement.

a 3 m^2 into cm^2 **b** 10 cm^2 into mm^2
c 6.5 m^2 into cm^2 **d** 19.7 cm^2 into mm^2
e 1.6 km^2 into m^2 **f** 0.75 km^2 into m^2

EXAMPLE 8H-2 Converting to a larger area unit

Convert 100 000 cm^2 into m^2.

THINK	WRITE
1 1 m = 100 cm so 1 m^2 = 100^2 cm^2. Divide by conversion factor (100^2) to convert to a larger unit.	100 000 cm^2 = (100 000 ÷ 100^2) m^2
2 Calculate 100^2. (100 × 100 = 10 000)	= (100 000 ÷ 10 000) m^2
3 Complete the division.	= 10 m^2

4 Convert each measurement.

a 25 000 cm^2 into m^2 **b** 750 000 mm^2 into cm^2
c 400 mm^2 into cm^2 **d** 125 000 m^2 into km^2
e 675 cm^2 into m^2 **f** 500 000 000 m^2 into km^2

EXAMPLE 8H-3 Converting to a smaller volume unit

Convert 2 m^3 into cm^3.

THINK	WRITE
1 1 m = 100 cm so 1 m^3 = 100^3 cm^3. Multiply by conversion factor (100^3) to convert to a smaller unit.	2 m^3 = (2 × 100^3) cm^3
2 Calculate 100^3. (100 × 100 × 100 = 1 000 000)	= (2 × 1 000 000) cm^3
3 Complete the multiplication.	= 2 000 000 cm^3

5 Convert each measurement.

a 9 cm^3 into mm^3 **b** 18 m^3 into cm^3
c 4.2 km^3 into m^3 **d** 4.56 m^3 into cm^3
e 0.15 km^3 into m^3 **f** 6.1 cm^3 into mm^3

EXAMPLE 8H-4 Converting to a larger volume unit

Convert 216 mm^3 into cm^3.

THINK	WRITE
1 1 cm = 10 mm so 1 cm^3 = 10^3 mm^3. Divide by conversion factor (10^3) to convert to a larger unit.	216 mm^3 = (216 ÷ 10^3) cm^3
2 Calculate 10^3. (10 × 10 × 10 = 1000)	= (216 ÷ 1000) cm^3
3 Complete the division.	= 0.216 cm^3

UNDERSTANDING AND FLUENCY

6 Convert each measurement.

a 16 000 mm^3 into cm^3
b 1 750 000 m^3 into km^3
c 4 000 000 cm^3 into m^3
d 845 000 cm^3 into m^3
e 28 mm^3 into cm^3
f 1 700 000 000 000 m^3 into km^3

7 Convert each measurement.

a 5.6 cm^3 into mm^3
b 2.8 m^2 into cm^2
c 3 752 000 m^2 into km^2
d 913 458 mm^3 into cm^3
e 186 cm^2 into m^2
f 0.075 km^3 into m^3
g 456 cm^2 into mm^2
h 75 m^3 into km^3
i 1 cm^3 into m^3
j 1.32 km^2 into m^2
k 0.555 m^3 into cm^3
l 16 mm^2 into cm^2

PROBLEM SOLVING AND REASONING

8 Ahmed needed to convert 11 cm^2 into mm^2. He said that because there are 10 mm in 1 cm, then there are 110 mm^2 in 11 cm^2. Explain where he went wrong and provide the correct answer.

9 Jess completed a worksheet of conversions, shown below.

i 40 000 cm^2 = (40 000 ÷ 100) m^2
= 400 m^2

ii 200 cm^2 = (200 × 10^2) mm^2
= 20 000 mm^2

iii 7 m^3 = (7 × 100^3) cm^3
= 2100 cm^3

iv 3000 mm^3 = (3000 ÷ 100^3) cm^3
= 30 cm^3

a Mark her work and give her a score out of 4.
b Provide a suggestion for why she made each mistake.
c Provide the correct working for the problems that she got incorrect.

10 A company produces painted wooden toy boxes.

- **a** Calculate the surface area of the outside of the box (all six faces are to be painted).
- **b** If each box needs two coats of paint and one tin of paint covers 15 m^2, how many toy boxes can be painted with one tin?

11 The company would like to know the volume of the box from question **10** in cubic metres, but the dimensions are in cubic centimetres.

- **a** Calculate the volume in cubic centimetres.
- **b** Convert this to cubic metres.
- **c** Another way to do this is to first convert all the dimensions into metres and then find the volume. Show how doing the conversion first gives you the same answer to part **b**.

12 Aaron harvests wheat on his farm and gets a yield of about 3.2 tonnes per hectare. A hectare is 10 000 m^2.

- **a** Write this in:
  - **i** kilograms per hectare
  - **ii** kilograms per square metre
  - **iii** grams per square metre
  - **iv** grams per square centimetre
- **b** Which unit do you think makes the most sense to use? Explain.
- **c** If Aaron is paid 35 cents per kilogram of wheat, find how much money he will earn if he harvests 3000 hectares of wheat.

13 Remember that a hectare is 10 000 m^2.

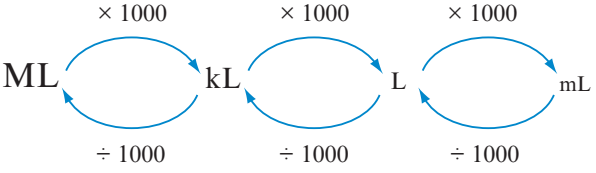
- **a** How many hectares are in 1 km^2?

There are many other units of area that are still used today that are not metric, such as the acre. A hectare is roughly equal to 2.5 acres.

- **b** Approximately how many square metres are in an acre?
- **c** Investigate the exact conversion factor between an acre and metric units such as the square metre and hectare.
- **d** Investigate other units of area; for example, square mile, square yard, and explain how they relate to the metric units of area such as the square metre.

14 Look at this conversion chart for capacity.

- **a** How many millilitres in a litre?
- **b** Convert:
  - **i** 7.5 L into mL
  - **ii** 450 mL into L
  - **iii** 900 kL into ML
  - **iv** 3.75 kL into L.



PROBLEM SOLVING AND REASONING

15 A container of volume 1 cm^3 holds 1 mL of liquid. Similarly, 1 m^3 holds 1 kL of liquid.

a Find the volume of the container (in cm^3) that would hold:

i 15 mL **ii** 1 L **iii** 5 L **iv** 1 kL

b Find the volume of the container (in m^3) that would hold:

i 4 kL **ii** 13 kL **iii** 200 L **iv** 745 L

c Find the capacity held in a container with a volume of:

i 26 cm^3 **ii** 5000 cm^3 **iii** 9 m^3 **iv** 0.4 m^3

16 **a** Calculate the volume of this perfume bottle in cubic centimetres.

b Calculate its capacity in litres.

17 A rectangular bath tub measures 1.5 m long by 30 cm wide, with a depth of 45 cm. How many litres of water could it hold?

18 A car engine is said to be 1200 cc. This means that the cylinders in the engine have a volume of 1200 cm^3. How many litres of petrol can the cylinders hold?

19 A rectangle has an area of 4800 mm^2. Give three possible sets of dimensions in centimetres.

20 A rectangular box has a volume of 36 000 cm^3. Give a possible set of dimensions in:

a millimetres **b** centimetres **c** metres.

21 Write your own open-ended question about area and volume and swap with a classmate. Be careful of conversion errors. Discuss any difference in answers.

CHALLENGE

22 Melbourne's water storages have a capacity of 1 812 175 ML.

a Write this in:

i kilolitres **ii** litres **iii** cubic metres **iv** cubic kilometres.

b Which expression do you think has the most meaning for people? Explain.

c If the water storages are only 47% full, how many kilolitres is this?

d Melbourne Water estimates that each person uses 300 L of water per day.

i How many litres of water is this per year?

ii How many kilolitres of water is this per year?

e If there are about 4 million people living in Melbourne, how many kL of water is this a year?

f If the storages are 47% full, use your answer from part **e** to find how quickly our storages would run out if there was no rain. Answer to the nearest year.

g What other uses of water are there that would take water from storages?

Reflect

What common mistakes might people make when converting area or volume units?

CHAPTER REVIEW

SUMMARISE

Create a summary of this chapter using the key terms below. You may like to write a paragraph, create a concept map or use technology to present your work.

length	total surface area	dimensions	annulus
perimeter	volume	perpendicular	net
estimate	capacity	composite shapes	rectangular prism
circumference	width	quadrilaterals	triangular prism
diameter	rectangle	parallelogram	square-based prism
radius	triangle	rhombus	cube
area	base	kite	pyramids
sector	height	trapezium	conversion factors

MULTIPLE-CHOICE

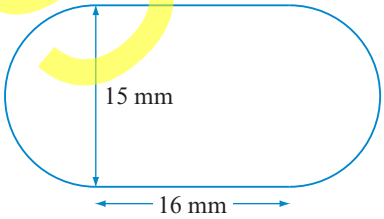
8A **1** What is 7.84 m equal to?

A 0.784 km **B** 7840 mm
C 78.4 cm **D** 0.0784 km

8B **2** A circle has a diameter of 6 cm. What is its radius?

A 12 cm **B** 6π cm
C 36π cm **D** 3 cm

8B **3** What is the total perimeter of this shape?



A 31 mm **B** 47 mm
C 63.1 mm **D** 79.1 mm

8C **4** A triangle has a base length of 10 cm and an area of 20 cm^2. What is its height?

A 2 cm **B** 4 cm
C 12 cm **D** 200 cm

8D **5** A rhombus has diagonals of lengths 5 cm and 6 cm. What is its area?

A 30 cm^2 **B** 11 cm^2
C 56 cm^2 **D** 15 cm^2

8E **6** What is the area of the shape in question **3**?

A 946.9 mm^2 **B** 754 mm^2
C 416.7 mm^2 **D** 240 mm^2

8F **7** What is the total surface area of a cube with side length 5 mm?

A 150 mm^2 **B** 125 mm^2
C 25 mm^2 **D** 15 mm^2

8G **8** What is the volume of an irregular prism with base area 2.5 cm^2 and length 10 mm?

A 250 mm^3 **B** 25 mm^3
C 2.5 cm^3 **D** 25 cm^3

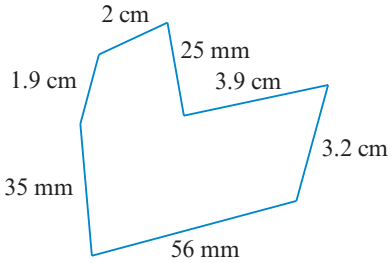
8H **9** What is 3 cm^3 equal to?

A 30 mm^3 **B** 300 mm^3
C 300 m^3 **D** 3000 mm^3

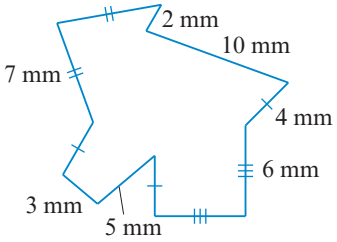
SHORT ANSWER

8A **1** Calculate the perimeter of each shape.

a

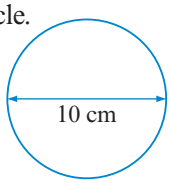


b



8B **2** Calculate the circumference of each circle.

a



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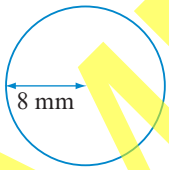
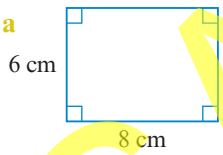


8C **3** Calculate the area of each shape.

a



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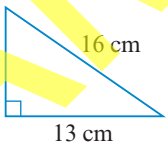
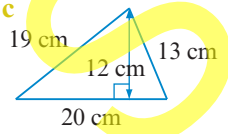
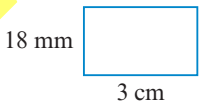


c

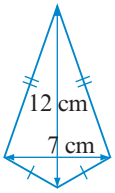


d



8D **4** Calculate the area of each shape.

a



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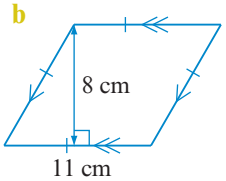

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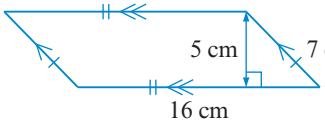
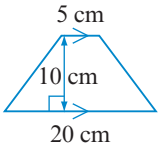


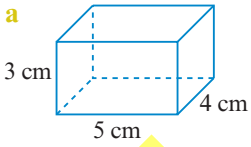
d



8E **5** Calculate the area of each circle in question **2**.

8F **6** Calculate the total surface area of each object.

a



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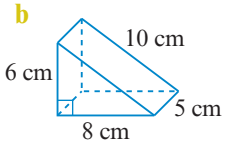

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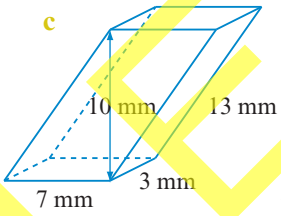

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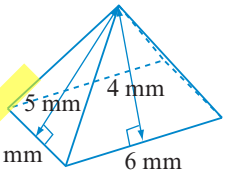
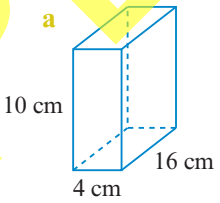
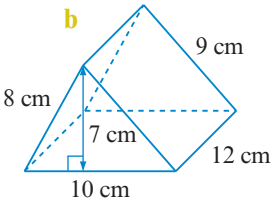


8G **7** Calculate the volume of each object.

a



b



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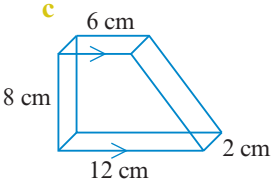
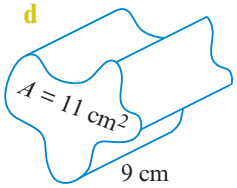
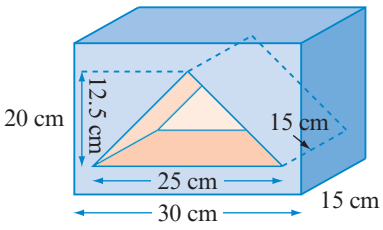


d



8G **8** Calculate the volume of clay in this brick.



8H **9** Convert each measurement.

a 5 m^2 into cm^2

b 50 mm^2 into cm^2

c 3.5 cm^3 into mm^3

d 400 cm^3 into m^3

e 7.5 L into mL

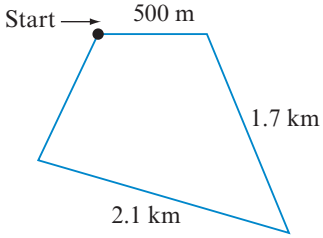
f 845 kL into L.

NAPLAN-STYLE PRACTICE

1 Juan is building a model aeroplane. He needs a plank of wood that is 1150 mm long. If he buys a plank of wood 1.5 m long, how many centimetres will he have to cut off?

1.15 ☐ 350 ☐ 45 ☐ 35 ☐

2 The total length of a cross-country course is 5 km. What is the length of the last leg?



☐ 700 m
☐ 4.3 km
☐ 9.3 km
☐ 430 m

3 A vegetable garden is in the shape of a rectangle. The total length of fencing is 3.4 m and the garden is 1 m long. How wide is the garden?

☐

4 A circular sushi hand roll measures 4.5 cm across its diameter. What length of seaweed wraps around the circumference?

☐

5 A circular hat measures 65 cm around the brim. How wide is it across its diameter?

☐ 204.2 m ☐ 20.69 km
☐ 13 273 cm ☐ 10.35 cm

Questions **6** and **7** refer to a car wheel with a radius of 20 cm.

6 What is the length of one revolution of the wheel?

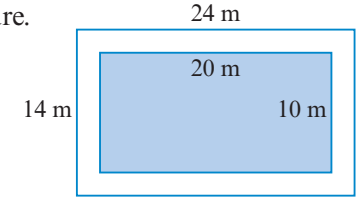
☐ 20 cm ☐ 62.83 cm
☐ 125.66 cm ☐ 1256.64 cm

7 By how much would this radius need to increase if the wheel had to cover 1.5 m in one revolution?

☐ 24.34 cm ☐ 12.17 cm
☐ 7.75 cm ☐ 3.87 cm

Questions **8** and **9** refer to the following information and figure.

A pool has concrete pavers around its edges, as shown in the figure.



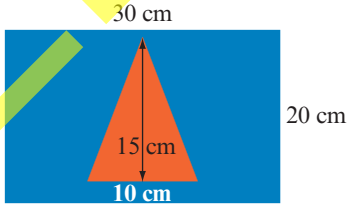
8 What is the area of the swimming pool?

☐

9 What is the area covered by the concrete pavers?

☐ 336 m^2 ☐ 136 m^2
☐ 76 cm^2 ☐ 38 m^2

10 Derek designed this flag for his sports team. What is the area of the blue section?



☐ 75 cm^2 ☐ 450 cm^2
☐ 525 cm^2 ☐ 600 cm^2

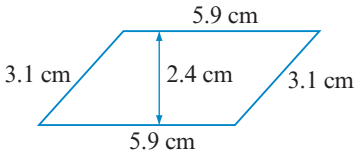
11 A triangle has an area of 40 cm^2. If it is 8 cm high, how long is its base?

☐

12 Brittany has a kite that is 75 cm long and 40 cm wide. What is the area of this kite?

☐

13 What is the area of this shape?



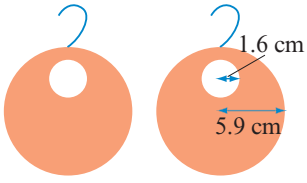
☐

14 A Frisbee has a diameter of 25 cm. What is its area?

☐

15 A pair of earrings is to be made according to the blueprints shown. How much metal is needed to make the pair?

☐ 218.72 cm^2
☐ 202.63 cm^2
☐ 109.36 cm^2
☐ 101.32 cm^2



16 What is the diameter of the largest plate that could be made with 200 cm^2 of porcelain (to the nearest centimetre)?

4 cm ☐ 8 cm ☐ 16 cm ☐ 64 cm ☐

Questions **17**–**19** refer to the following information.

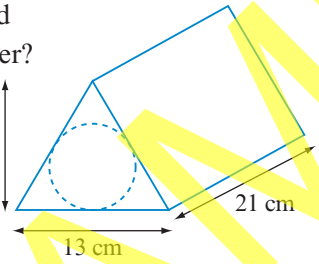
Tennis balls are placed into a container that is a rectangular prism with the dimensions 7 cm by 7 cm by 21 cm.

17 How much cardboard is required to make this container?

☐

18 The tennis balls are instead placed inside a container in the shape of an equilateral triangular prism, as shown. How much cardboard is required to make this container?

☐ 44 cm^2
☐ 949 cm^2
☐ 1079 cm^2
☐ 2730 cm^2



19 What is the difference in volume between these containers?

☐ 263 cm^3 ☐ 336 cm^3
☐ 1029 cm^3 ☐ 1701 cm^3

Questions **20**–**22** refer to the following information.

Katie has a vase in the shape of a rectangular prism. Its base measures 5 cm by 5 cm and it is 20 cm high.

20 What is the volume of the vase?

☐

21 What amount of water will fit inside the vase?

5 L ☐ 50 L ☐ 500 mL ☐ 25 mL ☐

22 How many vases would be required to hold 1 m^3 of water?

2 ☐ 20 ☐ 200 ☐ 2000 ☐

23 A sheet of glass has an area of 3500 mm^2. What is this measurement in cm^2?

☐

ANALYSIS

A friend wants to have a ball pit at their birthday party. They have set aside a rectangular space in their backyard that is 3 m long and 2 m wide.

a What area would this cover?

b How much fencing would be needed to go around the ball pit?

Your friend can only buy the wood that they need for the fencing in planks that are 50 cm wide. The walls of the pit need to stand 1 m tall.

c What length of wood is needed?

d Your friend wants to paint the wooden fencing inside and out with two coats of paint. What is the total surface area to be painted?

They also want to paint a diamond on the front fence of the ball pit. From point to point (that is, its diagonals) it measures 55 cm vertically and 30 cm horizontally.

e What is the area of this diamond?

Around the diamond will be six circles representing the coloured balls in the ball pit. Each ball has a diameter of 6.6 cm.

f What is the circumference of each circle?

g Find the total area to be painted for the six balls.

h What will be the volume within the pit?

i If each ball to go into the pit has a volume of 150 cm^3, how many could theoretically fit into the pit? Be careful with unit conversions!

j Your friend finds that only about 25 000 balls fit into the pit. What explanation can you offer for this difference?

CONNECT

Planning a house

Planning and constructing any building requires a good understanding of measurements and mathematics. What measurements are needed when planning to build a house?

Your task

For your investigation consider the design and cost of constructing a simple house, such as a cubby house, dog kennel, doll house or even a birdhouse. You will need to complete these steps.

- Record the type and purpose of house.
- Prepare diagrams showing the shape, size and dimensions of the house
- Also prepare diagrams to show the shape, size and dimensions of house features (for example, doors, windows, balconies).
- Make lists of the type and cost of building materials (for example, wood, plastic, glass, tiles)
- Work out the cost of painting the house, inside and out, and other decoration.

Complete the 8 CONNECT worksheet to show all your working and answers to this task.

You may like to present your findings as a report. Your report could be in the form of:

- a catalogue
- blueprints
- a brochure
- other (check with your teacher).