



# 8

## Measurement and geometry Area and volume

The largest city square in the world is Tiananmen Square in the centre of Beijing, China. It measures 880 m by 500 m, so it has an area of 440 000 square metres. It is the size of 62 soccer fields and can contain a million people. The largest city square in Australia is Adelaide's Victoria Square, measuring 322 m by 161 m, with an area of 51 842 square metres, or 7 soccer fields. This means one Tiananmen Square = 8.5 Victoria Squares!



## Chapter outline

	Proficiency strands			
	U	F	PS	R
8-01 The metric system				C
8-02 Perimeter	U	F	PS	R
8-03 Metric units for area	U	F	PS	R C
8-04 Area of a rectangle	U		PS	R
8-05 Area of a triangle	U		PS	R
8-06 Area of a parallelogram	U		PS	R
8-07 Areas of composite shapes	U	F	PS	C
8-08 Drawing prisms	U	F		C
8-09 Metric units for volume	U	F	PS	R C
8-10 Volume of a rectangular prism	U	F	PS	R
8-11 Volume and capacity	U	F	PS	C

## Wordbank

- area** The amount of surface enclosed by a shape
- capacity** The amount of fluid (liquid or gas) in a container
- cubic metre** The volume of a cube that measures 1 m by 1 m by 1 m
- kilo** A prefix that means one thousand of something
- perimeter** The distance around the outside of a shape
- perpendicular height** The height of a shape taken at right angles to its base
- square metre** The area of a square that measures 1 m by 1 m
- volume** The amount of space inside a solid

## In this chapter you will:

- connect decimal representations to the metric system
- convert between common metric units of length, mass and capacity
- recognise the significance of the metric prefixes in units of measurement
- identify and use the correct operations when converting units, including millimetres, centimetres, metres, kilometres, milligrams, grams, kilograms, tonnes, millilitres, litres, kilolitres and megalitres
- calculate the perimeter of polygons including squares, rectangles and triangles
- choose appropriate units of measurement for area and convert from one unit to another
- establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving
- draw different views of prisms and solids formed from combinations of prisms
- choose appropriate units of measurement for volume and convert from one unit to another
- calculate volumes of rectangular prisms
- connect volume and capacity and their units of measurement
- recognise that 1 mL is equivalent to 1 cm<sup>3</sup>

## SkillCheck

### Worksheet

StartUp assignment 8  
MAT07MGWK10059

### Skillsheet

Multiplying by 10, 100,  
1000  
MAT07NASS10026

- 1** Copy and complete each equation.

a 1 kg = \_\_\_\_\_ g

b 1 min \_\_\_\_\_ s

c 1 L = \_\_\_\_\_ mL

d 1 cm = \_\_\_\_\_ mm

e 1 g = \_\_\_\_\_ mg

f 1 day = \_\_\_\_\_ hours

g 1 kL = \_\_\_\_\_ L

h 1 t = \_\_\_\_\_ kg

i 1 m = \_\_\_\_\_ mm

j 1 h = \_\_\_\_\_ min

k 1 m = \_\_\_\_\_ cm

l 1 km = \_\_\_\_\_ m

- 2** Evaluate each expression.

a  $10.32 \times 100$

b  $9.45 \times 10$

c  $0.4 \times 1000$

d  $2.7 \times 1000$

e  $0.9 \times 100$

f  $6.3 \times 10$

g  $2000 \div 100$

h  $43\ 000 \div 1000$

i  $650 \div 10$

j  $3750 \div 100$

k  $95 \div 10$

l  $8200 \div 1000$

- 3** What metric unit would you use to measure:

a the distance from the street to your front door?

c the length of an ant?

b the length of your foot?

e the width of a basketball court?

d the length of your bed?

g the distance around a football field?

f the depth of a river?

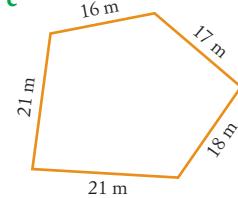
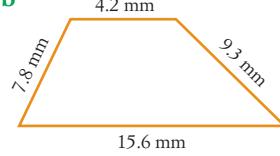
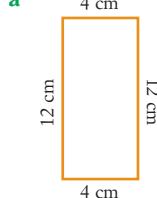
i the height of a door?

h the length of a long-jump pit?

k an athlete's time in a race?

j the length of a fingernail?

- 4** Find the perimeter of each shape.



## 8-01 The metric system

In Australia we measure using the **metric system**. This system began in France in the 1790s after the French revolution and, because it is based on powers of 10, it is logical and easy to use. The word ‘metric’ comes from the Greek word *metron* meaning ‘to measure’.

In 1970, the Metric Conversion Board was established in Australia to start the change to metric units. The following metric units are most commonly used.

Worksheet

Metric units

MAT07MGWK10060

Quantity	Name of unit	Abbreviation
Length	metre	m
	millimetre	mm
	centimetre	cm
	kilometre	km
Mass	kilogram	kg
	gram	g
	milligram	mg
	tonne	t
Time	second	s
	minute	min
	hour	h
	day	d
Area	square metre	$m^2$
	square centimetre	$cm^2$
	hectare	ha
	square kilometre	$km^2$
Volume	cubic metre	$m^3$
	cubic centimetre	$cm^3$
Capacity	litre	L
	millilitre	mL
	kilolitre	kL
	megalitre	ML
Temperature	degree Celsius	$^{\circ}\text{C}$

The metric system uses the following **prefixes** for metric units.

Prefix	Abbreviation	Meaning	Example
micro-	$\mu$	one-millionth: $\frac{1}{1\ 000\ 000}$	$1 \mu\text{m} = \frac{1}{1\ 000\ 000} \text{ m}$
milli-	m	one-thousandth: $\frac{1}{1000}$	$1 \text{ mg} = \frac{1}{1000} \text{ g}$
centi-	c	one hundredth: $\frac{1}{100}$	$1 \text{ cm} = \frac{1}{100} \text{ m}$
kilo-	k	one thousand times: $1000 \times$	$1 \text{ km} = 1000 \text{ m}$
Mega-	M	one million times: $1\ 000\ 000 \times$	$1 \text{ ML} = 1000 \text{ L}$

The following table shows the relationships between commonly-used units of measurement.

<b>Length</b>	$1 \text{ cm} = 10 \text{ mm}$ $1 \text{ m} = 100 \text{ cm} = 1000 \text{ mm}$ $1 \text{ km} = 1000 \text{ m}$	<b>Capacity</b>	$1 \text{ L} = 1000 \text{ mL}$ $1 \text{ kL} = 1000 \text{ L}$ $1 \text{ ML} = 1000 \text{ kL} = 1\,000\,000 \text{ L}$

<b>Mass</b>	$1 \text{ g} = 1000 \text{ mg}$ $1 \text{ kg} = 1000 \text{ g}$ $1 \text{ t} = 1000 \text{ kg}$	<b>Time</b>	$1 \text{ min} = 60 \text{ s}$ $1 \text{ h} = 60 \text{ min} = 3600 \text{ s}$ $1 \text{ day} = 24 \text{ h}$

### Example 1

Convert:

- a  $13 \text{ km}$  to  $\text{m}$       b  $5.8 \text{ t}$  to  $\text{kg}$       c  $16\,000 \text{ mL}$  to  $\text{L}$       d  $1500 \text{ min}$  to  $\text{h}$

### Solution

a  $13 \text{ km} = 13 \times 1000 \text{ m} = 13\,000 \text{ m}$       b  $5.8 \text{ t} = 5.8 \times 1000 \text{ kg} = 5800 \text{ kg}$



To convert large to small units, multiply ( $\times$ ).

c  $16\,000 \text{ mL} = 16\,000 \div 1000 \text{ L} = 16 \text{ L}$       d  $1500 \text{ min} = 1500 \div 60 \text{ h} = 25 \text{ h}$



To convert small to large units, divide ( $\div$ ).

## Exercise 8-01 The metric system

### See Example 1

1 Copy and complete:

- a  $1 \text{ h} = \underline{\hspace{1cm}}$  min  
d  $1 \text{ cm} = \underline{\hspace{1cm}}$  mm  
g  $1 \text{ t} = \underline{\hspace{1cm}}$  kg  
j  $1 \text{ g} = \underline{\hspace{1cm}}$  mg

- b  $1 \text{ km} = \underline{\hspace{1cm}}$  m  
e  $1 \text{ day} = \underline{\hspace{1cm}}$  h  
h  $1 \text{ min} = \underline{\hspace{1cm}}$  s  
k  $1 \text{ ML} = \underline{\hspace{1cm}}$  L

- c  $1 \text{ kg} = \underline{\hspace{1cm}}$  g  
f  $1 \text{ kL} = \underline{\hspace{1cm}}$  L  
i  $1 \text{ L} = \underline{\hspace{1cm}}$  mL  
l  $1 \text{ h} = \underline{\hspace{1cm}}$  s

2 Convert:

- |               |                |                   |
|---------------|----------------|-------------------|
| a 6.4 m to cm | b 4 t to kg    | c 3 days to hours |
| d 2.4 ML to L | e 0.9 m to mm  | f 12.7 kg to g    |
| g 8 h to min  | h 5.6 L to mL  | i 42 cm to mm     |
| j 72 g to mg  | k 3.8 km to cm | l 4.5 h to s      |

3 Convert each length to centimetres.

- |          |                           |           |          |
|----------|---------------------------|-----------|----------|
| a 2 m    | b 1500 mm                 | c 0.5 m   | d 3.5 m  |
| e 0.25 m | f 2 000 000 $\mu\text{m}$ | g 15.8 km | h 0.4 km |

4 Convert each length to metres.

- |          |           |          |           |
|----------|-----------|----------|-----------|
| a 200 cm | b 3000 mm | c 850 cm | d 9800 mm |
| e 75 cm  | f 325 mm  | g 6 km   | h 18 km   |

5 Write the metric prefix that means:

- |        |                   |                    |
|--------|-------------------|--------------------|
| a 1000 | b $\frac{1}{100}$ | c $\frac{1}{1000}$ |
|--------|-------------------|--------------------|

6 Find other prefixes that are used in the metric system. Write their meanings.

7 Copy and complete each statement.

- |                        |                          |                    |
|------------------------|--------------------------|--------------------|
| a 4.5 kg = ____ g      | b 3 hours = ____ minutes | c 750 mL = ____ L  |
| d 240 mm = ____ cm     | e 12 kL = ____ L         | f 5.2 m = ____ cm  |
| g 420 s = ____ min     | h 2 days = ____ hours    | i 8.65 t = ____ kg |
| j 72 hours = ____ days | k 65 mm = ____ m         | l 0.96 kL = ____ L |

8 Which length is the shortest? Select the correct answer A, B, C or D.

- |         |         |          |          |
|---------|---------|----------|----------|
| A 0.3 m | B 29 cm | C 300 mm | D 160 mm |
|---------|---------|----------|----------|

9 Karla and Cassie measured these objects in the classroom.

- length of pencil 12 cm
- width of computer screen 33 cm
- width of door 80 cm
- width of ruler 3.5 cm
- length of room 740 cm

a Karla wrote her measurements in millimetres. What did she write?

b Cassie wrote her measurements in metres. What did she write?

c What unit would you use (cm, mm or m)? Would you use different units for different objects? If so, what would they be?

10 Copy and complete each statement.

- |                    |                                   |                    |
|--------------------|-----------------------------------|--------------------|
| a 2.2 L = ____ mL  | b 800 mm = ____ m                 | c 235 cm = ____ m  |
| d 360 mg = ____ g  | e $5\frac{1}{2}$ hours = ____ min | f 4900 L = ____ kL |
| g 270 kg = ____ t  | h 4 years = ____ months           | i 10.8 km = ____ m |
| j 16.9 L = ____ mL | k 1 year = ____ days              | l 740 cm = ____ m  |

## 8-02 Perimeter

Worksheet

A page of composite shapes

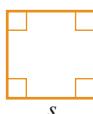
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### Summary

The **perimeter** of a shape is the distance around the shape.  
It is the sum of the lengths of the sides of the shape.

The **perimeter of a square** can be found by adding all of the sides:

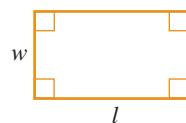
$$\begin{aligned}\text{Perimeter} &= s + s + s + s \\ &= 4s\end{aligned}$$



The general formula is  $P = 4s$ , where  $s$  is the length of one side.

The **perimeter of a rectangle** can be found by adding all the sides:

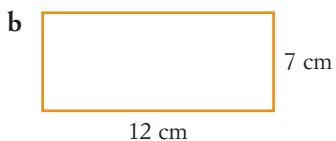
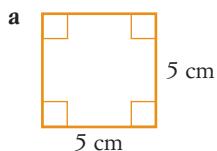
$$\begin{aligned}\text{Perimeter} &= l + w + l + w \\ &= 2l + 2w \text{ or } 2(l + w) \text{ using the distributive law.}\end{aligned}$$



The general formula is  $P = 2l + 2w$  or  $P = 2(l + w)$ , where  $l$  is the length and  $w$  is the width (breadth).

### Example 2

Find the perimeter of each shape.



### Solution

a Perimeter of a square =  $4s$

$$\begin{aligned}&= 4 \times 5 \\ &= 20 \text{ cm}\end{aligned}$$

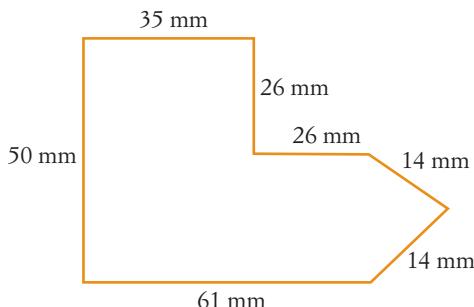
b Perimeter of a rectangle =  $2l + 2w$  or  $2(l + w)$

$$\begin{aligned}&= 2 \times 12 + 2 \times 7 \text{ or } 2 \times (12 + 7) \\ &= 38 \text{ cm}\end{aligned}$$

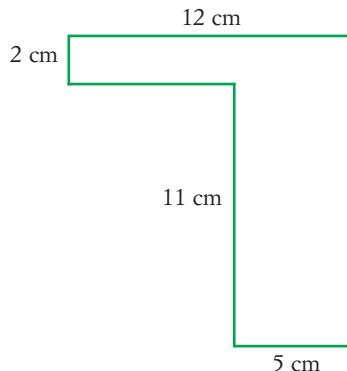
### Example 3

Find the perimeter of each shape.

a



b



### Solution

a Perimeter =  $50 + 35 + 26 + 26 + 14 + 14 + 61$   
 $= 226 \text{ mm}$

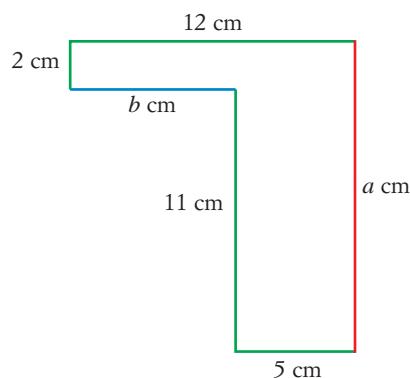
b First, we need to find the lengths of the unknown sides,  $a$  and  $b$ .

### Adding side lengths

Animated example

Calculating the perimeter

MAT07MGAE00014



$$a = 2 + 11 = 13 \text{ cm}$$

$$b = 12 - 5 = 7 \text{ cm}$$

$$\begin{aligned} \text{Perimeter} &= 12 + 13 + 5 + 11 + 7 + 2 \\ &= 50 \text{ cm} \end{aligned}$$

The side shown by the red line

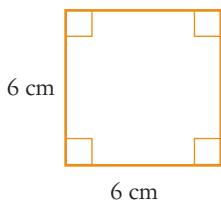
The side shown by the blue line

## Exercise 8-02 Perimeter

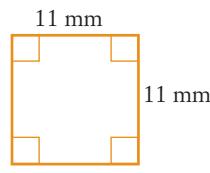
1 Find the perimeter of each shape.

See Example 2

a



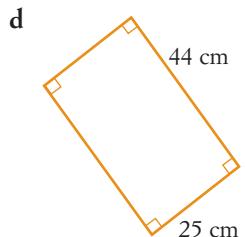
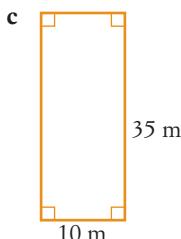
b



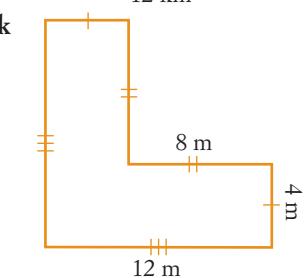
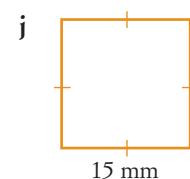
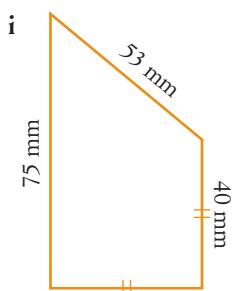
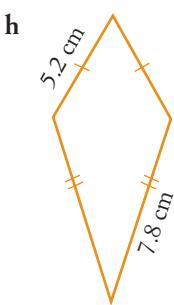
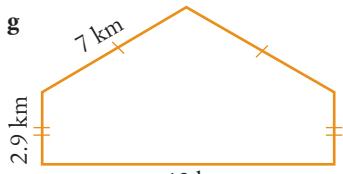
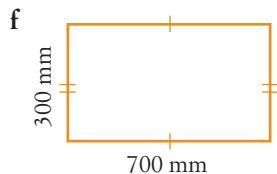
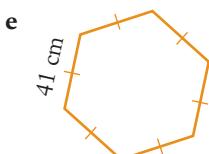
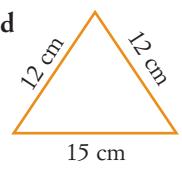
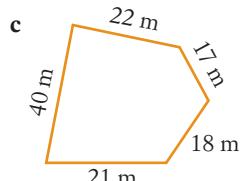
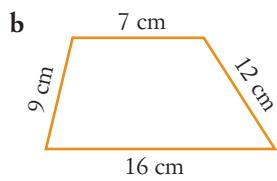
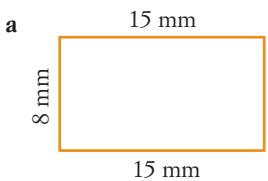
Extra questions

Calculating perimeter

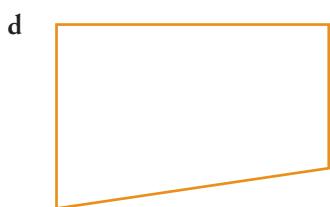
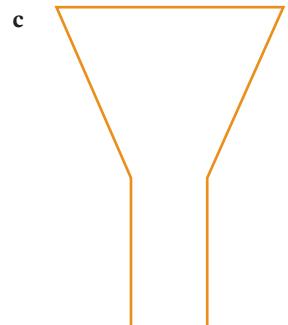
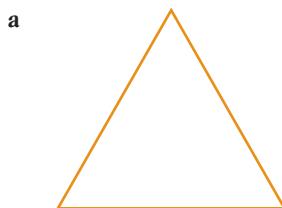
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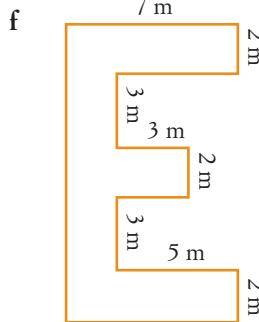
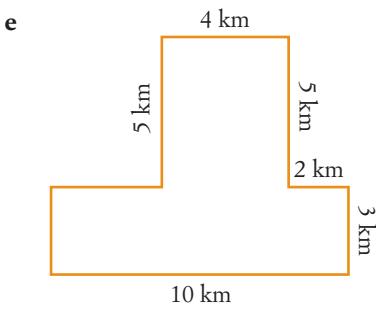
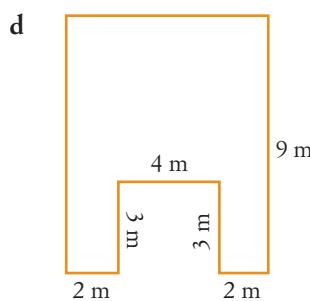
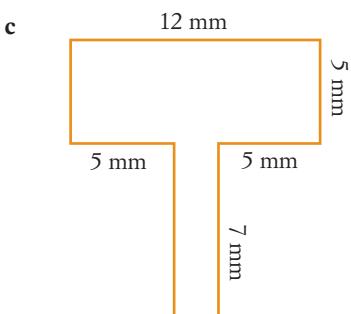
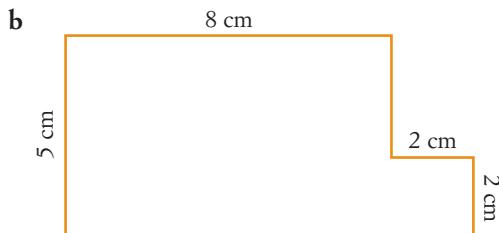
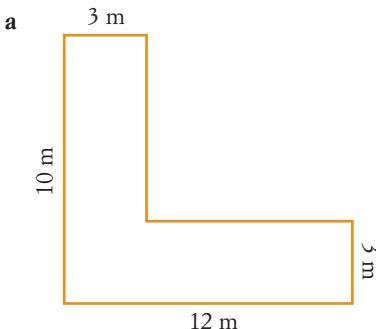
**See Example 3** 2 Find the perimeter of each shape.



3 Measure the sides of each shape in mm and find its perimeter.



- 4 Find the missing lengths and then calculate the perimeter of each figure.



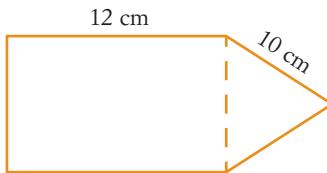
- 5 a A square has a perimeter of 16 cm. Find the length of one side.  
 b A rectangle has a perimeter of 40 cm. If its length is 12 cm, find its width.  
 c A square has a perimeter of 51 cm. Find the length of one side.  
 d A rectangle has a perimeter of 62 cm. If its width is 13 cm, find its length.  
 e A rectangle has a perimeter of 30 cm. What could its length and width be?  
 f The figure on the right is made up of a rectangle and an equilateral triangle. Find its perimeter. Select the correct answer A, B, C or D.

A 44 cm      B 64 cm      C 54 cm      D 22 cm

Worked solutions

Exercise 8-02

MAT07MGWS10047



## 8-03 Metric units for area

Skillsheet

What is area?

MAT07MGSS10028

Worksheet

Areas on a grid

MAT07MGWK10062

Worksheet

Australian areas

MAT07MGWK10063

A person estimating the number of tiles needed to cover the floor of a room needs to know the size of a tile and the size of the room. In this case, the **area** of the floor gives its ‘size’.



### Summary

The **area** of a shape is the amount of surface that is enclosed by the shape.

For example, the area of this trapezium has been shaded.



The table shows metric units for area.

Area unit	Abbreviation	The size of a square with each side measuring
square millimetre	$\text{mm}^2$	1 mm (Actual size: ■)
square centimetre	$\text{cm}^2$	1 cm (Actual size: ■)
square metre	$\text{m}^2$	1 m
hectare	ha	100 m

A **square centimetre** is about the area of a fingernail.

A **square metre** is approximately the size of the floor of a large shower recess.

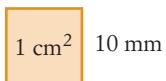
A **hectare** is about the area of two rugby league fields, side-by-side.

$$1 \text{ cm} = 10 \text{ mm}$$

$$1 \text{ cm}^2 = 10 \text{ mm} \times 10 \text{ mm} = 100 \text{ mm}^2$$

(double the number of zeros)

10 mm

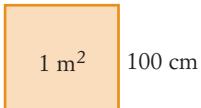


$$1 \text{ m} = 100 \text{ cm}$$

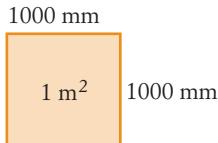
$$1 \text{ m}^2 = 100 \text{ cm} \times 100 \text{ cm} = 10000 \text{ cm}^2$$

(double the number of zeros)

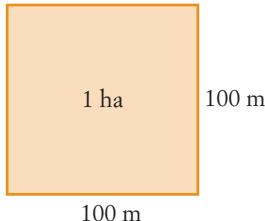
100 cm



$1 \text{ m} = 1000 \text{ mm}$   
 $1 \text{ m}^2 = 1000 \text{ mm} \times 1000 \text{ mm} = 1\ 000\ 000 \text{ mm}^2$   
 (double the number of zeros)



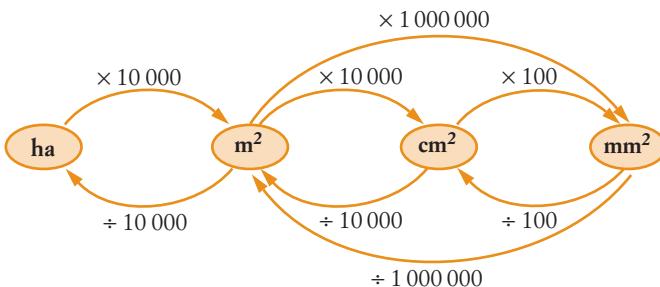
$1 \text{ ha} = 100 \text{ m} \times 100 \text{ m} = 10\ 000 \text{ m}^2$



## Summary

$$\begin{aligned}1 \text{ cm}^2 &= 100 \text{ mm}^2 \\1 \text{ m}^2 &= 10\ 000 \text{ cm}^2 = 1\ 000\ 000 \text{ mm}^2 \\1 \text{ ha} &= 10\ 000 \text{ m}^2\end{aligned}$$

This diagram shows how to convert between different units of area.



## Example 4

Convert

a  $3 \text{ cm}^2$  to  $\text{mm}^2$

b  $4000 \text{ mm}^2$  to  $\text{m}^2$

c  $81\ 000 \text{ m}^2$  to  $\text{ha}$

### Solution

a  $3 \text{ cm}^2 = 3 \times 100 \text{ mm}^2$   
 $= 300 \text{ mm}^2$

$\text{cm}^2$  to  $\text{mm}^2$  :  $\times 100$ .

b  $4000 \text{ mm}^2 = 4000 \div 1\ 000\ 000 \text{ m}^2$   
 $= 0.004 \text{ m}^2$

$\text{mm}^2$  to  $\text{m}^2$  :  $\div 1\ 000\ 000$ .

c  $81\ 000 \text{ m}^2 = 81\ 000 \div 10\ 000 \text{ ha}$   
 $= 8.1 \text{ ha}$

$\text{m}^2$  to  $\text{ha}$  :  $\div 10\ 000$ .

## Exercise 8-03 Metric units for area

Extra questions

Area and its measurement

MAT07MGEQ00037

See Example 4

Worked solutions

Exercise 8-03

MAT07MGWS10048

- 1 What unit of area would you use when measuring the area of:
- a farm?
  - a classroom?
  - a shirt?
  - the school oval?
  - a sheet of paper?
  - your eardrum?
- 2 What is the approximate area of a calculator? Select the correct answer A, B, C or D.
- $80 \text{ cm}^2$
  - $120 \text{ cm}^2$
  - $160 \text{ cm}^2$
  - $200 \text{ cm}^2$

- 3 Copy and complete each statement.

a $15 \text{ cm}^2 = \underline{\hspace{2cm}} \text{ mm}^2$	b $1500000 \text{ mm}^2 = \underline{\hspace{2cm}} \text{ m}^2$
c $690 \text{ mm}^2 = \underline{\hspace{2cm}} \text{ cm}^2$	d $6.5 \text{ m}^2 = \underline{\hspace{2cm}} \text{ cm}^2$
e $0.5 \text{ m}^2 = \underline{\hspace{2cm}} \text{ mm}^2$	f $12 \text{ ha} = \underline{\hspace{2cm}} \text{ m}^2$
g $12200 \text{ cm}^2 = \underline{\hspace{2cm}} \text{ m}^2$	h $1250 \text{ mm}^2 = \underline{\hspace{2cm}} \text{ cm}^2$
i $0.32 \text{ ha} = \underline{\hspace{2cm}} \text{ m}^2$	j $7.9 \text{ cm}^2 = \underline{\hspace{2cm}} \text{ mm}^2$
k $0.75 \text{ m}^2 = \underline{\hspace{2cm}} \text{ mm}^2$	l $2450000 \text{ m}^2 = \underline{\hspace{2cm}} \text{ ha}$
m $865000 \text{ cm}^2 = \underline{\hspace{2cm}} \text{ m}^2$	n $51300 \text{ mm}^2 = \underline{\hspace{2cm}} \text{ m}^2$
o $0.47 \text{ m}^2 = \underline{\hspace{2cm}} \text{ cm}^2$	p $9000 \text{ m}^2 = \underline{\hspace{2cm}} \text{ ha}$

- 4 A square tile has an area of  $1024 \text{ cm}^2$ . Write this area in:

- $\text{mm}^2$
- $\text{m}^2$

- 5 a Arrange  $6.5 \text{ m}^2$ ,  $114000 \text{ cm}^2$  and  $25050000 \text{ mm}^2$  in ascending order.  
 b Arrange  $990 \text{ mm}^2$ ,  $54 \text{ cm}^2$ ,  $0.000032 \text{ m}^2$  in descending order.
- 6 Sydney's central business district (CBD) is approximately a rectangle bounded by George Street, Circular Quay, Macquarie and College Streets and Liverpool Street, an area of  $875000$  square metres. What is this area:
- in hectares?
  - in square centimetres?
- 7 What is the approximate area of a 5-cent coin? Select the correct answer A, B, C or D.
- $25 \text{ mm}^2$
  - $2.5 \text{ cm}^2$
  - $25 \text{ cm}^2$
  - $2.5 \text{ m}^2$
- 8 Sydney Airport has an area of  $881$  hectares. Sydney Harbour has an area of about  $5500$  hectares.
- What is the area of Sydney Airport in square metres?
  - How many 'Sydney Airports' would fit onto Sydney Harbour?
- 9 A postage stamp has an area of  $8.36 \text{ cm}^2$ . What is this area in square millimetres?
- 10 The theme park, Dreamworld, on the Gold Coast, has an area of one square kilometre.
- How many square metres are there in a square kilometre?
  - How many hectares are there in a square kilometre?
  - Name something that might be measured in square kilometres.

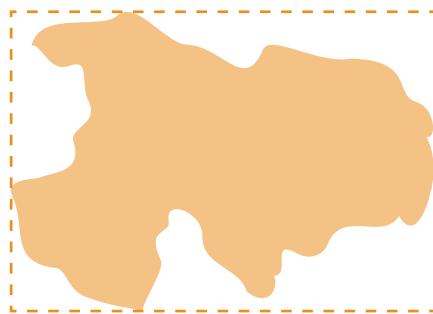
**Just for the record****Trafalgar Square**

Trafalgar Square in central London is one of Britain's great tourist attractions. It commemorates the Battle of Trafalgar in 1805 between the British navy, led by Admiral Nelson, and Napoleon's French navy. It is London's only metric square, having been designed to be one hectare in area.

**Find when the square was built and what famous British landmark stands in the centre of it.**

**Investigation: The human lagoon**

- 1 **a** Find a level area of concrete or bitumen. Carefully pour a litre of water over it to form a puddle.
  - b** Use a metre ruler or tape measure to measure the dimensions of the smallest rectangle that surrounds the puddle.
  - c** On graph paper marked in 1 cm squares, make a scale drawing of the rectangle that surrounds the puddle.
  - d** Sketch the shape of your puddle inside the rectangle on the graph paper.
  - e** Use the method of counting squares to find the area of the puddle formed by the litre of water.
- 2 **a** About 80% of the human body is made up of water. If 1 litre of water has a mass of 1 kilogram, measure your own mass and use it to calculate the number of litres of water in your body. Use this result, together with those from question 1, to find the area of the puddle the water in your body would make.
  - b** Go outside and mark out a rectangle that has the same area as the puddle you would make. Record the dimensions of this rectangle.
  - c** Using the scale  $1 \text{ cm} = 1 \text{ m}$ , draw a rectangle on graph paper that has the same area as the puddle you would make. Write a brief report of what this rectangle represents and how it was found.



### Investigation: Standing room only!

- 1 As a group, mark out a square metre in your classroom or school yard.
- 2 Estimate how many students could stand in the square.
- 3 Check your estimate by getting as many students as possible to stand in the square.
- 4 How could you estimate whether all the Year 7 students in your school could stand in your classroom?
- 5 How many Year 7 students could stand in your room?

### Investigation: Student space in a classroom

- 1 As a group, shift all the furniture to the sides of the classroom.
- 2 Use a set of metre-long sticks and connectors to lay out a grid of square metres on the floor.
- 3 Calculate or count the area of the floor in metres.
- 4 Sit two people to a square metre. Are you comfortable enough to stay within your square for a whole class?
- 5 Sit one person to a square metre. How comfortable are you?
- 6 Replace the furniture over the grid and sit at your desk.
- 7 How much area do you and your desk occupy?
- 8 Copy and complete each sentence.
  - a My class has \_\_\_\_\_ students.
  - b Today my maths class was held in a room with floor dimensions \_\_\_\_\_ by \_\_\_\_\_.
  - c The area of the floor is approximately \_\_\_\_\_.
  - d Each student is allocated \_\_\_\_\_ of floor space.
  - e The floor space left over for aisles and the teacher is \_\_\_\_\_.

Worksheet

Areas on a grid

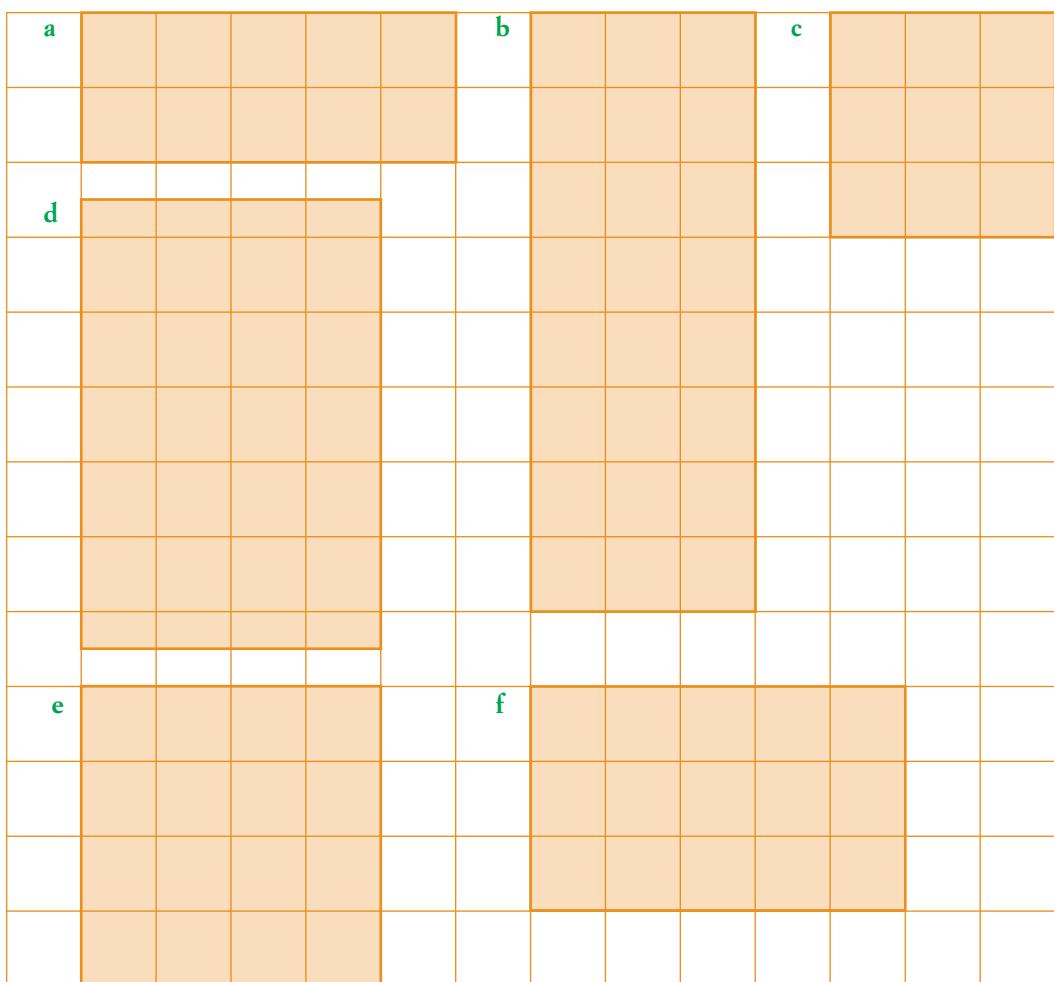
MAT07MGWK10062

TLF learning object

Exploring areas of rectangles and squares (L10569)

### Investigation: Area of a rectangle

- 1 The rectangles and squares on the next page are drawn on a grid of 1-cm squares. Find the area of each rectangle and square (in square centimetres) by counting the squares in it. Copy and complete the table. For rectangles, we usually call the *shorter* measurement the width.



Rectangle	Length (cm)	Width (cm)	Area ( $\text{cm}^2$ )
a	5	2	
b	8		
c			
d			
e			
f			

- 2 Look at your results for question 1. Write down a rule for finding the area of a rectangle or square from its length and width.

## 8-04 Area of a rectangle

Worksheet

Areas on a grid

MAT07MGWK10062

Worksheet

Australian areas

MAT07MGWK10063

Puzzle sheet

Area group clues

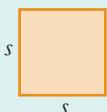
MAT07MGPS10031

### Summary

#### Square

$$\text{Area} = \text{side} \times \text{side} = s \times s$$

$$A = s^2$$



#### Rectangle

$$\text{Area} = \text{length} \times \text{width}$$

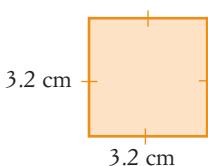
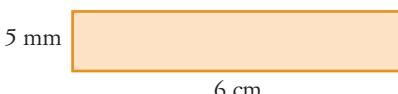
$$A = lw$$



Note: This formula can also be written as  $A = lb$ , where  $b$  stands for breadth, another name for width.

### Example 5

Find the area of each shape.

**a****b**

### Solution

$$\begin{aligned}\mathbf{a} \quad \text{Area} &= s^2 \\ &= 3.2^2 \\ &= 3.2 \times 3.2 \\ &= 10.24 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\mathbf{b} \quad \text{Area} &= l \times w \\ &= 60 \times 5 \\ &= 300 \text{ mm}^2\end{aligned}$$

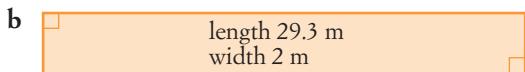
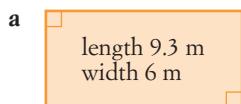
Change 6 cm to  
60 mm to make  
units the same

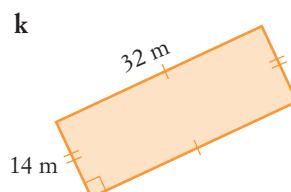
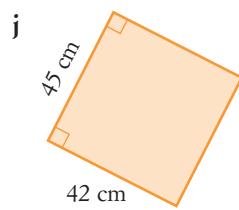
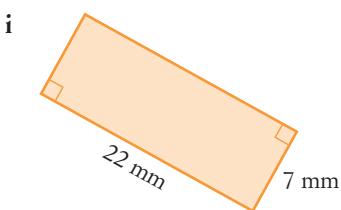
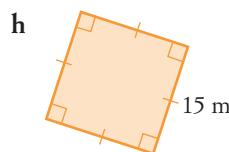
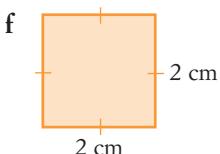
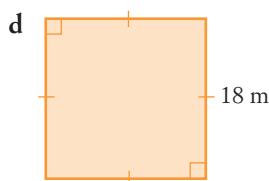
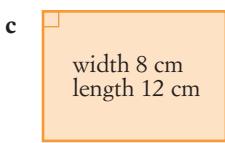
It is also possible to change  
5 mm to 0.5 cm to have an  
answer of 3 cm<sup>2</sup> instead

### Exercise 8-04 Area of a rectangle

#### See Example 5

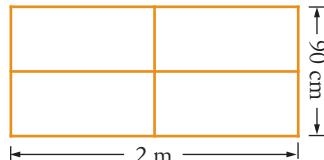
- 1 Find the area of each rectangle.





- 2 A window is 2 metres long and 90 centimetres wide.  
Find, in square metres, the area of the window. Select  
**A, B, C or D.**

**A**  $180 \text{ m}^2$     **B**  $0.18 \text{ m}^2$     **C**  $1.8 \text{ m}^2$     **D**  $18 \text{ m}^2$



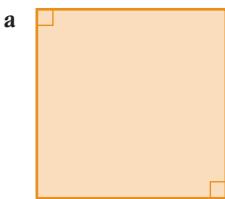
- 3 Find the area of each item described below:

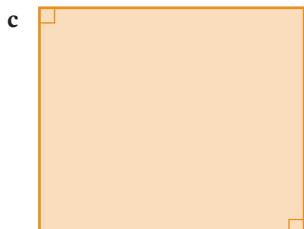
**i** in  $\text{m}^2$                           **ii** in  $\text{cm}^2$                           **iii** in  $\text{mm}^2$

- a** a square bowling green of length 5 m  
**b** a desk top measuring 95 cm by 54 cm.

- 4 Measure the sides of each rectangle below and calculate its area:

**i** in  $\text{mm}^2$                           **ii** in  $\text{cm}^2$





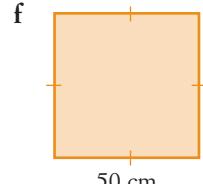
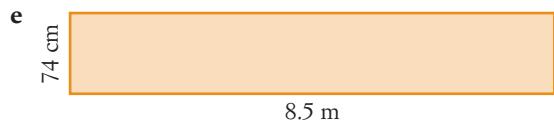
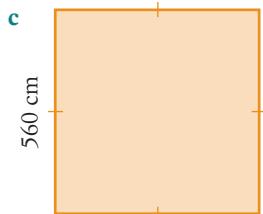
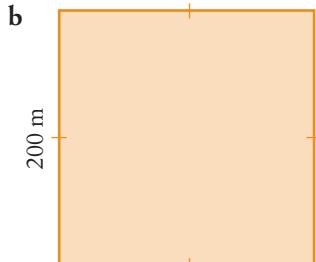
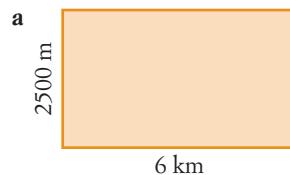
5 A square has an area of  $49 \text{ cm}^2$ . What is the length of one side?

6 Find the area of each rectangle in square metres.

## Worked solutions

## Exercise 8-04

MAT07MGWS10049



7 The front yard of a house measures 20 m by 8 m while the backyard measures 35 m by 7.5 m. Calculate the cost of covering both yards with grass if it costs \$18.60 per square metre.

8 A rectangle has a width of 4 m and an area of  $18 \text{ m}^2$ . What is its length?

9 Sandra's bedroom floor measures 3.6 m by 2.8 m. She buys carpet squares of length 40 cm.

a What is the area of Sandra's bedroom floor?

b What is the area of a carpet square in square metres?

c How many carpet squares are needed to cover Sandra's bedroom floor?

10 A rectangle has an area of  $35 \text{ cm}^2$ . What could its length and width be?

11 A  $4 \text{ m} \times 5 \text{ m}$  basement has a ceiling height of 3.2 m.

a Find the area of:

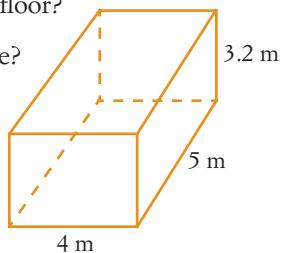
i the floor

ii the ceiling

iii one of the smaller walls

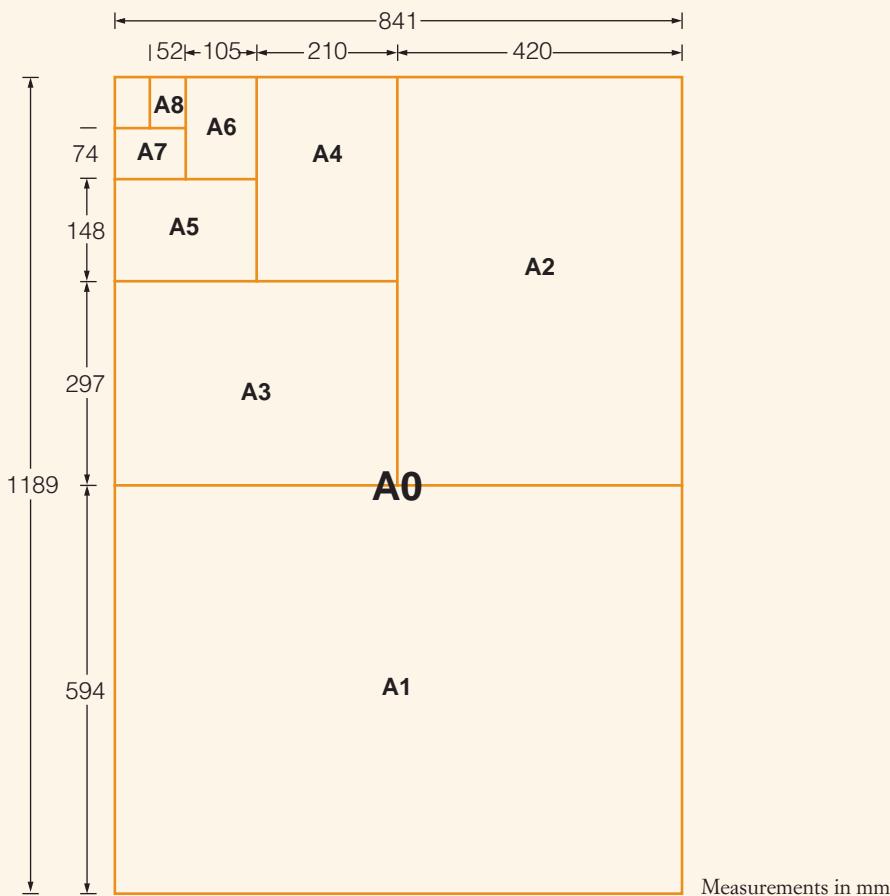
b How many square tiles measuring 50 cm on each side are needed to cover the floor of the basement?

c How many litres of paint are needed to cover the 4 walls of the basement if one litre of paint covers  $16 \text{ m}^2$ ?



**Just for the record****Paper sizes**

The size of a sheet of paper is labelled by the letter A and a number. An A4 sheet has a length of 297 mm and a width of 210 mm. If you cut an A4 sheet crosswise into halves, you will get two A5 sheets. If you cut an A5 sheet crosswise into halves, you will get two A6 sheets, and so on. Similarly, an A3 sheet is double the area of an A4 sheet, like two A4 sheets side-by-side. The largest size is A0. A diagram showing the A series of paper sizes from A0 to A8 is shown below.



- Find the area of a sheet of A3 paper and a sheet of A5 paper.
- How many A4 sheets of paper is equal to one A0 sheet?
- What fraction of an A4 sheet is an A8 sheet?

## Mental skills 8A Maths without calculators

### Doubling and halving numbers

You can double or halve a number by splitting it up first, then doubling or halving.

- 1** Study each example.

**a**  $92 \times 2$

*Think:* Double 92 = double 90 + double 2  
 $= 180 + 4$   
 $= 184$

**b**  $37 \times 2$

*Think:* Double 37 = double 30 + double 7  
 $= 60 + 14$   
 $= 74$

**c**  $\frac{1}{2} \times 86$

*Think:* Half of 86 = half of 80 + half of 6  
 $= 40 + 3$   
 $= 43$

**d**  $\frac{1}{2} \times 244$

*Think:* Half of 244 = half of 240 + half of 4  
 $= 120 + 2$   
 $= 122$

If the tens number is **odd**, then:

**e**  $\frac{1}{2} \times 78$

*Think:* Half of 78 = half of 60 + half of 18  
 $= 30 + 9$   
 $= 39$

**f**  $\frac{1}{2} \times 132$

*Think:* Half of 132 = half of 120 + half of 12  
 $= 60 + 6$   
 $= 66$

- 2** Now simplify each product.

**a**  $54 \times 2$

**b**  $77 \times 2$

**c**  $83 \times 2$

**d**  $105 \times 2$

**e**  $26 \times 2$

**f**  $41 \times 2$

**g**  $98 \times 2$

**h**  $162 \times 2$

**i**  $\frac{1}{2} \times 182$

**j**  $\frac{1}{2} \times 274$

**k**  $\frac{1}{2} \times 92$

**l**  $\frac{1}{2} \times 138$

**m**  $\frac{1}{2} \times 506$

**n**  $\frac{1}{2} \times 76$

**o**  $\frac{1}{2} \times 48$

**p**  $\frac{1}{2} \times 170$

**Technology**

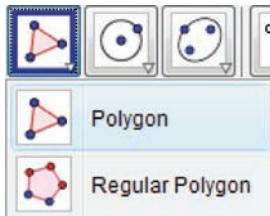
# Perimeter and area of a chicken pen

Farmer Jones has 36 m of fencing to make a rectangular chicken pen.

- Open a new spreadsheet and enter the labels, values and formula for calculating the perimeter of a rectangle as shown below.

	A	B	C	D
1	<b>Chicken Pens</b>			
2				
3	<b>Length (m)</b>	<b>Width (m)</b>	<b>Perimeter (m)</b>	<b>Area (m)</b>
4	10	8	=2*A4+2*B4	
5				
6				

- In cell D4, enter a formula for the area of the rectangle.
- Now use GeoGebra to help you solve this problem. To set up your drawing page, click **View**. Check that **Grid** is ticked and **Axes** is not ticked.
- Click the **Polygon** tool and use the grid to construct a rectangle 10 m by 8 m.



- Now click the **Area** tool and select the rectangle. You will see the area of this rectangle as 80.



- Now repeat steps 4 and 5 and find at least 3 pairs of dimensions (whole numbers only) for this rectangle and enter them into your spreadsheet.
- Return to the spreadsheet and enter the dimensions for length and width that you found. Also, **Fill Down** from cells C4 and D4 to complete the perimeter and area calculations.
- There are more pairs of whole-number dimensions (lengths and widths) for the rectangular chicken pen. Use GeoGebra and fill in your spreadsheet to find any missing pairs of dimensions.
- Which dimensions make the largest area for the chicken pen?

Worksheet

1 cm grid paper

MAT07MGWK10108

TLF learning object

Area of triangles  
(L145)

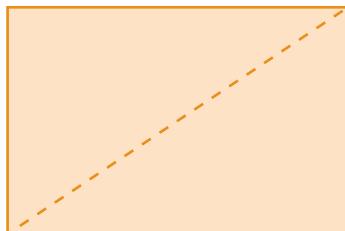
Worksheet

Triangle areas

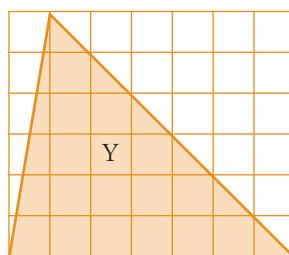
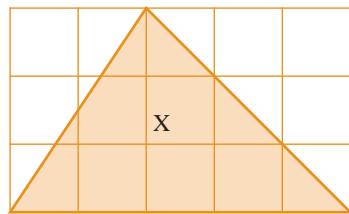
MAT07MGWK00059

## Investigation: Area of a triangle

You will need 1-cm grid paper and scissors.



- 1 On your grid paper, draw a rectangle 6 cm by 4 cm.
  - a Cut the rectangle in half along a diagonal. What shape have you made?
  - b Area of rectangle = \_\_\_\_  $\times$  \_\_\_\_ = \_\_\_\_  $\text{cm}^2$
  - c So what is the area of each triangle?
  - d Draw two other rectangles and repeat steps 2 to 4. What do you notice regarding the area of the triangle and the area of the rectangle?
- 2 On your grid paper, draw triangle X as shown, and cut out the rectangle.



- a Area of rectangle = \_\_\_\_\_
- b Cut out triangle X.
- c Place the leftover pieces on triangle X. Do they cover triangle X exactly?
- d Area of triangle = \_\_\_\_\_
- e Repeat the above steps for triangle Y.

## 8-05 Area of a triangle

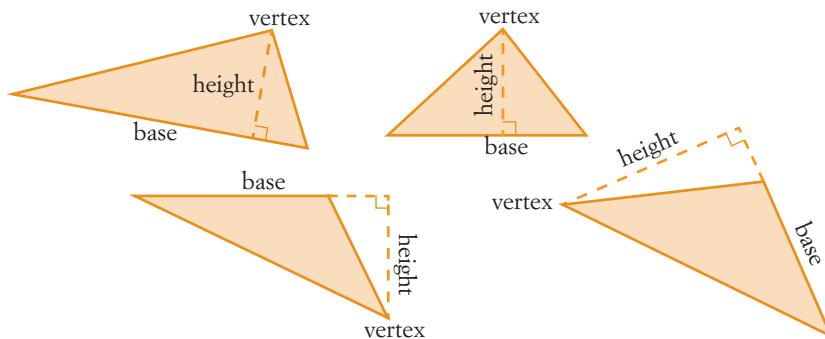
Technology

Geogebra

Area of a triangle

Any side of a triangle can be called its **base**. The **height** is the distance from the base to the opposite vertex. This distance is measured at right angles to the base, so it is also called the **perpendicular height**. Here are some examples:

MAT07MGCT00010

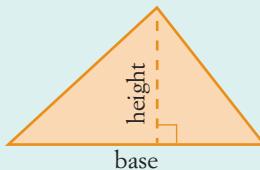


Note that with the last two examples involving obtuse-angled triangles, the perpendicular height is **outside** the triangle.

## Summary

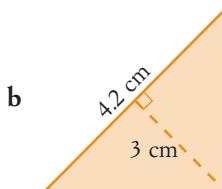
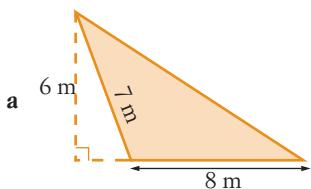
$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$A = \frac{1}{2} bh$$



## Example 6

Find the area of each triangle.



### Solution

$$\begin{aligned} \text{a Area} &= \frac{1}{2} bh \\ &= \frac{1}{2} \times 8 \times 6 \\ &= 24 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{b Area} &= \frac{1}{2} bh \\ &= \frac{1}{2} \times 4.2 \times 3 \\ &= 6.3 \text{ cm}^2 \end{aligned}$$

Choosing 8 m as the base

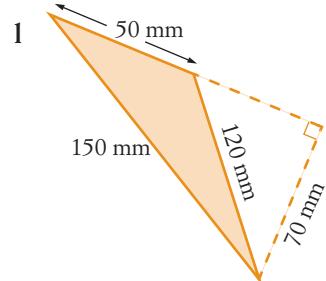
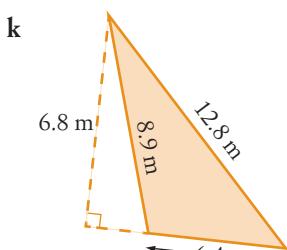
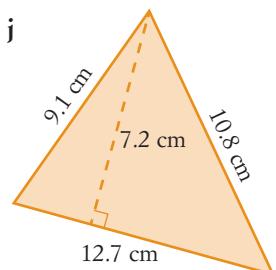
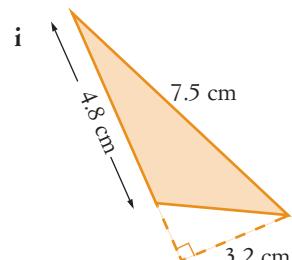
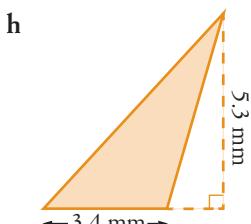
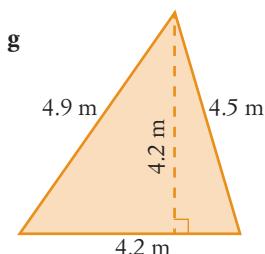
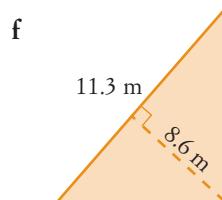
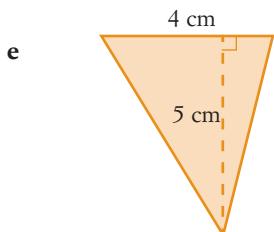
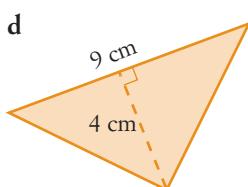
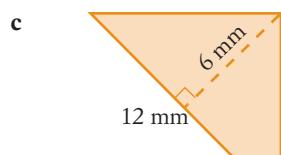
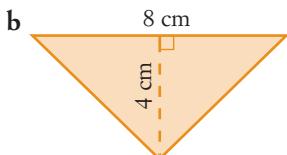
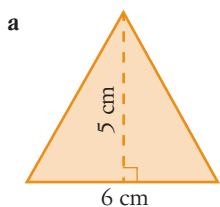
The length of 7 m is not required to find this triangle's area

Choosing 4.2 cm as the base

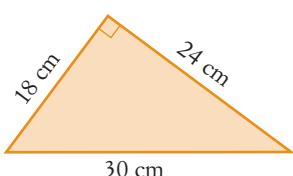
## Exercise 8-05 Area of a triangle

**See Example 6**

- 1 Find the area of each triangle.



- 2 What is the area of this triangle? Select the correct answer A, B, C or D.



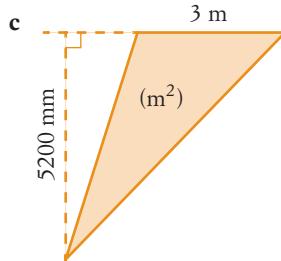
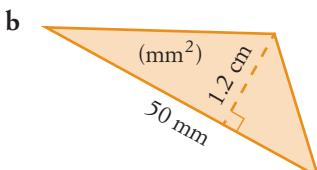
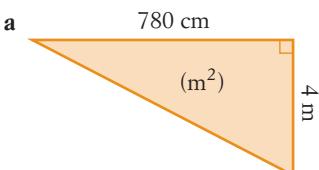
- A  $360 \text{ cm}^2$       B  $432 \text{ cm}^2$       C  $270 \text{ cm}^2$       D  $216 \text{ cm}^2$

Worked solutions

Exercise 8-05

MAT07MGWS10050

- 3 Find the area of each triangle, using the units given in brackets.



- 4 A triangle has a base of length 4 m and an area of  $40 \text{ m}^2$ . What is its perpendicular height?
- 5 A triangle with an area of  $27 \text{ cm}^2$  has a perpendicular height of 18 cm. How long is its base?
- 6 The fly-screen of a tent is to be made into the shape of a triangle 0.8 m long and 1.4 m high. Calculate the cost of the screen if one square metre costs \$9.10.
- 7 A triangle has an area of  $36 \text{ m}^2$ . What could its base length and perpendicular height be?
- 8 A triangle's perpendicular height is the same as its base length. If its area is  $32 \text{ cm}^2$ , what is its perpendicular height?

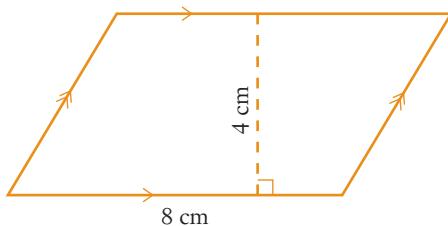
Worked solutions

Exercise 8-05

MAT07MGWS10050

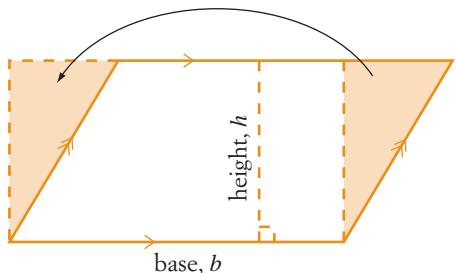
### Investigation: Area of a parallelogram

A **parallelogram** is a quadrilateral with opposite sides parallel and equal in length.



- 1 On a sheet of paper, draw a parallelogram with a base length of 8 cm and a perpendicular height of 4 cm.
- 2 Draw an identical parallelogram in your book.
- 3 Cut out the parallelogram from the sheet of paper.
- 4 Cut along the dotted line (perpendicular height) and rearrange the pieces to form a rectangle.
- 5 Measure the length and width of the rectangle to the nearest millimetre, and then find its area.
- 6 Why is the area of the rectangle the same as the area of the parallelogram?
- 7 Suggest a general formula for finding the area of any parallelogram. (Check your answer with your teacher.)

- 8 Paste the rectangle in your book under your diagram of the parallelogram.



## 8-06 Area of a parallelogram

Technology worksheet

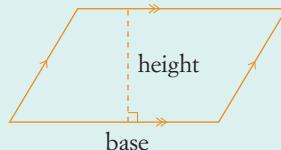
Excel  
Area formulas

MAT07MGCT10004

### Summary

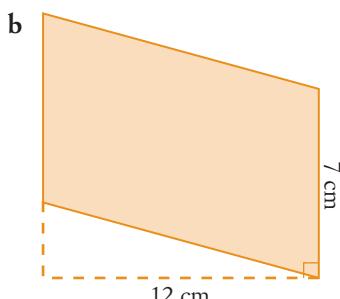
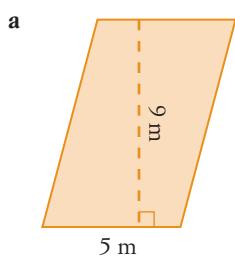
Area = base × height

$$A = bh$$



### Example 7

Find the area of each parallelogram.



### Solution

a    Area =  $bh$   
 $= 5 \times 9$   
 $= 45 \text{ m}^2$

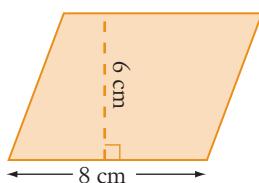
b    Area =  $bh$   
 $= 7 \times 12$   
 $= 84 \text{ cm}^2$

## Exercise 8-06 Area of a parallelogram

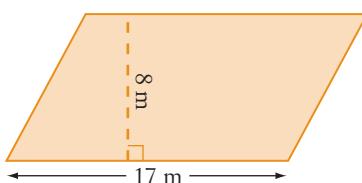
- 1 Find the area of each parallelogram.

See Example 7

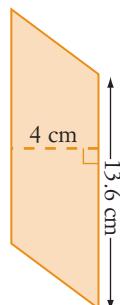
a



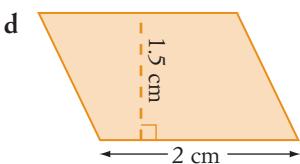
b



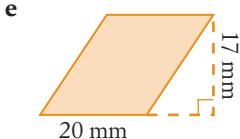
c



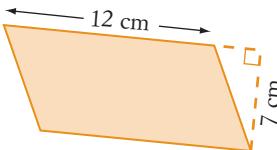
d



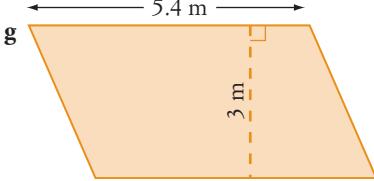
e



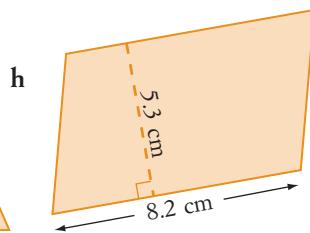
f



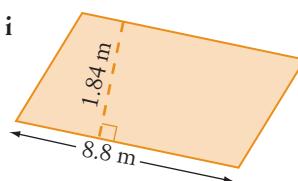
g



h



i



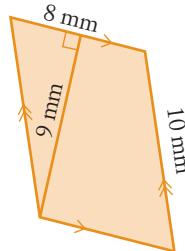
- 2 What is the area of this parallelogram?  
Select the correct answer A, B, C or D.

- A  $72 \text{ mm}^2$   
B  $36 \text{ mm}^2$   
C  $45 \text{ mm}^2$   
D  $80 \text{ mm}^2$

Worked solutions

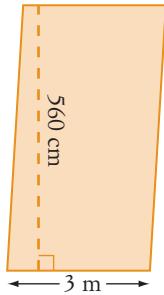
Exercise 8-06

MAT07MGWS10051

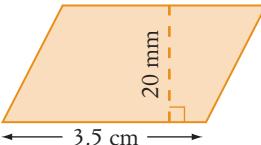


- 3 Find the area of each parallelogram in square centimetres. Make sure you change both lengths to centimetres first.

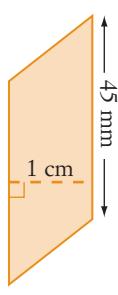
a

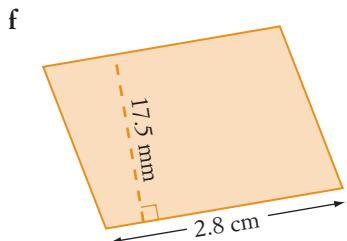
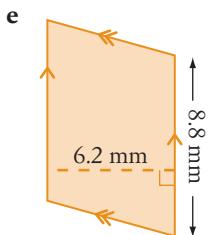
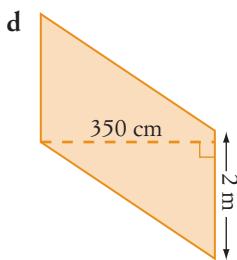


b



c





- 4 The courtyard of a house is in the shape of a parallelogram with a base length of 4.3 m and an area of  $24.94 \text{ m}^2$ . What is its perpendicular height? Select **A**, **B**, **C** or **D**.
- A**  $5.8 \text{ m}^2$       **B**  $10.6 \text{ m}^2$       **C**  $53.621 \text{ m}^2$       **D**  $107.24 \text{ m}^2$
- 5 A parallelogram has an area of  $245 \text{ cm}^2$ . What could be its base length and perpendicular height?

## 8-07 Areas of composite shapes

Worksheet

A page of composite shapes

MAT07MGWK10061

Worksheet

Composite areas

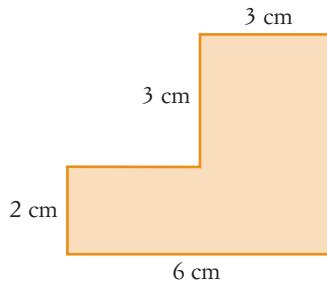
MAT07MGWK10064

Video tutorial

Areas of composite shapes

MAT07MGVT10018

Find the area of this shape.



### Solution

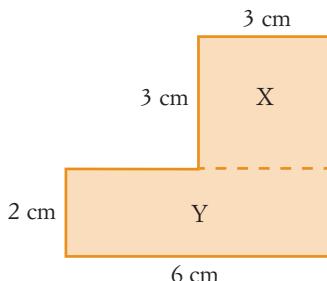
#### Method 1

Separate the shape into a square (X) and a rectangle (Y).

Area of shape = area of square X + area of rectangle Y

$$= 3 \times 3 + 6 \times 2$$

$$= 21 \text{ cm}^2$$



Puzzle sheet

Area puzzles

MAT07MGPS10032

Homework sheet

Area

MAT07MGHS10025

TLF learning object

Exploring area and perimeter (L6557)

TLF learning object

Compound shapes (L153)

**Method 2**

Separate the shape into two rectangles P and Q.

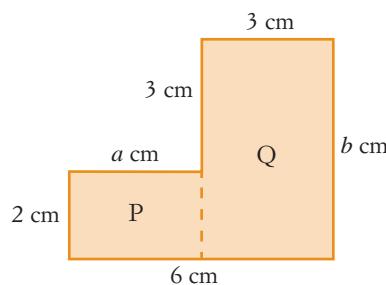
$$a = 6 - 3 = 3$$

$$b = 3 + 2 = 5$$

$$\text{Area of shape} = \text{area of } P + \text{area of } Q$$

$$= 3 \times 2 + 5 \times 3$$

$$= 21 \text{ cm}^2$$


**Method 3**

The area can also be found by subtracting areas.

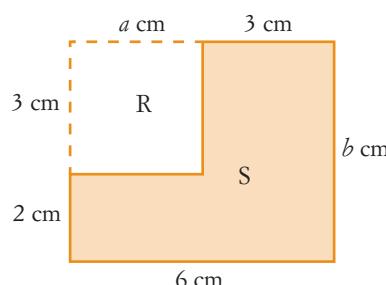
$$a = 6 - 3 = 3$$

$$b = 3 + 2 = 5$$

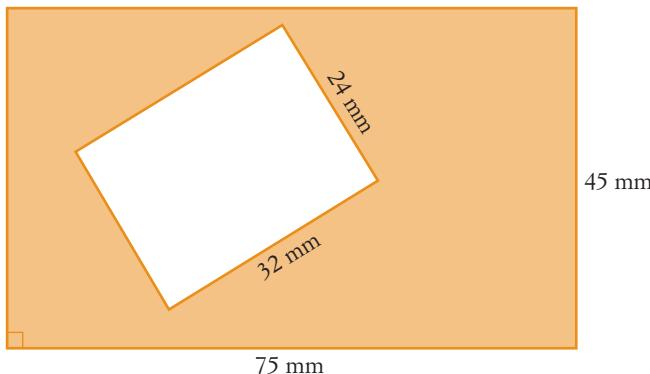
$$\text{Area of shape} = \text{area of big rectangle} - \text{area of } R$$

$$= 6 \times 5 - 3 \times 3$$

$$= 21 \text{ cm}^2$$


**Example 9**

Find the shaded area.


**Solution**

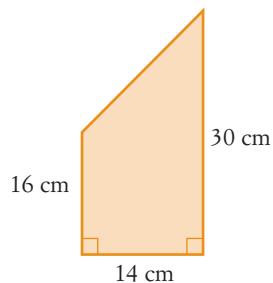
$$\text{Shaded area} = \text{area of big rectangle} - \text{area of small rectangle}$$

$$= 75 \times 45 - 32 \times 24$$

$$= 2607 \text{ mm}^2$$

## Example 10

Find the area of this shape.

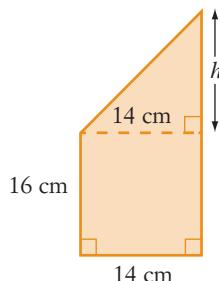


## Solution

Divide the shape into a triangle and a rectangle.

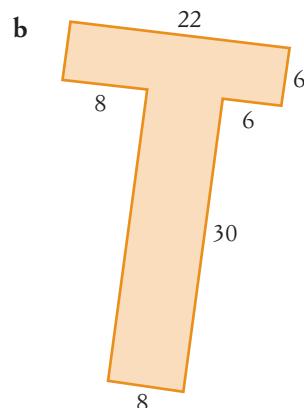
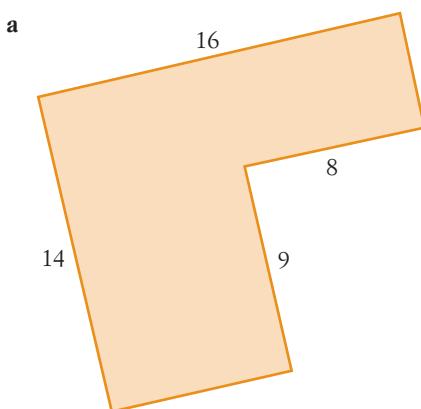
$$\begin{aligned}\text{Height of triangle, } h &= 30 - 16 \\ &= 14 \text{ cm}\end{aligned}$$

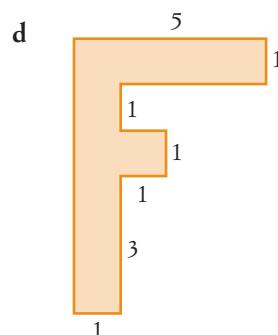
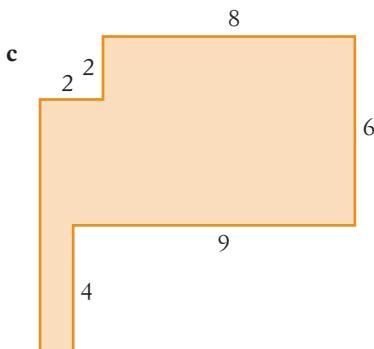
$$\begin{aligned}\text{Area of shape} &= \text{area of rectangle} + \text{area of triangle} \\ &= 16 \times 14 + \frac{1}{2} \times 14 \times 14 \\ &= 224 + 98 \\ &= 322 \text{ cm}^2\end{aligned}$$



## Exercise 8-07 Areas of composite shapes

**See Example 8** 1 Find the area of each shape. All measurements are in centimetres.





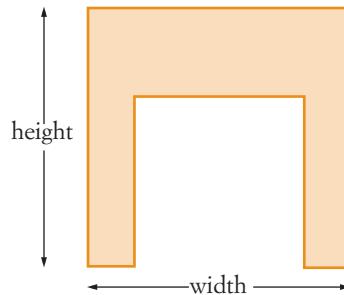
2 Find the area of each shape.

**See Example 9**

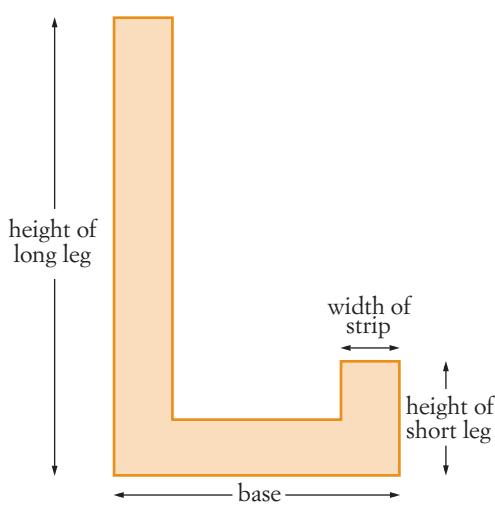
- a Outside dimensions:  $230 \text{ cm} \times 55 \text{ cm}$ . Hole dimensions:  $40 \text{ cm} \times 35 \text{ cm}$



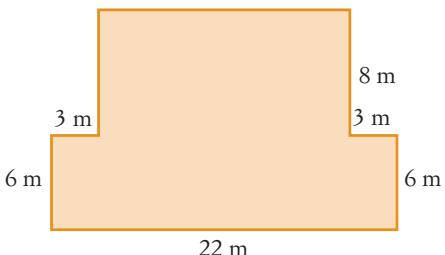
- b Total height: 30 cm, total width: 30 cm  
Dimensions of cut-out:  $20 \text{ cm} \times 20 \text{ cm}$



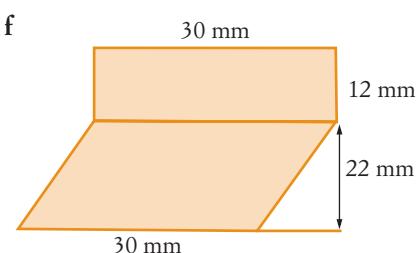
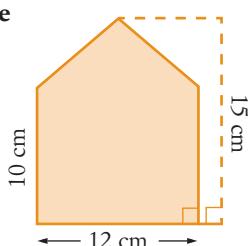
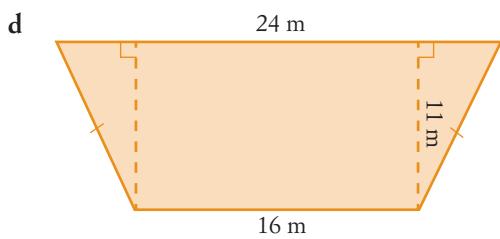
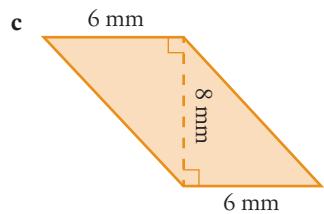
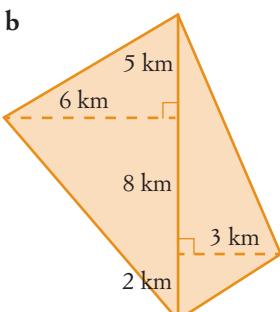
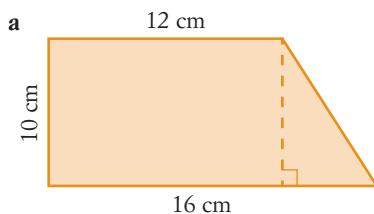
- c This shape is formed from strips of metal 10 cm wide. The height of the long leg is 80 cm. The base is 50 cm wide. The height of the short leg is 20 cm.



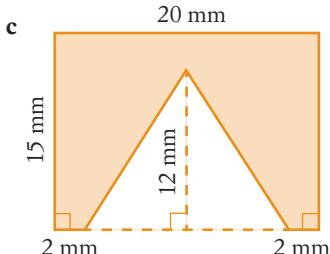
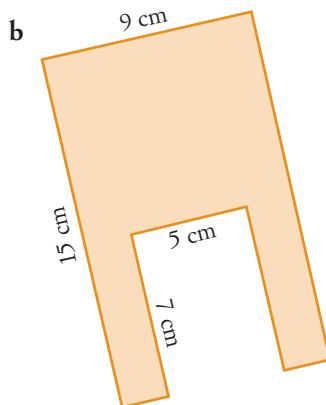
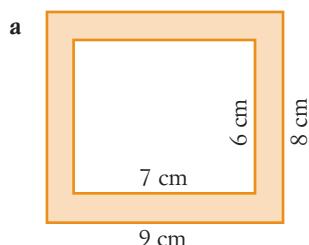
- 3 The diagram on the right shows a swimming pool in a holiday resort. What is the area of the floor of the pool? Select the correct answer A, B, C or D.

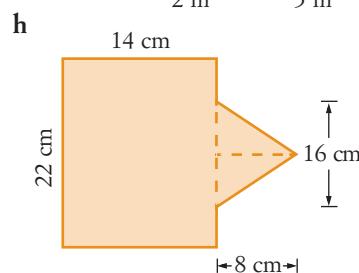
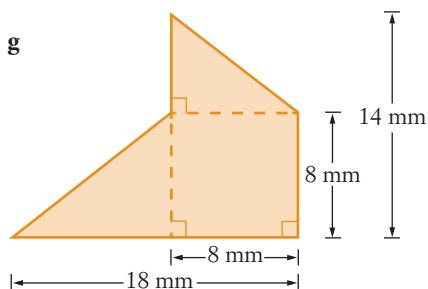
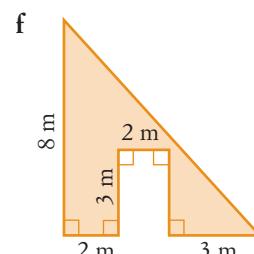
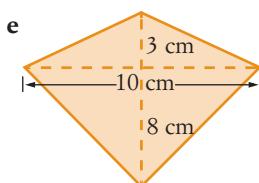
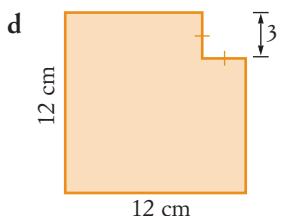
A  $156 \text{ m}^2$ C  $72 \text{ m}^2$ B  $180 \text{ m}^2$ D  $260 \text{ m}^2$ 

- See Example 10** 4 Find the area of each shape.

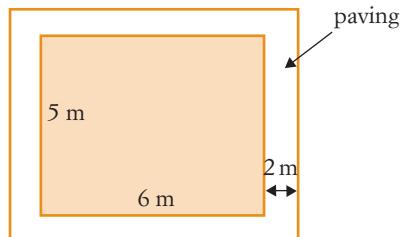


- 5 Find each shaded area.

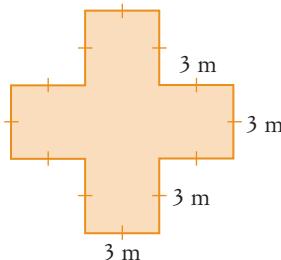




- 6 A rectangular lawn contains two square flower gardens, each measuring 3 m by 3 m. If the lawn measures 9.5 m by 6.4 m, find the area of the grass.
- 7 A garden measuring 6 m by 5 m has a 2 m wide strip of paving around its border. What is the area of the paving?

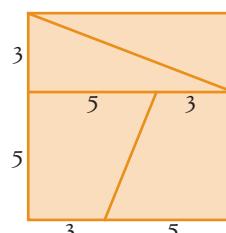


- 8 The floor of a children's pool is in the shape of a cross as shown. Each side is 3 m long. How many tiles are required to tile this floor if one tile covers  $1600 \text{ cm}^2$ ?



### Investigation: Area puzzles

- 1 Draw this square on 1 cm dot paper or print out the worksheet 'Area puzzles'. All measurements are in centimetres. What is its area in  $\text{cm}^2$ ?



- 2 a Cut out the square, then cut along the marked lines.  
b Arrange the four pieces to make a rectangle. Find its length and width. Use these to find its area.

Worked solutions

Exercise 8-07

MAT07MGWS10052

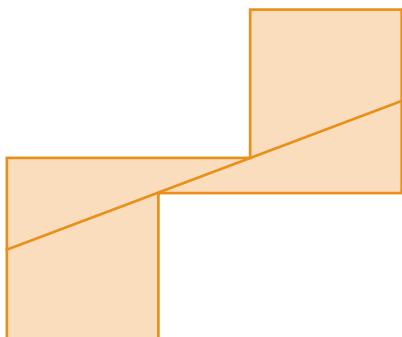
Puzzle sheet

Area puzzles

MAT07MGPS10032

- 3** Is the calculated area of the rectangle the same as the area of the original square? Should it be? Explain this mystery.

- 4** Use the same four pieces to make this shape. Calculate its area. Is this the same as the area of the original square? Should it be? Why?

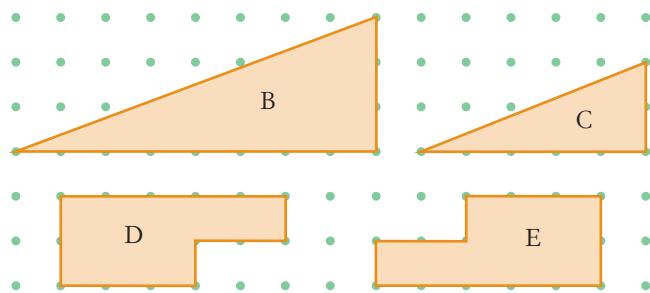


Worksheet

Square dot paper

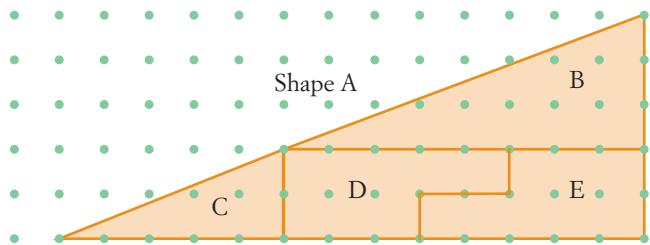
MAT07MGWK10109

- 5 a** Use square dot paper to draw each of the shapes B, C, D and E as shown, or access the worksheet on NelsonNet and print them out.



- b** Find the area of each shape in  $\text{cm}^2$ , then find the sum of the areas.

- c** Cut out the shapes and combine them to form Shape A, as shown.



- 6 a** Shape A looks like a right-angled triangle. Find its height and the length of its base. Use these to find its area.

- b** Does the area of the triangle equal the sum of the areas of B, C, D and E from question 1? Explain the mystery about the area of the triangle, the area of Shape A and the sum of the areas of B, C, D and E.

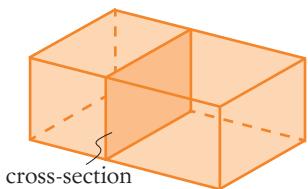
## Investigation: Local areas

- 1 a Use a map or street directory to find a recreation area (park, garden or reserve) near where you live.
  - b Find the scale for measuring distance used on your map or street directory.
  - c Estimate the area of the park, garden or reserve.
- 2 a Rule lines on a sheet of tracing paper to make a grid of squares scaled like your map or street directory. Trace your park, garden or reserve from question 1 onto the paper.
  - b Approximate the area (in  $\text{m}^2$  and ha) of your park, garden or reserve. Use the method of counting squares. (It may be more accurate to subdivide each square on the grid into smaller shapes.)

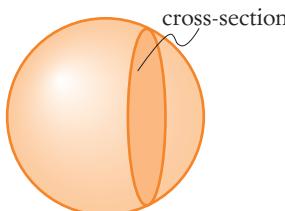
## 8-08 Drawing prisms

### Cross-sections

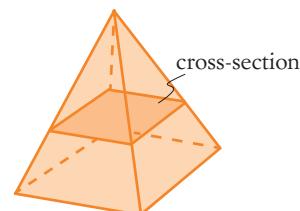
A **cross-section** of a solid is a ‘slice’ of the solid, cut *across* it, parallel to its end faces, rather than along it. These diagrams show cross-sections of a rectangular prism, a sphere and a square pyramid.



Rectangular prism



Sphere



Square pyramid

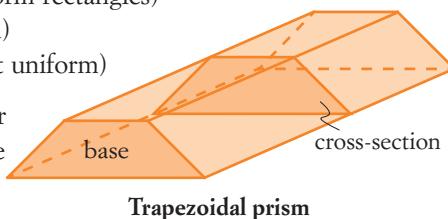
Note that the cross-sections of a rectangular prism are congruent (identical) rectangles, the cross-sections of a sphere are circles (but of different sizes), and the cross-sections of a square pyramid are squares (again, of different sizes).

### Prisms

If a solid has the same (uniform) cross-section along its length, and each cross-section has straight sides (not rounded), then the solid is called a **prism**. From the above diagrams:

- a rectangular prism is a prism (its cross-sections are uniform rectangles)
- a sphere is not a prism (its cross-sections are not uniform)
- a square pyramid is not a prism (its cross-sections are not uniform)

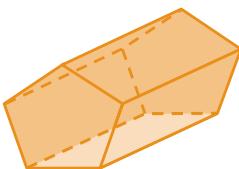
The end faces of a prism are called its **base**. Prisms take their names from their base. For example, the prism shown on the right is called a **trapezoidal prism** because its cross-sections are all trapeziums, identical and parallel to its base.



Trapezoidal prism

## Example 11

- a Draw a cross-section of the prism shown.  
 b What shape is the prism's cross-section?  
 c What shape are the side faces?  
 d What is the name of this prism?



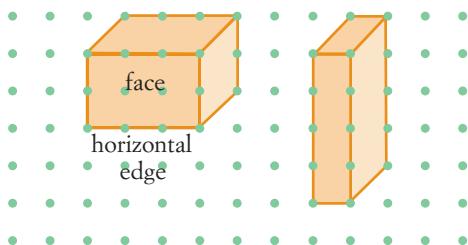
## Solution



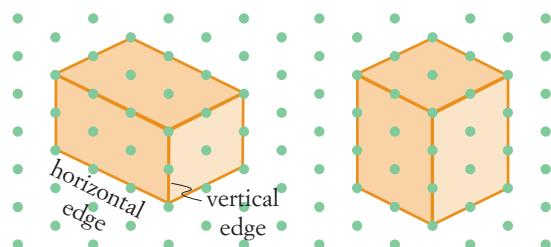
- b The cross-section is a pentagon.  
 c The side faces are all rectangles.  
 d This is a pentagonal prism.

## Drawing different views of solids

Prisms can be difficult to draw. Sometimes it is easier to use square or isometric dot paper to draw them. These rectangular prisms are drawn on **square dot paper**, a square grid of dots.



These rectangular prisms are drawn on **isometric dot paper**, a '3D' triangular grid of dots arranged as equilateral triangles. A 2D (flat) diagram of a 3D figure (solid) looks more natural when drawn on isometric paper. On isometric paper, all horizontal edges are shown at an angle of 30°.

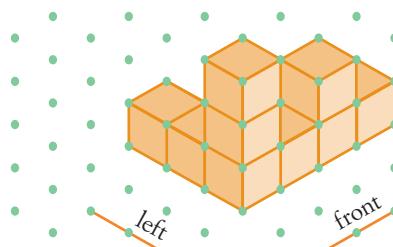


- When drawing on **square** paper, one of the prism's **faces** is shown at the forefront.
- When drawing on **isometric** paper, one of the prism's **vertical edges** is shown at the forefront.

### Example 12

For the solid shown, assume that there are no hidden cubes. Draw:

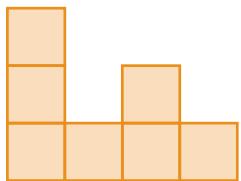
- the front view
- the left view
- the top view



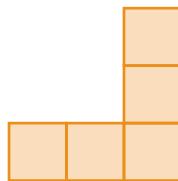
### Solution

For each view, there will be some cubes hidden behind the cubes closest to you.

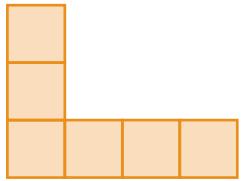
a Viewed from the front



b Viewed from the left



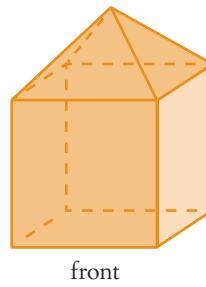
c Viewed from the top



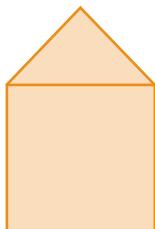
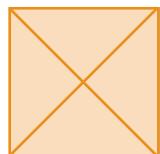
### Example 13

For the solid shown, draw:

- the front view
- the top view



front

**Solution****a** Viewed from the front**b** Viewed from the top**Exercise 8-08** Drawing prisms

Worksheet

Square dot paper

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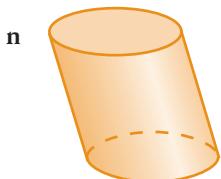
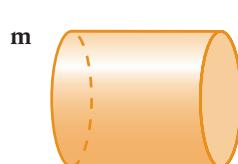
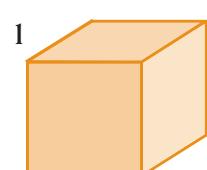
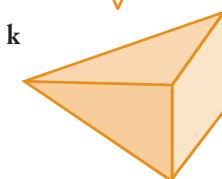
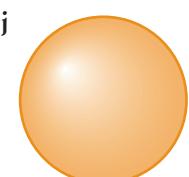
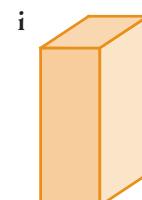
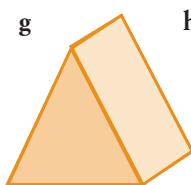
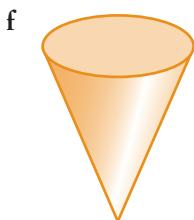
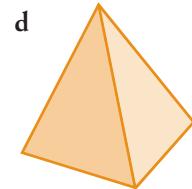
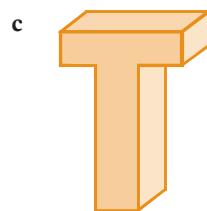
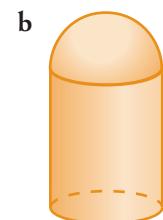
Worksheet

Isometric dot paper

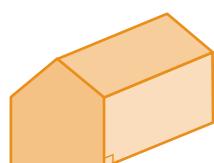
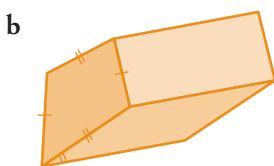
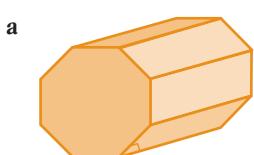
MAT07MGWK10110

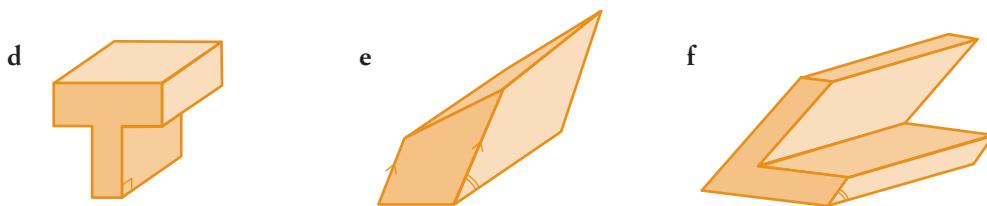
For this exercise you will need square dot paper, isometric dot paper and construction cubes. Both types of dot paper can be printed out from NelsonNet. You can also draw shapes using dynamic geometry software, using a square grid or an isometric grid.

**1** State whether each solid is a prism or not.

**See Example 11**

**2** For each of the prisms below,  
**i** draw its cross-section  
**ii** write the name of the prism



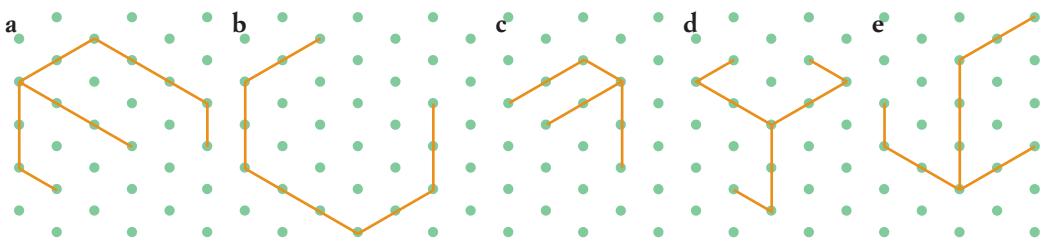


3 Draw each prism listed below and shade its base.

- a square prism
- b isosceles triangular prism
- c trapezoidal prism

- d hexagonal prism

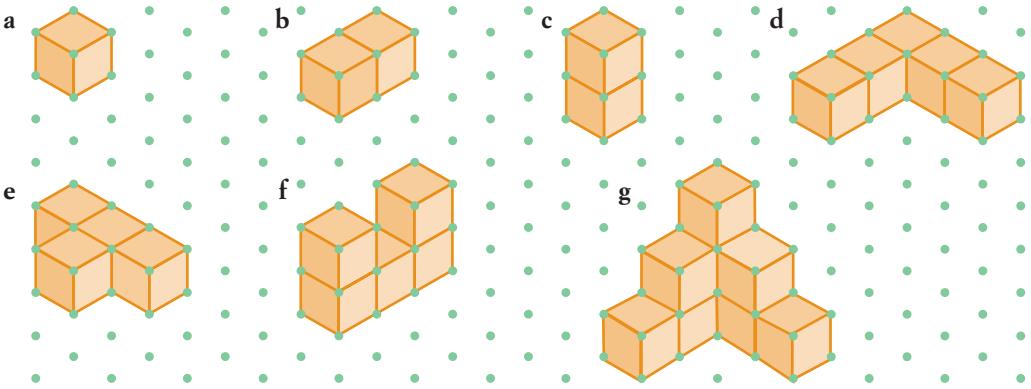
4 Each diagram is the start of a drawing of a rectangular prism. Copy each drawing onto isometric dot paper and complete it.



5 Draw a triangular prism:

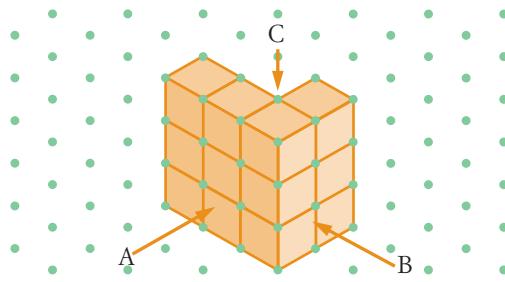
- a on square dot paper
- b on isometric dot paper.

6 Use cubes to make each solid, then draw them on isometric dot paper.

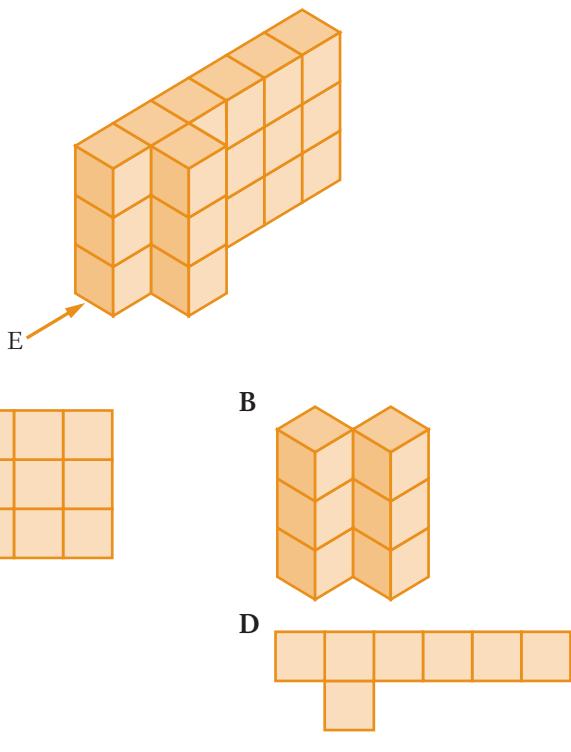


7 Draw what you would see of this prism if you were looking from A, then from B, and then from C.

**See Example 12**



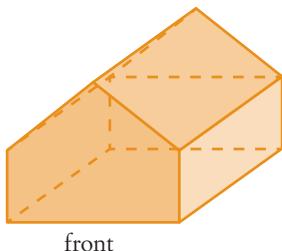
- 8 What would Pooja see if she were looking at this prism from point E? Select the correct answer **A**, **B**, **C** or **D**.



**See Example 13**

- 9 For each prism, draw each view requested.

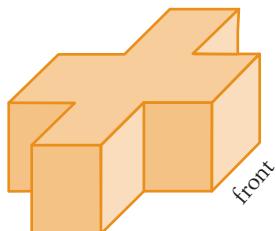
a



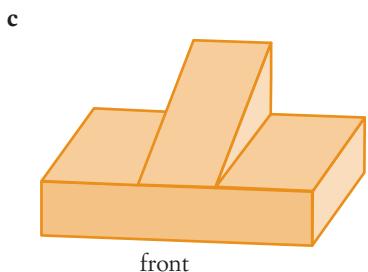
front

- i front view  
ii right view

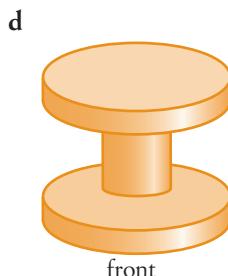
b



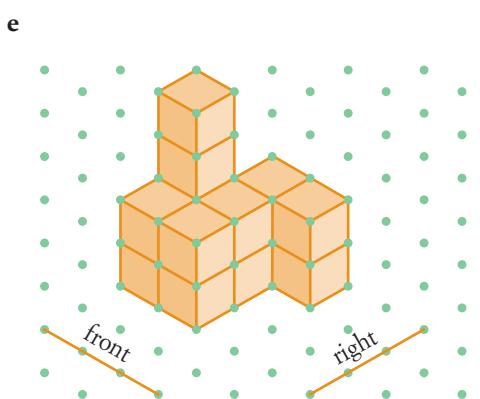
- i left view  
ii top view  
iii front view



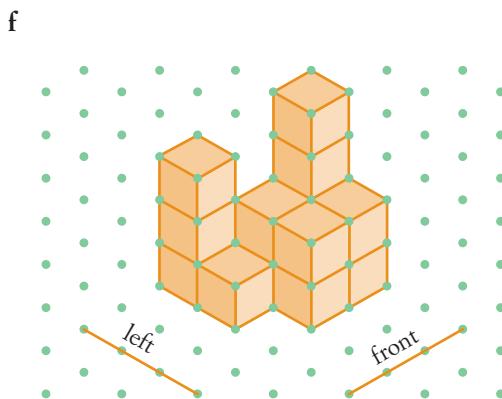
- i front view
- ii left view
- iii right view
- iv top view



- i top view
- ii front view

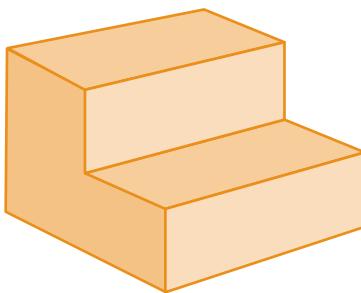


- i front view
- ii right view
- iii top view

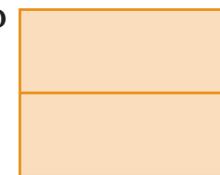
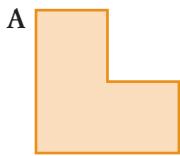


- i back view
- ii left view
- iii top view

10 Damien flew over the top of this building.



Which view would he see when directly overhead? Select A, B, C or D.



## Mental skills 8B Maths without calculators

### Multiplying and dividing by 4 or 8

Multiplying and dividing by 4 or 8 involves repeated doubling or halving.

- 1** Study each example.

**a**  $65 \times 4$

*Think:*

Double twice  
Double  $65 = 130$   
Double  $130 = 260$

**b**  $27 \times 4$

*Think:*

Double twice.  
Double  $27 = 54$   
Double  $54 = 108$

**c**  $14 \times 8$

*Think:*

Double three times.  
Double  $14 = 28$   
Double  $28 = 56$   
Double  $56 = 112$

**d**  $236 \div 4$

*Think:*

Halve twice.  
 $\frac{1}{2} \times 236 = 118$   
 $\frac{1}{2} \times 118 = 59$

**e**  $564 \div 4$

*Think:*

Halve twice.  
 $\frac{1}{2} \times 564 = 282$   
 $\frac{1}{2} \times 282 = 141$

**f**  $392 \div 8$

*Think:*

Halve three times  
 $\frac{1}{2} \times 392 = 196$   
 $\frac{1}{2} \times 196 = 98$   
 $\frac{1}{2} \times 98 = 49$

- 2** Now evaluate each expression.

**a**  $14 \times 4$

**b**  $27 \times 4$

**c**  $16 \times 4$

**d**  $105 \times 4$

**e**  $43 \times 8$

**f**  $16 \times 8$

**g**  $28 \times 8$

**h**  $33 \times 8$

**i**  $184 \div 4$

**j**  $272 \div 4$

**k**  $560 \div 4$

**l**  $432 \div 4$

**m**  $624 \div 8$

**n**  $312 \div 8$

**o**  $256 \div 8$

**p**  $152 \div 8$

## 8-09 Metric units for volume

## Summary

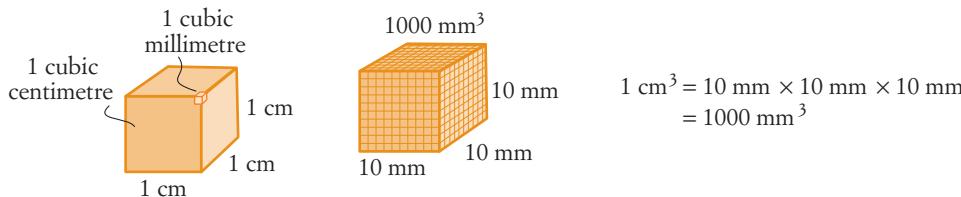
The **volume** of a solid is the amount of space occupied by the solid.

MAT07MGSS10029

The table shows metric units of volume.

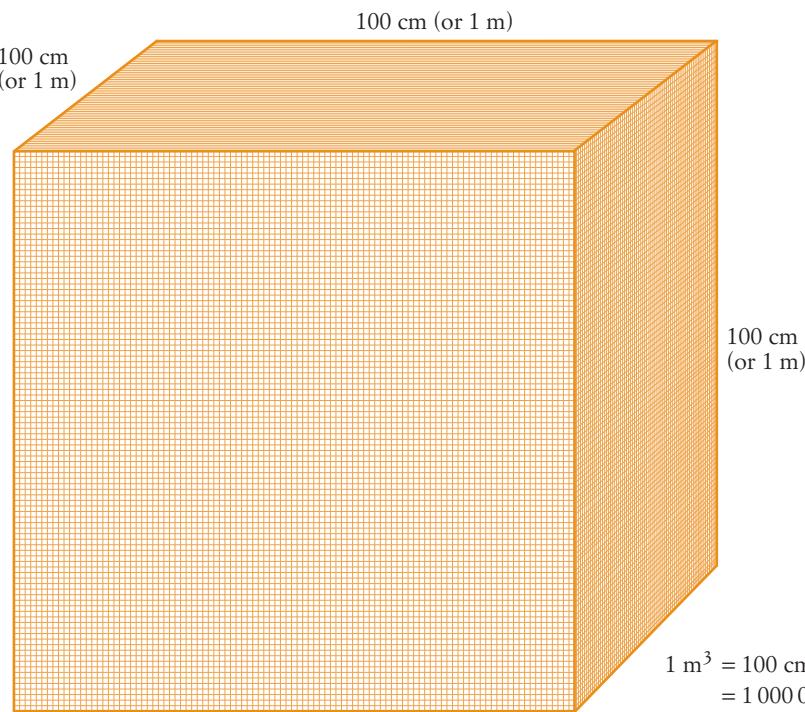
Volume unit	Abbreviation	The size of a cube with each side measuring ...
cubic millimetre	$\text{mm}^3$	1 mm
cubic centimetre	$\text{cm}^3$	1 cm
cubic metre	$\text{m}^3$	1 m

A **cubic millimetre** is about the size of a grain of raw sugar or rock salt. A **cubic centimetre** is about the size of a person's tooth or a medical pill.



There are 1000 cubic millimetres in one cubic centimetre.

A **cubic metre** is about the size of two washing machines. There are 1 000 000 cubic centimetres in one cubic metre.



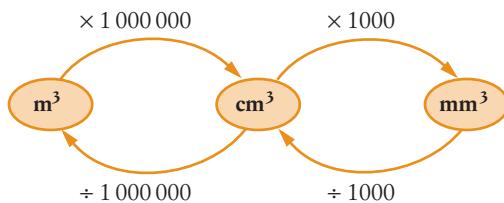
## Inside a cubic metre (L164)

**Summary**

$$1 \text{ cm}^3 = 1000 \text{ mm}^3$$

$$1 \text{ m}^3 = 1\ 000\ 000 \text{ cm}^3$$

This diagram shows how to convert between different units of volume.

**Example 14**

Convert:

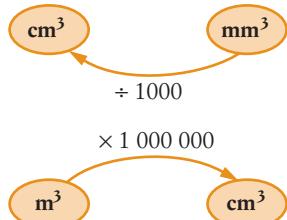
a  $12\ 000 \text{ mm}^3$  to  $\text{cm}^3$

b  $48 \text{ m}^3$  to  $\text{cm}^3$

**Solution**

$$\begin{aligned} \text{a } 12\ 000 \text{ mm}^3 &= (12\ 000 \div 1\ 000) \text{ cm}^3 \\ &= 12 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{b } 48 \text{ m}^3 &= (48 \times 1\ 000\ 000) \text{ cm}^3 \\ &= 48\ 000\ 000 \text{ cm}^3 \end{aligned}$$

**Exercise 8-09 Metric units for volume**

- What unit of volume would you use when measuring the volume of:
  - a textbook?
  - a backpack?
  - a large suitcase?
  - a matchbox?
  - the carton for a large TV?
  - a room?
- What is the approximate volume of a brick? Select the correct answer A, B, C or D.
 

A $1000 \text{ cm}^2$	B $20 \text{ cm}^2$	C $1600 \text{ cm}^3$	D $2100 \text{ cm}^3$
-----------------------	---------------------	-----------------------	-----------------------

**See Example 14**

- Copy and complete the following.

a  $3 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ mm}^3$

b  $5 \text{ m}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

c  $2.6 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ mm}^3$

d  $4000 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

e  $7.2 \text{ m}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

f  $66\ 000 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

g  $1 \text{ m}^3 = \underline{\hspace{2cm}} \text{ mm}^3$

h  $2300 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ m}^3$

i  $126\ 000\ 000 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ m}^3$

j  $3450 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

k  $25 \text{ m}^3 = \underline{\hspace{2cm}} \text{ mm}^3$

l  $78\ 000 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ m}^3$

m  $63\ 000 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ m}^3$

n  $1.4 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

o  $5000 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ m}^3$

- 4 The volume of a chest of drawers is  $306\ 000\ \text{cm}^3$ . Convert this to cubic metres.
- 5 Match the correct volume (A to G) with each of the items (a to g) listed.

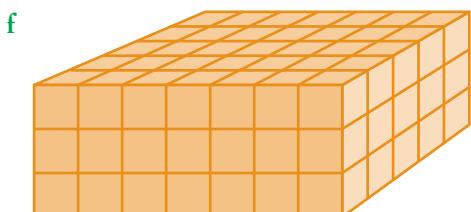
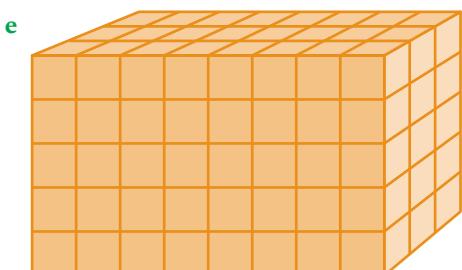
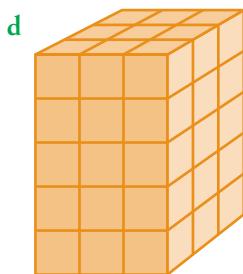
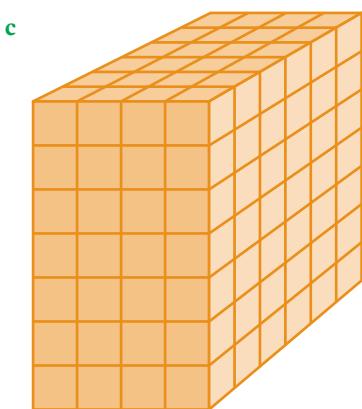
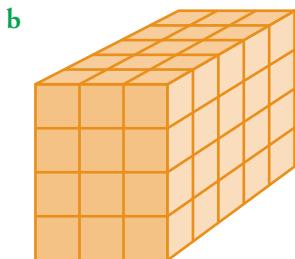


- |                            |                          |
|----------------------------|--------------------------|
| a a bottle of liquid paper | A $200\ \text{m}^3$      |
| b a box of tissues         | B $3890\ \text{m}^3$     |
| c a glass of water         | C $1250\ \text{cm}^3$    |
| d a bottle of lemonade     | D $5000\ \text{cm}^3$    |
| e a classroom              | E $20\ 000\ \text{mm}^3$ |
| f a school hall            | F $250\ \text{cm}^3$     |
| g a cereal package         | G $2200\ \text{cm}^3$    |
- 6 The volume of a lunchbox is  $2520\ \text{cm}^3$ . Convert this to cubic millimetres.
  - 7 A swimming pool has a volume of  $38\ \text{m}^3$ . Convert this to cubic centimetres.

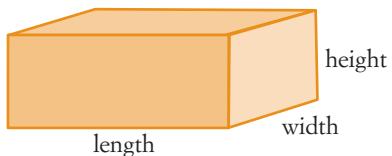
### Investigation: Volume of a rectangular prism

- 1 The rectangular prisms on the next page are made up of 1 cm cubes. Copy and complete this table.

Shape	Number of cubes in one layer	Number of layers	Volume ( $\text{cm}^3$ )
a			
b			
c			
d			
e			
f			



2 Copy and complete this table for the rectangular prisms in question 1.



Shape	Length (cm)	Width (cm)	Height (cm)	Volume (cm <sup>3</sup> )
a	4	4	1	16
b				
c				
d				
e				
f				

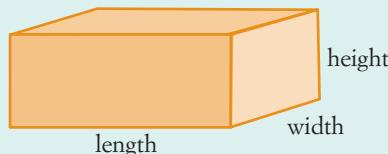
- 3 What is the relationship between the length, width and height of a rectangular prism and its volume?  
 4 Write the relationship as a rule: Volume of a rectangular prism = \_\_\_\_  $\times$  \_\_\_\_  $\times$  \_\_\_\_

## 8-10 Volume of a rectangular prism

### Summary

Volume = length × width × height

$$V = lwh$$



Worksheet

Volume

MAT07MGWK10065

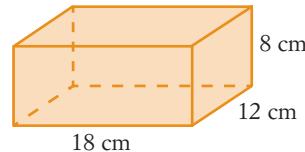
TLF learning object

Measures: Volumes (L2316)

Note: This formula is sometimes written as  $V = lbh$ , where  $b$  = breadth, another name for width.

### Example 15

Find the volume of the rectangular prism.



### Solution

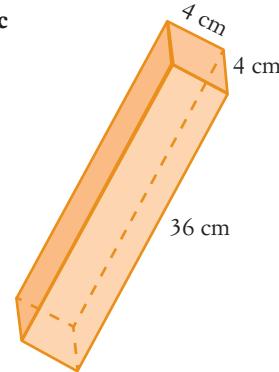
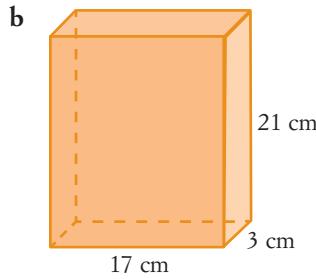
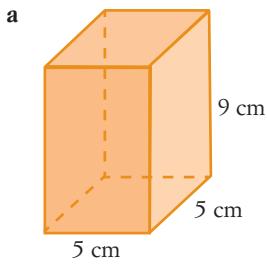
$$\begin{aligned} V &= lwh \\ &= 18 \times 12 \times 8 \\ &= 1728 \end{aligned}$$

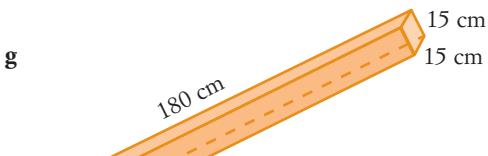
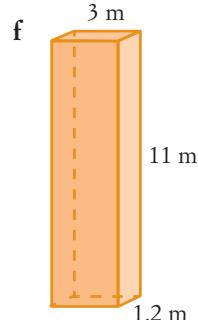
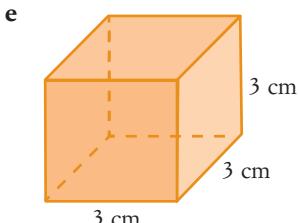
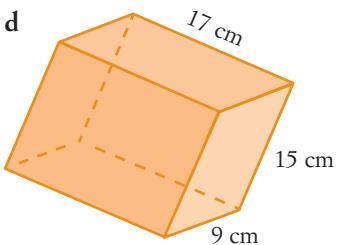
The volume is  $1728 \text{ cm}^3$ .

## Exercise 8-10 Volume of a rectangular prism

- 1 Find the volume of each prism.

**See Example 15**





2 Calculate the volume of each rectangular prism, given its dimensions shown in this table.

	Length	Width	Height
a	50 cm	50 cm	50 cm
b	5 cm	10 cm	18 cm
c	4 m	2.5 m	1.4 m
d	24 mm	16 mm	11 mm

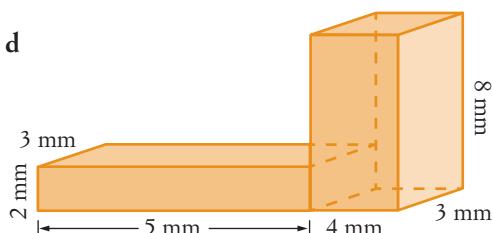
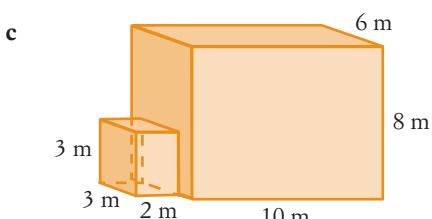
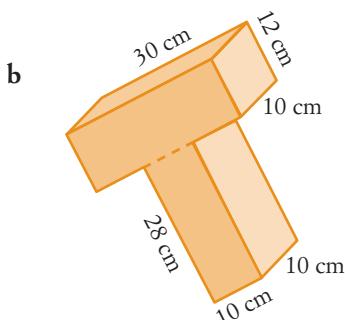
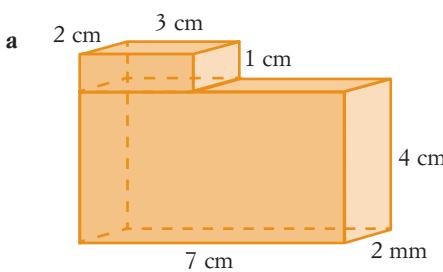
3 A rectangular prism has length 5 mm, width 3 mm and volume  $100 \text{ mm}^3$ . What is its height?

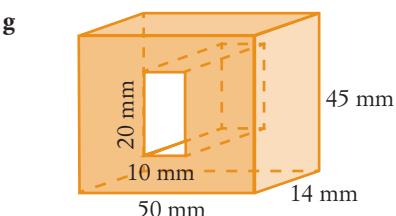
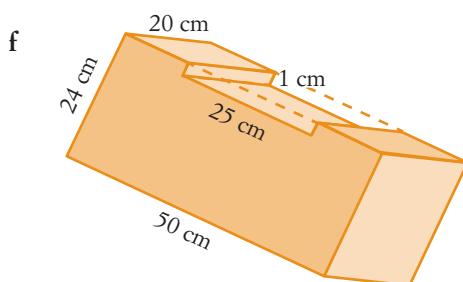
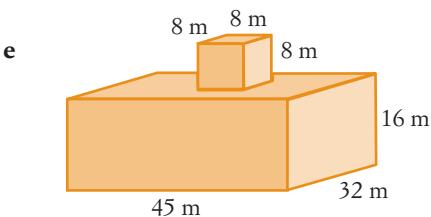
4 A tissue box has dimensions of 21 cm by 9 cm by 12 cm. Calculate its volume:

a in cubic centimetres

b in cubic millimetres

5 Find the volume of each composite prism.



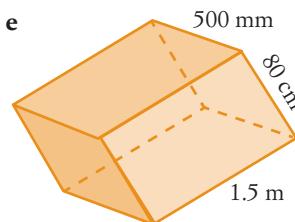
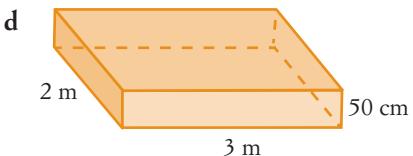
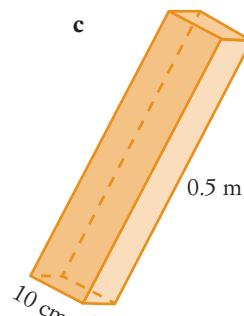
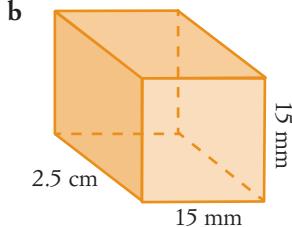
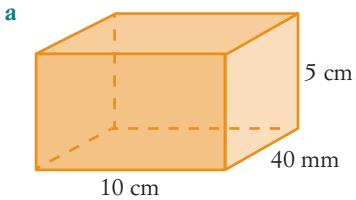





## Worked solutions

## Exercise 8-10

MAT07MGWS10053



- 9 A rectangular prism has a volume of  $880 \text{ cm}^3$ . What could its length, width and height be?

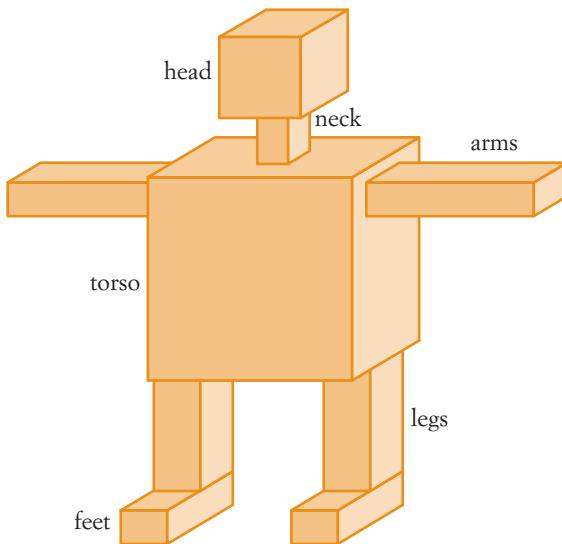
10 A rectangular garden is 12 m long and 4 m high. It is filled with soil to a depth of 15 cm. Calculate the volume of the soil. Select the correct answer **A**, **B**, **C** or **D**.

**A**  $0.72 \text{ m}^2$       **B**  $7.2 \text{ m}^2$       **C**  $72 \text{ m}^2$       **D**  $720 \text{ m}^2$

11 A cube has a volume of  $125 \text{ m}^3$ . What is its side length?

## Investigation: What is your volume?

Imagine that you are made up of rectangular prisms.



- With the help of a partner, make measurements of your body. Use them to find dimensions (to the nearest centimetre) for each of the prism body parts.
- Sketch each body part prism and label its dimensions.
- Use the prisms to find your volume, in  $\text{cm}^3$ .
- Write a report of what you did, showing all diagrams and calculations. Explain how you found the dimensions (length, width and height) for the prisms. Do you believe that you found a good approximation of your volume? Why?

## 8-11 Volume and capacity

Worksheet

Volume and capacity cards

MAT07MGWK10066

Worksheet

Volume and capacity

MAT07MGWK10067

Homework sheet

Volume and capacity

MAT07MGHS10026

'What is the capacity of the water tank?'

**Capacity** is the amount of fluid (liquid or gas) in a container.

The metric units of capacity are the litre (L), the millilitre (mL), the kilolitre (kL) and the megalitre (ML).

- A large drop of water is about 1 mL
- A teaspoon holds about 5 mL
- A tall standard carton of milk holds 1 L
- A small rainwater tank holds about 1 kL
- It takes 40 minutes to pump 1 kL of water out of a garden hose
- Half an Olympic-sized swimming pool holds about 1 ML



## Summary

$1 \text{ L} = 1000 \text{ mL}$

$1 \text{ kL} = 1000 \text{ L}$

$1 \text{ ML} = 1000 \text{ kL} = 1\,000\,000 \text{ L}$

Puzzle sheet

Capacity puzzle

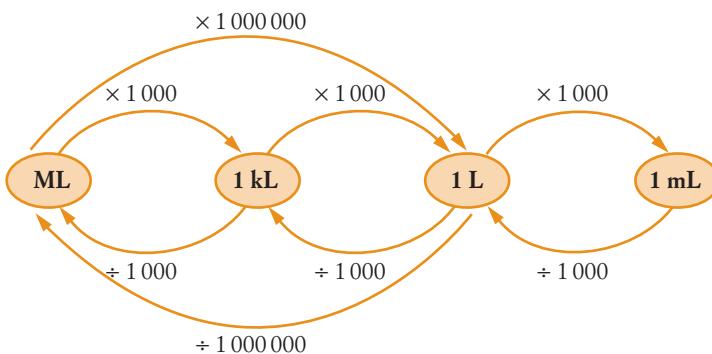
MAT07MGPS00048

Worksheet

Capacity

MAT07MGWK00078

This diagram shows how to convert between different units of capacity.



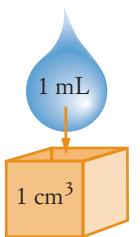
It is also useful to know the relationship between **volume** and **capacity**.

## Summary

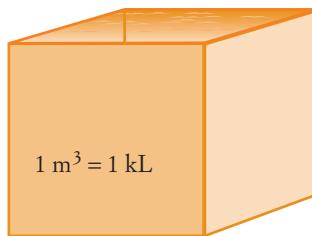
$1 \text{ cm}^3$  contains  $1 \text{ mL}$

$1 \text{ m}^3$  contains  $1 \text{ kL}$  or  $1000 \text{ L}$

This means that a cubic centimetre can hold  $1 \text{ mL}$  of liquid, while a cubic metre can hold  $1000 \text{ L}$  of liquid.



$$\times 1\,000\,000 =$$



## Exercise 8-11 Volume and capacity

1 State what unit of capacity you would use when measuring:

- |                        |                          |                       |
|------------------------|--------------------------|-----------------------|
| a a glass of milk      | b a dam                  | c a car's petrol tank |
| d a bottle of medicine | e an office water cooler | f a backyard pool     |

2 Copy and complete the following.

- |   |   |   |
|---|---|---|
| a $7000 \text{ mL} = \underline{\hspace{2cm}} \text{ L}$    | b $2.7 \text{ kL} = \underline{\hspace{2cm}} \text{ L}$   | c $3.5 \text{ L} = \underline{\hspace{2cm}} \text{ mL}$ |
| d $10\,000 \text{ L} = \underline{\hspace{2cm}} \text{ kL}$ | e $5200 \text{ kL} = \underline{\hspace{2cm}} \text{ ML}$ | f $1.4 \text{ ML} = \underline{\hspace{2cm}} \text{ L}$ |

Extra questions

Volume and capacity

MAT07MGEQ00048

<b>g</b> 420 L = _____ kL	<b>h</b> 8.9 L = _____ mL	<b>i</b> 6.2 mL = _____ kL
<b>j</b> 1750 mL = _____ L	<b>k</b> 5 kL = _____ L	<b>l</b> 9000 kL = _____ mL
<b>m</b> 2500 kL = _____ L	<b>n</b> 520 L = _____ kL	<b>o</b> 23 mL = _____ L

- 3** What is the capacity of a regular bottle of cough medicine? Select the closest answer **A**, **B**, **C** or **D**.
- A** 200 mL      **B** 500 mL      **C** 1500 mL      **D** 2000 mL
- 4** Match the correct capacity (**A** to **J**) with the items (**a** to **j**) listed.
- |                                |                   |
|--------------------------------|-------------------|
| <b>a</b> car petrol tank       | <b>A</b> 200 mL   |
| <b>b</b> a cup of flour        | <b>B</b> 23 kL    |
| <b>c</b> bath tub              | <b>C</b> 5 mL     |
| <b>d</b> bucket of water       | <b>D</b> 70 L     |
| <b>e</b> can of drink          | <b>E</b> 1250 mL  |
| <b>f</b> glass of water        | <b>F</b> 1.875 mL |
| <b>g</b> Olympic swimming pool | <b>G</b> 250 mL   |
| <b>h</b> bottle of lemonade    | <b>H</b> 9 L      |
| <b>i</b> teaspoon              | <b>I</b> 375 mL   |
| <b>j</b> water storage tank    | <b>J</b> 180 L    |
- 5** A jug holds 2 L of water. How many 250 mL glasses could be filled from it?
- 6** James is inviting 30 friends to a party. He calculates that each person will drink 1800 mL of soft drink.
- a** How many litres of soft drink must he buy?  
**b** If James intends to buy large 2 L bottles of drink, how many bottles must he buy?
- 7** Find out the name of the metric unit of capacity that is equal to 1000 megalitres.
- 8** A tap leaks 10 mL of water every 50 seconds. How much water will be lost in:
- a** 1 second?      **b** 1 minute?      **c** 3 hours?      **d** 1 day?
- 9** Your skin releases moisture as a way of controlling body temperature. On average 200 mL is released per hour. If all this moisture was captured, how long would it take to fill a 1.25 L soft drink bottle?
- 10** A lunch box is made in the shape of a rectangular prism. Its dimensions are 20 cm, 15 cm and 9 cm.
- a** Find the volume of the lunch box, in  $\text{cm}^3$ .  
**b** How many mL of water would fit in the lunch box?
- 11** Gina's swimming pool is a rectangular prism 8 m long, 4 m wide and 1.5 m deep.
- a** Find the volume of the swimming pool.  
**b** How many litres of water would be needed to fill the pool? (Hint:  $1 \text{ m}^3$  holds 1 kL)
- 12** A fish tank is a rectangular prism 60 cm long, 40 cm high and 30 cm wide.
- a** Find the volume of the tank.  
**b** How many litres of water will it hold?

Worked solutions

Exercise 8-11

MAT07MGWS10054

**Just for the record****Water, water, everywhere**

To help you better understand the size of a litre and a kilolitre, here are some examples of water use in and around the home:



• Washing your hands/face	5 L
• Brushing your teeth (tap running)	5 L
• Brushing your teeth (tap not running)	1 L
• Cooking and making coffee/tea	8 L per day
• Flushing the toilet	9 L to 13 L
• Flushing the toilet (half flush)	4.5 L to 6 L
• Household tap	18 L per minute
• Washing the dishes (hand)	18 L
• Washing the dishes (dishwasher)	25 L per cycle
• Bath	85 L to 150 L
• Shower (8 minutes)	80 L to 120 L
• Washing machine (front loading)	120 L per cycle
• Washing machine (top loading)	180 L per cycle
• Washing the car (with hose)	100 L to 300 L
• Garden sprinkler	1 kL to 1.5 kL per hour
• Garden hose	1.8 kL per hour
• Swimming pool (backyard)	20 kL to 55 kL
• Campbelltown swimming pool (Olympic 50 m)	1870 kL

On average, a four-person Sydney house (with garden) uses 936 litres of water per day. Half of it is used by outside taps or is flushed in a toilet.

**How much water does your household use each day? Find out by asking your parents to show you the water bill.**

## Technology Brogo and Windamere dams

Brogo Dam is situated near Bega on the south coast of NSW. Windamere Dam is between Dubbo and Newcastle. In this activity, we will examine the volume of water in the dams for each month of 2010.

- Start a new spreadsheet and enter only the labels and values in rows 1 and 3.  
(Note: ML = Megalitres.)

	A	B	C	D	E	F	G	H	I
1	Brogo Dam	Capacity=	8989	ML	Windamere Dam	Capacity =	368120	ML	
3	Date/Year	Volume (ML)	% Capacity		Date/Year	Volume (ML)	% Capacity		
4	1-Jan-10	1440			1-Jan-10	71607			
5	1-Feb-10	1068			1-Feb-10	69253			
6	1-Mar-10	9076			1-Mar-10	68456			
7	1-Apr-10	9018			1-Apr-10	67161			
8	1-May-10	8992			1-May-10	67164			
9	1-Jun-10	10258			1-Jun-10	67234			
10	1-Jul-10	9055			1-Jul-10	67738			
11	1-Aug-10	9032			1-Aug-10	71906			
12	1-Sep-10	9001			1-Sep-10	85247			
13	1-Oct-10	8898			1-Oct-10	98282			
14	1-Nov-10	8990			1-Nov-10	102291			
15	1-Dec-10	9157			1-Dec-10	110630			
16	Source: <a href="http://www.waterinfo.nsw.gov.au">www.waterinfo.nsw.gov.au</a>								

- Enter **1 Jan 2010** in cell A4 and **1 Feb 2010** in cell A5. **Highlight** cells A4 and A5, right-click and **Fill Down** until you finish at **1 Dec 2010**.
- Repeat (or copy) this for column F, cells F4 to F15.
- Enter the volume amounts in columns B and G.
- 'Capacity' refers to the total capacity of a dam. '% Capacity' calculates the volume as a percentage of the total capacity. To find the percentage capacity on 1 January 2010, enter **=B4/\$C\$1** in cell C4 and click %.
- Fill Down** the formula from cell C4 to C15. Notice that, by using an absolute cell reference (\$C\$1), each volume is divided by the same number (the dam's total capacity).

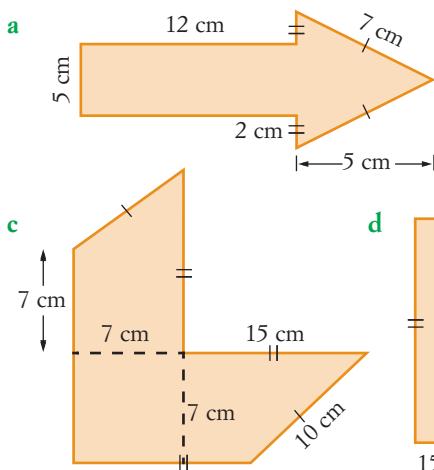
	A	B	C	D
1	Brogo Dam	Capacity=	8989	ML
3	Date/Year	Volume (ML)	% Capacity	
4	1-Jan-10	1440	16%	
5	1-Feb-10	1068	12%	
6	1-Mar-10	9076	101%	
7	1-Apr-10	9018	100%	

- Repeat the steps above in cells H4 to H15 to calculate Windamere Dam's percentage capacity.
- In cell A18, explain (in one sentence) why it is inappropriate to graph the % capacity for both dams on a single graph.
- State the driest month for:
  - Brogo Dam (answer in cell A19)
  - Windamere Dam (answer in B19).

- 10 State the wettest month for:
  - a Brogo Dam (A20)
  - b Windamere Dam (B20).
- 11 Use the '% Capacity' column to find the month which shows the lowest dam level for each dam. Answer in cell A21 (Brogo) and B21 (Windamere).
- 12 Describe what happened at Brogo Dam from February to March. (A22)
- 13 What do the % capacity values from March to December show? (A23)
- 14 Do you think this data can be used to find out which area is more suitable for the development of a new town in the region? Begin your answer in cell A24. Give reasons to support your answer.
- 15 Which dam seems to be located in an area more likely to receive rain? Give reasons to support your answer. Answer in cell A25.

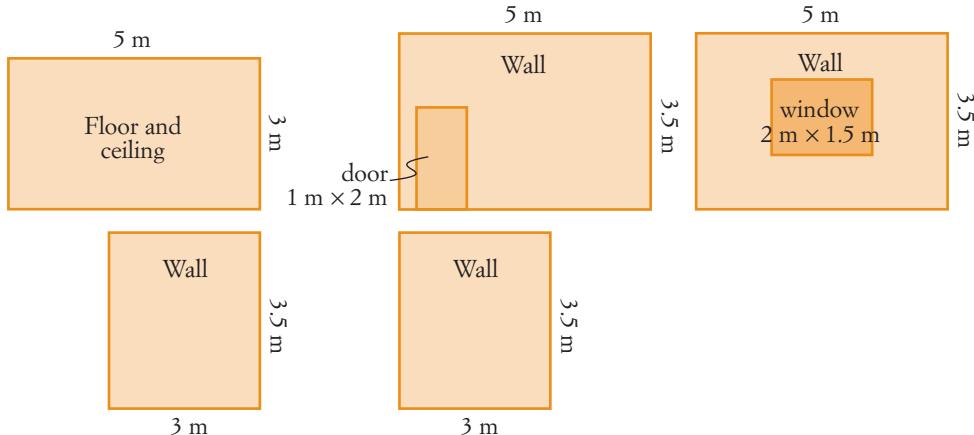
## Power plus

- 1 Find the perimeter and area of each shape.

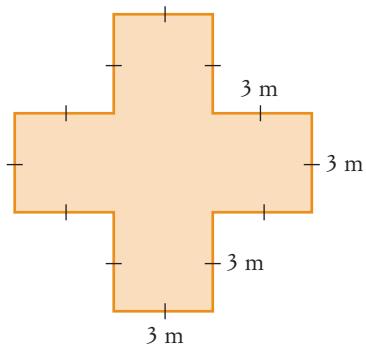


- 2 A rectangle has a perimeter of 30 cm.
  - a List some possible dimensions for this rectangle.
  - b For each pair of dimensions, calculate the area of the rectangle.
  - c Which dimensions give the greatest area?
- 3 Find the length and width of a rectangle whose perimeter value is equal to its area value.

- 4 A room has dimensions as shown.



- a The four walls and the ceiling are to be painted (not including the door and window). Calculate how many square metres are to be painted
- b Each surface requires two coats of paint, and 1 L of paint covers approximately  $12 \text{ m}^2$ . How many litres of paint are needed?
- c Paint comes in 4 L cans that cost \$45.95. Calculate how many 4 L cans are needed and calculate the cost of the paint.
- d The floor is to be carpeted. How many square metres of carpet are needed?
- 5 A children's pool is in the shape of a cross as shown on the right. Each side is 3 m long. The pool is filled with water to a depth of 300 mm.



- a Find the area of the pool's surface.
- b Calculate the volume of water in cubic metres ( $\text{m}^3$ ).
- c If water is charged for at \$0.80 per kL, how much does it cost to fill the pool?

## Language of maths

area	cubic	Mega-	perpendicular height
breadth	height	metric	prefix
capacity	isometric	micro-	prism
centi-	kilo-	milli-	square
composite shape	length	parallelogram	volume
cross-section	mass	perimeter	width

Puzzle sheet

Area and volume crossword

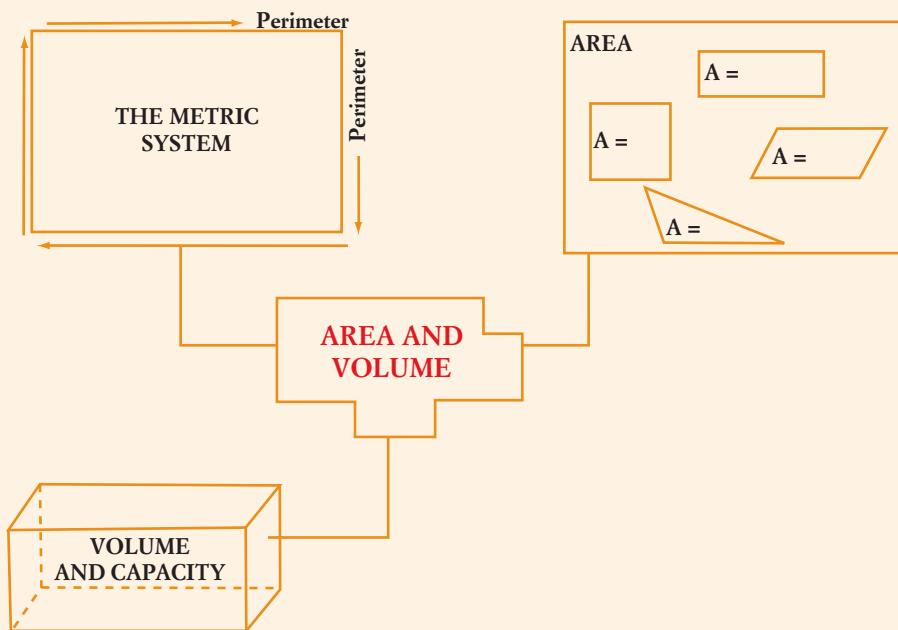
MAT07MGPS10033

- 1 Which Latin prefix means:
  - a one thousandth?
  - b one thousand?
- 2 What is another name for **width**?
- 3 In your own words, explain how you would calculate the perimeter of a square.
- 4 What does **perpendicular height** mean?
- 5 Complete: A prism has a uniform \_\_\_\_\_.
- 6 What is the difference between volume and capacity?

## Topic overview

- What have you learnt about measurement?
- What types of people use area as part of their jobs?
- List at least two measuring situations in which accuracy is important.
- Is there anything that you did not understand about the topic? Ask a friend or your teacher for help.

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



Worksheet

Mind map: Area and volume

MAT07MGWK10068

# Chapter 8 revision

See Exercise 8-01

1 Convert:

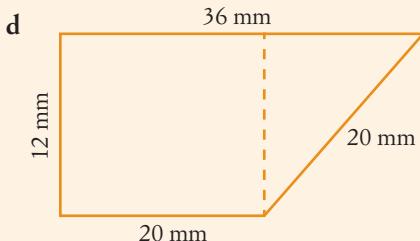
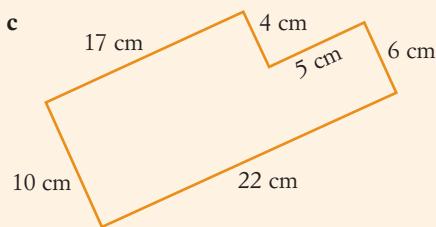
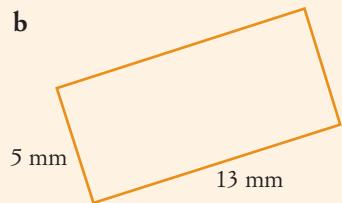
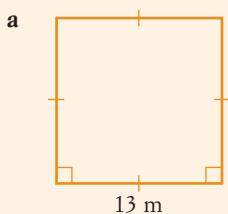
- a 240 min to h
- d 3200 m to km
- g 3.5 kg to t
- j 7150 mm to m

- b 0.042 kg to g
- e 8.3 L to mL
- h 15 h to min
- k 4.2 kL to mL

- c 125 L to kL
- f 904 cm to mm
- i 15 h to s
- l 17 000 000 mg to kg

See Exercise 8-02

2 Find the perimeter of each shape.



See Exercise 8-03

3 How many:

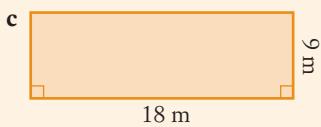
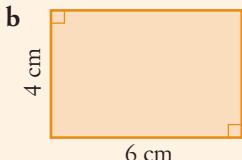
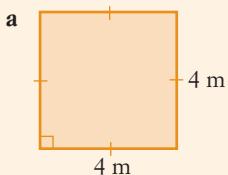
- a  $\text{cm}^2$  in  $9.1 \text{ m}^2$ ?
- d  $\text{m}^2$  in  $240\ 000 \text{ mm}^2$ ?

- b  $\text{mm}^2$  in  $2.5 \text{ cm}^2$ ?
- e  $\text{cm}^2$  in  $240 \text{ mm}^2$ ?

- c  $\text{m}^2$  in  $175\ 000 \text{ cm}^2$ ?
- f  $\text{mm}^2$  in  $8.6 \text{ m}^2$ ?

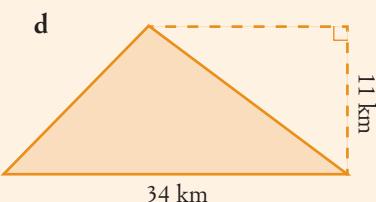
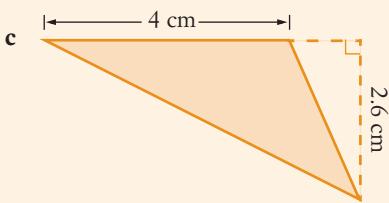
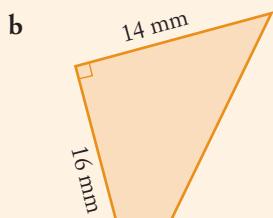
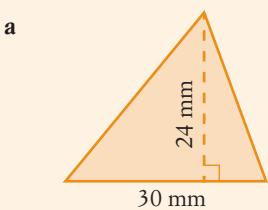
See Exercise 8-04

4 Find the area of each shape.



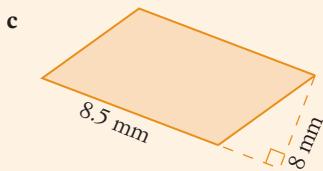
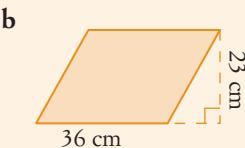
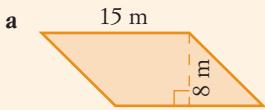
5 Find the area of each shape.

See Exercise 8-05



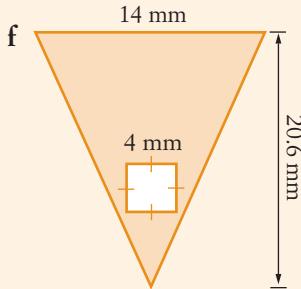
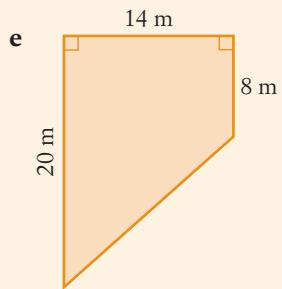
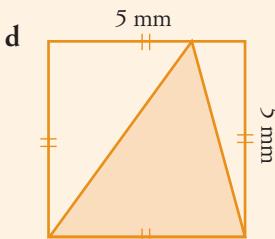
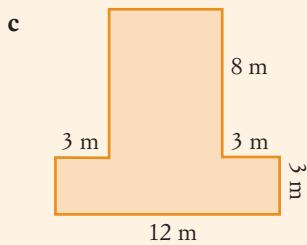
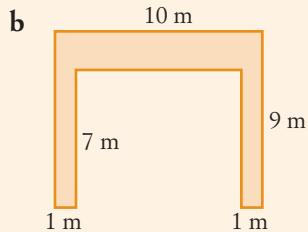
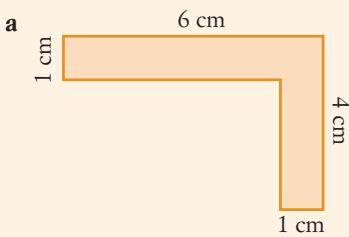
6 Find the area of each parallelogram.

See Exercise 8-06



7 Find the shaded area in each shape.

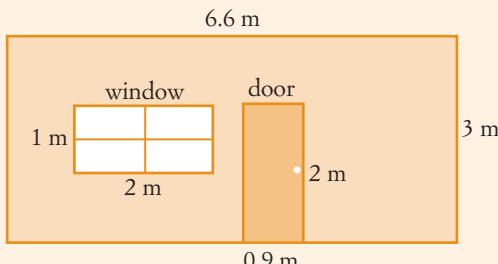
See Exercise 8-07



# Chapter 8 revision

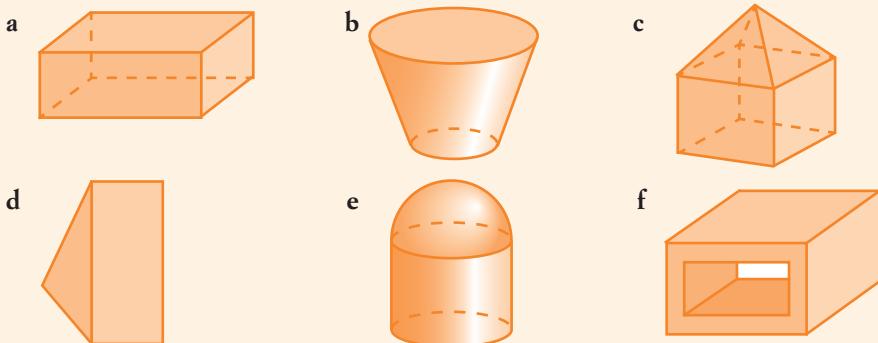
See Exercise 8-07

- 8 The wall shown in the diagram needs painting. If one litre of paint covers  $3 \text{ m}^2$  of wall, how many whole litres should be bought?



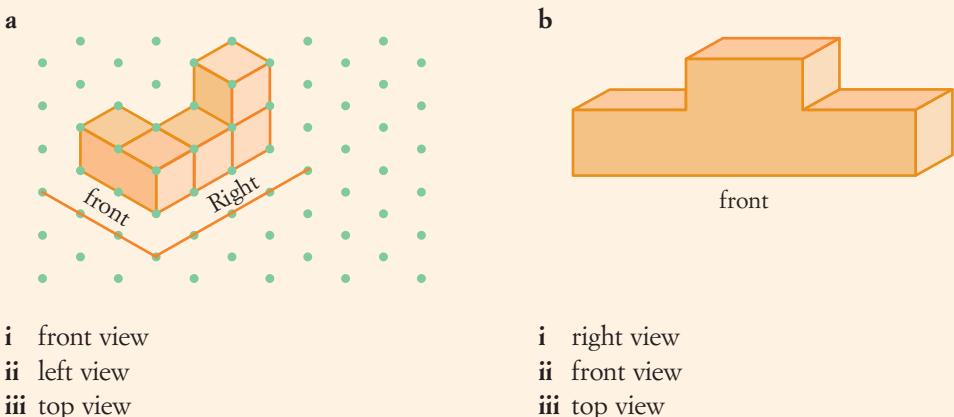
See Exercise 8-08

- 9 Draw a cross-section of each solid and state whether it is a prism.



See Exercise 8-08

- 10 For each solid, sketch each view requested.



See Exercise 8-09

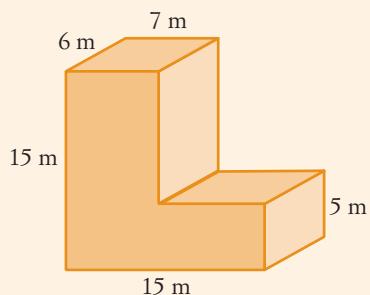
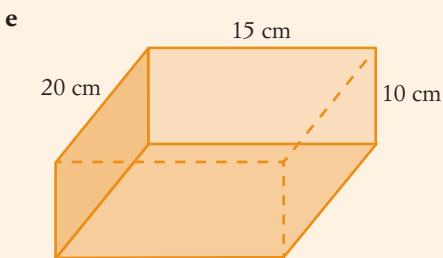
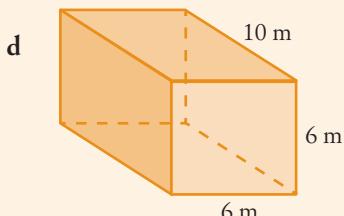
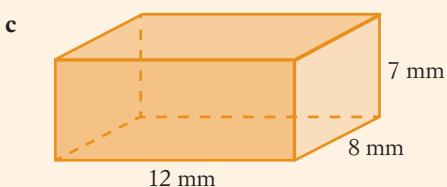
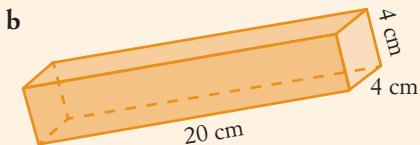
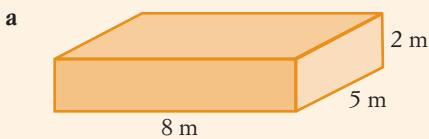
- 11 Copy and complete the following.

a  $20 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ mm}^3$   
c  $7500 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

b  $0.5 \text{ m}^3 = \underline{\hspace{2cm}} \text{ cm}^3$   
d  $230\,000 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ m}^3$

- 12** Find the volume of each prism.

See Exercise 8-10



- 13** Find the capacity, in litres, of each prism in question 12.

See Exercise 8-11

- 14** The biggest iceberg on record was called B9. It had the same volume as a rectangular prism with dimensions 160 km long, 50 km wide and 250 metres high. When B9 melted, how many megalitres of water were contained in B9?

See Exercise 8-11

