

# Investigation

## Paddocks

**Equipment required:**  
1 brain, graph paper

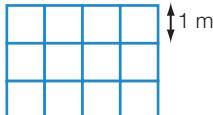
### The Big Question

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



### Engage

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



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

Dimensions of shape	Area ( $\text{m}^2$ )	Perimeter (m)
$1 \times 12$		
$2 \times 6$		
$3 \times 4$		

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

### Explore

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



#### Strategy options

- Draw a diagram.
- Test all possible combinations.

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

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

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

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

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

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



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

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

## Explain

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

## Elaborate

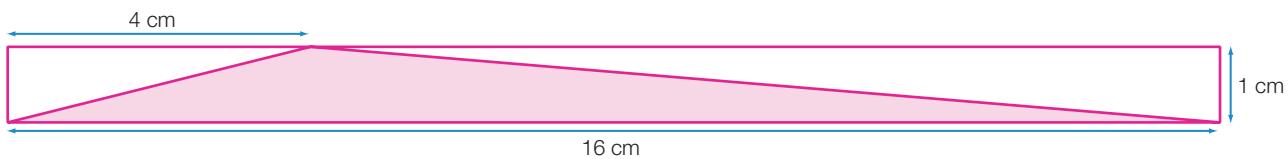
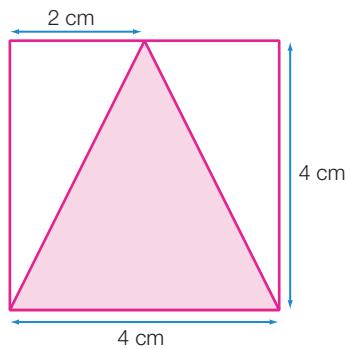
- 6 Answer the Big Question by stating which of the three paddocks you think the farmer should choose, giving reasons for your choice.

## Evaluate

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

## Extend

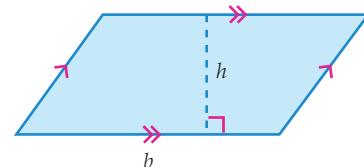
- 8 Investigate the perimeter and the area of other shapes by looking at the triangles below. Each triangle has an area of  $8 \text{ cm}^2$ .
- (a) Copy them onto graph paper using the actual measurements given in the diagrams. Then measure the perimeter of each triangle with a ruler.
- (b) Which triangle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



# 6.4

# Area of a parallelogram

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

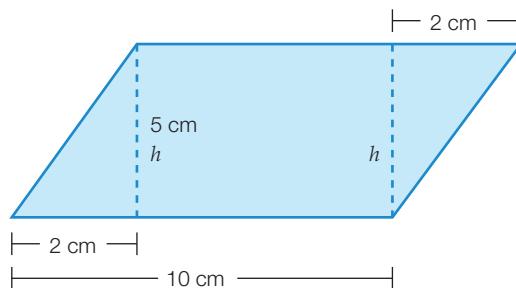


## Developing a formula for area

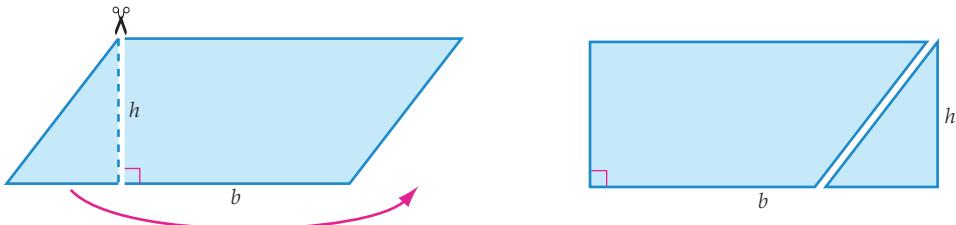
We can find a formula for calculating the area of a parallelogram by cutting and rearranging it into a familiar shape—a rectangle.

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

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



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



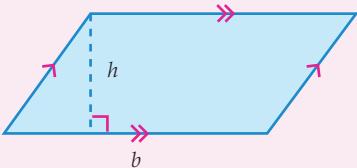
The base and height of the parallelogram become the length and width of a rectangle, and so we can multiply them together to find the area.

### Area of a parallelogram

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

$$A = bh$$

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

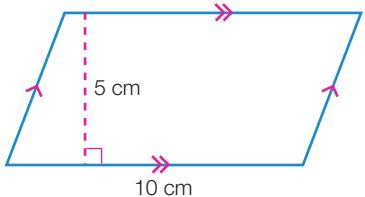


## Worked Example 7

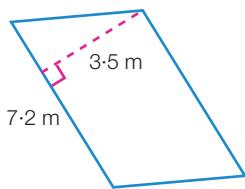
WE7

Find the area of each of the following parallelograms.

(a)



(b)



### Thinking

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

### Working

$$\begin{aligned} (a) \quad & A = bh \\ & A = 10 \times 5 \\ & A = 50 \text{ cm}^2 \end{aligned}$$

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

$$\begin{aligned} (b) \quad & A = bh \\ & A = 7.2 \times 3.5 \\ & A = 25.2 \text{ m}^2 \end{aligned}$$



# 6.4 Area of a parallelogram

## Navigator

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

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

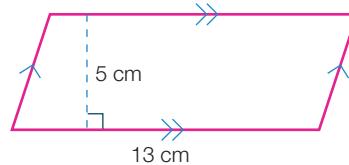
Q1 (e)–(f), Q2, Q3, Q4, Q5, Q7,  
Q8, Q9, Q10, Q11

## Fluency

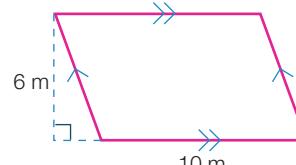
**WE7**

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

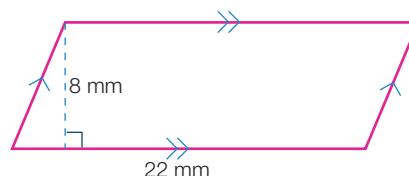
(a)



(b)



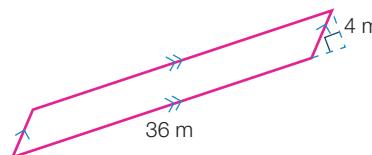
(c)



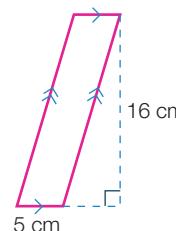
(d)



(e)

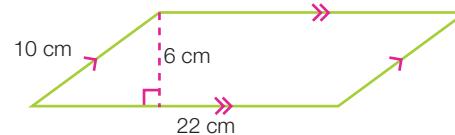


(f)



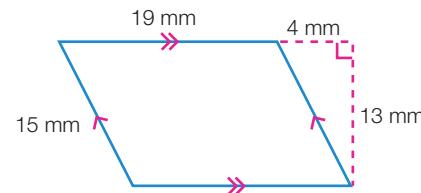
- 2 (a) Find the area of this parallelogram, in  $\text{cm}^2$ :

- (b) Find the perimeter, in cm.



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

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



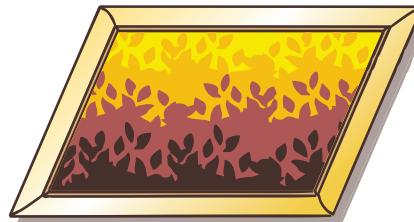
- (b) A parallelogram with a base length of 14 m, a sloping side length of 5 m and a height of 4 m has an area of:

- |                    |                    |                    |                    |
|--------------------|--------------------|--------------------|--------------------|
| A $20 \text{ m}^2$ | B $28 \text{ m}^2$ | C $56 \text{ m}^2$ | D $70 \text{ m}^2$ |
|--------------------|--------------------|--------------------|--------------------|

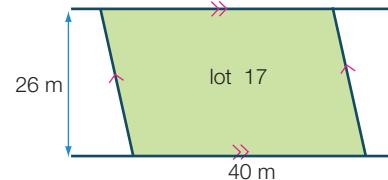
## Understanding

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

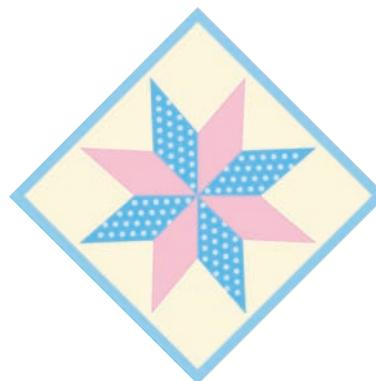
- 5 The picture frame shown has a height of 15 cm and encloses an area of  $300 \text{ cm}^2$ . What is the base length of the picture frame?



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

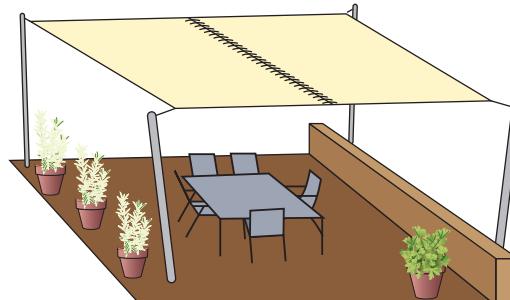


- 7 (a) How many identical parallelograms are shown in the quilt pattern below? (Ignore the different colours.)  
 (b) If a single parallelogram has a base length of 8.5 cm and a height of 6.5 cm, calculate the area of material required for all of the parallelograms on the quilt.



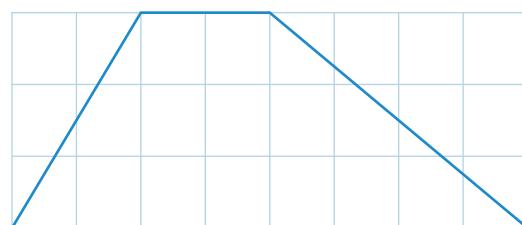
## Reasoning

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



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

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



## Open-ended

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

# 6.5

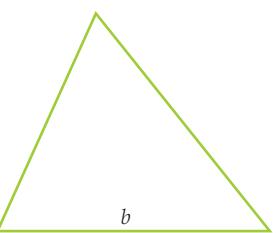
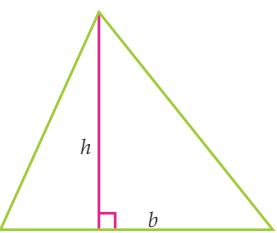
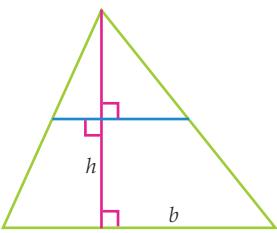
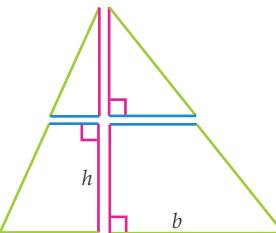
# Area of triangles and composite shapes

## Area of a triangle

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

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



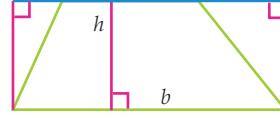
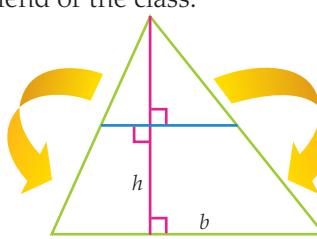
 <p>1 Use a ruler and a pencil to draw a triangle. So it is easy to work with, the side lengths should be at least 10 cm long. Label one side as the base, <math>b</math>.</p>	 <p>2 Rule a line from the apex (the point at the top) of the triangle to the base. The line should be perpendicular (at an angle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

Now:

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

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

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



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

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

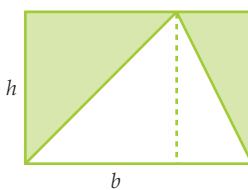
So, instead of writing  $A = \text{length} \times \text{width}$ , we can write:

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

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

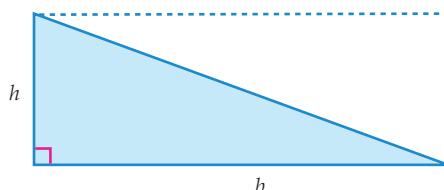
### Another way of looking at it

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



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

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

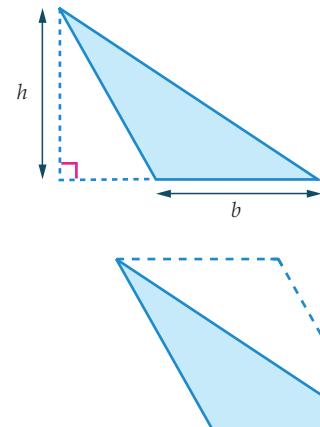


For some triangles, such as this one, the perpendicular height is measured outside of the triangle. We can find the height by extending the base, then drawing a perpendicular line from this extension to the opposite vertex. These triangles also follow the rule  $A = \frac{bh}{2}$ .

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

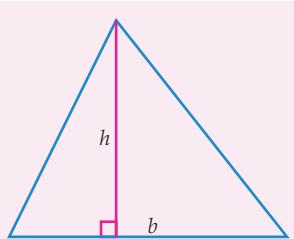
The area of the parallelogram is  $bh$ .

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



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

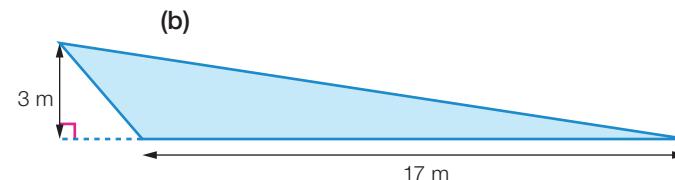
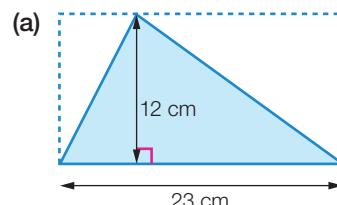
$$A = \frac{bh}{2}$$



## Worked Example 8

WE8

Calculate the area of the following triangles.



### Thinking

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

### Working

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

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

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

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

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

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

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

## Composite shapes

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

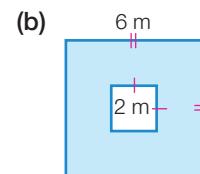
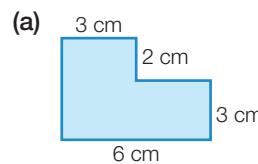


To find the area of a composite shape we divide it up into shapes that we can find the area of, then add or subtract the area of each individual shape.

## Worked Example 9

WE9

Calculate the shaded area of the following composite shapes.



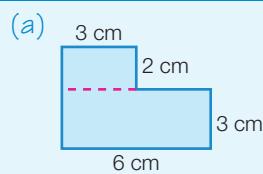


## Thinking

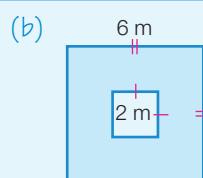
- (a) 1 Split the composite shape into recognisable shapes. (This may be done in different ways.)
- 2 Write the area of the composite shape as the sum of the areas of the individual shapes.
- 3 Calculate each of the smaller areas.
- 4 Perform the addition by writing the answer with the appropriate units.

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

## Working



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



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

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

## 6.5 Area of triangles and composite shapes

### Navigator

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

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

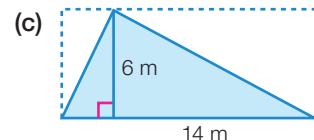
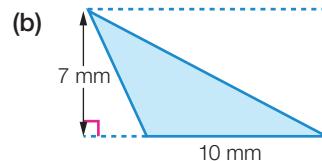
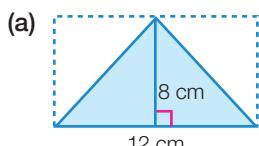
Q1 Column 3, Q2, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14

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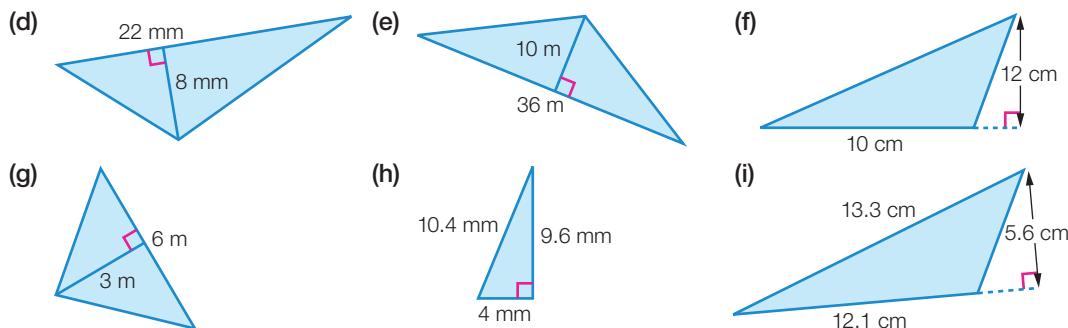
**Equipment required:** A calculator may be used for Questions 2, 4, 6, 8 and 9

### Fluency

- 1 Calculate the area of the following triangles.



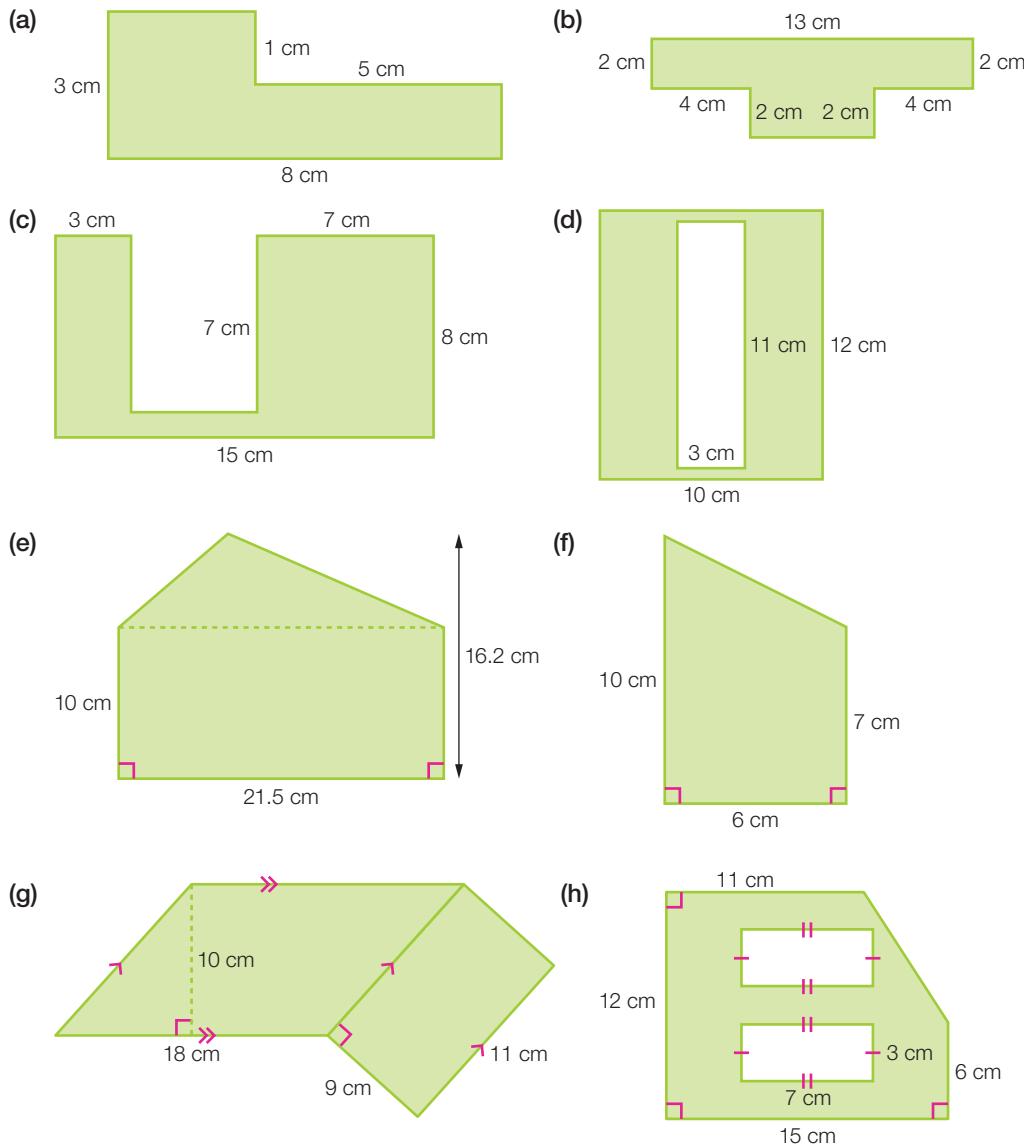
**W.E.8**



2 Calculate the shaded area of the following composite shapes.

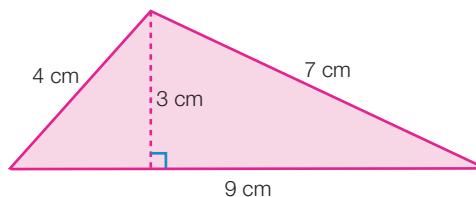
**WE9**

There is sometimes more than one way to split up a composite shape. Look for the easiest way.



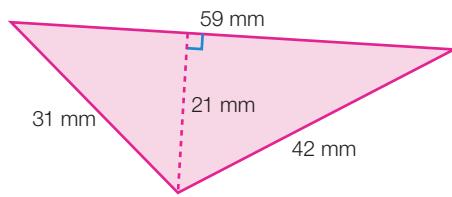
3 (a) In the diagram, the height of the triangle is:

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



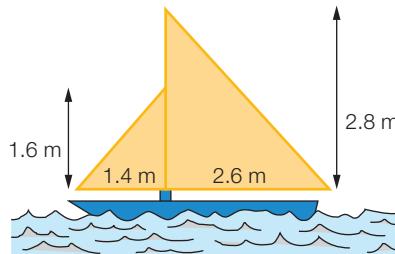
- (b) The base length of the triangle is:

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

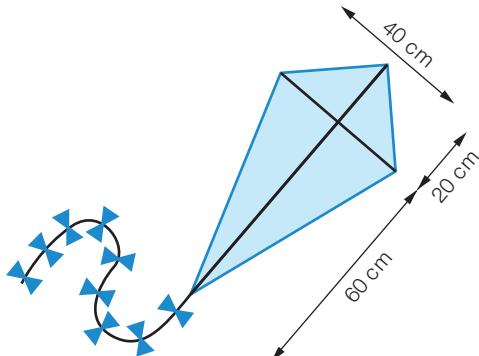


## Understanding

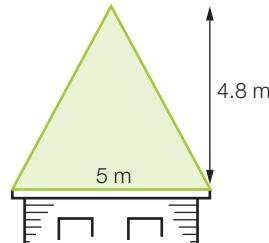
- 4 Find the total area of the sails on this yacht.



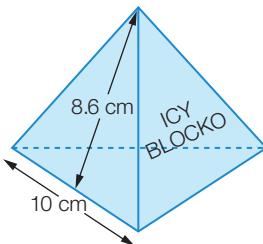
- 5 Find the area of paper required to build the kite shown.



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

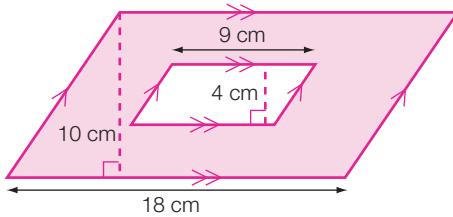


- 7 Find the total area of the four identical triangular faces of the container of frozen drink (a Tetrapak) shown.

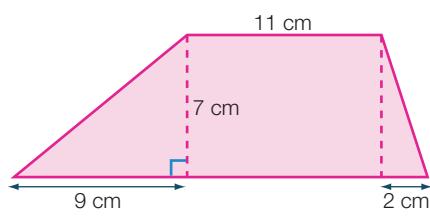


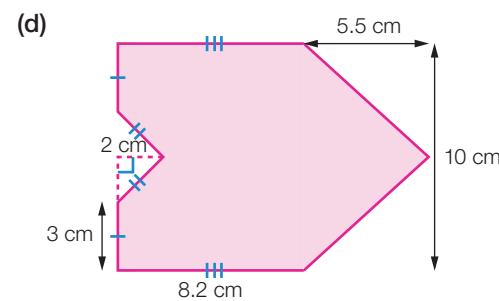
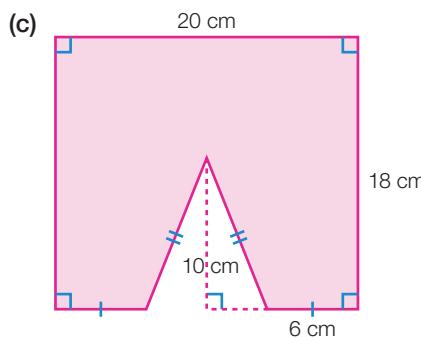
- 8 Find the area of each of the following composite shapes.

(a)



(b)

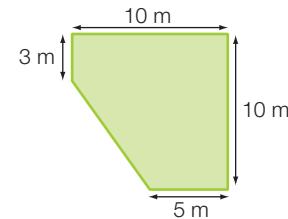




- 9 Terry is having a doorway put in one of the walls of his house.
- If the wall is 5 m long and 2.4 m high, and the doorway measures 0.82 m by 2 m, what area of wall will remain after the doorway is completed?
  - The architraves go along the sides and top of the doorway. What length of architraves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

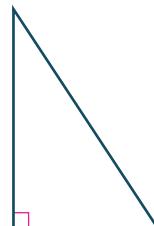
### Reasoning

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



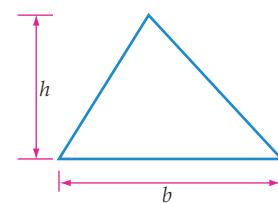
- 11 This triangle can be cut into two pieces to form a rectangle.

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



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

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



### Open-ended

- 13 A triangle has an area of  $36 \text{ cm}^2$ . Give two possible combinations for the triangle's base length and height.
- 14 The difference in area between a rectangle and a triangle is  $12 \text{ cm}^2$ . Draw a possible example of the pair, showing their dimensions.



# Volume

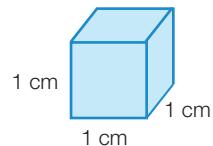
# 6.6

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

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

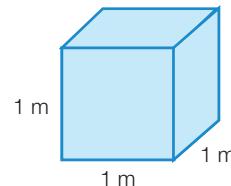
We can measure the volume of an object by counting or calculating the number of cubic centimetres that would fit inside it. A cubic centimetre ( $\text{cm}^3$ ) is a cube with a length, width and height of 1 cm. The volume of larger objects may be measured in cubic metres ( $\text{m}^3$ )—a cube with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

A cubic centimetre



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

A cubic metre



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

Note that this cube is not drawn to scale.



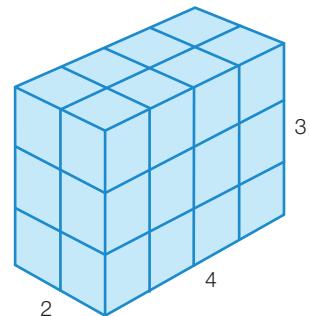
$\text{mm}^3$	$\text{cm}^3$	$\text{m}^3$
The volume of a red head on a match is about $4 \text{ mm}^3$ .	The volume of a die is about $1 \text{ cm}^3$ .	The volume of a standard dishwasher is just over $1 \text{ m}^3$ .

The symbol, ' $\text{cm}^3$ ', can be said in two ways: 'cubic centimetres' or 'centimetres cubed'.

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

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

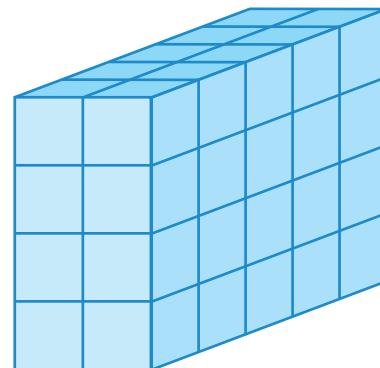
The rectangular prism shown here has 8 cm cubes on its top face, and 3 layers of cubes. Its volume is  $8 \times 3 = 24 \text{ cm}^3$ .



## Worked Example 10

WE10

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



### Thinking

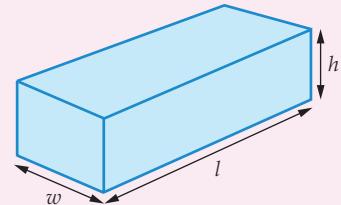
- Find the number of squares on the top face of the prism.
- Find the height of the prism.
- Work out the total number of cubes.

### Working

There are 10 squares on the top face.  
It is 4 units high.  
 $10 \times 4 = 40 \text{ cubes}$   
 $= 40 \text{ cm}^3$

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

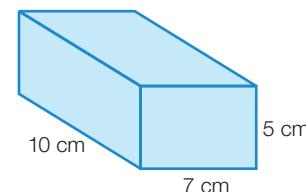
$$V = l \times w \times h$$



## Worked Example 11

WE11

Find the volume of the following rectangular prism in  $\text{cm}^3$ .



### Thinking

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

### Working

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

# 6.6 Volume

## Navigator

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

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

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

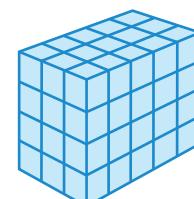
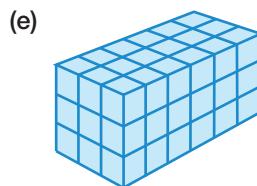
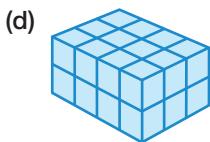
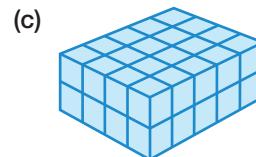
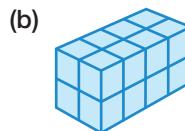
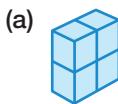
**Answers  
page 660**

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

## Fluency

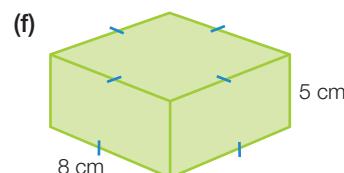
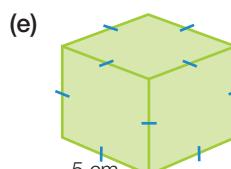
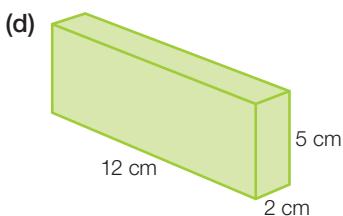
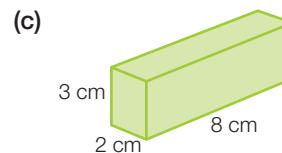
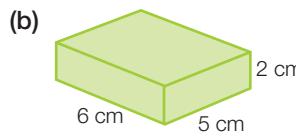
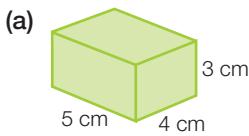
- 1 How many cubic centimetres are there in the following rectangular prisms? (Each small cube represents  $1 \text{ cm}^3$ .)

**WE 10**



- 2 Find the volume of the following rectangular prisms in  $\text{cm}^3$ .

**WE 11**



- 3 A room is 3 m long, 2 m wide and 2 m high. What is its volume in metres cubed?

- 4 A pocket dictionary has a cover 12 cm long and 9 cm wide and is 2 cm thick. Find the volume of this book.

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

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

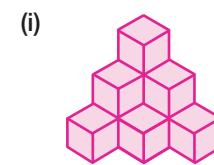
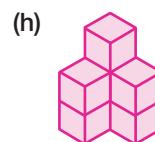
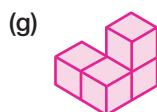
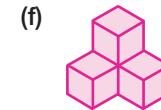
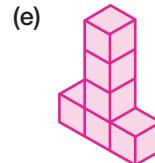
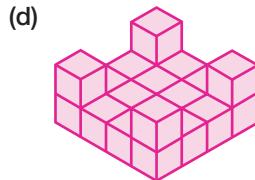
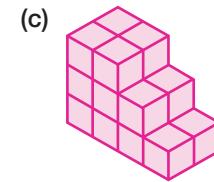
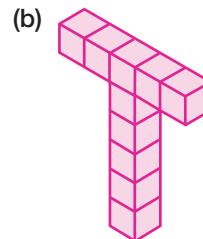
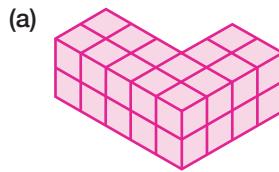
A  $35 \text{ cm}^3$       B  $100 \text{ cm}^3$       C  $700 \text{ cm}^3$       D  $1000 \text{ cm}^3$

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

A  $11.25 \text{ m}^3$       B  $112.5 \text{ cm}^3$       C  $11250 \text{ cm}^3$       D  $1125000 \text{ cm}^3$

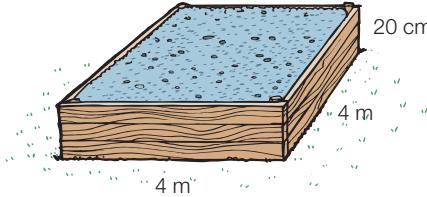


- 6 Find the volume of each of these compound solids by counting the number of centimetre cubes.



## Understanding

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



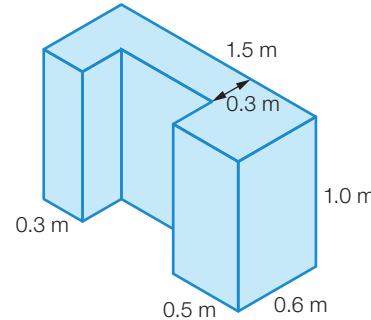
- 8 If a cake in the shape of a rectangular prism is 20 cm long, 15 cm wide and 6 cm thick when baked, what will its volume be after it is iced all over (including the bottom) with a layer of icing 0.5 cm thick?



Divide the solid into rectangular prisms.



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





## Reasoning

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

## Open-ended

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



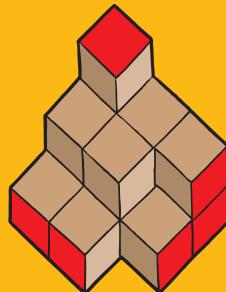
## Outside the Square

### Problem solving

#### The red cube

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

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



#### Strategy options

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