4 2D shapes and 3D solids

4.1 Area of triangles, parallelograms and trapezia

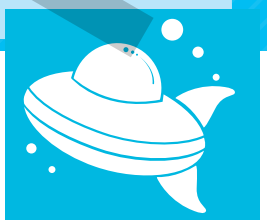
You will learn to:
- Derive and use the formula for the area of a triangle and a parallelogram.
- Know and use the formula for the area of a trapezium.

Confidence

Why learn this?
Architects and engineers need to work out the areas of various shapes so that they can design and construct interesting buildings.

Fluency
Work out the missing numbers.
- $\frac{1}{2} \times 8 \times 7 = \square$
- $\frac{1}{2} \times 3 \times 6 = \square$
- $7 \times \square = 35$
- $\frac{1}{2}(5 + 3) \times 10 = \square$

What does perpendicular mean?



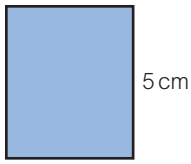
Explore
What different shapes can you make from fitting two triangles together?

Exercise 4.1

Warm up

1 Work out the area of each shape.

a



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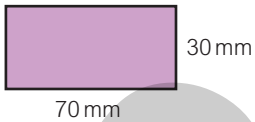

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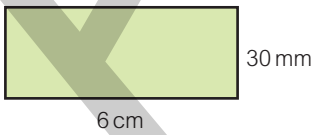
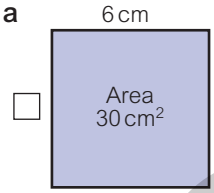


2 Work out the missing side length for each shape.

a



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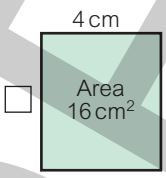

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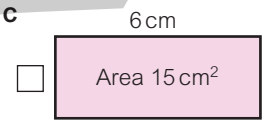


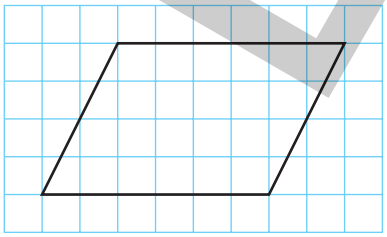
3 Substitute $a = 4$, $b = 5$ and $c = 2$ into these expressions.

a $\frac{1}{2}ab$ **b** $(c + b) \times a$ **c** $\frac{1}{2}(a + b)c$

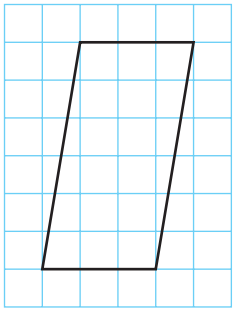
4 Reasoning

a Copy these parallelograms on to centimetre squared paper. Label them **A** and **B**.

A



B



Q1c hint
Both sides need to be in the same units.

Q2 Literacy hint
Read 'cm²' as 'square centimetres'.

Topic links: Using formulae, Properties of 2D shapes

b Find the area of each parallelogram by counting squares.

c Write the measurements for each parallelogram in a table like this.

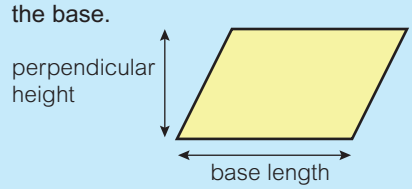
Parallelogram	Base length (cm)	Perpendicular height (cm)	Area (cm^2)
A			

d What do you notice about the relationship between the base length, perpendicular height and area of a parallelogram?

e Copy and complete this formula.
Area of a parallelogram = _____

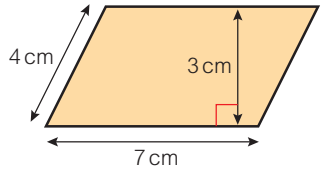
Q4c hint

The **perpendicular height** is the height measured at right angles to the base.



5 Work out the area of each parallelogram.

a



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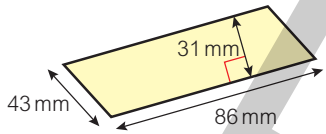


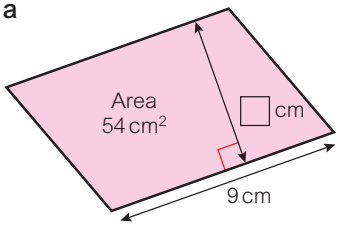
Key point

Area of a parallelogram
= base length × perpendicular height
= $b \times h$
= bh

The height measurement *must* be perpendicular (at 90°) to the base.

6 Work out the missing measurement for each shape.

a



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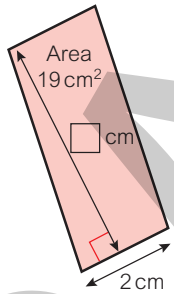

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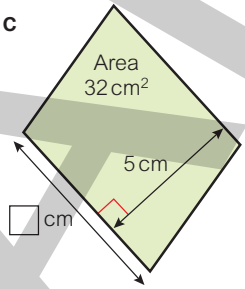
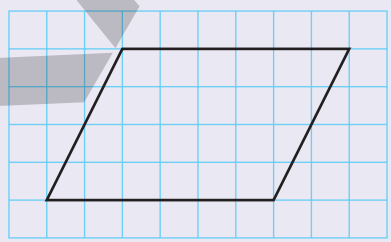


Investigation

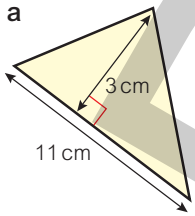
Reasoning

1. Copy this parallelogram on to squared paper.
2. Calculate the area of the parallelogram.
3. Split the parallelogram in half to make two triangles.
4. What is the area of one of the triangles?
5. Complete these formulae.
   - Area of a parallelogram =
   - Area of a triangle =



7 Work out the area of each triangle.

a



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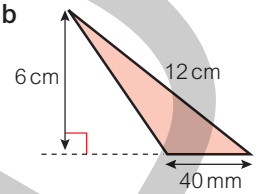

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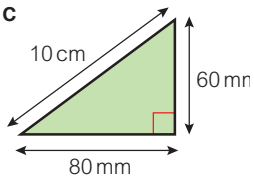
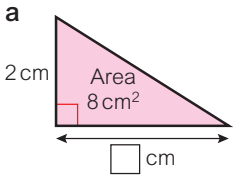


Key point

Area of a triangle
= $\frac{1}{2}$ × base length × perpendicular height
= $\frac{1}{2} \times b \times h$
= $\frac{1}{2}bh$

8 Work out the missing measurement for each triangle.

a



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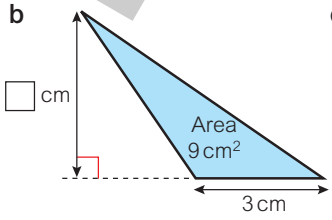

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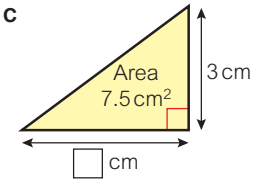
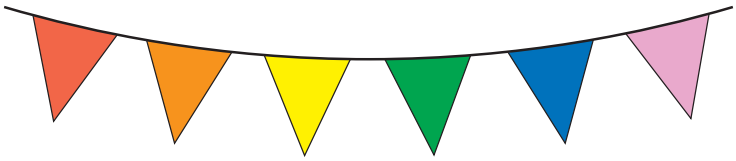


Q8 hint

Substitute the values you know into the formula
Area = $\frac{1}{2}bh$
Then solve the equation.

9 **Real / Problem-solving** Meena is making some bunting.
Each flag is a triangle of height 40 cm and base 25 cm.
She wants to make 12 triangles.
Work out the total area of material that she needs.



Q9 Strategy hint

Sketch the triangle.

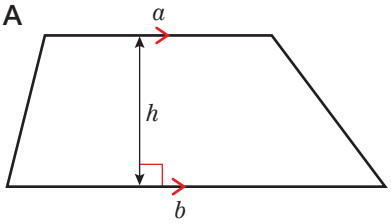
10 **Problem-solving** Draw as many right-angled triangles as you can with an area of 12 cm^2.
Discussion How will you know when you have drawn them all?

Q10 hint

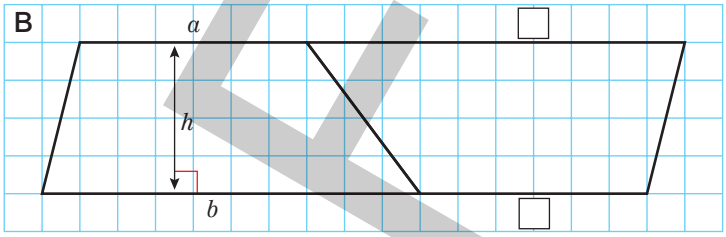
Use whole number lengths only.

11 **Reasoning** Diagram A shows a trapezium. Diagram B shows two identical trapeziums put together.

A



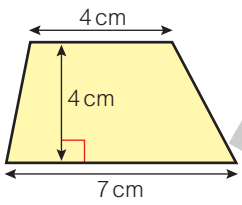
B



a What letters go in the two empty boxes in diagram B?
b What new shape has been made?
Copy and complete these sentences.
c The length of the base of the parallelogram is ☐ + ☐
d The area of the parallelogram is ☐ × ☐
e The area of one trapezium is ☐

12 Work out the area of each trapezium.

a



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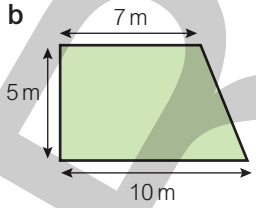
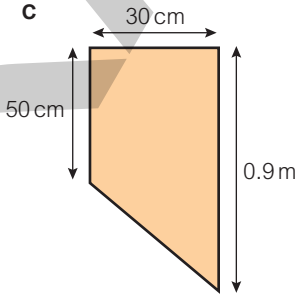
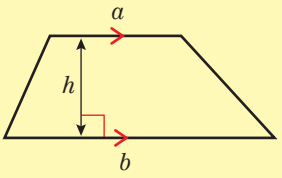


c

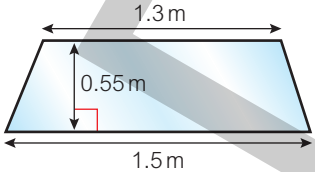


Key point

Area of a trapezium = $\frac{1}{2}(a + b)h$



13 **Real / Finance** Car windscreen glass costs £325 per square metre.
Work out the cost of the glass for this car windscreen.



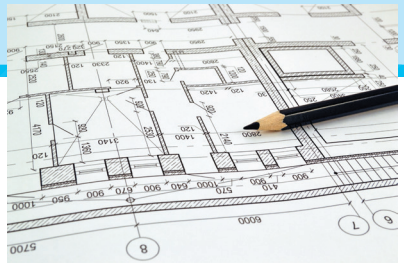
14 **Explore** What different shapes can you make from fitting two triangles together?
What have you learned in this lesson to help you answer this question?
What other information do you need?

15 **Reflect** After this lesson, Halima says, 'Area is length × width.'
Shazia says, 'The area is the amount of space something takes up.'
Use what you have learned in this lesson to improve Shazia's definition.

ActiveLearn Homework, Year 8, Unit 4

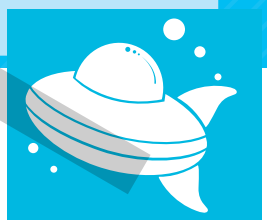
4.2 Area of compound shapes

You will learn to:
- Calculate the area of compound shapes made from rectangles and triangles.



Why learn this?
Real estate agents need to calculate areas of floor plans when selling properties

Fluency
Work out
- $\frac{1}{2} \times 2 \times 3 + \frac{1}{2} \times 4 \times 3$
- $5 \times 6 - \frac{1}{2} \times 4 \times 3$
- $\frac{1}{2} \times 7 \times 4 - \frac{1}{2} \times 1 \times 8$



Explore
How much does it cost to paint the front of a house?

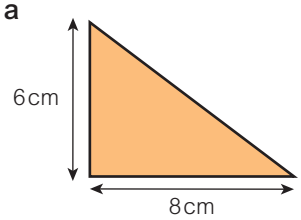
Confidence

Warm up

Exercise 4.2

1 Calculate the area of these triangles.

a



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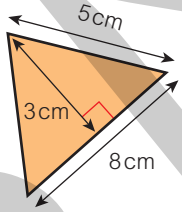

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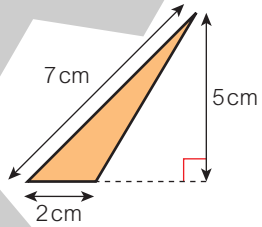
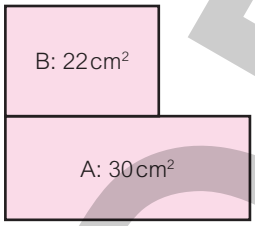


2 Find the total area of each of these compound shapes.

a



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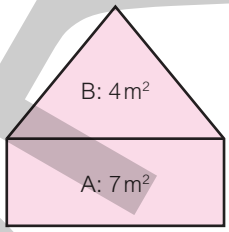

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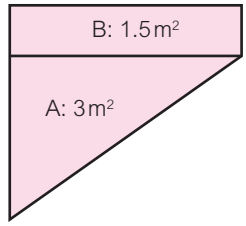
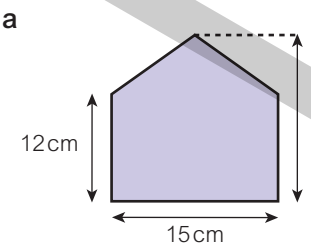


3 Copy these shapes and split them into triangles and rectangles. Write the height and width of each part.

a



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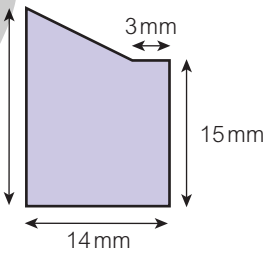


Rectangle: base = ☐ height = ☐
Rectangle: base = ☐ height = ☐ Triangle: base = ☐ height = ☐
Triangle: base = ☐ height = ☐

4 Copy and complete to find the total area of the shape.

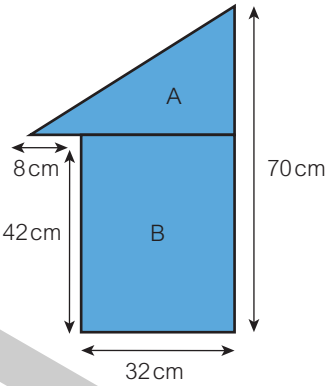
Triangle A: base: 32 + 8 = ☐ height: 70 – 42 = ☐

Area of triangle A = $\frac{1}{2}$ × ☐ × ☐ = ☐

Rectangle B: base: ☐ height: ☐

Area of rectangle B = ☐ × ☐ = ☐

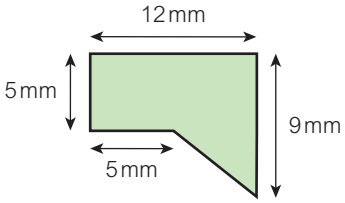
Total area = ☐ + ☐ = ☐



5 Find the total area of the shapes in Q3.

6 Calculate the area of each shape. Give the units with your answer.

a



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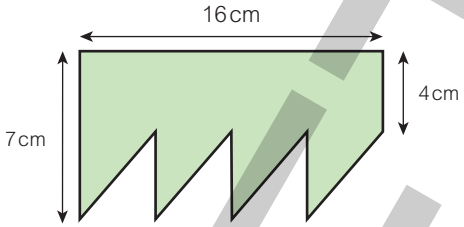
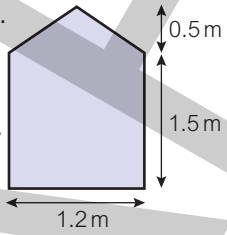


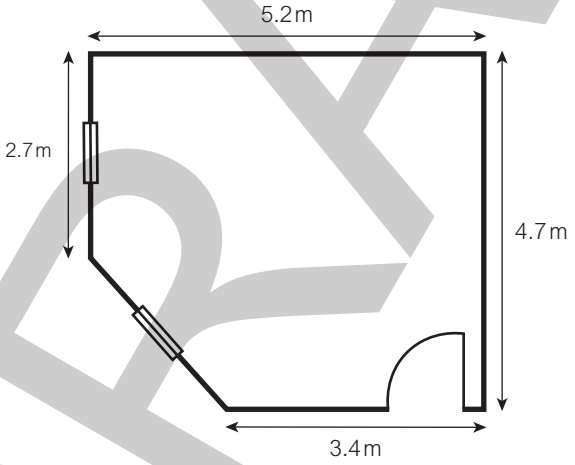
7 **Real** Samir makes stained glass windows like this.

a What is the area of the window?
Give your answer in square metres.
The stained glass costs $153 per square metre.

b What is the cost of the glass for this window?

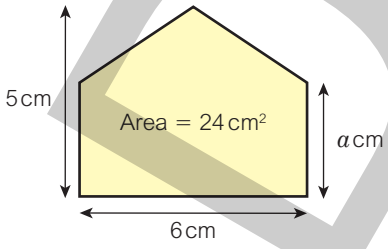


8 **Real** This is the floor plan of a living room. Calculate the area of the floor.



9 **Problem-solving** Find the missing sides of these shapes.

a



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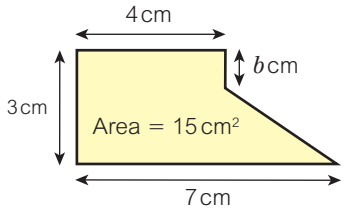
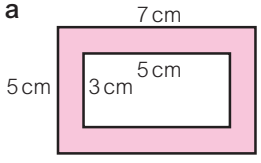
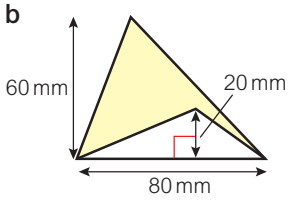


10 **Problem-solving** Work out the shaded area of each shape.

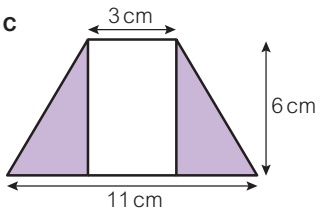
a



b



c



Q5 hint

Find the area of the rectangle and the triangle first, then add the areas together.

Q7a hint

Split the window into a rectangle and a triangle.

Q8 hint

Split the shape up into two rectangles and one triangle.

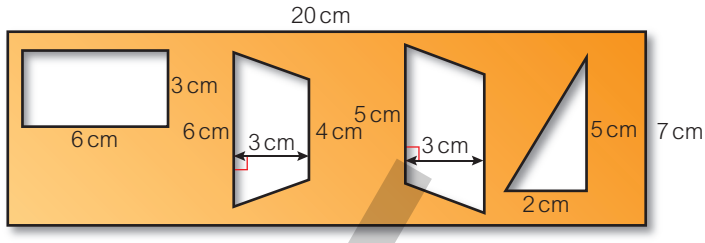
Q9 hint

Try guessing different lengths to see if they work.

Q10 hint

Shaded area = area of whole shape – area of cut-out shape

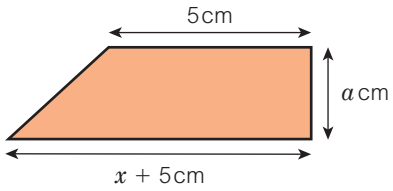
11 **Real** What is the area of plastic used in this shapes stencil?



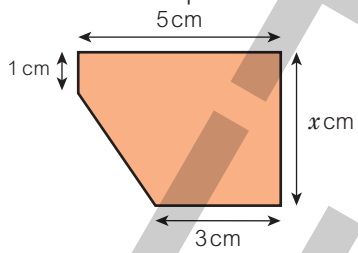
12 **Problem-solving/reasoning**

a Write an expression for the area of each of the shapes

i

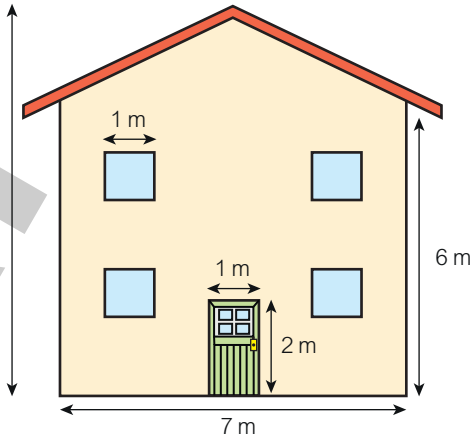


ii



b These two shapes have the same area. Find the value of x and then find the area.

13 **Real** Here is the front of a house. The wall is painted, but the door and windows are not. The windows are square and are all the same size.



a Calculate the area of the wall

b Paint costs $10 per litre. 1 litre of paint will cover 5 m^2. How much will it cost to paint

i 1 m^2

ii the front of the house?

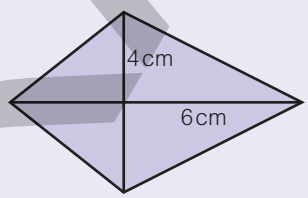
Investigation

1 A kite has diagonals of length 4 cm and 6 cm. Split the kite into triangles and find the area.

2 A rhombus has diagonals of length 5 cm each. Find the area.

3 A square has diagonals of length 12 cm each. Find the area.

4 For which quadrilaterals can you use the lengths of the diagonal to find the area? Explain why.



14 **Explore** How much does it cost to paint the front of a house? What have you learned in this lesson to help you to answer this question? What other information do you need to know?

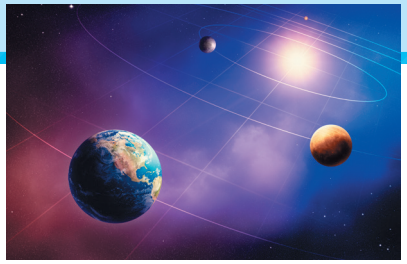
15 **Reflect** What different strategies did you use in this lesson to find compound areas? How did you decide which strategy to use? Design a shape and ask a classmate to split it up and then work out the total area? What lengths do they need to know before they can work out the area?

Explore

Reflect

4.3 Properties of 3D solids

You will learn to:
- Identify nets of different 3D solids.
- Know the properties of 3D solids.



Why learn this?
People used to think the Earth was flat, but now we know it's a sphere.

Fluency
What are the names of these 2D shapes?

Which of these shapes have parallel sides?

Explore
How could you make a 4-sided dice?

Confidence

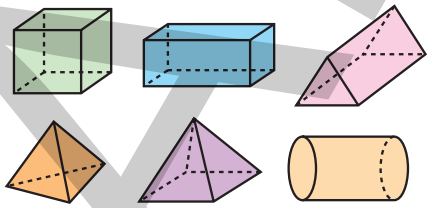
Warm up

Exercise 4.3

1 Look at these solids.

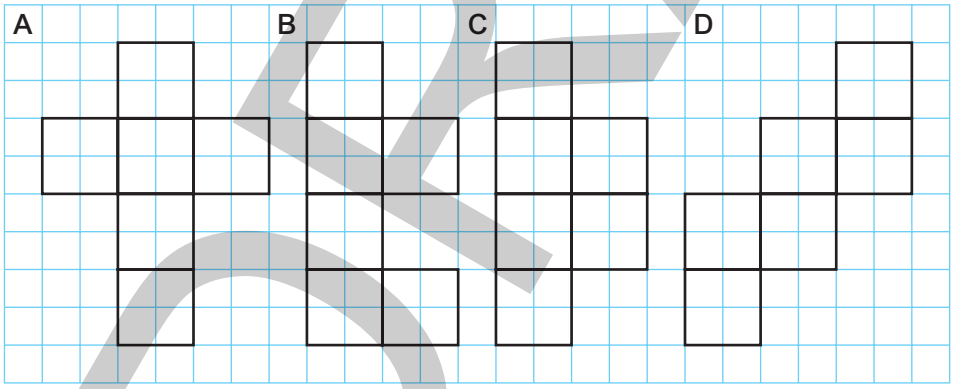
a Write the names of the solids.

b Write the names of the 2D shapes you can see.



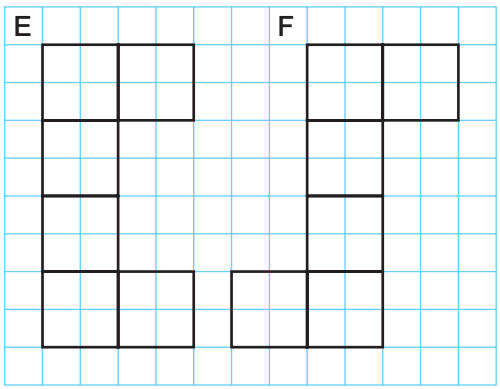
2 **Problem-solving**

a Draw each **net** on squared paper and cut them out.



b Fold them up.
Do any of them form a cube?

Discussion Predict which of **E** and **F** will form a cube.



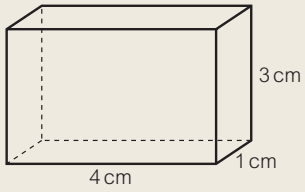
c Draw one more net that you think will form a cube.
Cut it out and check that it works.

Key point

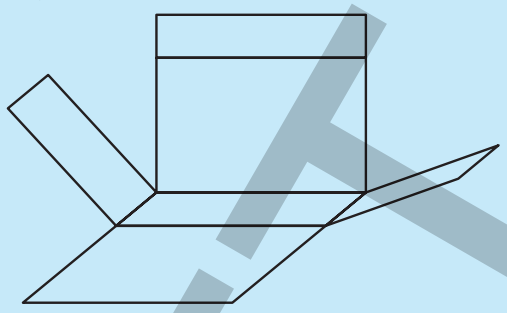
A **net** is a 2D shape that folds to make a 3D solid.

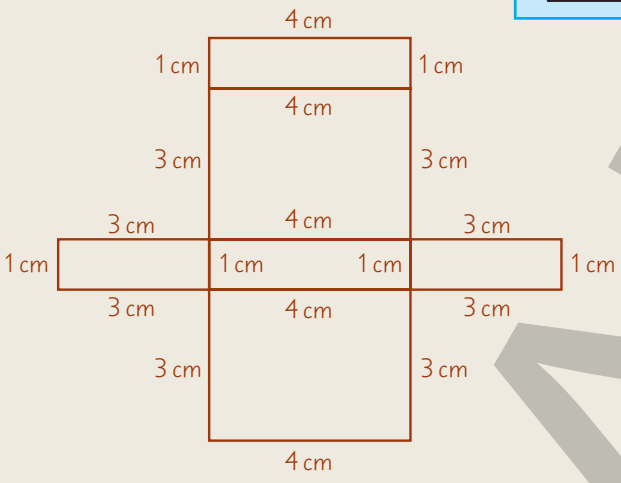
Worked example

Sketch a net of this cuboid.



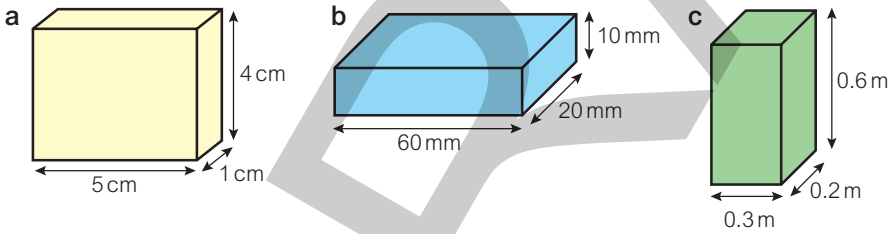
Imagine breaking the cuboid apart along its edges.





Write the measurements on the net.

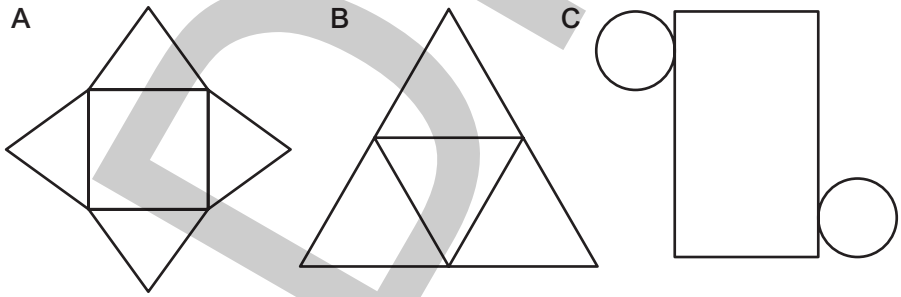
3 Sketch a net for each cuboid.



Q3 hint

For a sketch you should use a ruler and a pencil, but you don't need to measure the lengths accurately.

4 Look at these nets.



Which one folds to make

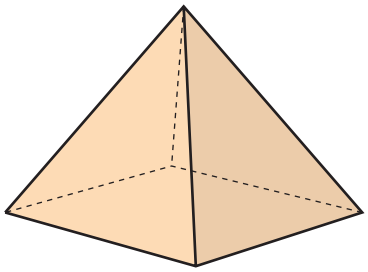
a a triangle-based pyramid

b a cylinder

c a square-based pyramid?

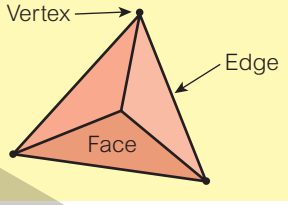
Topic links: Properties of 2D shapes, Formulae, Parallel and perpendicular lines

5 Write the number of **faces**, **edges** and **vertices** in this pyramid.



Key point

3D solids have **faces** (flat surfaces), **edges** (where two faces meet) and **vertices** (corners).
A single corner is called a **vertex**.

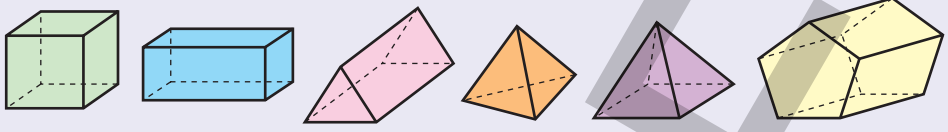


6 **Problem-solving** A 3D solid has 3 rectangular and 2 triangular faces.
What could you call this solid?

Investigation

Reasoning

1 Record the number of faces (F), edges (E) and vertices (V) for each solid.

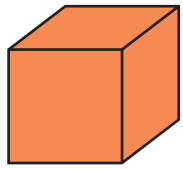


Solid	Faces (F)	Edges (E)	Vertices (V)
Cube			

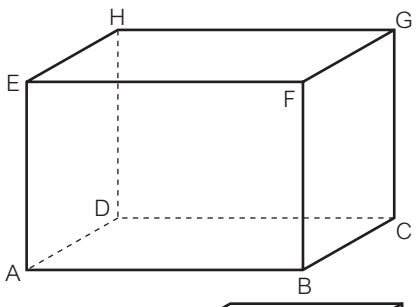
2 Try to find a rule that links the number of faces, edges and vertices.

Discussion Does your rule work for a cone, sphere and cylinder?

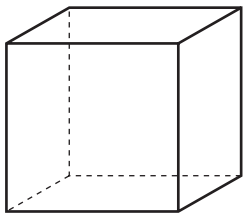
7 **Problem-solving** Look at this cube. You can cut a cube into two equal parts.
What new 3D solids would you make if you cut it
a horizontally **b** vertically **c** diagonally?



8 Look at this cuboid.
Copy and complete these sentences.
a The edge AE is parallel to the edges DH, BF and ___.
b The edge EF is parallel to the edges ___, ___ and ___.
c The edge AB is perpendicular to ___ and ___.
d The faces ABCD and _____ are parallel.
e The faces ABFE and BCGF meet at edge ___.
f If two edges meet, they meet at a _____.
g If two faces meet, they meet at an _____.



9 **Problem-solving** This cube needs painting.
What is the smallest number of colours you must use so that no two faces that touch are the same colour?



10 **Explore** How could you make a 4-sided dice?
What have you learned in this lesson to help you answer this question?
What other information do you need?

11 **Reflect** In Q6 you worked out which solid was being described from the shape of its faces.
Describe two other solids in terms of the shape of their faces.

Explore

Reflect

ActiveLearn Homework, Year 8, Unit 4

4.4 Surface area

You will learn to:
- Calculate the surface area of cubes and cuboids.

Why learn this?
Upholsterers use surface area to work out how much fabric they need to cover sofa cushions.

Fluency
Work out
- $6 \times 9 = \square$
- $6 \times \square = 96$
- 5^2
- 3^2

Explore
How many posters can you fit on your bedroom walls and ceiling?

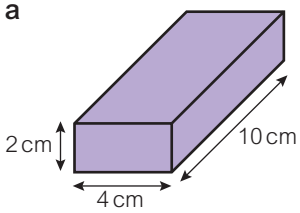
Confidence

Warm up

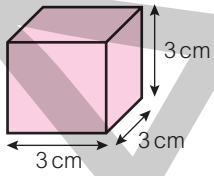
Exercise 4.4

1 Sketch a net for each shape.

a

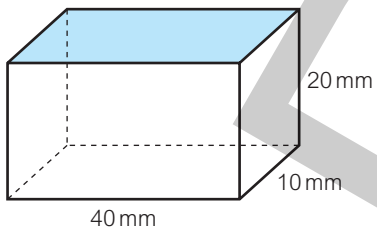


b

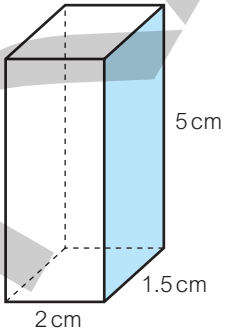


2 Work out the area of the shaded face on each shape.

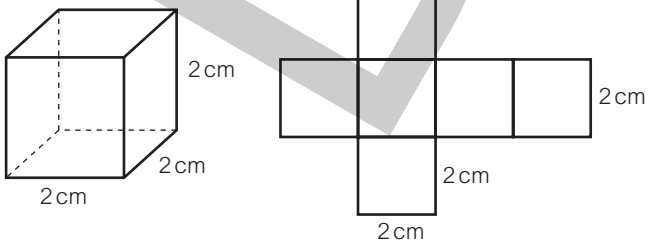
a



b



3 The diagrams show a cube and its net.
Work out the **surface area** of the cube.



Discussion You may have started by working out the area of one face of the cube. Is there a shortcut for finding the surface area of a cube?

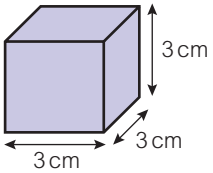
Key point

The **surface area** of a 3D solid is the total area of all its faces.

Topic links: Formulae

4 Work out the surface area of each cube.

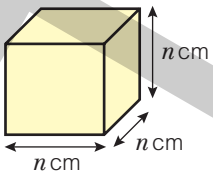
a



b a 20 mm by 20 mm by 20 mm cube

c a cube with edge length 5 cm.

5 **Reasoning** Here is a cube with edge length n cm.



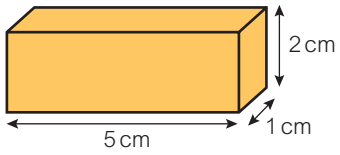
a What is the area of one face on this cube?

b Write a formula for the surface area of a cube with side n.

c Use your formula from part **b** to calculate the surface area of a cube with side 4 cm.

6 Work out the surface area of each cuboid.

a



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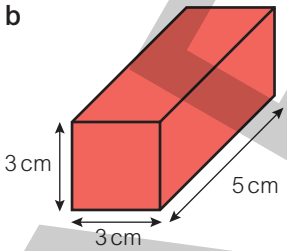
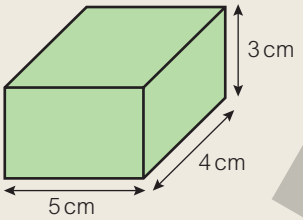


Discussion Is there a shortcut for finding the surface area of a cuboid?

Worked example

Find the surface area of this cuboid.



Surface area

Area of top face = 5 × 4 = 20 cm²

Area of front face = 3 × 5 = 15 cm²

Area of side face = 4 × 3 = 12 cm² +

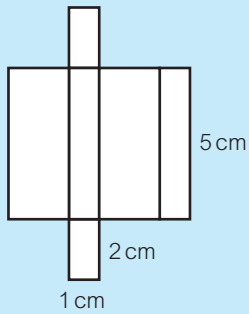
Sum of 3 faces = 47 cm²

Total surface area = 2 × 47 = 94 cm²

Each face is part of an identical pair.

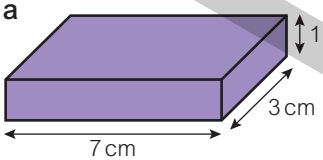
Q6a hint

Sketch a net. Then work out the area of each rectangle and add the areas together.

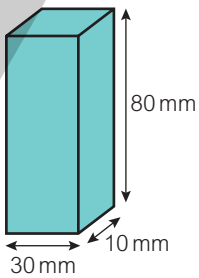


7 Work out the surface area of each cuboid.

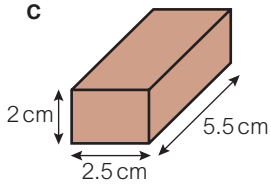
a



b



c



Q7 hint

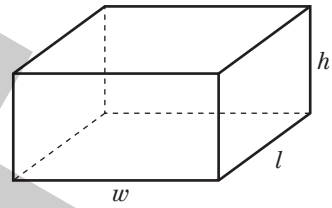
Use the same method as in the worked example.

8 **Problem-solving** A cube has a surface area of 96 cm^2.

a What is the area of each face?

b What is the length of one edge?

9 **Reasoning** Use the diagram to help you copy and complete:



a The area of the front face is ☐.

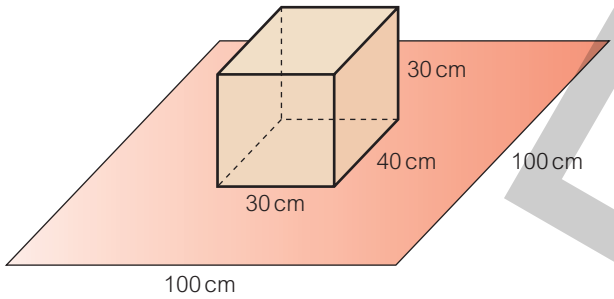
b The area of the top face is ☐.

c The area of the side face is ☐.

d The total area of these 3 faces is ☐.

e The total surface area (all 6 faces) is ☐.

10 **Real / Problem-solving** Joey wants to wrap a present for his sister.



Does he have enough wrapping paper?

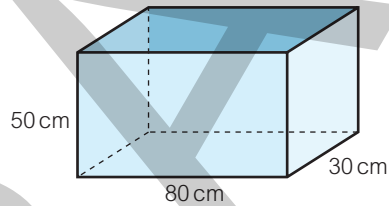
Discussion How does the hint help you answer the question?

Q10 hint

Would a net of this box fit on the wrapping paper?

11 **Real / Problem-solving** Kevin wants to paint the outside of this toy box. He has enough paint to cover 15 000 cm^2.

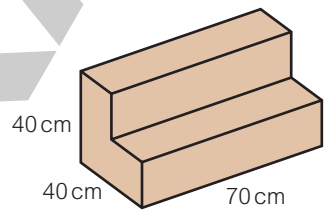
Will this be enough?



Q11 hint

The box only has 5 faces.

12 **Real / Problem-solving** Louise wants to make a two-step stool. Both the steps are the same size. She does not need to put wood on the base. How much wood does she need for this project?



13 **Explore** How many posters can you fit on your bedroom walls and ceiling?

What you have learned in this lesson to help you answer this question?

What other information do you need?

14 **Reflect** This lesson showed you two methods for finding the surface area of a cube or cuboid.

- Method 1 (draw then add)

  Draw a net, write the area of each face on the net, add them together (Q6)
- Method 2 (visualise then calculate)

  Visualise pairs of opposite faces, calculate the area of each different face, add them together, double your answer (Q7)

Which method did you prefer? Why?

Q14 hint

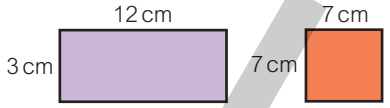
What are the advantages and disadvantages of your method?

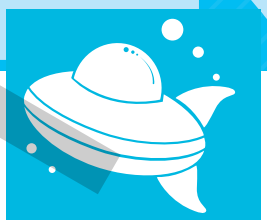
4.5 Volume

You will learn to:
- Calculate the volume of a cube or a cuboid.
- Convert between cm^3, ml and litres.

Why learn this?
The number of fish that can be put in a fish tank depends on the size (volume) of the tank.

Fluency
What is the area of these shapes?





Explore
How many fish can you put in a cuboid-shaped tank that measures 50 cm by 40 cm by 80 cm?

Confidence

Warm up

Exercise 4.5

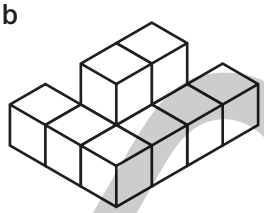
1 Work out

a $5 \times 3 \times 8$ **b** $6 \times 4 \times 3$ **c** $4 \times 2 \times 4$

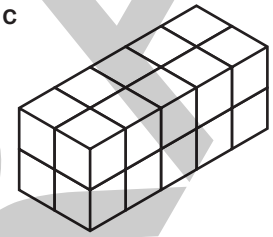
2 How many 1 cm cubes make up each shape?

a

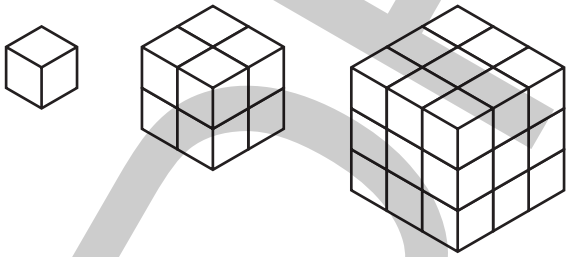
b



c



3 **a** How many 1 cm cubes make up each cube?



b Work out the first three cube numbers.

$1^3 = \square$ $2^3 = \square$ $3^3 = \square$

What do you notice?

4 A cube has a side length of 8 cm.
What is the **volume** of the cube?

5 **Problem-solving** A cube has a surface area of 54 cm^3.

a What is the area of one face?

b What is the length of one side?

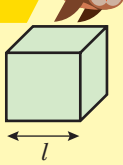
c What is the volume of the cube?

Key point

The **volume** of a solid shape is the amount of 3D space it takes up.
The units of volume are cubic units (e.g. mm^3, cm^3, m^3).

Key point

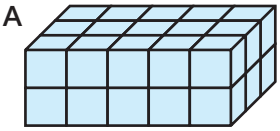
Volume of a cube
= side length (l) cubed
= l^3

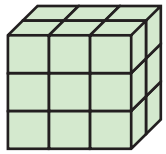


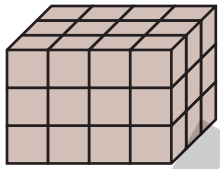
Q5 Strategy hint

Sketch a cube.

6 a Count the 1 cm cubes in each cuboid.

A 

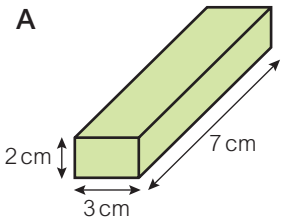
B 

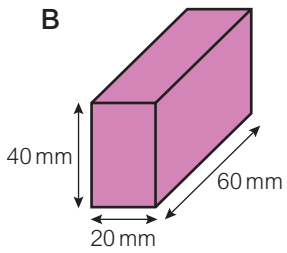
C 

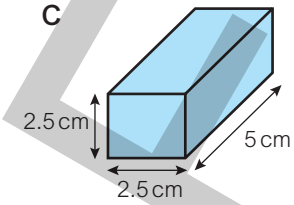
b Copy and complete this table for the cuboids.

Cuboid	Length	Width	Height	Length × width × height
A				

7 a Calculate the volume of each cuboid.

A 

B 

C 

b **Reasoning** Imagine that the three cuboids are put together.

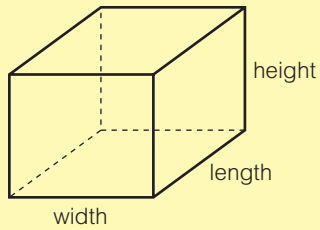
i Will the volume of the new shape be the sum of the volumes?

ii Will the surface area of the new shape be the sum of the surface areas?

Explain your answers.

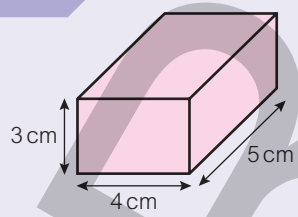
Key point

Volume of a cuboid
= length × width × height
= $l \times w \times h = lwh$



Investigation **Reasoning**

Look at this cuboid.



1 What is the volume of the cuboid?

2 Write the dimensions of at least three more cuboids with the same volume.

3 Usman says the cuboid with dimensions $\frac{1}{2}$ cm by 12 cm by 10 cm has the same volume as this cuboid. Is he right?

Discussion Are there more cuboids with the same volume?

8 Copy and complete these conversions.

a 0.45 litres = ☐ cm^3

b 6.3 cm^3 = ☐ ml

c ☐ litres = 7346 cm^3

Key point

The **capacity** of a container is how much it can hold. The units of capacity are cm^3, millilitres (ml) and litres (l).

- 1 millilitre (ml) = 1 cm^3
- 1 litre (l) = 1000 cm^3

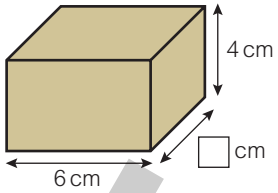
9 **Real / Reasoning** For a long-distance camping trip, students need a rucksack that has a **capacity** of at least 65 litres.
Peter buys a rucksack measuring 34 cm by 26 cm by 75 cm.

a Work out the capacity in cm^3.

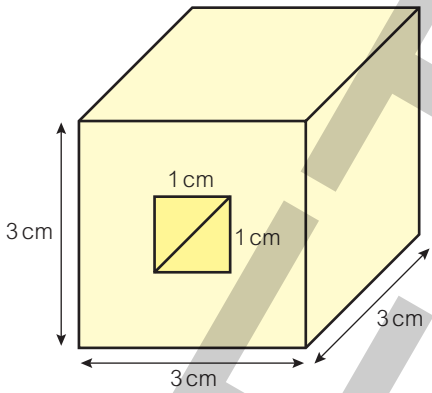
b Work out the capacity in litres.

c Is Peter's rucksack big enough?

10 **Problem-solving** The volume of this cuboid is 168 cm^3.
Find the missing length.



11 **Problem-solving**
A 3 cm by 3 cm by 3 cm cube has a 1 cm by 1 cm square hole cut through it.
What is the volume of the remaining solid?



Q11 hint
What is the volume of the piece cut out of the cube?

12 **Problem-solving** Here are the areas of three faces of the same cuboid.

A Area = 30 cm^2

B Area = 42 cm^2

C Area = 35 cm^2

a What are the dimensions of each rectangle?
b What is the volume of the cuboid?
c What is the surface area of the cuboid?

13 **Explore** How many fish can you put in a cuboid-shaped tank that measures 50 cm by 40 cm by 80 cm?
Is it easier to explore this question now you have completed the lesson?
What further information do you need to be able to answer this?

14 **Reflect** Maths is not the only subject where you use volume.
You use it in science too.
Describe how you have used volume in science.
In what ways is volume the same or different in science as in this maths lesson?
Do you think volume means the same in all subjects?
Explain your answer.

Explore

Reflect

4.6 STEM: Measures of area and volume

You will learn to:
- Convert between metric measures for area and volume.

Confidence

Why learn this?
Ecologists use measures of area and volume when studying plants and animals in hedgerows.

Fluency
How many m^2 in one hectare?
Multiply each number by 100
- 7
- 7.5
- 7.53

Explore
How much land is needed to support a herd of deer?

Exercise 4.6: Ecology

1 Work out
- **a** $2.5 \times 10 \times 10$
- **b** $0.04 \times 100 \times 100$
- **c** $450 \div 10 \div 10$
- **d** $9045 \div 100 \div 100$

2 Work out the missing numbers.
- **a** $2 \times \square = 20\,000$
- **b** $760 \div \square = 7.6$
- **c** $\square \div 100 = 0.03$

3 Which unit of area would be sensible for measuring
- **a** the area of a school pond
- **b** the area of Scotland
- **c** the area of an oak leaf?

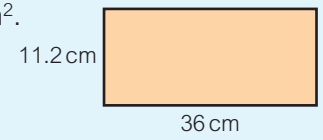
4 **STEM / Modelling** A conservation trust has been given a 5.3 **hectare** piece of land. It plans to use 18 750 m^2 for woodland and 28 125 m^2 for a wildlife meadow.
- **a** Is the area they have been given big enough for their planned use?
- **b** They estimate that they will need 2.4 m × 5 m sections for every 10 oak seedlings they plant. How many seedlings can they plant?

Discussion Is this a good model for working out the number of trees? Will they need any other space in the woodland?

5 **Real** A rectangular reservoir measures 1.2 km by 1.6 km. How many hectares is this?

6 Copy and complete these conversions.
- **a** 4 cm^2 = □ mm^2
- **b** □ cm^2 = 0.58 m^2
- **c** 17 000 m^2 = □ km^2
- **d** □ m^2 = 3.5 km^2

7 **a** **i** Work out the area of this rectangle in cm^2.
ii Convert the area to mm^2.
b Convert the lengths to mm and work out the area in mm^2.

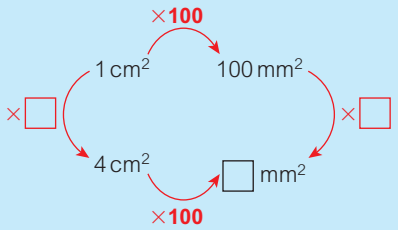


Discussion Which method was easier, the one in part **a** or part **b**?

Key point
It is important to be able to choose the most suitable metric units for measuring. Some of the metric units that you already know are
- mm, cm, m, km (length)
- mm^2, cm^2, m^2, km^2, hectares (area)

Q4 hint
A **hectare** is 10 000 m^2. Convert km to m and then m^2 to hectares.

Q6a hint



Warm up

Topic links: Powers of 10

Subject links: Science (Q3, Q4, Q8, Q11)

8 **STEM / Problem-solving** Ann is surveying the plants growing in some wasteland (unused land), measuring 7.5 m by 3.2 m. She places **quadrats** at random within the survey area. Each quadrat is a 50 cm × 50 cm square.

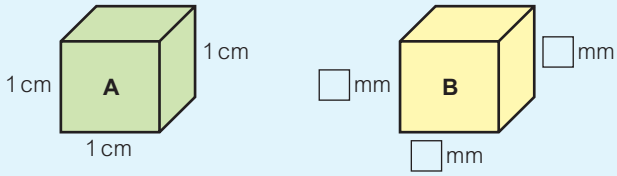
a What is the maximum number of quadrats that would fit?

b She **samples** the plants in 12 quadrats randomly.
What proportion of the wasteland has she sampled?

Q8 Literacy hint

A **quadrat** is a square frame used to **sample** organisms, such as plants, in a large area.

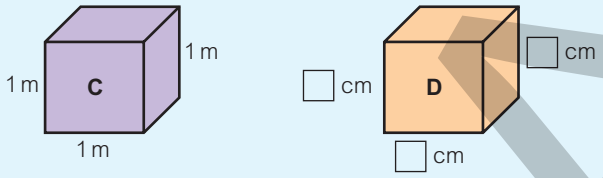
9 **a** These cubes are the same size.
Copy the diagrams and write in the measurements.



b Find the volume of
i **A** in cm^3 **ii** **B** in mm^3

c Copy and complete these sentences.
i To convert from cm^3 to mm^3 _____ by □
ii To convert from mm^3 to cm^3 _____ by □

d These cubes are also the same size. Copy the diagrams and write in the measurements.



e Find the volume of
i **C** in m^3 **ii** **D** in cm^3

f Copy and complete these sentences.
i To convert from m^3 to cm^3 _____ by □
ii To convert from cm^3 to m^3 _____ by □

Q9 Strategy hint

You might find it easier to convert the units first and then find the volume.

Key point

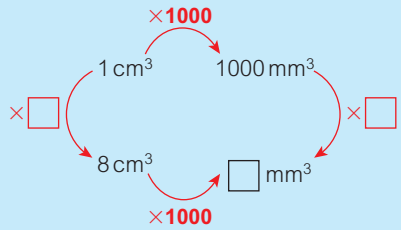
To convert from
- cm^3 to mm^3 you multiply by 10^3 or 1000
- mm^3 to cm^3 you divide by 10^3 or 1000
- m^3 to cm^3 you multiply by 100^3 or 1 000 000
- cm^3 to m^3 you divide by 100^3 or 1 000 000

10 Copy and complete these conversions.

a 8 cm^3 = □ mm^3 **b** □ cm^3 = 95 mm^3

c 73.4 m^3 = □ cm^3 **d** □ m^3 = 250 000 cm^3

Q10a hint



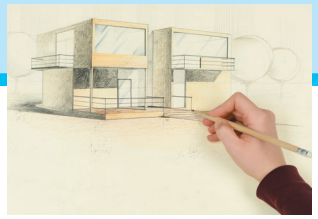
11 **STEM / Problem-solving** Earthworms have been called 'ecosystem engineers'. They improve soil structure and help release important nutrients to growing plants.
Fred reads that healthy soil should have 5600 earthworms per cubic metre. He finds 40 earthworms in a 20 cm × 20 cm × 20 cm sample.
Is his sample healthy soil? Explain your answer.

12 **Explore** How much land is needed to support a herd of deer?
What have you learned in this lesson to help you answer this question?
What other information do you need?

13 **Reflect** Jan says, '1 cm is 10 mm so 1 cm^2 is 10 mm^2.'
Choose two questions from this lesson that will help Jan understand her mistake.
Using your knowledge from the previous two lessons, draw a diagram or write an explanation to show Jan how many mm^3 are equal to 1 litre.

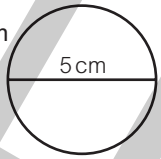
4.7 Plans and elevations

You will learn to:
- Use 2D representations of 3D solids.



Why learn this?
Architects create drawings to show the side and front views of planned new buildings.

Fluency
Draw accurately
- a square with side length 3 cm
- an isosceles triangle with base length 4 cm and height 5 cm
- this circle.

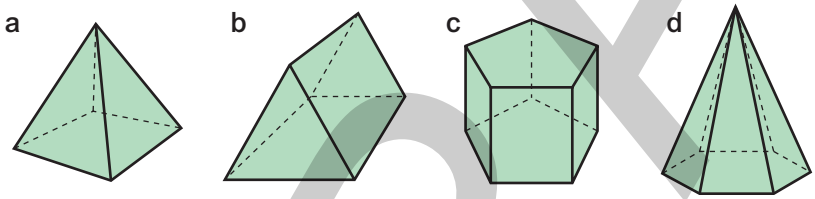


Explore
What would some famous landmarks look like if photographed from above?

Confidence

Exercise 4.7

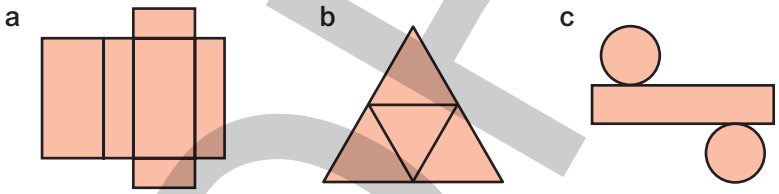
1 For each solid, write
- **i** the shapes of the faces
- **ii** the name of the solid.



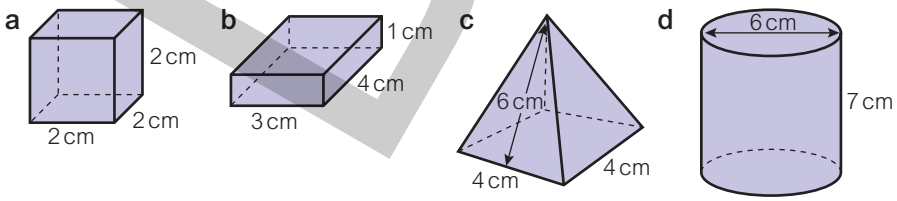
Q1a hint

4 ____
1 square

2 What 3D solid does each net make?

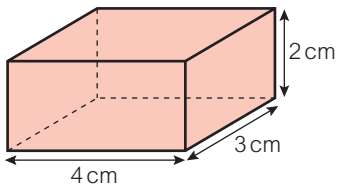


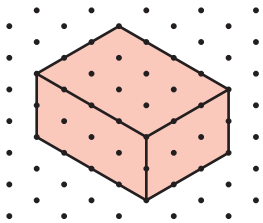
3 Sketch a net for each solid.
Label the lengths.



Warm up

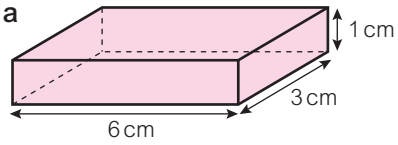
4 Here are two views of the same cuboid.
The second is drawn on isometric paper.



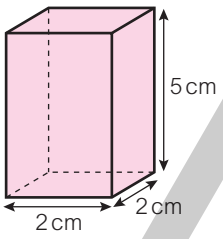


Draw these solids on isometric paper.

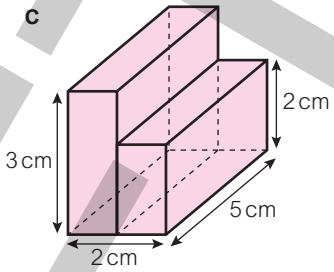
a



b



c

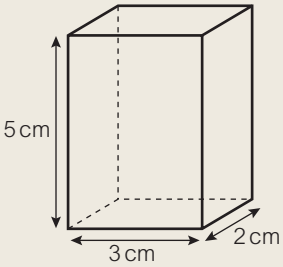


Q4 hint

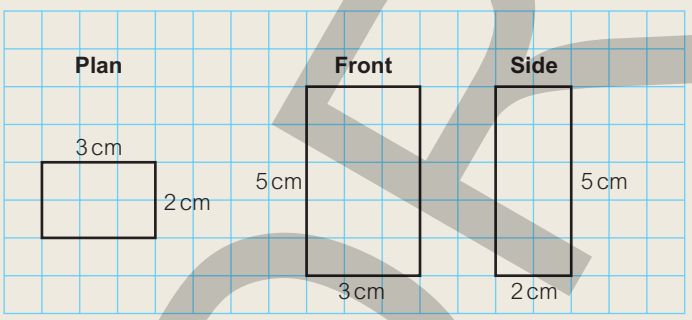
Use a ruler and start with a vertical edge of the cuboid.
On isometric paper, the distance between two adjacent (neighbouring) dots represents 1 cm.

Worked example

Draw the **plan**, the **front elevation** and the **side elevation** of this cuboid on squared paper.

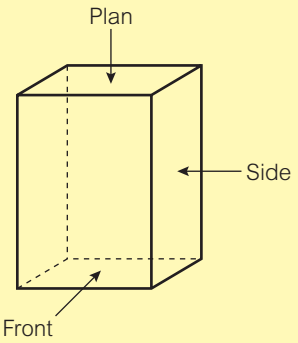


Use a ruler.
Measure accurately.
Label lengths.



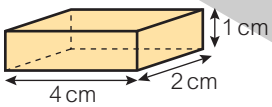
Key point

The **plan** is the view from above the object.
The **front elevation** is the view of the front of the object.
The **side elevation** is the view of the side of the object.

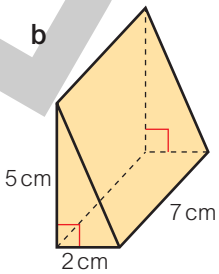


5 Draw the plan, the front elevation and the side elevation of each solid on squared paper.

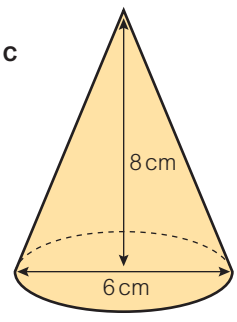
a



b



c

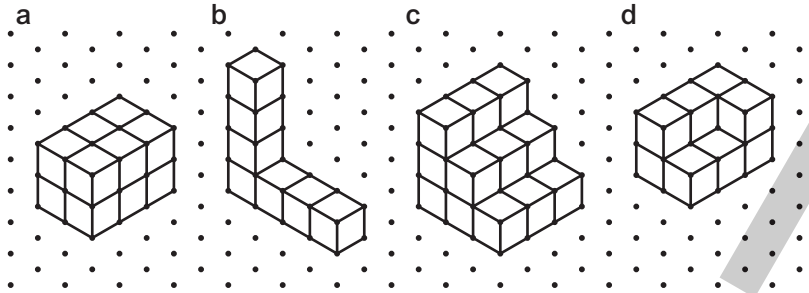


Q5c hint

Draw a circle using a pair of compasses.

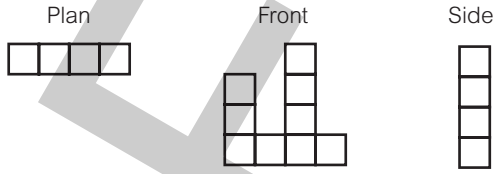
6 These solids are made from centimetre cubes.
Draw the plan, front elevation and side elevation of each solid on squared paper.

a b c d



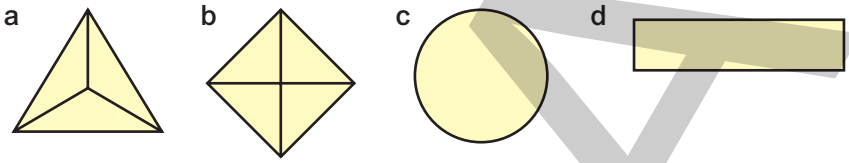
Discussion What do you notice about your answers to parts **a** and **d**?
Why does this happen?

7 **Problem-solving** Here are the plan, front and side elevations of an irregular 3D solid.
Use cubes to make the solid.
Then draw it on isometric paper.



8 Here are the plan views of some solids.
What could each one be?

a b c d

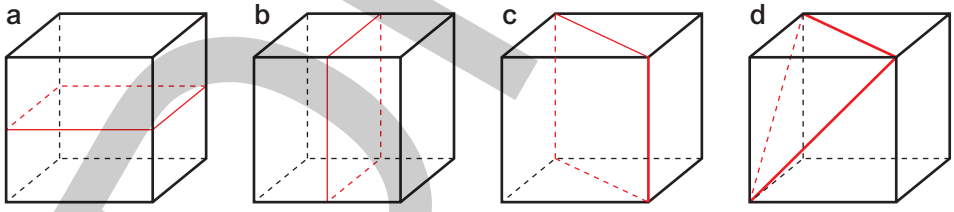


Discussion Is there more than one answer?

9 **Problem-solving** Here is the side elevation of a 3D solid.
Sketch three possible 3D solids it could belong to.

10 This cube is 'cut' in different ways along the red line.
For each cut in parts **a** and **d**, what is the name of
i the 2D shape of the new faces?
ii the new 3D solid(s) created?

a b c d



11 **Explore** What would some famous landmarks look like if photographed from above?
Look back at the maths you have learned in this lesson.
How can you use it to answer this question?

12 **Reflect** Look back at Q6.
Draw the plan, front and side elevations for a unique solid shape.
Is it possible to draw two distinct solids that look the same on isometric paper?

Q12 Literacy hint

Unique means that there can't be a different solid with the same plan, front and side elevations.
Distinct means different.

Explore

Reflect

4.8 Solving problems with 3D solids and measures

You will learn to:
- Solve problems involving area, surface area and volume.
- Solve problems in everyday contexts involving measure.

Why learn this?
Builders need to calculate the amount of materials needed to create buildings.

Fluency
Write down the formula for the
- area of a parallelogram
- volume of a cube
- surface area of a cuboid.

Explore
How much wrapping paper is needed to wrap a present?

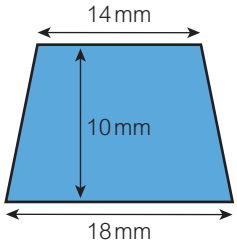
Confidence

Warm up

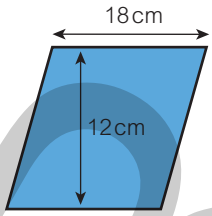
Exercise 4.8

1 Calculate the area of each shape.

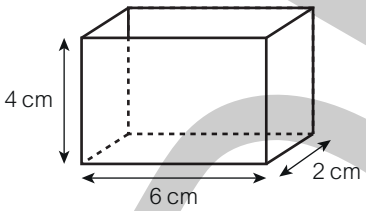
a



b



2 Calculate the volume of this cuboid.



3 **Problem-solving** A medicine bottle says, 'Take two 5 ml spoonfuls four times a day.'
The bottle contains 0.15 litres. Sara has to take the medicine for 4 days.
Is there enough medicine in the bottle? Explain your answer.

4 The mass of a new-born elephant is 5% of the mass of an adult female elephant.
The average mass of an adult female elephant is 3 **tonnes**.
What is the average mass in kilograms of a new-born elephant?

Key point
mass: 1 **tonne** (t) = 1000 kg

5 Joe is using his calculator to solve some problems. Which value, A, B or C, should he enter for each measure?

a 2 m 4 cm (in metres)	**A** 2.4	**B** 2.04	**C** 2.004
b 5 kg 250 g (in kilograms)	**A** 5.25	**B** 5.025	**C** 5.0025
c 950 ml (in litres)	**A** 9.5	**B** 0.95	**C** 0.095

6 An Olympic swimming pool has a length of 50 m, a width of 25 m and a depth of 2 m.

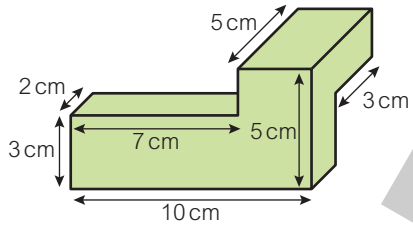
a Write the dimensions of the pool in centimetres.

b Work out the **capacity** of the pool in litres.

Q6b hint

$V = lwh$

7 Find the volume of this shape.



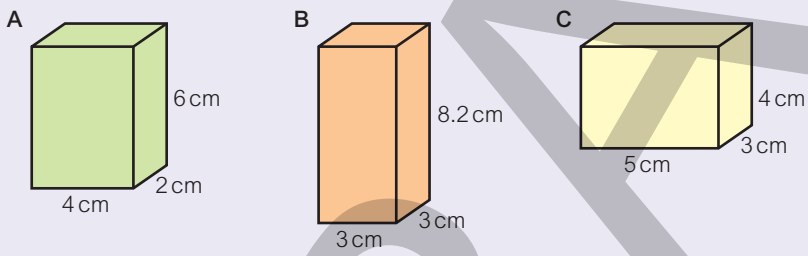
Q7 hint

Split the shape into two cuboids.

Investigation

Problem-solving

Each box of Akmal's Sweets contains 50 cm^3 of sweets, plus about 10% air.
Here are three designs for the box.



Which design is the most suitable? Why?
Work out the side length, to one decimal place, of a cube-shaped box that has the correct volume.
Work out the dimensions of two more boxes with the correct volume.

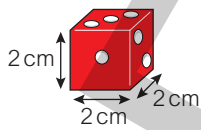
8 **Problem-solving** A cube has volume 27 cm^3. What is the length of the cube?

9 **Problem-solving** A cuboid has a length of 3.6 m and a width of 2.5 m. Its volume is 37.8 m^3. Work out the surface area of the cuboid.

Q9 hint

Use the volume to work out the height of the cuboid first.

10 **Problem-solving** The diagram shows the dimensions of a dice.

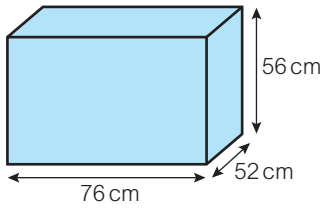


A box has dimensions 12 cm by 10 cm by 8 cm.
How many dice will the box hold?

Q10 hint

Start by working out how many dice will fit along the length of the box.

11 **Problem-solving** The diagram shows the dimensions of a water tank.



Alex puts water in the tank so that it is three quarters full.
What volume of water is in the tank?

Discussion In how many different ways can you work out the volume of a water tank that is three quarters full?

12 **Real** A box with a toy in it has height 10 cm, width 28 cm and length 38 cm.

a Draw a net of the box.

b Wrapping paper is 70 cm wide. What length of wrapping paper is needed if there is

i no overlap (no extra amount)

ii an overlap of 3 cm when folded in both directions?

Q12b hint

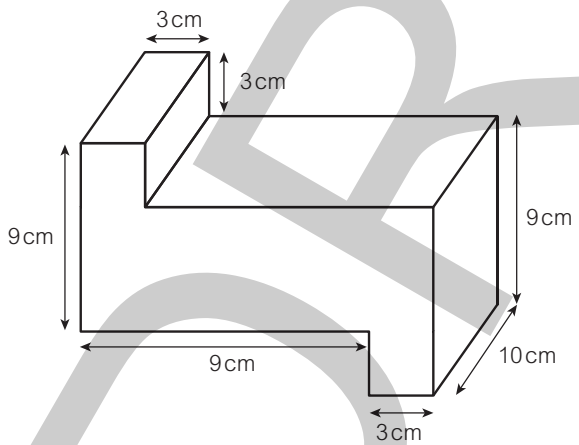
Use the net to help position on the wrapping paper and calculate the length.

Investigation

Problem-solving

The width of a cuboid is twice its height. Its length is three times its height. The surface area of the cuboid is 352 cm^2. What is its height?

13 **Problem-solving** Three cuboids of the same length are placed on top of each other.
Calculate the volume of the solid.



14 **Explore** How much wrapping paper do you need to wrap a present? What have you learned this lesson to help you answer this question? What other information do you need to know?

15 **Reflect** You have learned lots of different formulae and methods for measures, area, surface area and volume. How can you remember them? Share with a friend any tips or strategies you have used to help you remember them.

Explore

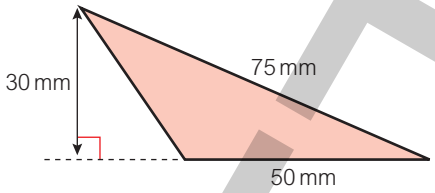
Reflect

ActiveLearn Homework, Year 8, Unit 4

4 Check up

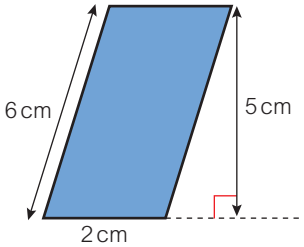
Area of 2D shapes

1 Work out the area of this triangle.

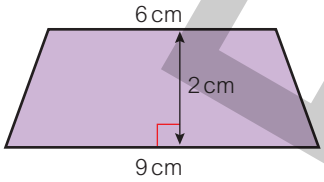


2 Work out the area of each shape.

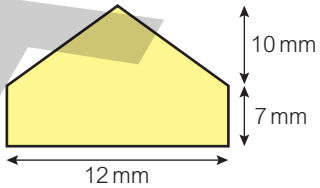
a



b

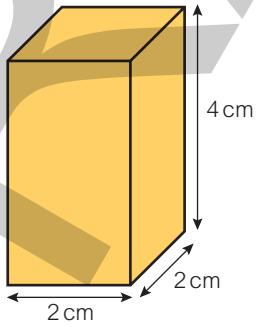


3 The diagram shows the dimensions of a badge.
What is the total area of the badge?

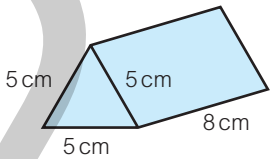


Nets, surface area and volume of 3D solids

4 Work out the surface area of this cuboid.

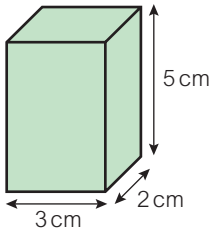


5 Sketch a net of this 3D solid.

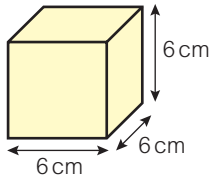


6 Calculate the volume of these solids.

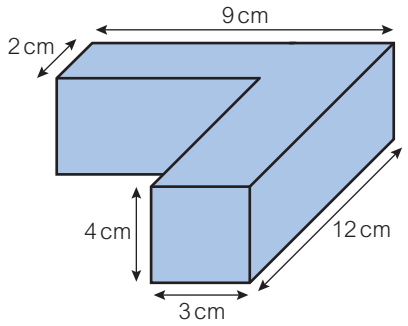
a



b

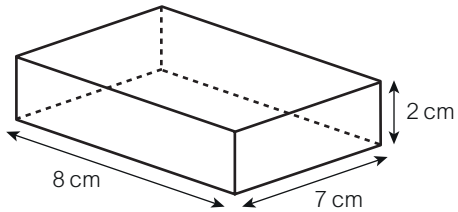


7 Calculate the volume of this solid.



Plans and elevations

8

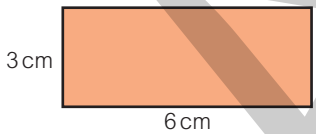


a Draw this cuboid on isometric paper.

b Draw the front elevation, side elevation and plan view of the cuboid.

Measures of area, volume and capacity

9 What is the area of this rectangle in mm^2?



10 Copy and complete these conversions.

a $6\,cm^2 = \square\,mm^2$ **b** $0.9\,cm^2 = \square\,mm^2$

c $350\,mm^2 = \square\,cm^2$ **d** $3\,m^2 = \square\,cm^2$

e $5.02\,m^2 = \square\,cm^2$ **f** $2590\,cm^2 = \square\,m^2$

11 Copy and complete these conversions.

a $18\,cm^3 = \square\,mm^3$ **b** $\square\,cm^3 = 265\,mm^3$

c $0.7\,m^3 = \square\,cm^3$ **d** $\square\,m^3 = 931\,000\,cm^3$

e $42\,m^3 = \square\,ml$ **f** 3 litres = $\square\,cm^3$

12 **Real** An Olympic-size swimming pool measures 50 m by 25 m and has a depth of 3 m.

a Calculate the volume of the pool in

i m^3 **ii** cm^3

b How many litres of water can the pool hold?

13 **How sure are you of your answers? Were you mostly**

Just guessing **Feeling doubtful** **Confident**

What next? Use your results to decide whether to strengthen or extend your learning.

Challenge

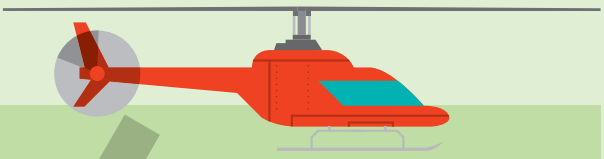
14 A shape has an area of $10\,cm^2$.
Sketch and label the lengths of a possible

a triangle **b** rectangle

c parallelogram **d** trapezium.

Reflect

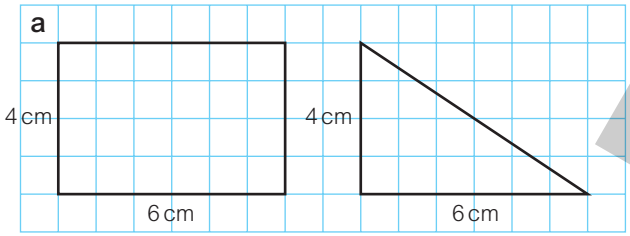
4 Strengthen



You will:
- Strengthen your understanding with practice.

Area of 2D shapes

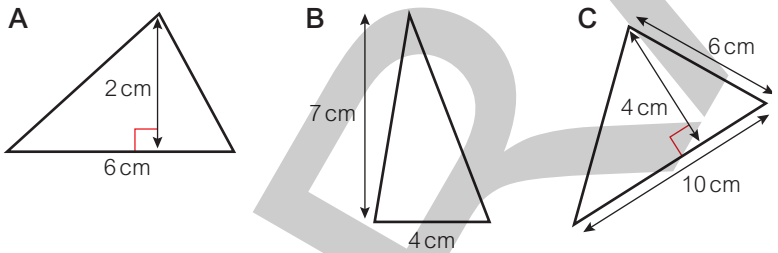
1 For each pair of shapes, find the area of the rectangle and the area of the triangle.



2 **a** For each triangle write

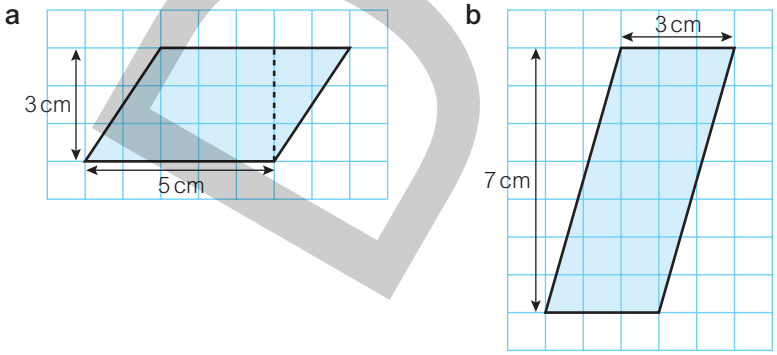
i base length = ☐cm

ii perpendicular height = ☐cm



b Work out the area of each triangle.

3 Calculate the area of each parallelogram.



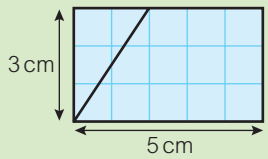
Q2 hint

Area of a triangle

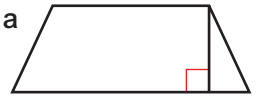
$= \frac{1}{2} \times$ base length $\times$ perpendicular height

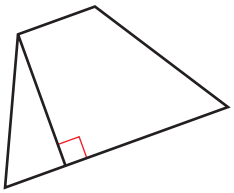
Q3a hint

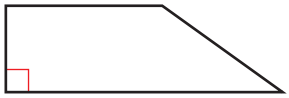
Imagine making the parallelogram into a rectangle by moving part of the shape to the other side.



4 Sketch these trapeziums.

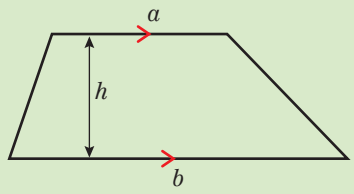
a 

b 

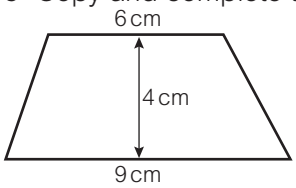
c 

Label the parallel sides a and b and the perpendicular height h.

Q4a hint



5 Copy and complete the working to find the area of this trapezium.

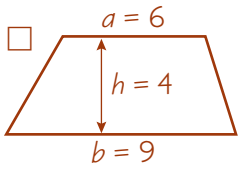


Area $= \frac{1}{2}(a + b)h$

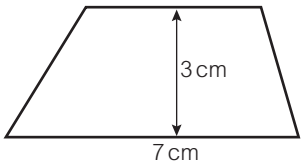
$= \frac{1}{2} \times (\square + \square) \times \square$

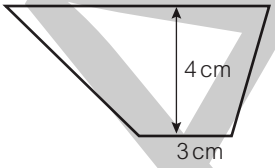
$= \frac{1}{2} \times \square \times \square$

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



6 Find the area of each trapezium.

a 

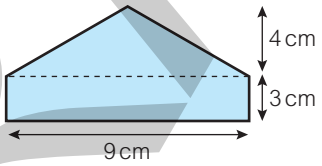
b 

Q6 hint

Use the method in Q5.

7 Work out the area of this shape.

The working has been started for you.



area of rectangle = length × width

$= 9 \times \square$

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

area of triangle $= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 9 \times \square$

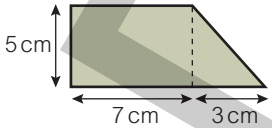
$= \square \text{cm}^2$

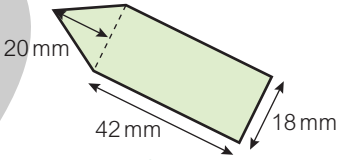
total area = area of rectangle + area of triangle

$= \square + \square$

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

8 Work out the area of each compound shape.

a 

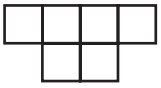
b 

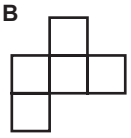
Q8a Strategy hint

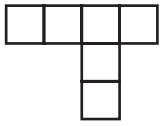
Split the shape into a rectangle and a triangle.

Nets, surface area and volume of 3D solids

1 Which of these nets will fold to make a closed cube?

A 

B 

C 

Q1 Strategy hint

Draw the shapes and cut them out. Try to fold each one into a cube.

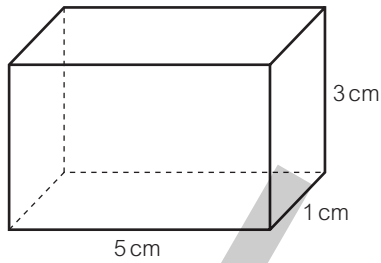
2 a Look at this cuboid.
Choose the correct words to make these sentences true.

back left-hand side bottom

i The area of the top face is the same as the area of the _____ face.

ii The area of the front face is the same as the area of the _____ face.

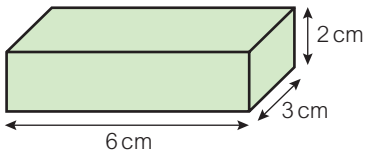
iii The area of the right-hand side face is the same as the area of the _____ face.



b Copy and complete the table to find the surface area of the cuboid.

Face	Area
Top	□ × 5 = □ cm²
Bottom	
Front	3 × □ = □ cm²
Back	
Right	□ × 3 = □ cm²
Left	
Total surface area	

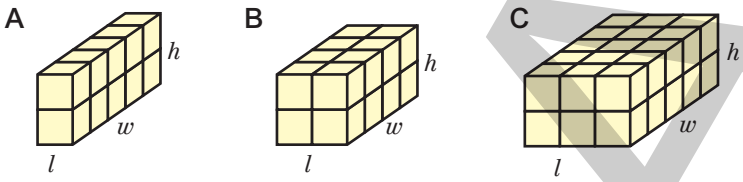
3 Work out the surface area of the cuboid.



Q3 hint

Use a table.

4 These cuboids are made from 1 cm cubes.



a For each cuboid write l = □ cm, w = □ cm, h = □ cm.

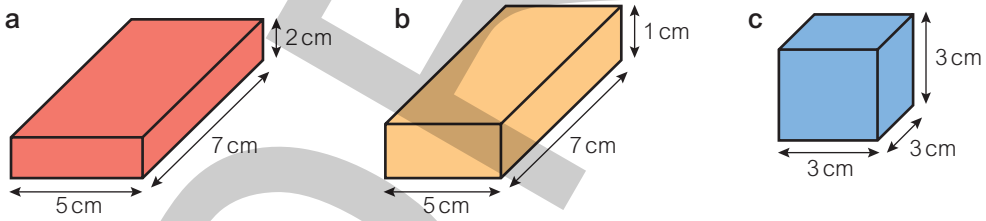
b Find each volume.

c Check your answers by counting cubes.

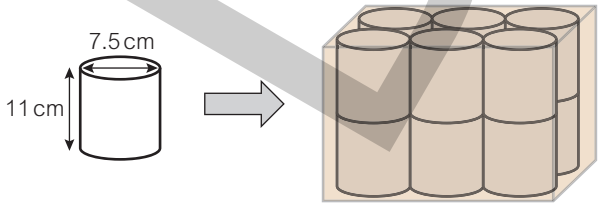
Q4b hint

Volume of a cuboid
= length × width × height
= $l \times w \times h$ = □ cm³

5 Calculate the volume of each cuboid.



6 **Real / Problem-solving** A box holds 12 tins of baked beans as shown.



a Work out the surface area of cardboard needed to make the box.

b What is the volume of the box?

Q6 hint

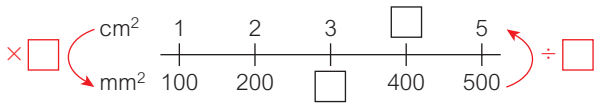
Use the dimensions of the tin to work out the length, width and height of the box, then work out the surface area of the box.

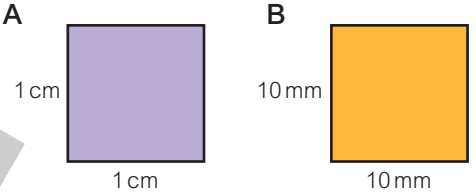
Measures of area, volume and capacity

1 These squares are the same size.

a Work out the area of each square.

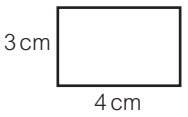
b Copy and complete this number line for converting cm^2 to mm^2 areas.



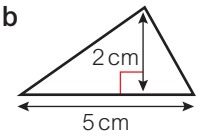


2 Work out the area of each shape in cm^2. Then convert it to mm^2.

a



b

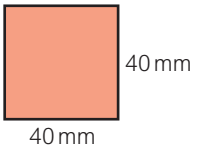


Q2 hint

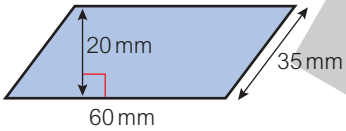
Use your number line from Q1 to help you.

3 Work out each area in mm^2. Then convert it to cm^2.

a



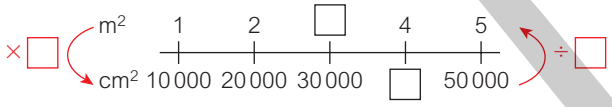
b

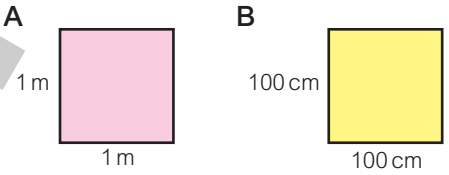


4 These squares are the same size.

a Work out the area of each square.

b Copy and complete this number line for converting m^2 to cm^2 areas.





5 Copy and complete these conversions.

a $2.05\,m^2 = 2.05 \times \square = \square\,cm^2$ **b** $0.07\,m^2 = \square\,cm^2$

c $\square\,m^2 = 8600\,cm^2$

6 Copy and complete these conversions.

a **i** $6\,cm^3 = \square\,mm^3$ **ii** $0.012\,cm^3 = \square\,mm^3$

iii $\square\,cm^3 = 15\,800\,mm^3$

b **i** $0.04\,m^3 = \square\,cm^3$ **ii** $12.7\,m^3 = \square\,cm^3$

iii $\square\,m^3 = 1.4$ million cm^3

Q7 hint

Use your number line from Q6 to help. Draw a similar one for converting cm^3 to m^3 volumes.

Enrichment

1 **Problem-solving** Jo wants to grow vegetables.

She buys 16 raised beds measuring 1 m by 4 m by 0.5 m.

a Calculate the volume of one raised bed.

b Write its dimensions in centimetres.

c Calculate the volume in cubic centimetres.

A 40-litre bag of soil costs £2.50.

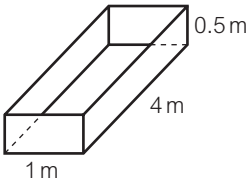
d How many 40-litre bags of soil will Jo need for each raised bed?

e How much will soil cost for one raised bed?

f How much will she spend on soil in total?

Q1 hint

1 litre = 1000 cm^3



2 **Reflect** In this unit you have covered lots of different topics:

A Area **B** Surface area **C** Volume **D** Measures

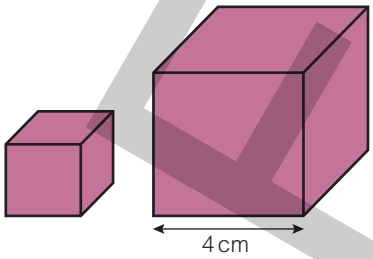
Write down something you understand from each of the topics and something you want to understand better. What learning strategies can you use to help you to understand more?

4 Extend

You will:
- Extend your understanding with problem-solving.

1 A cube has a total surface area of 8.64 cm^2. Work out
a the area of one face of the cube
b the side length of the cube.

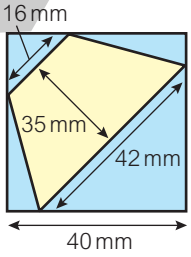
2 **Problem-solving** The diagram shows two cubes.
The side length of the larger cube is 4 cm.



The ratio of their surface areas is 1 : 4.
Work out
a the surface area of the smaller cube
b the side length of the smaller cube.

3 **Problem-solving** A red cuboid has length 6 cm, width 3 cm and height 2 cm.
A blue cuboid has length 8 cm and width 2 cm.
The red and blue cuboids have the same surface area.
Work out the height of the blue cuboid.

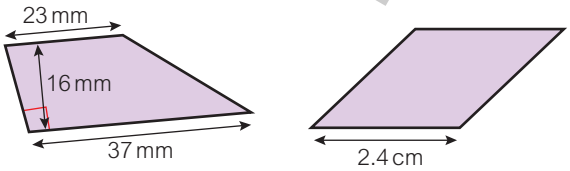
4 **Problem-solving** The diagram shows a square company logo.
Work out the area of blue in the logo.



5 **Reasoning** The diagram shows a trapezium.
Dave says, 'If I double the height of the trapezium, the area of the trapezium will also double.'
Is he correct? Explain how you worked out your answer.

6 **Reasoning** Carmen says, 'If I double the length of one of the parallel sides of a trapezium, but keep the other parallel side and the height the same, the area of the trapezium will also be doubled.'
Show, using a counter example, that she is wrong.

7 **Problem-solving** This trapezium and this parallelogram have the same area.



What is the perpendicular height of the parallelogram?

Q1a hint
A cube has six identical faces.

Q2a Strategy hint
Work out the surface area of the larger cube first.

Q3 Strategy hint
Draw a sketch of each cuboid and label the missing height h. Then work out the surface area of the red cuboid.

Q4 hint
Work out the area of the square and the area of the trapezium.

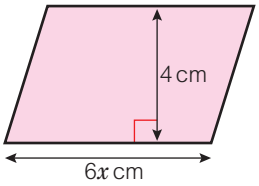
Q6 Literacy hint
A counter example is one example that proves the statement is wrong.

Q6 Strategy hint
Draw your own trapezium to test Caroline's statement.

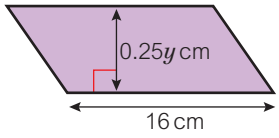
Q7 Strategy hint
Make sure all measurements are in the same units.

8 Write an expression for the area of each parallelogram.
Write each answer in its simplest form.

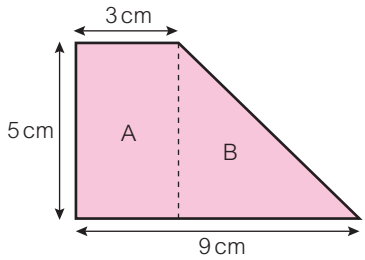
a



b



9 **a** Work out the area of A and B.

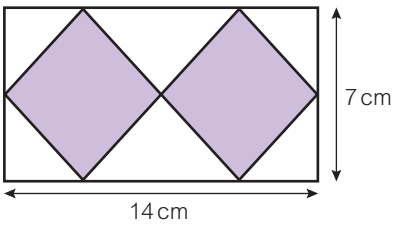


b What is the total area?

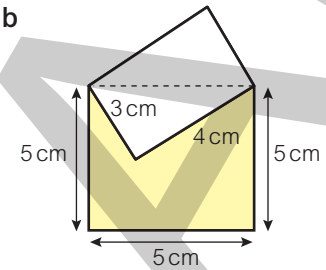
c How else could you have worked out the total area?

10 Work out the shaded area of each shape.

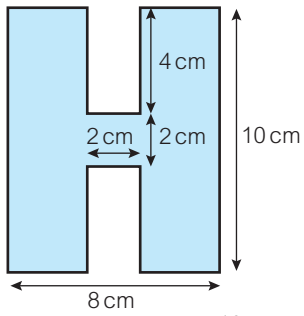
a



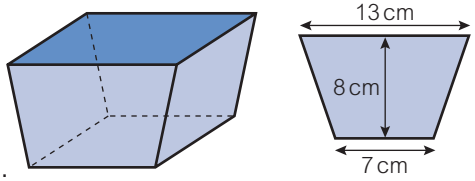
b



c



11 **Problem-solving** The diagram shows a foldaway camping bowl. It has four sides in the shape of congruent trapezia. The bottom of the bowl is a square. Work out the total surface area of the bowl.



Bowl **Side**

12 **Problem-solving** A water container is in the shape of a cuboid. It has length 1.5 m, width 0.7 m and height 0.8 m.

a Write the dimensions of the trough in centimetres.
Water is put into the trough. The depth of the water is three quarters of the height of the trough.

b Work out the volume of the water in the trough in cm^3.

c Work out the capacity of the water in the trough in litres.

13 **Problem-solving / Finance** Ghadif has an oil tank that is approximately the shape of a cuboid.
It has length 1.8 m, width 80 cm and height 90 cm. It contains oil to a depth of 25 cm.

a Can he fit 1000 litres more into his oil tank? Explain your answer.
Ghadif orders oil to fill his tank to 90% full.

b How much oil does he order to the nearest litre?
The price of oil is 69.8p per litre if you order 1000 litres or more, and 70.2p per litre if you order less than 1000 litres.

c How much does he pay for this oil?
Give your answer in pounds to the nearest penny.

Q13a Strategy hint

Draw a diagram to help you.

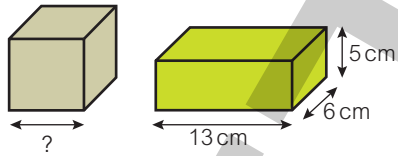
14 A cuboid has length 8 cm.
The width of the cuboid is three quarters of its length. The height of the cuboid is 30% of its length.
Work out the surface area of the cuboid.

15 **Problem-solving** A cuboid has length, width and height in the ratio 4 : 5 : 3. The total of the length, width and height is 96 mm.
Work out the surface area of the cuboid.

Q15 Strategy hint

Work out the length, width and height of the cuboid first, by sharing 96 mm in the ratio 4 : 5 : 3.

16 **Problem-solving** This cube and cuboid have the same volume.
Work out the side length of the cube.
Give your answer to the nearest millimetre.



17 **Problem-solving** A gold bar is in the shape of a cuboid with length 150 mm, width 45 mm and height 45 mm.
The bar is melted and made into cubes with side length 12 mm.
How many cubes of gold can be made from the cuboid?

Q17 hint

The answer must be the largest whole number you can make.

18 **Problem-solving** A tap drips every second into a square sink 40 cm wide and 17 cm deep.
30 drips have a volume of 10 ml.
With the plug in, how long before the sink overflows?
Give your answer in hours and minutes.

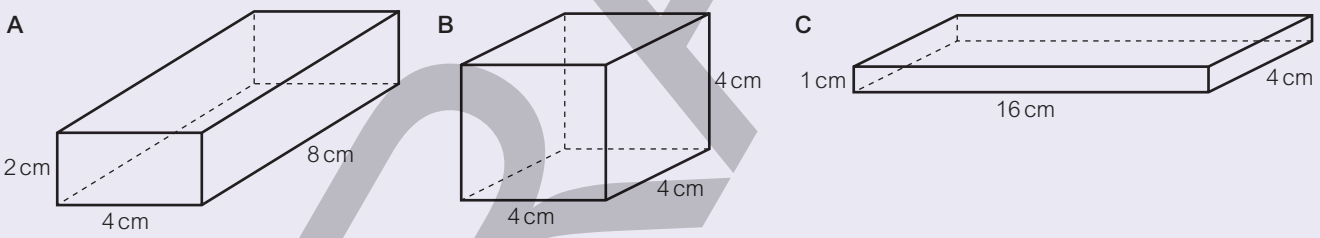
Q18 hint

Start by working out the capacity of the sink.
Use $1\,cm^3 = 1\,ml$.

Investigation

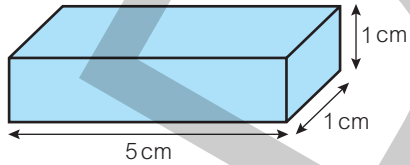
Real / Reasoning

These boxes have the same volume.



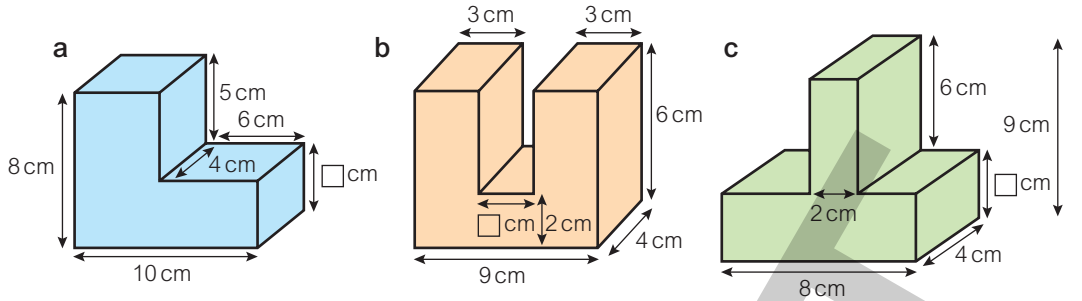
1 Do they all have the same surface area?
2 You run a packaging company. Which box would you choose and why?
3 Here are the dimensions of three more boxes with the same volume.
2 cm by 24 cm by 3 cm 6 cm by 6 cm by 6 cm 4 cm by 9 cm by 6 cm
Which box do you think would have the smallest surface area?

19 **Reasoning** Look at this cuboid.



a Calculate the volume of the cuboid.
b Calculate the surface area of the cuboid.
c Jamal has six of these cuboids.
How can he put them together to make a cuboid with
i the smallest surface area
ii the largest surface area?

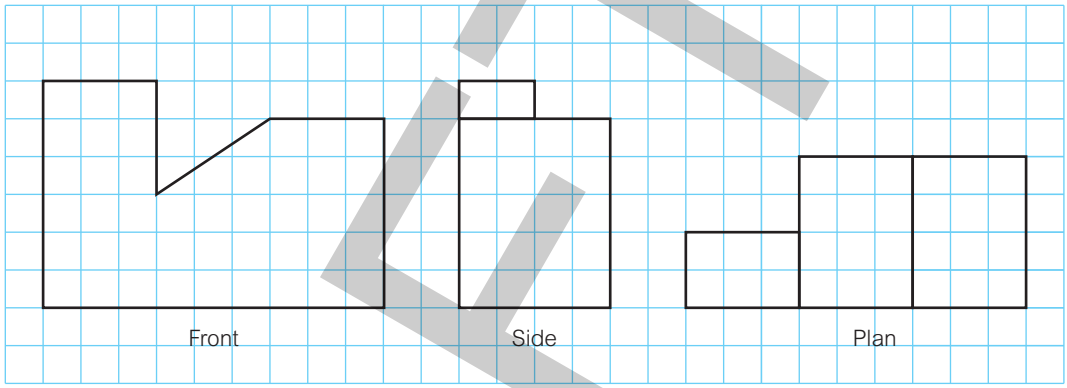
20 Calculate the volume of each solid.



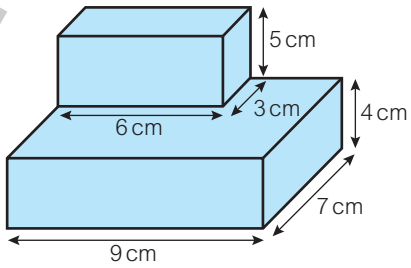
Q20 hint

First calculate any missing lengths. Then divide the shape into cuboids and work out the volume of each cuboid separately.

21 The diagram shows the front, side and plan views of a shape.
Draw an isometric diagram of the shape.



22 The diagram shows a shape made from cuboids.
Find the total surface area of the shape. The working has been started for you.

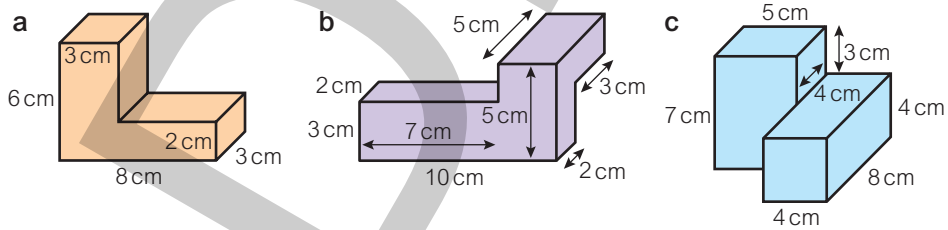


Base cuboid
area front and back = □ cm²
area right and left ends = □ cm²
area bottom = □ cm²
area top = 9 × □ + 3 × □ = □ cm²
Top cuboid
area front and back = □ cm²
area right and left ends = □ cm²
area top = □ cm²
total surface area = □ cm²
Discussion How else could you work out the total surface area of this shape?

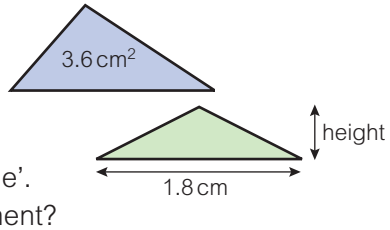
Q22 hint

Why don't you use the whole area of the top face in the base cuboid?

23 Calculate the surface area of each 3D solid.



24 **Problem-solving** The blue triangle has an area of 3.6 cm².
The area of the green triangle is 40% of the area of the blue triangle.
Work out the height of the green triangle.



25 **Reflect** Look back at Q6. It asked you for a 'counter example'.
What did this counter example show about Carmen's statement?
In what sort of situation might you need to prove a statement is untrue? Could you use a counter example? Explain.

4 Unit test

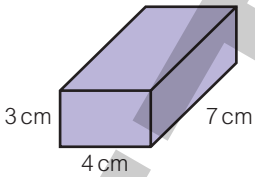
1 For this cuboid:

a Work out the volume.

b Work out the surface area.

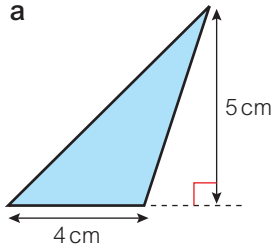
c Draw the cuboid on isometric paper.

d Draw the front elevation, side elevation and plan view.

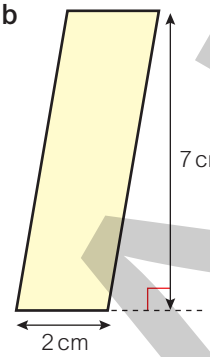


2 Work out the area of each shape.

a

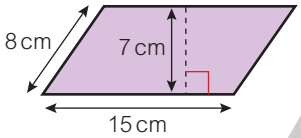


b

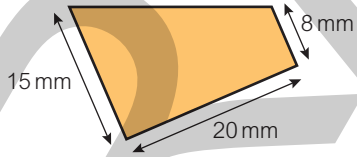


3 Work out the area of each shape.

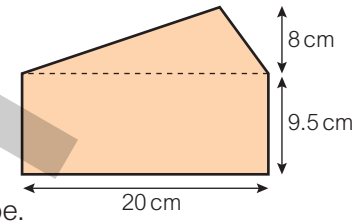
a A parallelogram



b A trapezium.

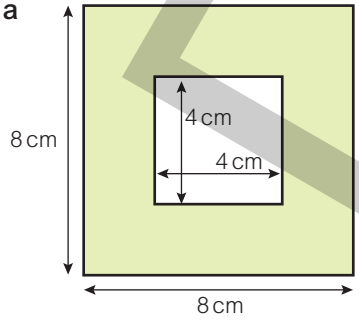


4 Work out the area of this shape.

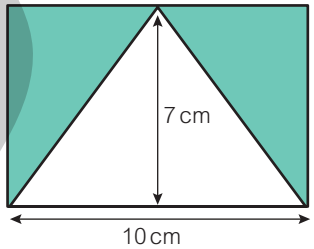


5 Calculate the shaded area of each shape.

a



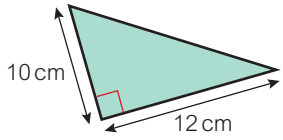
b

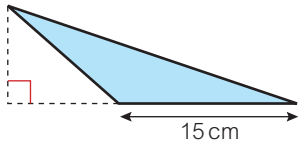


6 These two triangles have the same area.

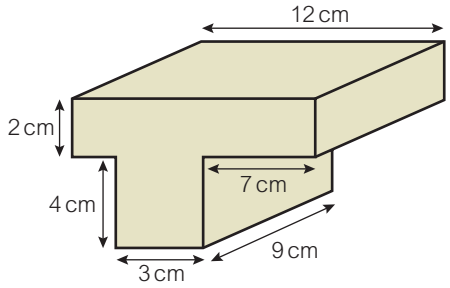
a Work out the area of the green triangle.

b Work out the height of the blue triangle.





7 Work out the volume of this solid.



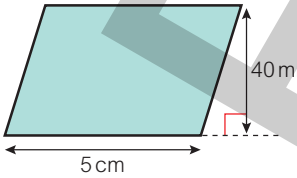
8 Copy and complete these conversions.

a $4.3\,m^3 = \square\,cm^3$ **b** $\square\,cm^3 = 8500\,mm^3$

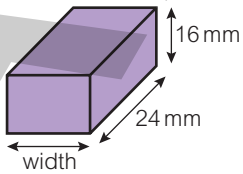
c $540\,ml = \square\,cm^3$

9 An open gift box is a cuboid. It has length 18.5 cm, width 9.4 cm and height 6.2 cm.
Work out the area of cardboard needed to make the open box.

10 Work out the area of this shape in square centimetres.

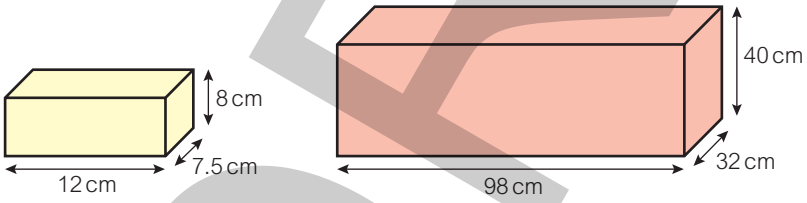


11 The diagram shows a cuboid with volume $5760\,mm^3$.
Work out the width of the cuboid.



Challenge

12 The box for a wireless router measures 12 cm by 7.5 cm by 8 cm.
Boxes of wireless routers are packed into a larger box for transportation.
The larger box measures 98 cm by 32 cm by 40 cm.



a What is the greatest number of wireless router boxes that will fit into the larger box?

b What volume of empty space will be left in the box?

c Work out the dimensions of a box that will hold 60 wireless router boxes with no wasted space.

13 **Reflect** Write a heading, 'Five important things about area and volume'.
Now look back at the work you have done in this unit, and list the five most important things you have learned.
You might include

- formulae
- conversions
- methods for working things out
- mistakes to avoid (with tips on how to avoid them in future).