

Volume of Cuboids and Prisms

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

A cube has a volume of 125 cm^3

Write down the length of one edge.

All the edges of a cube are the same length.

So edge $\times$ edge $\times$ edge = 125

$$5 \times 5 \times 5 = 125$$

So the edge is $\sqrt[3]{125} = 5 \text{ cm}$.

Answer: 5 cm

2 (2 marks)

Here is a cuboid.

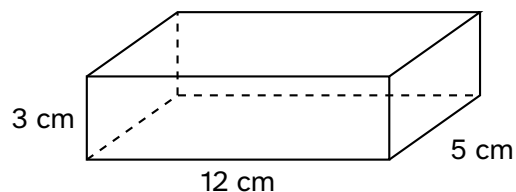


Diagram **NOT** accurately drawn

Work out the volume of the cuboid.

Volume = length $\times$ width $\times$ height

$$= 12 \times 5 \times 3$$

$$= 180$$

Answer: 180 cm^3

Tip: Multiply the three lengths. Do not add them, and do not find the surface area. Remember the units are cm^3 .

Marks: 1 mark for $12 \times 5 \times 3$. 1 mark for 180.

3 (2 marks)

A prism has a volume of 2700 cm^3 and a length of 15 cm.
Work out the area of the cross-section of the prism.

Volume = area of cross-section $\times$ length

So area of cross-section = volume $\div$ length

$$= 2700 \div 15$$

$$= 180$$

Answer: 180 cm^2

Tip: You are working backwards, so **divide** the volume by the length. Do not multiply.

Marks: 1 mark for $2700 \div 15$. 1 mark for 180.

4 (3 marks)

The cross-section of this prism is a right-angled triangle.

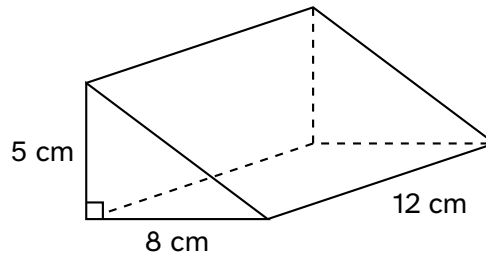


Diagram **NOT** accurately drawn

Work out the volume of the prism.

The cross-section is a triangle.

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

$$= \frac{1}{2} \times 8 \times 5 = 20 \text{ cm}^2$$

Volume = area of cross-section $\times$ length

$$= 20 \times 12 = 240$$

Answer: 240 cm³

Marks: 1 mark for the area of the triangle, 20. 1 mark for multiplying by 12. 1 mark for 240.

5 (3 marks)

The diagram shows a cuboid.

The base of the cuboid is a square of side x cm.

The height of the cuboid is 10 cm.

The volume of the cuboid is 490 cm^3

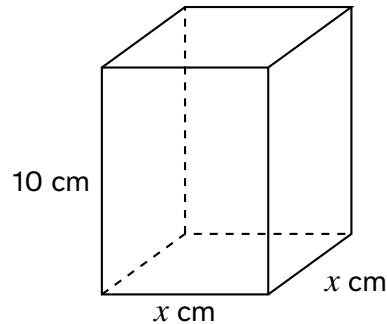


Diagram **NOT** accurately drawn

Work out the value of x .

Volume = area of base $\times$ height

So area of the square base = $490 \div 10 = 49 \text{ cm}^2$

The base is a square, so $x \times x = 49$

$$x = \sqrt{49} = 7$$

Answer: $x = 7$

Tip: The base is a square, so after dividing by the height you need the **square root** of 49, not $49 \div 2$.

Marks: 1 mark for $490 \div 10 (= 49)$. 1 mark for $x^2 = 49$ or $\sqrt{49}$. 1 mark for 7.

6 (4 marks)

A water trough is a prism 150 cm long.

Its cross-section is a trapezium.

1 litre = 1000 cm³

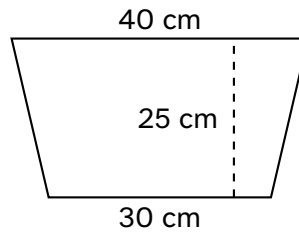


Diagram **NOT** accurately drawn

Work out how many litres of water the trough holds when it is full.

The cross-section is a trapezium.

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

$$= \frac{1}{2} \times (40 + 30) \times 25$$

$$= 875 \text{ cm}^2$$

$$\text{Volume} = 875 \times 150 = 131250 \text{ cm}^3$$

Change to litres (divide by 1000):

$$131250 \div 1000 = 131.25 \text{ litres}$$

Answer: 131.25 litres

Marks: 1 mark for the area of the trapezium, 875. 1 mark for multiplying by 150. 1 mark for dividing by 1000. 1 mark for 131.25.

7 (4 marks)

A fish tank is in the shape of a cuboid.

The tank contains water to a depth of 12 cm.

1 litre = 1000 cm³

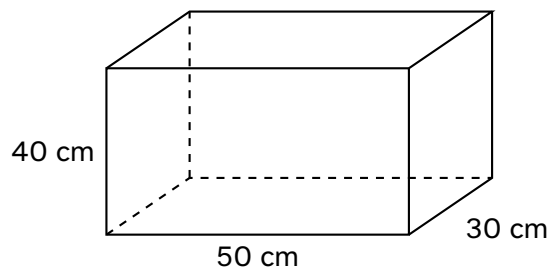


Diagram **NOT** accurately drawn

Mia pours another 9 litres of water into the tank.

Work out the new depth of the water.

Area of the base of the tank = $50 \times 30 = 1500 \text{ cm}^2$

9 litres = $9 \times 1000 = 9000 \text{ cm}^3$

Rise in depth = $9000 \div 1500 = 6 \text{ cm}$

New depth = $12 + 6 = 18 \text{ cm}$

(Or: water at first = $1500 \times 12 = 18\,000 \text{ cm}^3$; new volume = $27\,000 \text{ cm}^3$; depth = $27\,000 \div 1500 = 18 \text{ cm}$.)

Answer: 18 cm

Tip: The water only covers the base of the tank, so divide by the area of the base (50×30). The height of the tank, 40 cm, is not needed.

Marks: 1 mark for $50 \times 30 = 1500$. 1 mark for 9000 cm^3 . 1 mark for $9000 \div 1500$ (or $27\,000 \div 1500$). 1 mark for 18.

8 (5 marks)

A company packs soaps into boxes.

Each soap is a cube with edges of 4 cm.

Each box is a cuboid 20 cm long, 18 cm wide and 12 cm high.

(a) Work out the greatest number of soaps that will fit into one box.

Work out how many soaps fit along each edge of the box.

Along the 20 cm edge: $20 \div 4 = 5$

Along the 18 cm edge: $18 \div 4 = 4.5$, so only 4 fit.

Along the 12 cm edge: $12 \div 4 = 3$

Number of soaps = $5 \times 4 \times 3 = 60$

Answer: 60

Marks: 1 mark for 5, 4 and 3. 1 mark for 60.

- (b) The company needs to send 1000 soaps.
How many boxes does it need?

Each box holds 60 soaps.

$1000 \div 60 = 16.66 \dots$

16 boxes would hold only $16 \times 60 = 960$ soaps.

So the company needs 17 boxes.

Answer: 17

Tip: Round **up** here: 16 boxes are not enough for all 1000 soaps.

Marks: 1 mark for $1000 \div 60$ (or your answer to part (a)). 1 mark for 17.

- (c) Kareem says,
“The volume of the box is 4320 cm^3 and the volume of a soap is 64 cm^3 .
 $4320 \div 64 = 67.5$, so 67 soaps will fit into one box.”

Explain why Kareem is wrong.

4.5 soaps do not fit along the 18 cm edge: only 4 whole soaps fit.

So there is space in the box that cannot be filled with whole soaps.

Dividing the volumes assumes the soaps could be cut up to fill every gap.

Answer: The soaps cannot be cut up: only 4 soaps fit along the 18 cm edge, so some space is wasted