

Surface Area of Prisms and Cylinders

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 (2 marks)

A cube has edges of length 5 cm.

Work out the total surface area of the cube.

A cube has 6 faces, and they are all squares.

$$\text{Area of one face} = 5 \times 5 = 25 \text{ cm}^2$$

$$\text{Total surface area} = 6 \times 25 = 150 \text{ cm}^2$$

Answer: 150 cm²

Tip: Surface area is an area, so the units are cm². $5 \times 5 \times 5 = 125$ is the volume, not the surface area.

Marks: 1 mark for 5×5 . 1 mark for 150.

2 (3 marks)

Here is a cuboid.

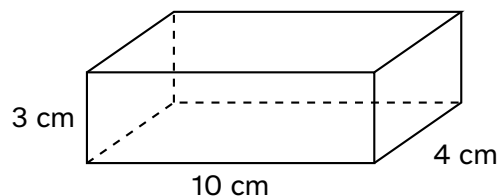


Diagram **NOT** accurately drawn

Work out the total surface area of the cuboid.

A cuboid has 6 faces, in 3 matching pairs.

Front and back: $10 \times 3 = 30 \text{ cm}^2$ each

Top and bottom: $10 \times 4 = 40 \text{ cm}^2$ each

Two ends: $4 \times 3 = 12 \text{ cm}^2$ each

Total = $2 \times (30 + 40 + 12)$

= $2 \times 82 = 164$

Answer: 164 cm^2

Marks: 1 mark for the areas of two different faces. 1 mark for adding all six faces. 1 mark for 164.

3 (2 marks)

A cylinder has radius 4 cm and height 9 cm.

Work out the area of the curved surface of the cylinder.

Give your answer correct to 1 decimal place.

If you unroll the curved surface, it makes a rectangle.

The rectangle's length is the circumference, $2\pi r$, and its width is the height, h .

Curved surface area = $2\pi rh$

= $2 \times \pi \times 4 \times 9 = 226.19 \dots$

Round to 1 decimal place: 226.2

Answer: 226.2 cm^2

Marks: 1 mark for $2 \times \pi \times 4 \times 9$. 1 mark for 226.2.

4 (3 marks)

A cube has a volume of 512 cm^3

Work out the total surface area of the cube.

Volume of a cube = edge $\times$ edge $\times$ edge

Edge = $\sqrt[3]{512} = 8 \text{ cm}$

Area of one face = $8 \times 8 = 64 \text{ cm}^2$

A cube has 6 faces: $6 \times 64 = 384 \text{ cm}^2$

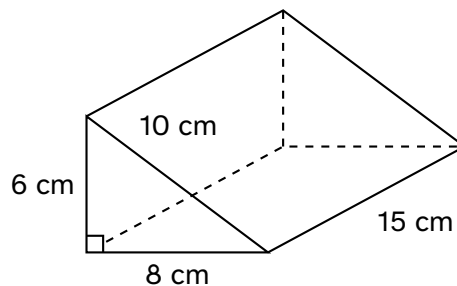
Answer: 384 cm^2

Tip: Use the **cube** root to find the edge ($8 \times 8 \times 8 = 512$). Then remember a cube has 6 faces.

Marks: 1 mark for 8. 1 mark for 64. 1 mark for 384.

5 (4 marks)

The cross-section of this prism is a right-angled triangle with sides 6 cm, 8 cm and 10 cm.



*Diagram **NOT** accurately drawn*

Work out the total surface area of the prism.

The prism has 5 faces: 2 triangles and 3 rectangles.

$$\text{One triangle} = \frac{1}{2} \times 8 \times 6 = 24 \text{ cm}^2$$

$$\text{Two triangles} = 2 \times 24 = 48 \text{ cm}^2$$

Each rectangle is 15 cm long.

$$\text{Rectangles: } 6 \times 15 = 90, \quad 8 \times 15 = 120, \quad 10 \times 15 = 150$$

$$\text{Three rectangles} = 90 + 120 + 150 = 360 \text{ cm}^2$$

$$\text{Total} = 48 + 360 = 408 \text{ cm}^2$$

Answer: 408 cm^2

Marks: 1 mark for 48. 1 mark for the area of one rectangle. 1 mark for 360. 1 mark for 408.

6 (4 marks)

Tom has 3 garden planters.

Each planter is a cuboid with no top.

Each planter is 1.2 m long, 0.4 m wide and 0.5 m high.

Tom is going to paint the outside of the planters, including the base but not the top.

One tin of paint covers 2.5 m^2

Each tin of paint costs £9.80

Work out the cost of the paint Tom needs.

Tom paints 5 faces of each planter (not the top).

$$\text{Base: } 1.2 \times 0.4 = 0.48 \text{ m}^2$$

$$\text{Front and back: } 2 \times 1.2 \times 0.5 = 1.2 \text{ m}^2$$

$$\text{Two ends: } 2 \times 0.4 \times 0.5 = 0.4 \text{ m}^2$$

$$\text{One planter} = 0.48 + 1.2 + 0.4 = 2.08 \text{ m}^2$$

$$\text{Three planters} = 3 \times 2.08 = 6.24 \text{ m}^2$$

$$\text{Number of tins} = 6.24 \div 2.5 = 2.496$$

He must buy whole tins, so he needs 3 tins.

$$\text{Cost} = 3 \times £9.80 = £29.40$$

Answer: £29.40

Tip: There is no top, so there are only 5 faces to paint. Round the number of tins **up**: 2.496 tins means Tom must buy 3.

Marks: 1 mark for the area of one face. 1 mark for 2.08 (or 6.24). 1 mark for $6.24 \div 2.5$ and rounding up to 3 tins. 1 mark for £29.40.

7 (5 marks)

A factory makes closed cylindrical tins.

Each tin has a diameter of 7 cm and a height of 11 cm.

The factory has a sheet of metal with an area of 2 m^2

Assume that none of the metal is wasted.

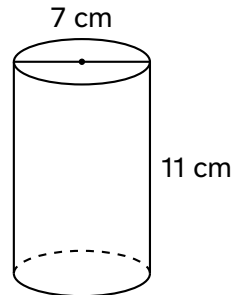


Diagram **NOT** accurately drawn

Can the factory make 80 tins from the sheet of metal?

You must show how you get your answer.

The diameter is 7 cm, so the radius is $7 \div 2 = 3.5 \text{ cm}$.

Top and bottom: $2 \times \pi \times 3.5^2 = 76.96 \dots \text{ cm}^2$

Curved surface = $\pi \times \text{diameter} \times \text{height} = \pi \times 7 \times 11 = 241.90 \dots \text{ cm}^2$

One tin = $76.96 \dots + 241.90 \dots = 318.87 \dots \text{ cm}^2$

80 tins = $80 \times 318.87 \dots = 25\,509.7 \dots \text{ cm}^2$

Change 2 m^2 to cm^2 : $2 \times 10\,000 = 20\,000 \text{ cm}^2$

$25\,510 \text{ cm}^2$ is more than $20\,000 \text{ cm}^2$, so the factory cannot make 80 tins.

Answer: No (80 tins need about $25\,510 \text{ cm}^2$, but the sheet is only $20\,000 \text{ cm}^2$)

Tip: $1 \text{ m}^2 = 100 \times 100 = 10\,000 \text{ cm}^2$, not 100 cm^2 . Include the top and the bottom of each tin as well as the curved surface.

Marks: 1 mark for $\pi \times 3.5^2$. 1 mark for $\pi \times 7 \times 11$. 1 mark for a full method for one tin (= 318.9). 1 mark for multiplying by 80 and using the same units (or $20\,000 \div 318.9 = 62.7$). 1 mark for No, with correct figures.