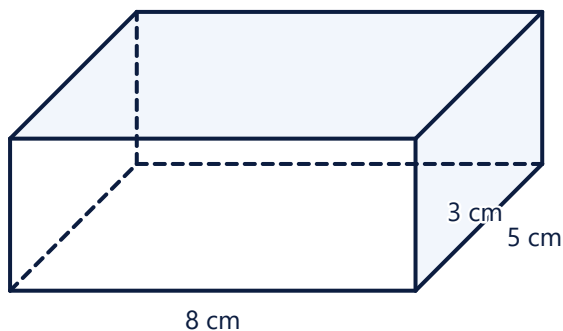




- 1** The diagram shows a cuboid.
- Work out the volume of the cuboid.
 - Work out the total surface area of the cuboid.



(4 marks)

a)

$$V = 8 \times 5 \times 3$$

$$V = 120$$

$$120 \text{ cm}^3$$

b)

Three pairs of faces

$$8 \times 5 = 40$$

$$8 \times 3 = 24$$

$$5 \times 3 = 15$$

$$SA = 2 \times (40 + 24 + 15)$$

$$SA = 2 \times 79$$

$$SA = 158$$

$$158 \text{ cm}^2$$

2

A cube has a volume of 64 cm^3 .

Work out the total surface area of the cube.

(3 marks)

The side length of the cube is the cube root of 64, which is 4 cm
(since $4 \times 4 \times 4 = 64$)

Each face has area $4 \times 4 = 16 \text{ cm}^2$

A cube has 6 faces, so total surface area = $6 \times 16 = 96 \text{ cm}^2$

96 cm^2

3

a. A prism has a cross-section with an area of 24 cm^2 . The prism is 15 cm long. Work out the volume of the prism.

b. Another prism has a volume of 540 cm^3 . Its cross-section has an area of 72 cm^2 . Work out the length of this prism.

(3 marks)

a)

$V = \text{area of cross-section} \times \text{length}$

$$V = 24 \times 15$$

$$V = 360$$

360 cm^3

b)

$$\begin{array}{rcl} 72 \times L & = & 540 \\ \hline L & = & 7.5 \end{array}$$

$\div 72$

$\div 72$

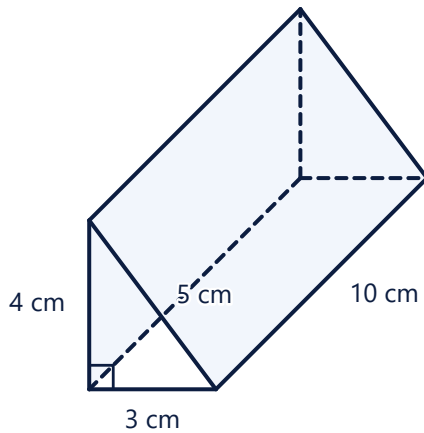
7.5 cm

4

The cross-section of a triangular prism is a right-angled triangle with base 3 cm, height 4 cm and hypotenuse 5 cm.

The length of the prism is 10 cm.

Work out the total surface area of the prism.



(3 marks)

The two triangular ends each have area $\frac{1}{2} \times 3 \times 4 = 6 \text{ cm}^2$,

giving 12 cm^2 in total

The three rectangular faces have areas $3 \times 10 = 30 \text{ cm}^2$, $4 \times 10 = 40 \text{ cm}^2$ and $5 \times 10 = 50 \text{ cm}^2$

Total surface area = $12 + 30 + 40 + 50 = 132 \text{ cm}^2$

132 cm²

5

- Change 5 litres to cm^3 .
- Change 3 m^3 to cm^3 .
- Change 4500 cm^3 to litres.
- Change 2.5 cm^3 to mm^3 .

(4 marks)

a)

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

$$5 \times 1000 = 5000$$

$$\boxed{5000 \text{ cm}^3}$$

b)

$$1 \text{ m}^3 = 100 \times 100 \times 100 \text{ cm}^3$$

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

$$3 \times 1\,000\,000 = 3\,000\,000$$

$$\boxed{3\,000\,000 \text{ cm}^3}$$

c)

$$4500 \div 1000 = 4.5$$

$$\boxed{4.5 \text{ Litres}}$$

d)

$$1 \text{ cm}^3 = 10 \times 10 \times 10 \text{ mm}^3 = 1000 \text{ mm}^3$$

$$2.5 \times 1000 = 2500$$

$$\boxed{2500 \text{ mm}^3}$$

6

A fish tank is a cuboid with a base measuring 40 cm by 25 cm and a height of 20 cm.

The tank is filled with water to a depth of 15 cm.

All of the water is poured into cups. Each cup holds 250 ml.

Work out the number of cups that can be completely filled.

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

(4 marks)

$$\text{Volume of water} = 40 \times 25 \times 15 = 15000 \text{ cm}^3$$

$$15000 \text{ cm}^3 = 15000 \text{ ml}$$

$$\text{Number of cups} = 15000 \div 250 = 60$$

$$\boxed{60}$$

7

The cross-section of a prism is an L-shape.

The L-shape is made by starting with a rectangle 12 cm wide and 9 cm tall, then removing a 7 cm by 5 cm rectangle from the top right corner.

The length of the prism is 24 cm.

Show that the volume of the prism is 1752 cm^3 .

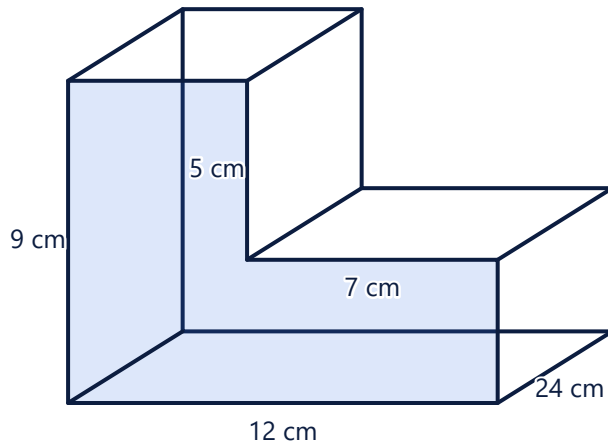


Diagram NOT accurately drawn

(5 marks)

$$\text{Area of the full rectangle} = 12 \times 9 = 108 \text{ cm}^2$$

$$\text{Area removed} = 7 \times 5 = 35 \text{ cm}^2$$

$$\text{Area of the L-shaped cross-section} = 108 - 35 = 73 \text{ cm}^2$$

$$\text{Volume} = \text{area of cross-section} \times \text{length} = 73 \times 24 = 1752 \text{ cm}^3$$

8

A skip is a prism. Its cross-section is a trapezium.

The diagram shows the measurements of the skip.

- Work out the volume of the skip.
- Callum fills the skip with garden rubbish. Each wheelbarrow load is 0.25 m^3 . How many wheelbarrow loads fill the skip?

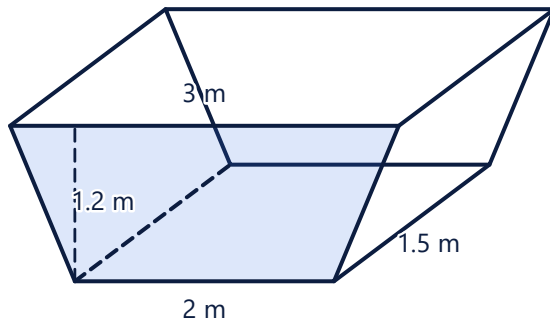


Diagram NOT accurately drawn

(4 marks)

a)

$$\text{Area} = \frac{2 + 3}{2} \times 1.2$$

$$\text{Area} = 2.5 \times 1.2$$

$$\text{Area} = 3 \text{ m}^2$$

$$V = 3 \times 1.5$$

$$V = 4.5$$

$$\boxed{4.5 \text{ m}^3}$$

b)

$$4.5 \div 0.25 = 18$$

$$\boxed{18 \text{ Loads}}$$

- 9 A water tank is a cuboid measuring 1.5 m by 0.8 m by 0.6 m.
The tank is empty. Dev fills the tank completely with water.
Water costs £1.25 for every 100 litres.
Work out the cost of the water needed to fill the tank.
 $1 \text{ m}^3 = 1000 \text{ litres}$

(5 marks)

$$\begin{aligned}\text{Volume of the tank} &= 1.5 \times 0.8 \times 0.6 = 0.72 \text{ m}^3 \\ 0.72 \text{ m}^3 &= 0.72 \times 1000 = 720 \text{ Litres} \\ 720 \div 100 &= 7.2 \text{ lots of 100 Litres} \\ \text{Cost} &= 7.2 \times £1.25 = £9.00\end{aligned}$$

£9.00

- 10 A cuboid has a square base of side 5 cm and height h cm.
The total surface area of the cuboid is 190 cm^2 .
Work out the volume of the cuboid.

(5 marks)

$$\begin{aligned}\text{The top and bottom faces have total area } 2 \times 5 \times 5 &= 50 \text{ cm}^2 \\ \text{The four vertical faces have total area } 4 \times 5h &= 20h \text{ cm}^2 \\ 50 + 20h &= 190, \text{ so } 20h \\ &= 140 \text{ and} \\ h &= 7 \text{ cm} \\ \text{Volume} &= 5 \times 5 \times 7 \\ &= 175 \text{ cm}^3\end{aligned}$$

175 cm³

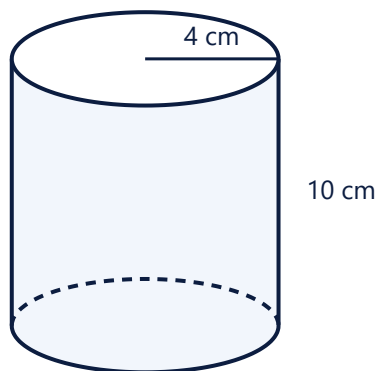
EXTENSION QUESTIONS

11

The diagram shows a solid cylinder with radius 4 cm and height 10 cm.

- Work out the volume of the cylinder. Give your answer in terms of π .
- Work out the total surface area of the cylinder. Give your answer in terms of π .
- A sphere has radius 3 cm. Work out its volume and its surface area. Give your answers in terms of π .

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3 \quad \text{Surface area of a sphere} = 4\pi r^2$$



(5 marks)

a)

$$V = \pi r^2 h$$

$$V = \pi \times 4^2 \times 10$$

$$V = 160\pi$$

$$\boxed{160\pi \text{ cm}^3}$$

b)

$$\text{Two circles: } 2 \times \pi \times 4^2 = 32\pi$$

$$\text{Curved: } 2 \times \pi \times 4 \times 10 = 80\pi$$

$$SA = 32\pi + 80\pi$$

$$SA = 112\pi$$

$$\boxed{112\pi \text{ cm}^2}$$

c)

$$V = \frac{4}{3} \times \pi \times 3^3$$

$$V = \frac{4}{3} \times 27\pi$$

$$V = 36\pi$$

$$SA = 4 \times \pi \times 3^2$$

$$SA = 36\pi$$

$$36\pi \text{ cm}^3 \text{ and } 36\pi \text{ cm}^2$$

- 12 A cylinder has a volume of 1500 cm^3 and a radius of 6 cm.

Work out the height of the cylinder.

Give your answer correct to 1 decimal place.

(4 marks)

$$\text{Volume} = \pi r^2 h, \text{ so } 1500 = \pi \times 36 \times h$$

$$h = 1500 \div (36\pi) = 1500 \div 113.097..$$

$$h = 13.262... = 13.3 \text{ cm (1 decimal place)}$$

$$13.3 \text{ cm}$$

EXTENSION QUESTIONS

13

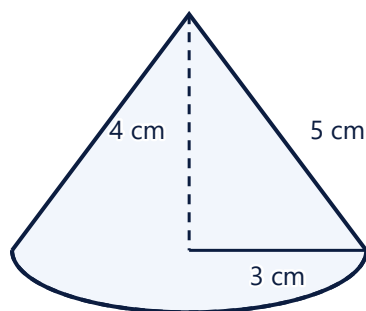
- a. A square-based pyramid has a base of side 6 cm and a vertical height of 10 cm. Work out the volume of the pyramid.

$$\text{Volume of a pyramid} = \frac{1}{3} \times \text{area of base} \times \text{height}$$

- b. The diagram shows a solid cone with base radius 3 cm, vertical height 4 cm and slant height 5 cm.

Work out the volume and the total surface area of the cone. Give your answers in terms of π .

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h \quad \text{Curved surface area of a cone} = \pi r l$$



(5 marks)

a)

$$V = \frac{1}{3} \times 6 \times 6 \times 10$$

$$V = \frac{1}{3} \times 360$$

$$V = 120$$

$$\boxed{120 \text{ cm}^3}$$

b)

$$V = \frac{1}{3} \times \pi \times 3^2 \times 4$$

$$V = \frac{1}{3} \times 36\pi$$

$$V = 12\pi$$

$$\text{Curved: } \pi \times 3 \times 5 = 15\pi$$

$$\text{Base: } \pi \times 3^2 = 9\pi$$

$$SA = 15\pi + 9\pi$$

$$SA = 24\pi$$

$$\boxed{12\pi \text{ cm}^3 \text{ and } 24\pi \text{ cm}^2}$$

14

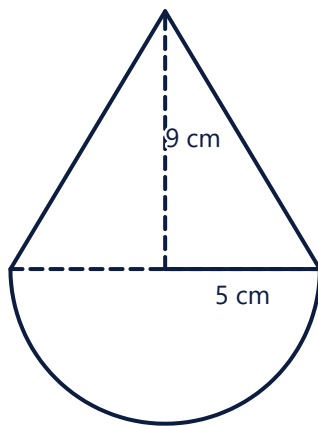
A solid is made from a cone and a hemisphere.

The cone has base radius 5 cm and vertical height 9 cm.

The flat face of the hemisphere, of radius 5 cm, is joined to the base of the cone.

Work out the total volume of the solid.

Give your answer correct to 3 significant figures.



Central vertical cross-section

Diagram NOT accurately drawn

(4 marks)

$$\text{Volume of the cone} = \frac{1}{3} \times \pi \times 5^2 \times 9 = \frac{1}{3} \times \pi \times 225 = 75\pi \text{ cm}^3$$

$$\text{Volume of the hemisphere} = \frac{2}{3} \times \pi \times 5^3 = \frac{250\pi}{3} \text{ cm}^3$$

$$\text{Total volume} = 75\pi + \frac{250\pi}{3} = \frac{475\pi}{3} = 497.41\dots \text{ cm}^3$$

$$\text{Total volume} = 497 \text{ cm}^3 \text{ (3 s.f.)}$$

$$\boxed{497 \text{ cm}^3}$$