



- 1 A cylinder has a radius of 5 cm and a height of 12 cm.

Work out the volume of the cylinder.

Give your answer correct to 3 significant figures.

(3 marks)

The circular cross-section has area πr^2 . Multiplying by the perpendicular height gives the volume, just as base area $\times$ height does for a cuboid

$$\text{Volume of a cylinder} = \pi r^2 h$$

$$\text{Volume} = \pi \times 5^2 \times 12 = 300\pi$$

$$\text{Volume} = 942.477... = 942 \text{ cm}^3 \text{ (3 significant figures)}$$

$$\boxed{942 \text{ cm}^3}$$

- 2 A cylindrical tin has a diameter of 8 cm and a height of 10 cm.

Work out the volume of the tin.

Give your answer correct to 3 significant figures.

(3 marks)

$$\text{The radius} = 8 \div 2 = 4 \text{ cm}$$

$$\text{Volume} = \pi r^2 h = \pi \times 4^2 \times 10 = 160\pi$$

$$\text{Volume} = 502.654... = 503 \text{ cm}^3 \text{ (3 significant figures)}$$

$$\boxed{503 \text{ cm}^3}$$

- 3 A solid cylinder stands on a table.

Looking down from above (the plan), the cylinder looks like a circle with diameter 10 cm.

Looking from the front (the elevation), the cylinder looks like a rectangle 10 cm wide and 14 cm tall.

Work out the volume of the cylinder. Give your answer correct to 3 significant figures.

(3 marks)

$$\text{Plan: diameter 10, so } r = 5$$

$$\text{Elevation: } h = 14$$

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

$$V = \pi \times 5^2 \times 14$$

$$V = 350\pi = 1099.55...$$

$$\boxed{1100 \text{ cm}^3}$$

- 4 A cylindrical water butt has a radius of 25 cm and a height of 80 cm.
Work out the number of litres of water the water butt holds when it is full.
Give your answer to the nearest litre.

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

(4 marks)

$$\text{Volume} = \pi r^2 h = \pi \times 25^2 \times 80 = 50000\pi \text{ cm}^3$$

$$\text{Volume} = 157079.6... \text{ cm}^3$$

$$157079.6 \div 1000 = 157.08 \text{ litres}$$

The water butt holds 157 litres (nearest litre)

157 litres

- 5 A solid cylinder has a radius of 6 cm and a height of 5 cm.
a. Work out the volume of the cylinder. Give your answer in terms of π .
b. Work out the total surface area of the cylinder. Give your answer in terms of π .

(4 marks)

$$\text{a) Volume} = \pi r^2 h = \pi \times 36 \times 5 = 180\pi \text{ cm}^3$$

$$\text{b) The two circular ends have total area } 2\pi r^2 = 2 \times \pi \times 36 = 72\pi \text{ cm}^2$$

$$\text{The curved surface has area } 2\pi rh = 2 \times \pi \times 6 \times 5 = 60\pi \text{ cm}^2$$

$$\text{Total surface area} = 72\pi + 60\pi = 132\pi \text{ cm}^2$$

Unrolling the curved surface produces a rectangle whose width is the circumference $2\pi r$ and whose height is h . Its area is therefore $2\pi rh$

- 6 A tunnel is in the shape of half a cylinder lying on its flat face. The semicircular ends have radius 3 m and the tunnel is 20 m long.
Work out the volume of the tunnel. Give your answer in terms of π .

(3 marks)

$$\text{Full cylinder: } V = \pi r^2 h$$

$$V = \pi \times 3^2 \times 20 = 180\pi$$

$$\text{Half: } 180\pi \div 2$$

$$90\pi \text{ m}^3$$

- 7 A cylindrical tank has a radius of 30 cm and a height of 100 cm.

The tank is empty.

Water flows into the tank at a rate of 20 litres per minute.

Work out how long it takes to fill the tank completely.

Give your answer in minutes, correct to 1 decimal place.

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

(4 marks)

$$\text{Volume} = \pi r^2 h = \pi \times 30^2 \times 100 = 90000\pi \text{ cm}^3$$

$$\text{Volume} = 282743.3... \text{ cm}^3 = 282.743... \text{ Litres}$$

$$\text{Time} = 282.743... \div 20 = 14.137... \text{ minutes}$$

$$\text{Time} = 14.1 \text{ minutes (1 decimal place)}$$

14.1 minutes

- 8 A metal pipe is a hollow cylinder 50 cm long. The outer radius of the pipe is 5 cm and the inner radius is 4 cm.

Work out the volume of metal used to make the pipe. Give your answer correct to 3 significant figures.

(4 marks)

$$\text{Outer: } \pi \times 5^2 \times 50 = 1250\pi$$

$$\text{Inner: } \pi \times 4^2 \times 50 = 800\pi$$

$$1250\pi - 800\pi = 450\pi$$

$$450\pi = 1413.7...$$

1410 cm³

- 9 A cylindrical can has a diameter of 7 cm and a height of 11 cm.

Soup is poured from a large pot containing 20 litres into the cans, filling each one completely.

Work out the greatest number of cans that can be filled completely.

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

(4 marks)

$$r = 7 \div 2 = 3.5$$

$$V = \pi \times 3.5^2 \times 11 = 423.3... \text{ cm}^3$$

$$20 \text{ Litres} = 20\,000 \text{ cm}^3$$

$$20\,000 \div 423.3... = 47.2...$$

47 cans

- 10 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)

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

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

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

$$\boxed{13.3 \text{ cm}}$$

- 11 A solid metal cylinder has radius 6 cm and height 10 cm. It is melted down and recast into a solid cylinder of radius 3 cm.

Work out the height of the new cylinder.

(3 marks)

$$\text{Original: } V = \pi \times 6^2 \times 10 = 360\pi$$

$$\text{New: } V = \pi \times 3^2 \times h = 9\pi h$$

$$\begin{array}{rcl} 9\pi h & = & 360\pi \\ \div 9\pi & & \div 9\pi \\ h & = & 40 \end{array}$$

$$\boxed{h = 40 \text{ cm}}$$

- 12 A cylinder has a volume of 2000 cm^3 and a height of 15 cm.

Work out the radius of the cylinder.

Give your answer correct to 1 decimal place.

(4 marks)

$$\text{Volume} = \pi r^2 h, \text{ so } 2000 = \pi \times r^2 \times 15$$

$$r^2 = 2000 \div (15\pi) = 42.441..$$

$$r = \sqrt{42.441...} = 6.514... = 6.5 \text{ cm (1 decimal place)}$$

$$\boxed{6.5 \text{ cm}}$$

- 13 A solid metal cylinder has radius 2 cm and height 10 cm.

The density of the metal is 8 g/cm^3 .

Work out the mass of the cylinder. Give your answer correct to 3 significant figures.

(4 marks)

$$V = \pi \times 2^2 \times 10 = 40\pi = 125.66... \text{ cm}^3$$

$$\text{mass} = \text{density} \times \text{volume}$$

$$\text{mass} = 8 \times 125.66...$$

$$\text{mass} = 1005.3...$$

$$\boxed{1010 \text{ g}}$$

14

A cylindrical drinks dispenser has a radius of 20 cm and a height of 50 cm.

Priya wants to fill the dispenser completely with squash.

Squash is made by mixing cordial and water in the ratio 1 : 9 by volume.

Priya has 5.5 litres of cordial and an unlimited supply of water.

Does Priya have enough cordial to fill the dispenser? You must show your working.

1 litre = 1000 cm³

(5 marks)

$$\text{Volume of the dispenser} = \pi r^2 h = \pi \times 20^2 \times 50 = 20000\pi = 62831.8... \text{ cm}^3$$

$$62831.8... \text{ cm}^3 = 62.83... \text{ litres}$$

In the ratio 1

$$\begin{aligned} 9, \text{ cordial is 1 part out of 10, so cordial needed} &= 62.83... \div 10 = \\ &6.28... \text{ litres} \end{aligned}$$

6.28 litres > 5.5 litres, so Priya does not have enough cordial