

Cylinders

Solutions

For AQA GCSE Mathematics (8300) • 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 cylinder has volume $72\pi \text{ cm}^3$ and radius 3 cm.

Circle the height of the cylinder.

Options: 4 cm, 8 cm, 12 cm, 24 cm

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

$$\pi \times 3^2 \times h = 72\pi$$

$$9\pi \times h = 72\pi$$

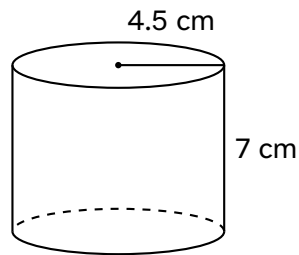
$$h = 72 \div 9 = 8$$

Answer: 8 cm

Tip: Square the radius first: the base area is 9π , not 3π . Dividing 72 by 3 gives the wrong answer 24 cm.

2 (2 marks)

Here is a cylinder.



Not drawn accurately

Work out the volume of the cylinder.

Give your answer to 1 decimal place.

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

Here $r = 4.5$ and $h = 7$.

$$V = \pi \times 4.5^2 \times 7$$

$$= 445.32 \dots$$

Round to 1 decimal place: 445.3

Answer: 445.3 cm³

Marks: 1 mark for $\pi \times 4.5^2 \times 7$. 1 mark for 445.3 (or 445.32...).

3 (2 marks)

A cylinder has radius 3 cm and height 5 cm.

Work out the volume of the cylinder.

Give your answer in terms of π .

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

$$= \pi \times 3^2 \times 5$$

$$= \pi \times 9 \times 5 = 45\pi$$

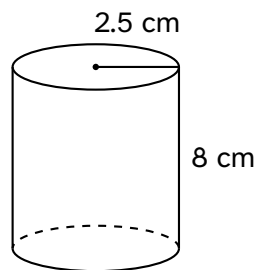
Answer: $45\pi \text{ cm}^3$

Tip: “In terms of π ” means keep π in the answer. Work out the numbers and write π after them.

Marks: 1 mark for $\pi \times 3^2 \times 5$. 1 mark for 45π .

4 (2 marks)

A cylinder has radius 2.5 cm and height 8 cm.



Not drawn accurately

Work out the area of the curved surface of the cylinder.
Give your answer 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 = $2\pi rh$

$$= 2 \times \pi \times 2.5 \times 8$$

$$= 125.66 \dots$$

Round to 1 decimal place: 125.7

Answer: 125.7 cm^2

Tip: The length of the rectangle is the **circumference** of the circle, not the radius or diameter.

Marks: 1 mark for $2 \times \pi \times 2.5 \times 8$. 1 mark for 125.7.

5 (3 marks)

A cylinder has a volume of 1000 cm^3 and radius 5 cm.
Work out the height of the cylinder.
Give your answer to 1 decimal place.

$$\text{Volume} = \pi r^2 h, \text{ so } \pi \times 5^2 \times h = 1000$$

$$\pi \times 5^2 = 78.53 \dots \text{ (the area of the circular base)}$$

$$\text{So } 78.53 \dots \times h = 1000$$

$$h = 1000 \div 78.53 \dots = 12.73 \dots$$

Round to 1 decimal place: 12.7

Answer: 12.7 cm

Marks: 1 mark for $\pi \times 5^2$ (or 25π). 1 mark for dividing 1000 by this. 1 mark for 12.7.

6 (3 marks)

A tin is a cylinder with radius 4 cm and height 11 cm.
 $1 \text{ ml} = 1 \text{ cm}^3$

Will the tin hold 500 ml of soup?

Tick a box.

You must show your working.

$$\text{Volume of the tin} = \pi \times 4^2 \times 11$$

$$= 552.9 \dots \text{ cm}^3$$

$$500 \text{ ml} = 500 \text{ cm}^3$$

552.9 is more than 500, so the soup will fit.

Answer: Yes (552.9 cm^3)

Marks: 1 mark for $\pi \times 4^2 \times 11$. 1 mark for 552.9. 1 mark for Yes, compared with 500 cm^3 .

7 (2 marks)

A candle is a cylinder with radius 3.8 cm and height 11 cm.
Some of these candles are packed upright, in one layer, in a box.
The inside of the box is 30 cm long, 23 cm wide and 12 cm high.

Leah says,

“I can fit 12 of the candles in the box.”

Is Leah correct?

Tick a box.

Show working to support your answer.

Each candle takes up its diameter across the box: $2 \times 3.8 = 7.6$ cm

Along the 30 cm side: $30 \div 7.6 = 3.9 \dots$, so only 3 candles fit.

Along the 23 cm side: $23 \div 7.6 = 3.02 \dots$, so 3 candles fit.

The candles are 11 cm tall and the box is 12 cm high, so they fit upright.

Number of candles = $3 \times 3 = 9$

9 is less than 12, so Leah is wrong.

Answer: No (only $3 \times 3 = 9$ candles fit)

Tip: Use the **diameter** (7.6 cm), not the radius. Also, you cannot fit part of a candle: 3.9 rounds **down** to 3.

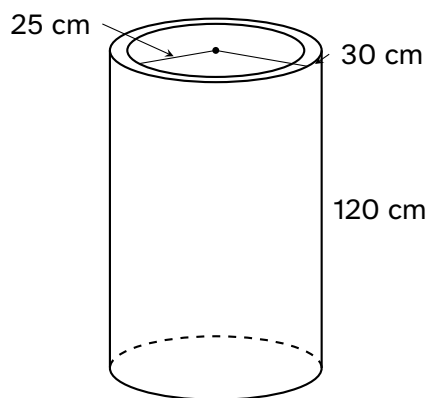
Marks: 1 mark for using the diameter 7.6 cm (e.g. $30 \div 7.6$ or $4 \times 7.6 = 30.4$). 1 mark for No with 9 candles.

8 (4 marks)

A concrete pipe is a hollow cylinder.

The outer radius is 30 cm and the inner radius is 25 cm.

The pipe is 120 cm long.



Not drawn accurately

Work out the volume of concrete in the pipe.

Give your answer to the nearest cm^3

Volume of concrete = volume of the whole cylinder – volume of the hole

Whole cylinder: $\pi \times 30^2 \times 120 = 339\,292.0 \dots \text{cm}^3$

Hole: $\pi \times 25^2 \times 120 = 235\,619.4 \dots \text{cm}^3$

Concrete: $339\,292.0 \dots - 235\,619.4 \dots = 103\,672.5 \dots$

Round to the nearest cm^3 : 103 673

Answer: 103 673 cm^3

Tip: Work out each volume first, then subtract. Subtracting the radii first ($30 - 25 = 5$) and using $\pi \times 5^2 \times 120$ is wrong.

Marks: 1 mark for $\pi \times 30^2 \times 120$. 1 mark for $\pi \times 25^2 \times 120$. 1 mark for subtracting. 1 mark for 103 673.

9 (4 marks)

A cuboid tank 20 cm by 10 cm by 8 cm is full of water.

All the water is poured into an empty cylinder with radius 6 cm.

The water does not overflow.

Work out the depth of the water in the cylinder.

Give your answer to 1 decimal place.

$$\text{Volume of water} = 20 \times 10 \times 8 = 1600 \text{ cm}^3$$

The same volume of water goes into the cylinder.

$$\text{Area of the cylinder's base} = \pi \times 6^2 = 113.09 \dots \text{ cm}^2$$

Volume = base area $\times$ depth, so depth = volume $\div$ base area

$$\text{Depth} = 1600 \div 113.09 \dots = 14.14 \dots$$

Round to 1 decimal place: 14.1

Answer: 14.1 cm

Marks: 1 mark for 1600. 1 mark for $\pi \times 6^2$. 1 mark for dividing 1600 by the base area. 1 mark for 14.1.
