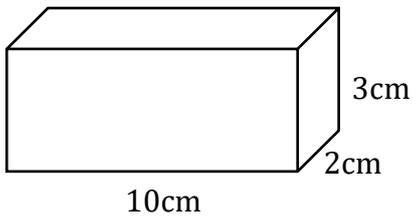


Volume - Lesson 1

We first learned about volume in S1, calculating the volume of cuboids. Remember the volume is the amount of space a 3D shape occupies, and it is measured in mm^3 , cm^3 , m^3 etc.

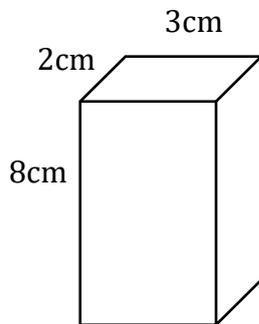
Calculate the volume of this cuboid.



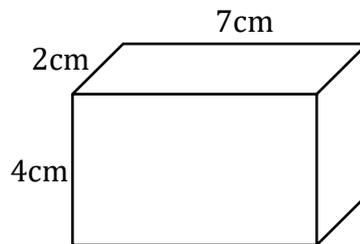
$$\begin{aligned}\text{Volume} &= l \times b \times h \\ &= 10 \times 2 \times 3 \\ &= 60\text{cm}^3\end{aligned}$$

Now calculate the volume of these cuboids: -

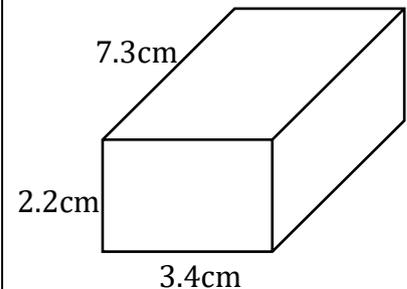
1)



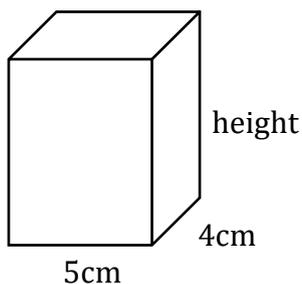
2)



3)



This cuboid has a volume of 120cm^3 . Calculate its height.



$$l \times b \times h = \text{Volume}$$

$$5 \times 4 \times h = 120$$

$$20 \times h = 120$$

$$h = \frac{120}{20} = 6\text{cm}$$

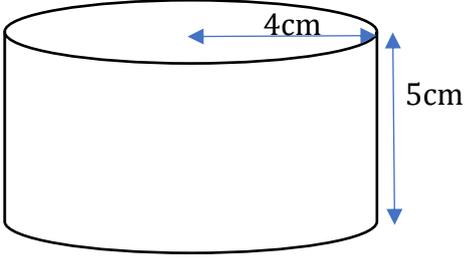
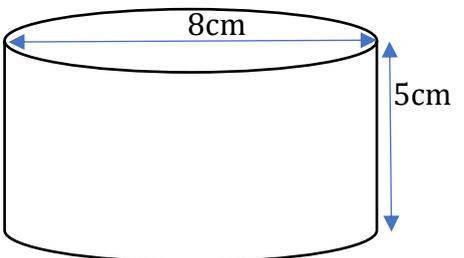
Now solve these problems in a similar way: -

4) A cuboid has a volume of 400cm^3 . It has a length of 10cm and a breadth of 5cm . Calculate its height.

5) A cuboid has a volume of 500cm^3 . It has a length of 25cm and a breadth of 4cm . Calculate its height.

6) A cuboid has a volume of 728cm^3 . It has a length of 13cm and a breadth of 8cm . Calculate its height.

We have also learned how to calculate the volume of a cylinder in the past. Look carefully at these two examples. What is the difference?

<p>A</p>  <p>Volume = $\pi \times r^2 \times h$ = $3.141... \times 4^2 \times 5$ = $251.3274.....$ = 251cm^3 (rounded to 3 sig. figs.)</p>	<p>B</p>  <p>Radius = $\frac{1}{2}$ of $8 = 4\text{cm}$ Volume = $\pi \times r^2 \times h$ = $3.141... \times 4^2 \times 5$ = $251.3274.....$ = 250cm^3 (rounded to 2 sig. figs.)</p>
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Did you notice: -

- a) The cylinders are the same.
- b) In **A** we are told the radius but in **B** we are told the diameter.
- c) In **A** the answer is given to three significant figures but in **B** it is rounded off to two significant figures.

Calculate the volume of these cylinders, rounding your answer as specified: -

7) Radius 10cm , height 20cm , round to three significant figures.

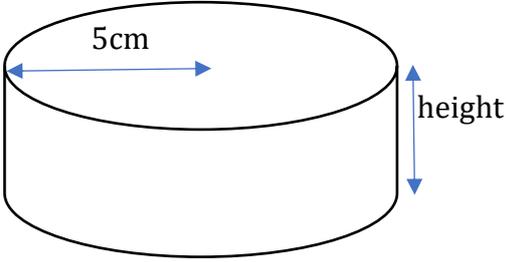
8) Radius 20cm , height 30cm , round to two significant figures.

9) Diameter 10cm , height 5cm , round to two significant figures.

10) Diameter 30cm , height 20cm , round to three significant figures.

We can also be told the volume and radius of the cylinder and asked to work out the height.

Example: -

<p>If the volume of this cylinder is 235cm^3 and its radius is 5cm, find its height. Round your answer to two significant figures.</p>  <p>The diagram shows a 3D perspective of a cylinder. A horizontal blue double-headed arrow across the top circular face is labeled '5cm'. A vertical blue double-headed arrow along the right side of the cylinder is labeled 'height'.</p>	<p>$\pi \times r^2 \times h = \text{Volume}$</p> <p>$3.1415\dots \times 5^2 \times h = 235$</p> <p>$78.5398\dots \times h = 235$</p> <p>$h = \frac{235}{78.5398\dots} = 2.9921\dots$</p> <p>Height = 3.0cm (rounded to two sig. figs.)</p>
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Click for a video of this explanation. https://youtu.be/xVg_XZXv7Mg

Now work out the height of these cylinders, rounding your answer as specified: -

11) Volume = 500cm^3 , radius = 4cm , answer to two significant figures.

12) Volume = 500cm^3 , radius = 5cm , answer to two significant figures.

13) Volume = 500cm^3 , radius = 6cm , answer to two significant figures.

Notice that, since the volume is 500cm^3 in all three questions the height must get less as the radius increased to keep the volume constant.

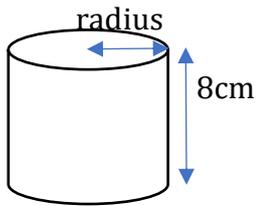
The next two questions are slightly different – can you see why?

14) Volume = 500cm^3 , diameter = 4cm , answer to three significant figures.

15) Volume = 500cm^3 , diameter = 6cm, answer to three significant figures.

We can also be told the volume and the height of the cylinder and asked to find the radius: -

The volume of this cylinder is 400cm^3 . If it is 8cm high calculate its radius. Round your answer to three significant figures.



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

$$3.1415\dots \times r^2 \times 8 = 400$$

$$25.1327\dots \times r^2 = 400$$

$$r^2 = \frac{400}{25.1327\dots} = 15.9154\dots$$

$$r = \sqrt{15.9154\dots} = 3.9894\dots$$

radius = 3.99cm (rounded to three sig. figs.)

Click for a video of this explanation. <https://youtu.be/hBmKD9K7yaM>

Now find the radius of these cylinders: -

16) Volume 500cm^3 , height = 10cm, answer to two significant figures.

17) Volume 500cm^3 , height = 8cm, answer to two significant figures.

18) Volume 500cm^3 , height = 6cm, answer to two significant figures.

Notice that, since the volume is 500cm^3 in all three questions the radius must get bigger as the height decreases to keep the volume constant.

In the final two questions, find the **diameter** of these cylinders:-

19) Volume 500cm^3 , height = 4cm, answer to three significant figures.

20) Volume 500cm^3 , height = 2cm, answer to three significant figures.