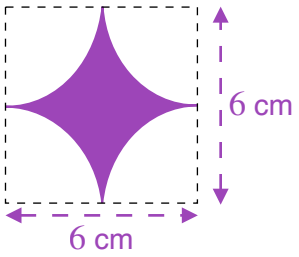
Volume and surface area of prisms and units of area/volume

Starter

1. **(Review of last lesson)**
Calculate the shaded area, giving your answer in terms of π.



2. **(Review of previous material)**
Convert: (a) 5 m^2 to cm^2 (b) 80000 mm^3 to cm^3 .

Notes

A prism is a solid with equal parallel faces. In addition, when the prism is sliced parallel to these faces, the same shape as the face appears.

Definition of a prism with examples

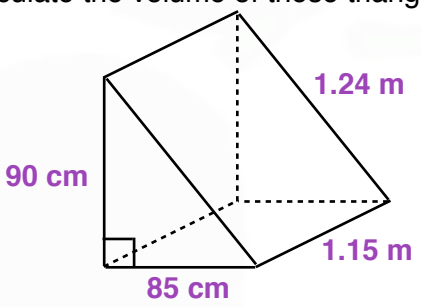
Cubes, cuboids and Toblerone boxes (i.e. triangular prisms) are all examples of prisms.

Volume of prism = area of cross section × length (or height)

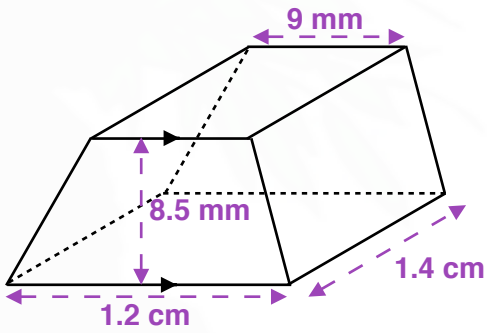
Before doing a question with ***mixed units***, ***convert lengths to the same unit*** and then calculate.

E.g. 1 Calculate the volume of these triangular prisms.

(a)



(b)



Working: (a) ***Change all the lengths into metres:***

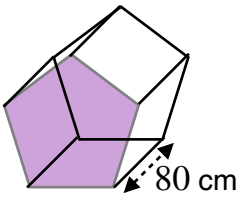
Volume of prism $= \frac{1}{2} \times 0.85 \times 0.9 \times 1.15 = 0.439875$ m^3.

…or…

Change all the lengths into centimetres:

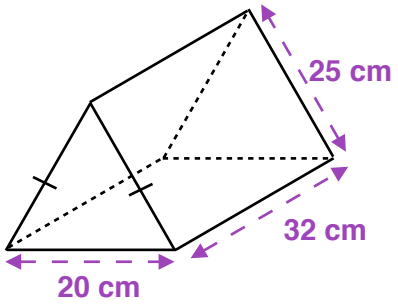
Volume of prism $= \frac{1}{2} \times 85 \times 90 \times 115 = 439875$ cm^3.

E.g. 2 The volume of the pentagonal prism is 3 m^2.
Calculate the area of the pentagon that forms the cross-section.



Questions can bring in other areas of mathematics.

E.g. 3 Calculate the volume of the triangular prism.
Give your answer to the nearest integer.



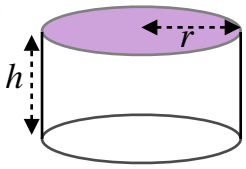
Working: To calculate the area of the triangular cross-section, we first need to calculate its perpendicular height, h, using Pythagoras:

Volume of a cylinder

The faces of a prism must be polygons, i.e. 2-D shapes with straight edges, so a cylinder is not actually a prism. However, when deriving a formula for the volume of a cylinder, the same formula can be used:

Volume of prism = Area of cross-section × Length

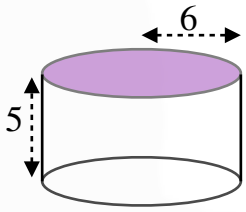
E.g. 4 Using the formula for the prism, write down the formula for the volume of a cylinder whose radius is r and whose height is h.



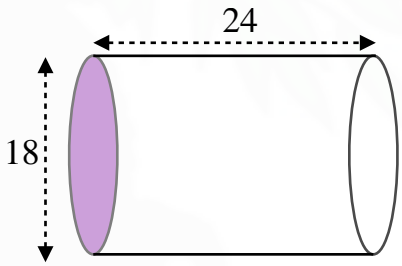
Volume of a cylinder, $V = \pi r^2 h$

E.g. 5 Calculate the volume of these cylinders, giving your answers in terms of π.
All measurements in centimetres.

(a)



(b)



Working: (a) $r = 6, h = 5$

Volume, $V = \pi r^2 h$: $V = \pi \times 6^2 \times 5 = 180\pi$

E.g. 6 Find the height of a cylinder of volume 300 cm³ and radius 7 cm. Give your answer to 3 s.f..

E.g. 7 Find the radius of a cylinder of volume 185 cm³ and length 5.3 cm.

Video: Volume of a prism
Video: Volumne of a cylinder
Video: Surface area of a cuboid

Video: Surface area of prisms
Video: Surface area of a cylinder

Solutions to Starter and E.g.s

Exercise

9-1 class textbook:	p437 M13.5 Qu 1-16
A*-G class textbook:	p392 M13.2 Qu 1-12
9-1 homework book:	p149 M13.5/13.6 Qu 1-6
A*-G homework book:	p110 M13.2 Qu 1-5

Summary

A prism is a solid with equal parallel faces. In addition, when the prism is sliced parallel to these faces, the same shape as the face appears.

Volume of prism = area of cross section × length (or height)

Before doing a question with ***mixed units***, ***convert lengths to the same unit*** and then calculate.

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