

# Calculate the Volume of Prisms, Cylinders & Pyramids – SS8

Higher students might note that additional Volume formula for Cones & Spheres are given on your formulae sheet – see SS7.

The **volume** of a solid object is the amount of '3D space' it occupies.

## A) The Volume of Prisms - 'Blobs', Cuboids and Cylinders

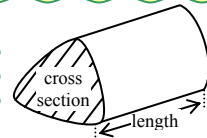
A prism is a solid (3D) object which has a constant area of cross-section. This means it has the same shape and size from one end to the other.

### Strategy 1 for cuboids and cylinders

1. Identify the cross-sectional shape
2. Recall the appropriate area formula.
3. Recall/work out the appropriate volume formula.

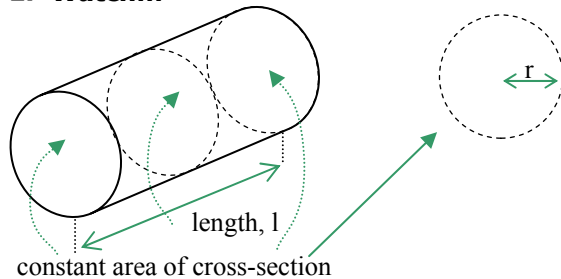
Volume of prism = Area of cross-section  $\times$  length

Your formulae sheet gives you this formula



Use the **V = Area of cross-section  $\times$  length** formula to remind you of the formula for cylinders and cuboids. This is **Strategy 1. Watch...**

A cylinder is a prism with a uniform circular cross-section



Remember...

$$\text{Area of a circle} = \pi r^2$$

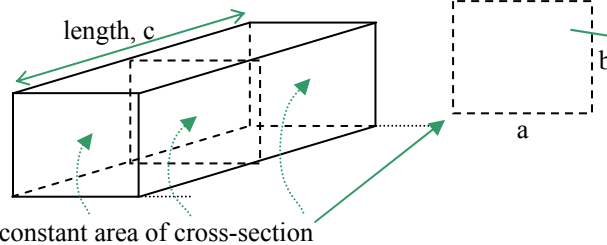
Therefore...

**Volume of Cylinder**

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

$$= \pi r^2 \times l = \pi r^2 l$$

A cuboid is a prism with a uniform rectangular cross-section



Remember...

$$\text{Area of a Rectangle} = ab$$

Therefore...

**Volume of Cuboid**

$$= ab \times c = abc$$

## Exam style Question

A blob of ink marks an area of  $0.2\text{cm}^2$  on some paper. The blob penetrates the paper uniformly by  $0.1\text{cm}$ . Calculate the volume of the blob of ink.

**Solution (Strategy 2)**

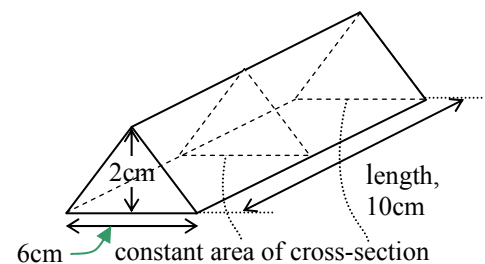
1. & 2. The cross section is a blob with an area of  $0.2\text{cm}^2$ .
3.  $V = \text{Area of cross-section} \times \text{length} = 0.2 \times 0.1 = 0.02\text{cm}^3$ .

### Strategy 2 for blobs and other prisms

1. Identify the shape of the cross-section
2. Calculate the area of this cross-section.
3. Use Volume of prism = Area of cross-section  $\times$  length

## Your Turn!!

- a) Use the above formula to work out the volume of a cuboid with dimensions  $1\text{cm}$  by  $2\text{cm}$  by  $3\text{cm}$ .
- b) Use the above formula to work out the volume of a cylinder with radius  $3\text{cm}$  and height  $10\text{cm}$ . **Note:** the word 'height' in this question represents the length in the formula above.
- c) Calculate the volume of the following triangular prism using **Strategy 2**.



## B) The Volume of a Pyramid – A Pyramid is like a prism but one end meets at a point!

Memorise this formula!!

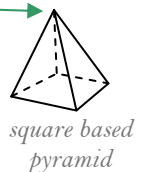
Volume of Pyramid =  $\frac{1}{3} \times \text{base area} \times \text{height}$

The 'third' also features in the volume of a cone – see formula book

Notice the similarity to the prism formula.

### Strategy 3 – Pyramids

1. Identify the shape of the base.
2. Calculate the area of this base.
3. Use the Volume of Pyramid formula.



square based pyramid

## RAPID 'ACID' TEST – Blank out the page above before answering these!

1. Find the volume of a cuboid with dimensions  $2\text{cm}$  by  $3\text{cm}$  by  $4\text{cm}$ .
2. Find the volume of a cylinder with radius  $5\text{cm}$  and height  $6\text{cm}$ .
3. Find the volume of an ink blob that marks an area of  $0.4\text{cm}^2$  on some paper and penetrates uniformly  $0.2\text{cm}$ .
4. Find the volume of a square based pyramid with base of sides  $3\text{cm}$  and a perpendicular height of  $5\text{cm}$ .