

Area and Volume Need to Know

Area and Volume 1

Area and Perimeter

There are a number of different shapes we have to deal with.

- (i) Square or Rectangle.
- (ii) Circle or part of a circle.
- (iii) Triangles and parallelograms.
- (iv) Double shapes.

When doing any of the questions on area and volume it is a good idea to follow the following steps.

Step 1 Write out the information in the question i.e. radius, height or length.

Step 2 Write down a formula.

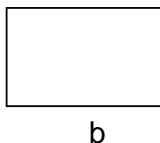
Step 3 Put the figures from the question into the formula to give you an answer.

Note If it will make it clear then draw a diagram.

The most important thing to remember is that the answer is in the question so use your eyes and use the right formula. Some of the formulae are in the math's tables but more of them must be learnt off.

The Square or Rectangle

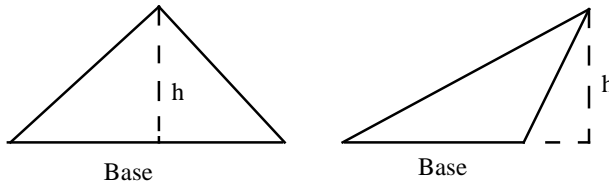
A rectangle has two sets of equal sides:



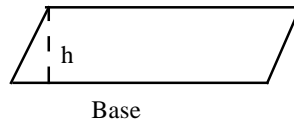
$$\text{Area} = \text{length} \times \text{breadth. Area} = l \times b$$

$$\text{Perimeter} = 2(\text{length} + \text{breadth}). \text{Perimeter} = 2(l+b)$$

Triangles and Parallelograms



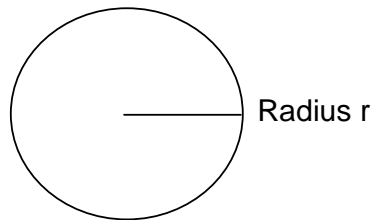
Area of triangle = $\frac{1}{2}$ base by perpendicular height.



Area of parallelogram = base by perpendicular height.

The circle

All of the following formulae are on page 6 and 7 of the Maths tables.



$$\text{Circumference} = 2\pi r$$

$$\text{Area} = \pi r^2$$

All of the formulae here deal with the radius so always try to write down what the radius is.

Note Remember the diameter is twice the radius $D = 2r$

Note All of the formulas contain π . In the questions we are going to do π can have 3 different values.

$\pi = \pi$ We use this when we are asked to write the answer "in terms of π ".

$$\pi = 3.14$$

$$\pi = \frac{22}{7}$$

Note Be careful of the word “circumference”, which is the distance around the outside of a circle, because the maths tables and a lot of questions use the word “length” or even “perimeter”.

Note When you look up the formula for the area of a circle in the math’s tables they call the circle a ‘disc’.

Note Answers do not always have to be nice whole numbers.

Sector of a circle

Make a fraction by using $\frac{\text{Given angle}}{360}$

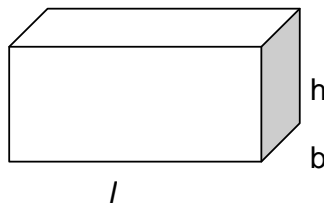
Area and Volume 2

Double Shapes

Most shapes are made up of parts of circles and rectangles so take your time and try to use the correct formula.

Volume and area of a box

Rectangular box has 6 sides (learn formulae)

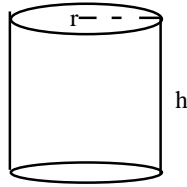


$$\text{Volume} = l \times b \times h$$

$$\text{Surface area} = 2(lb + lh + bh)$$

Cylinders

Two formulae again in the math's tables page 9



$$\text{Curved surface area} = 2\pi rh$$

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

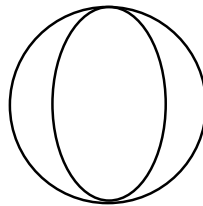
Note Both of these formulae are in the math's tables so we do not need to know them but we do have a problem depending on the type of cylinder it is.

- (i) The area of an open cylinder is the same as its surface area.
- (ii) The area of a closed cylinder is the curved surface area + 2 circles (one on top and the other on the bottom)
- (iii) The area of an open top cylinder is the curved area + 1 circle

Area and Volume 3

Spheres and hemispheres

Two formulae again in the maths tables page 9



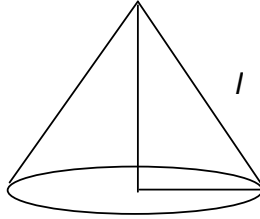
$$\text{Curved surface area} = 4\pi r^2$$

$$\text{Volume} = \frac{4}{3}\pi r^3$$

The formula for hemisphere is not in the tables. A hemisphere is half a sphere.

Cone

A cone has an extra dimension that we should be aware of which is the slant height of l .



$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\text{Curved surface area} = \pi r l$$

$$\text{An important property is that } h^2 + r^2 = l^2$$

Volume of triangular prism, or wedge

Multiplying the front area by the thickness of the object gets the volume.

Area and Volume 4

Recasting

These are questions in which one object is melted down and made into another.

The volume is the same for both objects concerned.

Water Displacement

When an object is placed in water the volume of water displaced is equal to the volume of the object.

There is some water in the cylinder but we do not know (or want to know) the height of the water.

The ball is thrown into the water and the water rises by the same volume as the volume of the sphere.

What we really need is the height of the upper region, which is a cylinder of radius 6 and volume, which has the same volume as the volume of a sphere of radius 3.

Flow of liquid

The main formulae to remember for these questions are

$$\text{Time} = \frac{\text{volume}}{\text{rate of flow}}$$

Note Speed of 2 cm per second means the height of the cylinder is 2.

To find the rate of flow we need to find the volume a cylinder i.e. how much water flows the pipe through per second?

Area and Volume 5

Shapes within a shape

We could have

- (i) A sphere in a box – length, breath and height of box will be the diameter of the sphere.
- (ii) A sphere in a cylinder – the height of the cylinder is the diameter of the sphere.
- (iii) A cone in a cylinder – the height of the cylinder would equal the height of the cone.

Double Shapes

With double shapes you must

State which two shapes you are dealing with.

Write down what you know about each shape, one length is missing (must be figured out).

Write down the formula and put figures in.