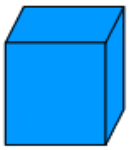
3-Dimensional shapes

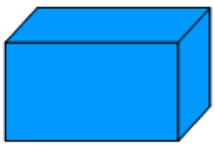
A 3 Dimensional (3-D) shape is an object which has length, width and height.

To begin with you need to be able to recognise and name the basic 3-D shapes

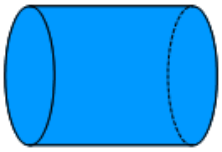
These are as follows:

Cube

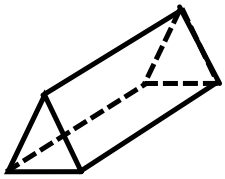




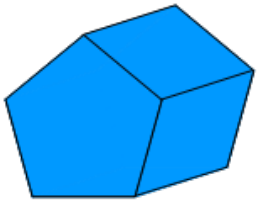
Cuboid



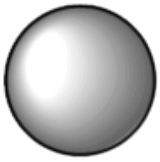
Cylinder



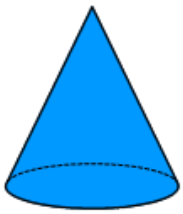
Triangular prism



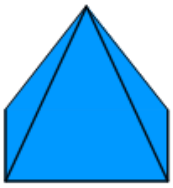
Pentagonal prism (there are lots of different types of prism)



Sphere



Cone



pyramid (there are lots of different types of pyramid)

Next you need to be able to classify 3-D shapes according to their properties

Some key words that you will need to know are:

Vertice - this is a corner

Parallel – Lines that are always the same distance apart are parallel

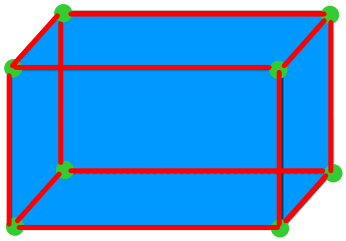
Perpendicular – Lines which meet or cross (intersect) at 90° are perpendicular

Prism – A solid (3-D shape) which has the same cross section throughout its length

Face - The flat surface of a 3-D shape

Edge - The lines that join the vertices

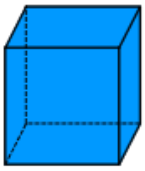
e.g in the diagram below we can see that the cuboid has 8 vertices (green) , 6 faces (blue) and 12 edges (red)

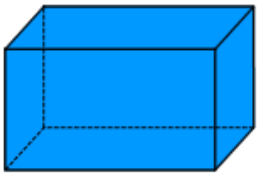


Some shapes look quite similar but there are some differences between them

A cube has all edges the same length but a cuboid does not

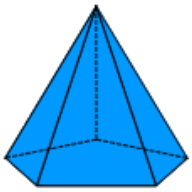
Cube



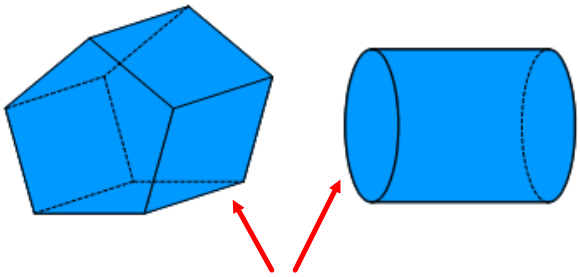


Cuboid

A pyramid has a 2-D shape as its base (a triangle or a square or a rectangle .....) but it has a point at the other end. Where as a prism has the same 2-D shape at both of its ends



Pyramid



Prisms

Volume

Volume is the amount of space occupied by an object.

Volume is measured in units^3 (units cubed)

We need to be able to calculate the volume of a Prism

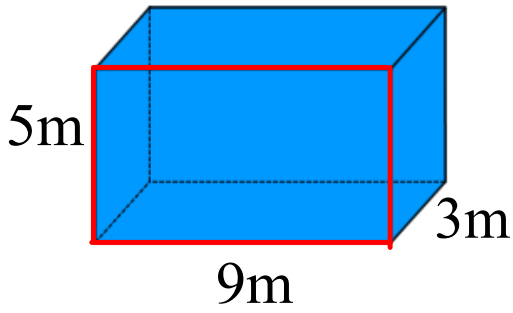
To calculate the volume of a prism you use the same formula:

volume = area of front face x depth

volume is ALWAYS measured in units^3

e.g mm^3 cm^3 m^3 etc.....

e.g calcualte the volume of the following shape:



The sides are not all the same length so this shape is a CUBOID.

we can use the formula volume = area of front face x depth

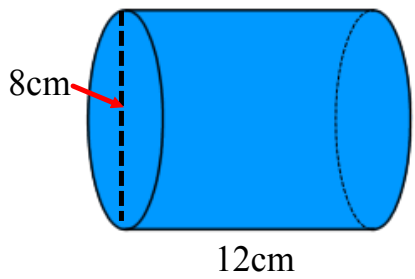
From the diagram we can see that: width = 9m
height = 5m
depth = 3m

so the area of the front face = width x height (because the front face is a rectangle)
= 9m x 5m
= $45m^2$

the front face is highlighted in red

So the volume = $45m^2$ x 3m
= $135m^3$

Another example of how to calculate the volume of a prism would be:



The diameter of the circular face is clearly labelled as 8cm
We can use this to work out the area of the circular edge.

Area of a circle = πr^2

If the diameter is 8 then the radius (r) is half of this so r = 4cm
$\pi = 3.14$

this gives us the area of the front face: $= 3.14 \times 4^2$
$= 3.14 \times 16$
$= 50.24\text{cm}^2$

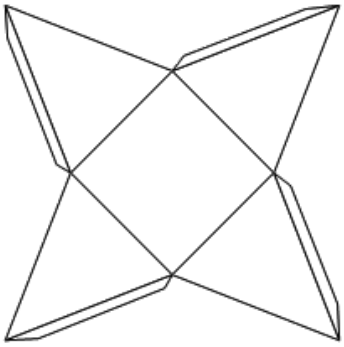
So the volume of the prism = $50.24\text{cm}^2 \times 12\text{cm}$
$= 602.88\text{cm}^3$

When we talk about area in the context of 3-D shapes we mean <u>surface area</u>

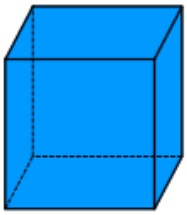
The surface area that a 3-D shape has is the amount of surface that it covers when you fold it out <u>flat</u>

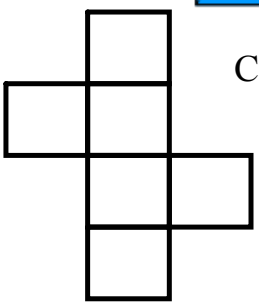
The shape that a 3-D shape makes when it is folded out flat is called a <u>net</u>

Examples of some nets and their equivalent 3-D shape can be seen below:



Square based pyramid

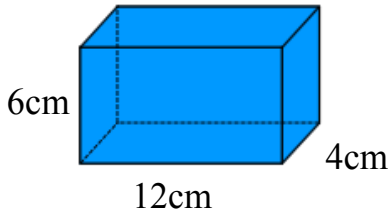




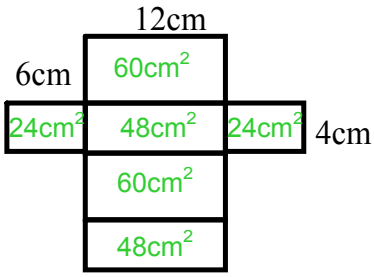
Cube

To calculate the surface area of a 3-D shape it is best to imagine the net of the shape and calculate the area of the net (similar to calculating the area of a compound shape)

e.g calculate the surface area of:



The net of this shape looks like:



Calculate the area of each rectangle in the net by doing width x height.

Adding all the areas together we get: $264cm^2$