

YEAR 9 — CONSTRUCTING IN 2D/3D... 3D Shapes

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Name 2D & 3D shapes
- Recognise Prisms
- Sketch and recognise nets
- Draw plans and elevations
- Find areas of 2D shapes
- Find Surface area for cubes, cuboids, triangular prisms and cylinders
- Find the volume of 3D shapes

Keywords

2D: two dimensions to the shape e.g length and width

3D: three dimensions to the shape e.g length, width and height

Vertex: a point where two or more line segments meet

Edge: a line on the boundary joining two vertex

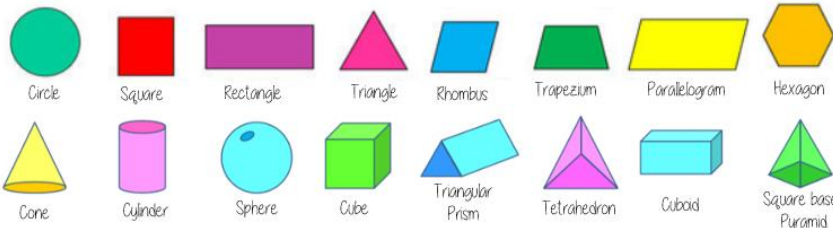
Face: a flat surface on a solid object

Cross-section: a view inside a solid shape made by cutting through it

Plan: a drawing of something when drawn from above (sometimes birds eye view)

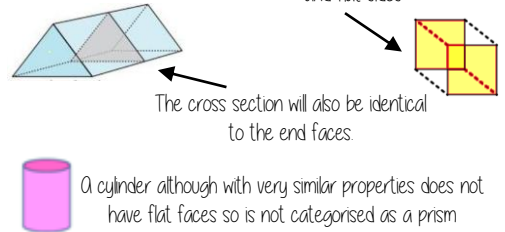
Perspective: a way to give illustration of a 3D shape when drawn on a flat surface.

Name 2D & 3D shapes

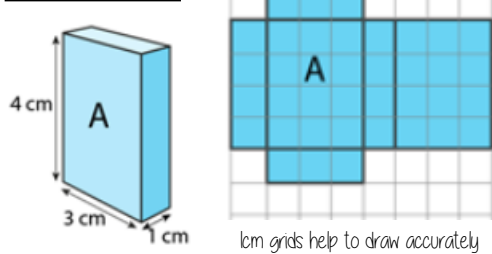


Recognise prisms

A solid object with two identical ends and flat sides

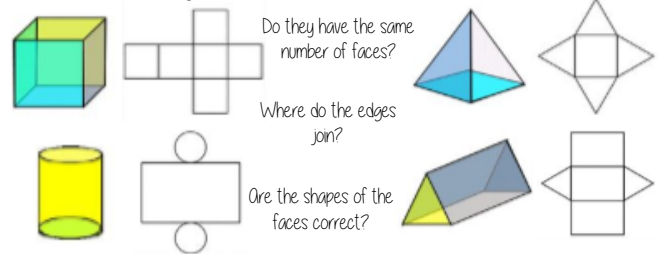


Nets of cuboids

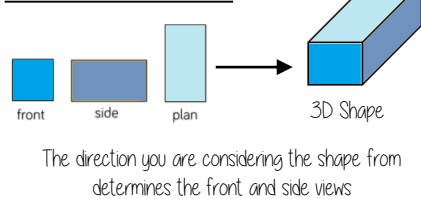


Visualise the folding of the net. Will it make the cuboid with all sides touching

Sketch and recognise nets

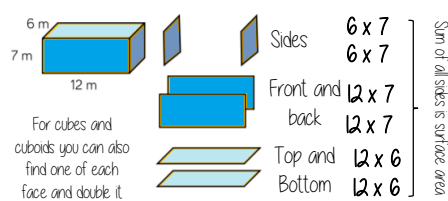


Plans and elevations



Surface area

Sketching nets first helps you visualise all the sides that will form the overall surface area



For other shapes - not all the sides are the same, so calculate the individually

Volumes

Volume is the 3D space it takes up - also known as capacity if using liquids to fill the space

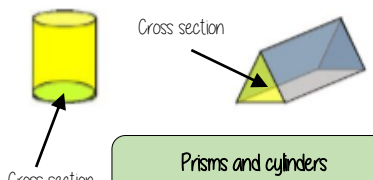


Counting cubes

Some 3D shape volumes can be calculated by counting the number of cubes that fit inside the shape

Cubes/ Cuboids = base x width x height

Remember multiplication is commutative

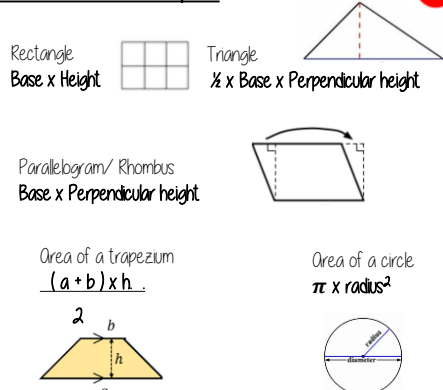


Height can also be described as depth

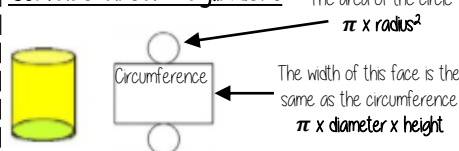
Areas - square units
Volumes - cube units

Areas and volumes can be left in terms of π

Area of 2D shapes



Surface area - cylinders



$2 \times \pi \times \text{radius}^2 + \pi \times \text{diameter} \times \text{height}$

YEAR 9 — CONSTRUCTING IN 2D/3D...

Constructions & congruency

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Draw and measure angles
- Construct scale drawings
- Find locus of distance from points, lines, two lines
- Construct perpendiculars from points, lines, angles
- Identify congruence
- Identify congruent triangles

Keywords

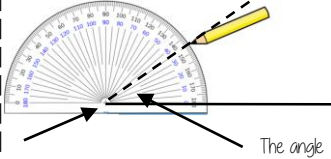
- Protractor:** piece of equipment used to measure and draw angles
- Locus:** set of points with a common property
- Equidistant:** the same distance
- Discorectangle:** (a stadium) — a rectangle with semi circles at either end
- Perpendicular:** lines that meet at 90°
- Arc:** part of a curve
- Bisector:** a line that divides something into two equal parts
- Congruent:** the same shape and size

Draw and measure angles

R

Draw a 35° angle

Make a mark at 35° with a pencil and join to the angle point (use a ruler)



Make sure the cross is at the end of the line (where you want the angle)

Scale drawings

R

A picture of a car is drawn with a scale of 1:30

For every 1cm on my image is 30cm in real life

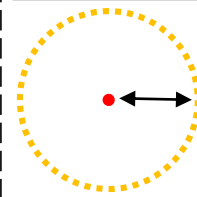
The car image is 10cm



Image: Real life
1cm : 30cm
 $\times 10$ \leftarrow \rightarrow $\times 10$
10cm : 300cm

Locus of a distance from a point

All points are equidistant (the same distance) from the fixed point in the middle



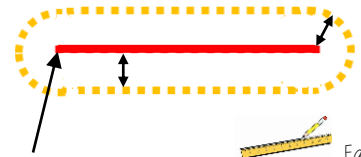
If the point is in the corner it can only make a quarter circle



Equipment needed
The radius is the distance from the fixed point

Locus of a distance from a straight line

All points are equidistant (the same distance) from line



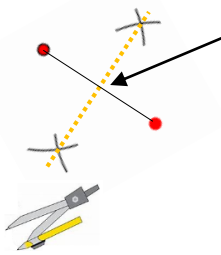
The ends of the line are fixed points



Equipment needed
The line is straight so a ruler is used for the straight lines parallel to your original line

Locus equidistant from two points

Also a perpendicular bisector
Because if the points are joined this new line intersects it at a 90°

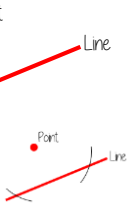


Join the intersections with a ruler.
All points on this line are equidistant from both points

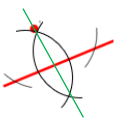
Construct a perpendicular from a point



Use a compass and draw an arc that cuts the line. Use the point to place the compass



Keep the compass the same distance and now use your new points to make new intersecting arcs



Connecting the arcs makes the bisector

If P is a point on the line the steps are the same

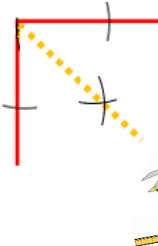
Locus of a distance from two lines

Also an angle bisector
This cuts the angle in half

From the angle vertex draw two arcs that cut the lines forming the angle

Keep the compass the same size and use the new arcs as centres to draw intersecting arcs in the middle

Join the vertex to the intersection

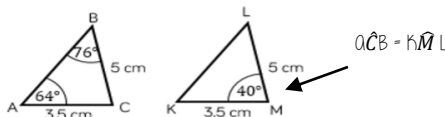


Congruent figures

Congruent figures are identical in size and shape — they can be reflections or rotations of each other



Congruent shapes are identical — all corresponding sides and angles are the same size



Because all the angles are the same and $AC=KM$ $BC=LM$ triangles ABC and KLM are congruent

Congruent triangles

Side-side-side

All three sides on the triangle are the same size

Angle-side-angle

Two angles and the side connecting them are equal in two triangles

Side-angle-side

Two sides and the angle in-between them are equal in two triangles (it will also mean the third side is the same size on both shapes)

Right angle-hypotenuse-side

The triangles both have a right angle, the hypotenuse and one side are the same

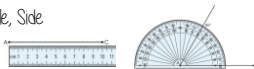
Constructing Triangles

Link to steps → R

Side, Angle, Angle



Side, Angle, Side



Side, Side, Side

