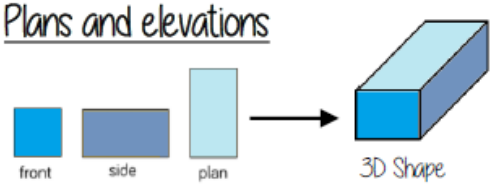
Knowledge Organiser: Year 8 Maths; 3D Shapes

Plans and elevations



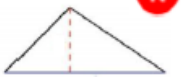
The direction you are considering the shape from determines the front and side views

Area of 2D shapes

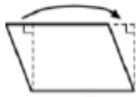
R

Rectangle
Base x Height

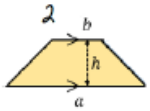
Triangle
½ x Base x Perpendicular height



Parallelogram/ Rhombus
Base x Perpendicular height



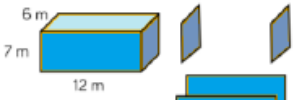
Area of a trapezium
$\frac{(a+b)}{2} \times h$



Area of a circle
$\pi \times radius^2$

Surface area

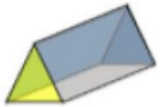
Sketching nets first helps you visualise all the sides that will form the overall surface area



For cubes and cuboids you can also find one of each face and double it

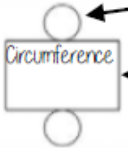
Sides	6 x 7 6 x 7
Front and back	12 x 7 12 x 7
Top and Bottom	12 x 6 12 x 6

Sum of all sides is surface area



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

Surface area - cylinders



The area of the circle
$\pi \times radius^2$

The width of this face is the same as the circumference
$\pi \times diameter \times height$

$2 \times \pi \times radius^2 + \pi \times diameter \times height$

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

Cross section

Cross section

Prisms and cylinders
= area cross section x height

Height can also be described as depth

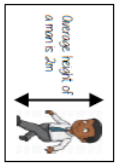
Areas – square units
Volumes – cube units

Areas and volumes can be left in terms of pi π

Metric measures

Length Common units of length or distance are

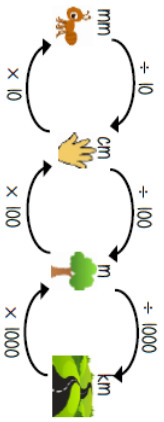
Millimetres (mm) – "Milli" prefix means one thousandth or ÷ 1000
Centimetres (cm) – "Centi" prefix means one hundredth or ÷ 100
Metres (m)
Kilometres (km) – "Kilo" prefix means a thousand x 1000



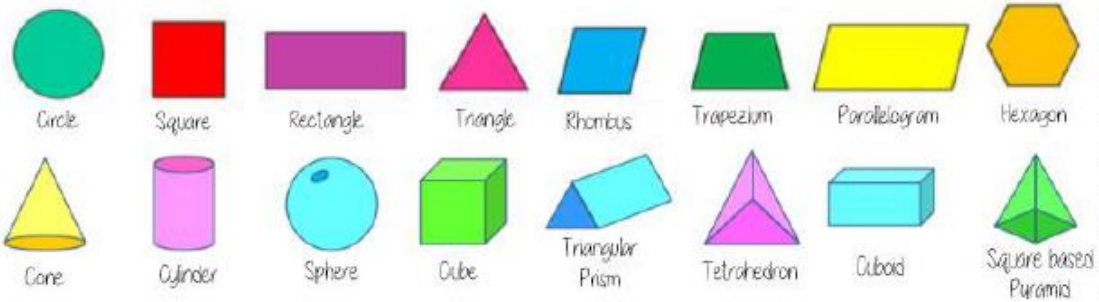
Metric conversions

Mass

Length



Name 2D & 3D shapes



Recognise prisms

A solid object with two identical ends and flat sides

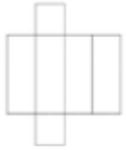
The cross section will also be identical to the end faces

A cylinder although with very similar properties does not have flat faces so is not categorised as a prism

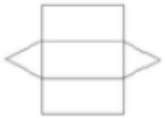
3D shapes and nets

Cube

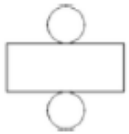
Cuboid



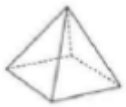
Triangular Prism



Cylinder

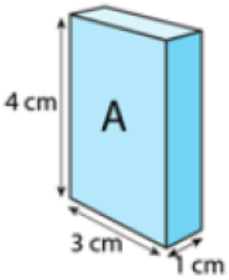


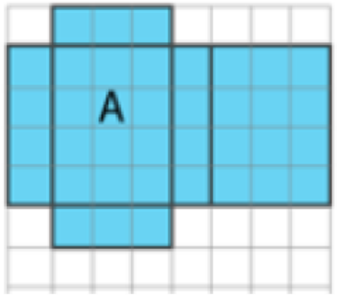
Square based pyramid



Vertex: a point where two or more line segments meet
Face: any of the flat surfaces of a solid object
Edge: a line segment on the boundary joining one vertex to another

Nets of cuboids



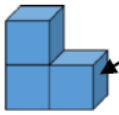


1cm grids help to draw accurately

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

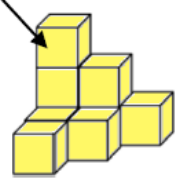
Volume (counting cubes)

Each cube has a given volume. Eg. $1cm^3$



This shape is made up of 3 cubes.
So the volume is $3cm^3$

Always check the units of measurement.
Volume can be mm^3, cm^3, m^3, km^3

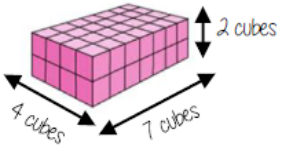


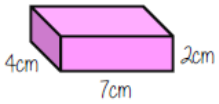
Don't forget about cubes you can't see. This is a 3D shape.

The volume of this shape is $9cm^3$

Use multilink cubes to notice that volume can be any shape – it is the number of cubes that make up the value

Volume of cuboids





Properties of cuboids
- 3D shape
- 8 vertices
- 6 faces
- 12 edges

Counting cubes
Counting the cubes = $56cm^3$
OR
There are 28 cubes on the bottom row and two rows.
$28 \times 2 = 56$

Volume of cuboid = length x width x height

Volume = $4 \times 7 \times 2 = 56cm^3$

Remember multiplication is commutative so the values can be multiplied in any order

Square and cube numbers

Square numbers

1, 4, 9, 16...

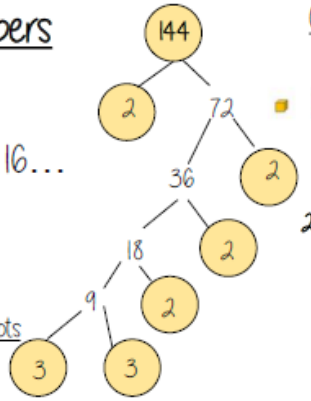
$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$(2 \times 2 \times 3) \times (2 \times 2 \times 3)$

12 x 12

Prime factors can find square roots

$\sqrt{144} = 12$



Cube numbers

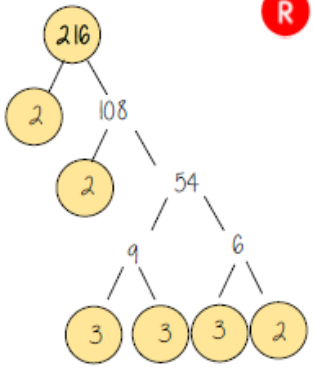
1, 8, 27, 64, 125...

$216 = 2 \times 2 \times 2 \times 3 \times 3 \times 3$

$(2 \times 3) \times (2 \times 3) \times (2 \times 3)$

6 x 6 x 6

$\sqrt[3]{216} = 6$



R

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.
Area: the size of a surface (2D shapes)
Perimeter: the distance around a 2D shape
Volume: the amount of 3-dimensional space an object takes up (with liquid this is called capacity)

How do we use Knowledge Organisers in Mathematics?

How can you use knowledge organisers at home to help us?

- **Retrieval Practice**: Read over a section of the knowledge organiser, cover it up and then write down everything you can remember. Repeat until you remember everything.
- **Flash Cards**: Using the Knowledge Organisers to help on one side of a piece of paper write a question, on the other side write an answer. Ask someone to test you by asking a question and seeing if you know the answer.
- **Mind Maps**: Turn the information from the knowledge organiser into a mind map. Then reread the mind map and on a piece of paper half the size try and recreate the key phrases of the mind map from memory.
- **Sketch it**: Draw an image to represent each fact; this can be done in isolation or as part of the mind map/flash card.
- **Teach it**: Teach someone the information on your knowledge organiser, let them ask you questions and see if you know the answers.

How will we use knowledge organisers in Mathematics?

Knowledge organisers will be used before I complete a Learning Check or Common Assessment. I will spend part of the lesson looking over each of the key topics of the half term before completing the Learning Check or Common Assessment.

I will also use these at home to complete my own independent learning and revision of these key topics.