Guide for Geometry – MAC Calculation policy

Shapes

It is important to use correct names of shapes. 2D and 3D shapes and their properties are below.

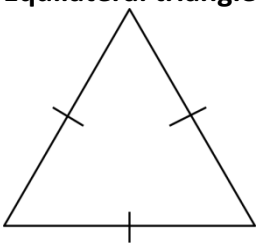
2D Shapes

A polygon is a 2D shape consisting of 3 or more straight sides. A regular polygon has all sides and angles the same size. Specific names of polygons are shown below the table.

Number of sides	Name of polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon

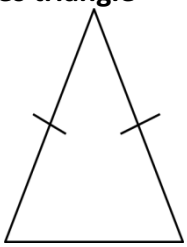
Some triangles have special names:

Equilateral triangle



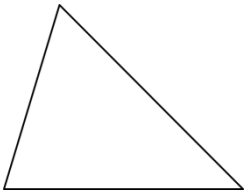
All sides and angles are equal.

Isosceles triangle



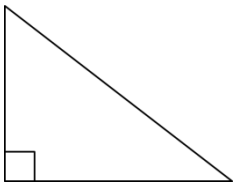
Two sides and two angles are equal.

Scalene triangle



All sides and angles are different.

Right-angled triangle
One angle is a right angle (90º)

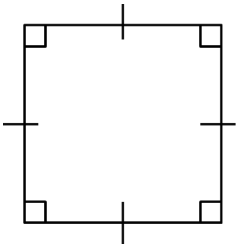


Some quadrilaterals have special names:

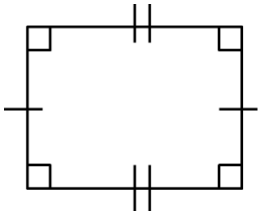
Square

Rectangle

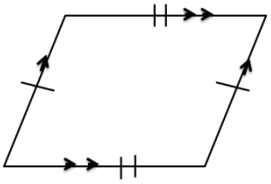
Parallelogram



All sides are the same length and all angles are 90º

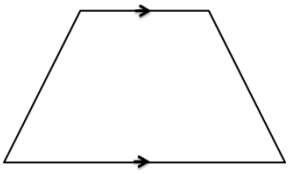


Opposite sides are the same length and all angles are 90º



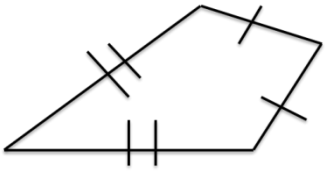
Opposite sides are parallel and the same length. Opposite angles are the same.

Trapezium



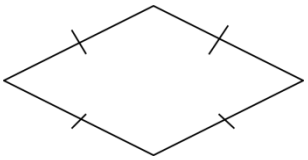
One pair of opposite sides are parallel.

Kite



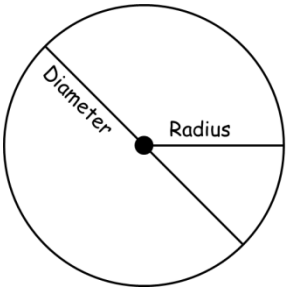
Two pairs of adjacent sides are equal. One pair of opposite angles are equal.

Rhombus (NOT diamond)



All sides are the same length. Opposite angles are equal.

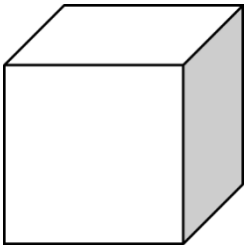
A **circle** has a radius which goes from the centre to the edge, and the diameter which is twice the length of the radius, and goes from side to side passing through the centre.



3D shapes

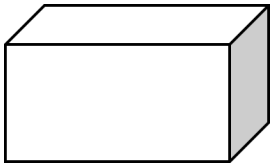
The flat surfaces of a 3D shape are called faces. The lines where two faces meet are called edges. The point (corner) at which edges meet is called a vertex. The plural of vertex is vertices. Some 3D shapes and their properties are below.

Cube



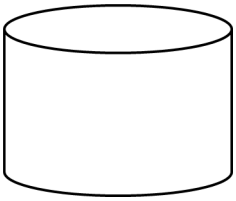
6 faces, 12 edges

Cuboid



6 faces, 12 edges

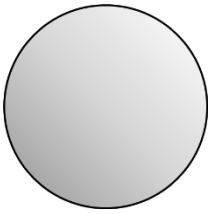
Cylinder



3 faces, 2 edges and

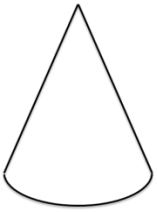
and 8 vertices. and 8 vertices. no vertices.

Sphere



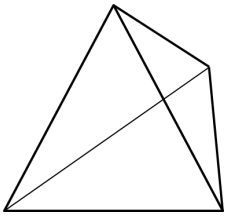
1 face, no edges
and no vertices.

Cone



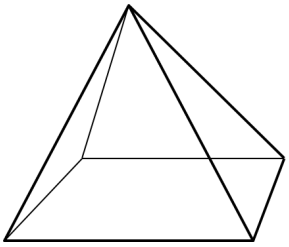
2 faces, 1 edge
and 1 vertex.

Tetrahedron



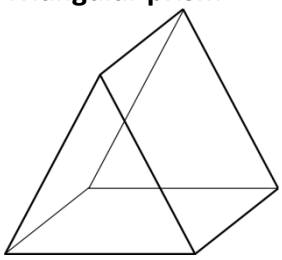
4 faces, 6 edges
and 4 vertices.

Square-based pyramid



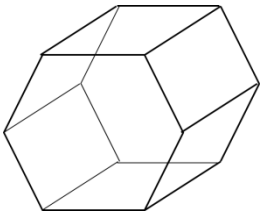
5 faces, 8 edges
And 5 vertices.

Triangular prism



5 faces, 9 edges
and 6 vertices.

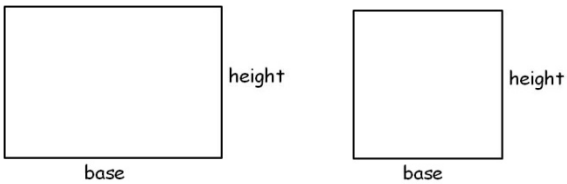
Hexagonal prism



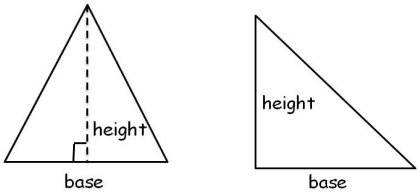
8 faces, 18 edges
and 12 vertices.

Area

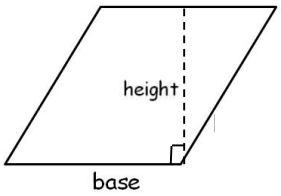
Area of Squares and Rectangles
= base x height



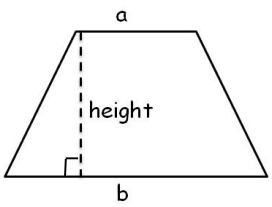
Area of Triangles
= ½ x base x perpendicular height



Area of Parallelograms
= base x perpendicular height



Area of Trapeziums
= ½ x (a + b) x h

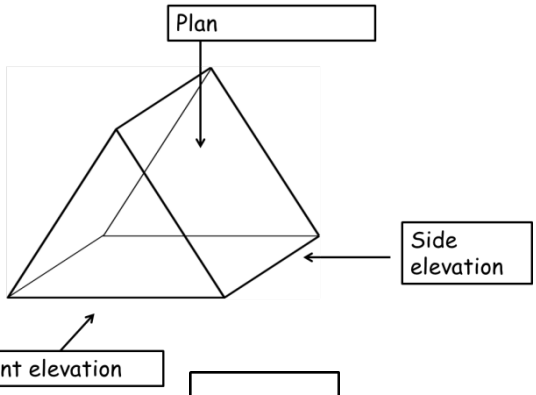


Surface Area

Surface area is the area of the surface of a 3D shape. To calculate the surface area, calculate the area of every face of the shape, then add those areas together.

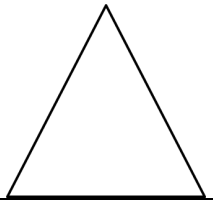
Plans/elevations

Plans and elevations can be drawn for any 3D shape.

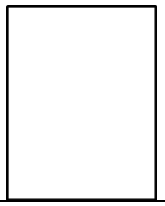


The view from above is called the plan:

The view from the front is called the front elevation:



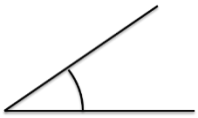
The view from the side is called the side elevation:



Angles

An angle is a measure of a turn. They are measured in degrees, for example, 60º. There are different types of angle.

Acute

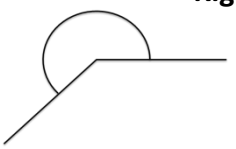


Less than 90º

Obtuse

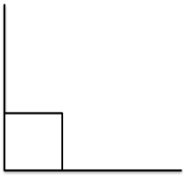
More than 90º but less than 180º

Reflex



More than 180º but less than 360º

Right angle

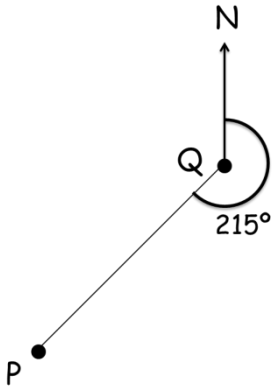


Exactly 90º

Angles are measured using a protractor. It is important to emphasise that you measure from zero.

Bearings

Bearings are used to describe directions with angles. They are more precise than using North, South, East and West. Bearings are always measure <u>clockwise</u>, from the <u>North</u> line and must have <u>3 digits</u>. For example 50º must be written as 050º.



Scale drawing

Maps and plans are accurate drawings from which measurements can be made. A scale is a ratio which shows the relationship between the length of the drawing (or model) and the length in real life.

Units of measure

The use of metric units of measure is encouraged. The metric system of measurement is based on powers of ten and uses the following prefixes:

- **Kilo-** meaning 1000
- **Centi-** meaning one hundredth
- **Milli-** meaning one thousandth
- **Micro-** meaning one millionth

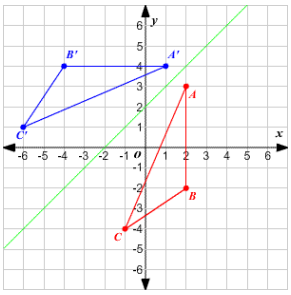
These prefixes are then followed by a base unit:

- The base unit for length is **metre**
- The base unit for mass is **gram**
- The base unit for capacity is **litre**

Transformations

There are four main transformations.

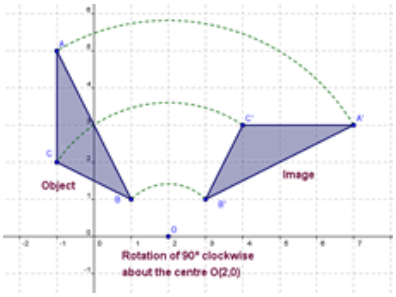
Reflection



Images of shapes that are formed by reflecting a given shape about a line of reflection (or mirror line) are called reflections of the shapes. Lines of symmetry can be identified in images where reflection has already taken place. When an object is reflected, the lengths and the angles remain the same.

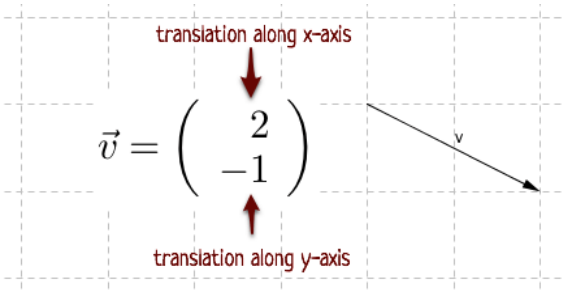
Rotation

A rotation can be described as a fraction of a turn or as an angle of a turn. The direction can be described as clockwise or anticlockwise. The point about which the shape is turned is called the centre of rotation and is often given as a coordinate. When an object is rotated, the lengths and the angles remain the same, but the shape is turned.



Translation

A translation is a sliding movement made from one or more moves. Both the direction and the distance need to be described for each move. Translations can be described using column vectors, for example $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$. The top number describes the movement to the left/right, the bottom number describes the movement down/up. When an object is translated, the lengths and the angles remain the same.



Enlargement

An enlargement changes the size of the shape. It changes the lengths of the sides but not the shape . The scale factor of the enlargement is the number by which the lengths are multiplied by to get the lengths in the image. For example, a scale factor of 2 means all the lengths are doubled. Shapes can be enlarged from a point called the centre of enlargement.