2D shape names

A 2D shape only has two dimensions.
We name them based on how many sides and angles (vertices) they have.

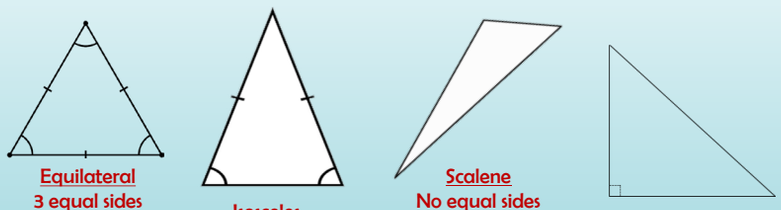
Name of shape	Number of sides	Number of angles
Triangle	3	3
Quadrilateral	4	4
Pentagon	5	5
Hexagon	6	6
Heptagon	7	7
Octagon	8	8
Nonagon	9	9
Decagon	10	10

Regular: all sides and angles are the same.

Irregular: sides and angles are not all the same.

Triangles

All triangles have got three sides and three angles.



Equilateral
3 equal sides
3 equal angles

Isosceles
2 equal sides
2 equal angles

Scalene
No equal sides
No equal angles

Right-angle
One right angle

Both isosceles and scalene triangles can also be right-angled if they contain a right-angle.

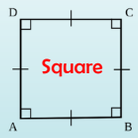
Quadrilaterals

All quadrilaterals have got four sides and four angles.

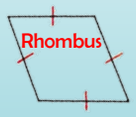
Rectangle
- Opposite sides are parallel and equal.
- All angles are 90°.

Kite
- Opposite sides are parallel and all sides are equal.
- All angles are 90°.
- Two pairs of adjacent sides are equal.
- One pair of opposite angles is equal.

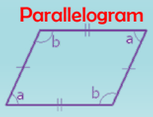
Trapezium
- All sides are equal and opposite sides are parallel.
- Opposite angles are equal.
- A trapezium has one pair of opposite sides parallel.
- A regular trapezium has non-parallel sides equal and its base angles are equal.



Square
- Opposite sides are parallel and equal.
- All angles are 90°.



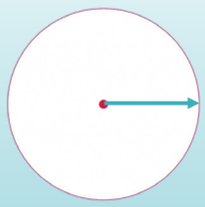
Rhombus
- Opposite sides are parallel and equal.
- Opposite angles are equal.



Parallelogram

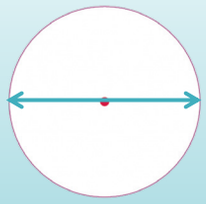
Parts of a Circle

radius



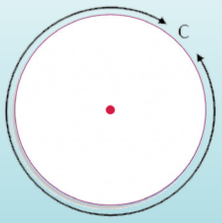
The distance halfway across the circle.

diameter



The distance across the middle of the circle.

circumference



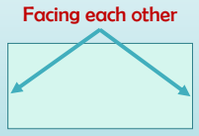
The distance all the way around a circle.

The diameter is twice as big as the radius (d = 2r or r = ½d)

Properties of 2D shapes

When naming shapes, it is important that we can describe their properties using correct mathematical vocabulary:

Opposite
Facing each other

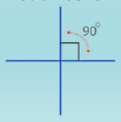


Adjacent
Next to each other

Diagonal
A line segment that goes from one vertex to another

Parallel
Lines always the same distance apart that never meet

Perpendicular
At right angles to each other



Lines of symmetry

A line of symmetry divides a shape into two mirror-image halves.

An equilateral triangle has 3 lines of symmetry.

An square has 4 lines of symmetry.

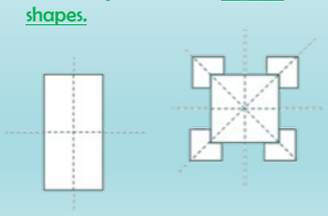
An regular pentagon has 5 lines of symmetry.

An regular hexagon has 6 lines of symmetry.

An regular octagon has 8 lines of symmetry.

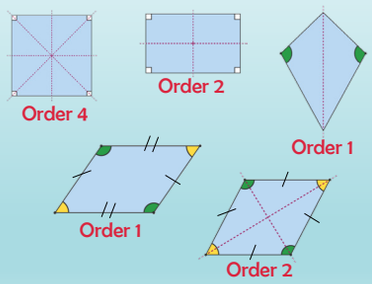
Regular shapes have the same number of lines of symmetry as they do sides!

This is only the rule for regular shapes.



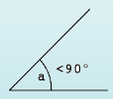
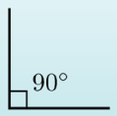
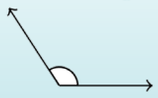
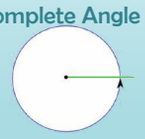
Rotational symmetry

A shape has rotational symmetry when it still looks the same after some rotation (of less than one full turn).
How many times it matches as we go once around is called the Order.



If the triangle is rotated a full 360°, it never looks the same except when it arrives back at its original starting position. It only has one order of rotational symmetry - the starting position.

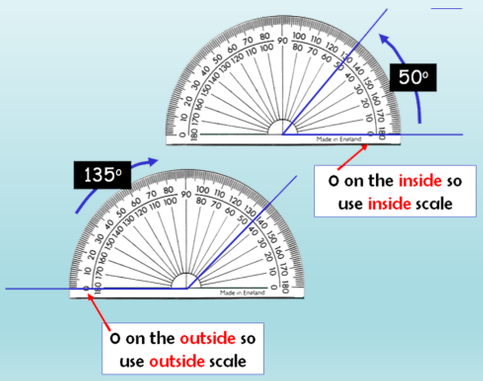
Types of angles

Acute Angle	Right Angle	Obtuse Angle
		
0° < Measure < 90°	Measure = 90°	90° < Measure < 180°
Straight Line Angle	**Reflex Angle**	**Complete Angle**
		
Measure = 180°	180° < Measure < 360°	Measure = 360°

Degrees are the unit of measurement used to measure angles.

Protractor

A protractor is used to measure angles.



Always place one of the lines on zero!

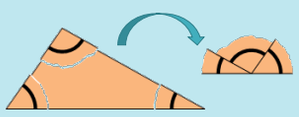
Try to use the protractor in a horizontal manner. Rotate the paper if you need to!

Think logically! Make sure your measurement matches what you know about the what type of angle it is (e.g. acute must be <90°).

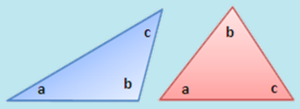
Interior angles

Straight line = 180°

Full turn = 360°

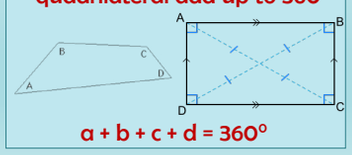


Interior angles in a triangle add up to 180°



a + b + c = 180°

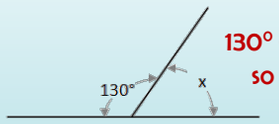
Interior angles in a quadrilateral add up to 360°



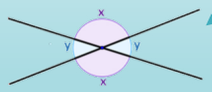
a + b + c + d = 360°

Calculating missing angles

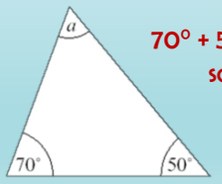
If we know that:
- Angles on a straight line = 180°
- Angles in a triangle = 180°
- Angles around a point = 360°
- Angles in a quadrilateral = 360°
- Vertically opposite angles are equal,



130° + x = 180°
so x = 50°



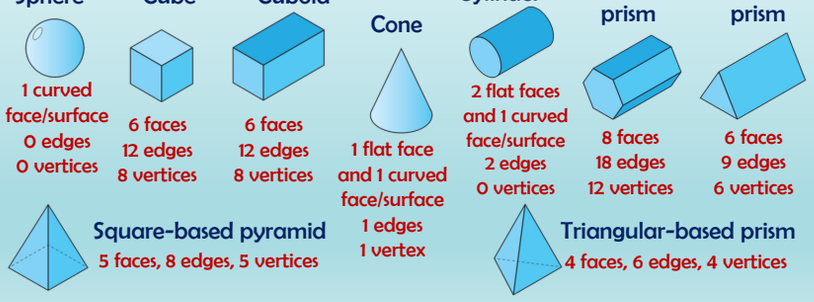
then we can work out missing angles!



70° + 50 ° + a = 180°
so a = 60°

3D shape names

A 3D shape has three dimensions.
We name them based on how many faces (surfaces), edges (where two faces meet) and vertices (a corner where edges meet) they have.



Sphere
1 curved face/surface
0 edges
0 vertices

Cube
6 faces
12 edges
8 vertices

Cuboid
6 faces
12 edges
8 vertices

Cone
1 flat face and 1 curved face/surface
1 edges
1 vertex

Cylinder
2 flat faces and 1 curved face/surface
2 edges
0 vertices

Hexagonal prism
8 faces
18 edges
12 vertices

Triangular prism
6 faces
9 edges
6 vertices

Square-based pyramid
5 faces, 8 edges, 5 vertices

Triangular-based prism
4 faces, 6 edges, 4 vertices

Prism or Pyramid?

A prism is a type of three-dimensional (3D) shape with flat sides. It has two ends that are the same shape and size. It has the same cross-section all along the shape from end to end; that means if you cut through it, you would see the same 2D shape as on either end.

cube | cuboid | triangular prism | pentagonal prism | octagonal prism

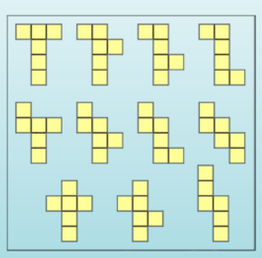
A pyramid is also a three-dimensional (3D) shape. It has a 2D base and triangular sides that join at a common point (called the apex).

square-based pyramid | triangular-based pyramid | Hexagonal-based pyramid

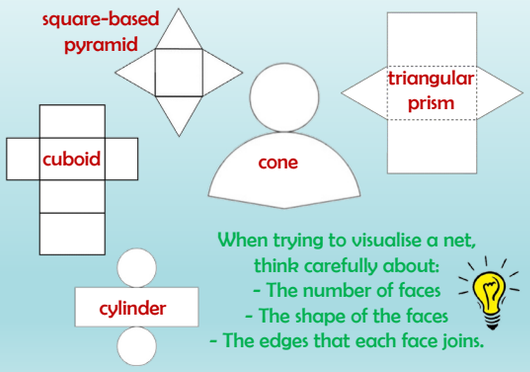
If you know the name of the 2D shape on the end of the prism or the base of the pyramid, you can work out its name!

Nets

A net is what a 3D (three-dimensional) shape would look like if it were opened out flat.



3D shapes can have more than one net. A cube has 11 possible nets!

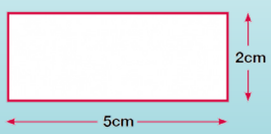


When trying to visualise a net, think carefully about:
- The number of faces
- The shape of the faces
- The edges that each face joins.

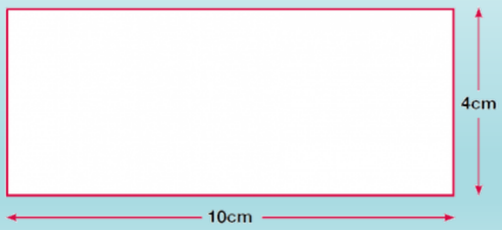
Scale factor

We use scale factor when we talk about increasing the size of a 2D shape.
The size by which we make the shape larger is described by its scale factor.

For example, this rectangle has the measurements 5cm and 2cm (not shown to scale):



If we increase this rectangle by a scale factor of 2, we double both the sides:

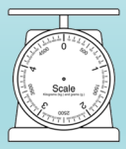


Units of measurement

A quantity used as a standard of measurement. It is how much makes up "1" of the measurement. These are the metric units of measurement:

Length
kilometre (km)
metre (m)
centimetre (cm)
millimetre (mm)

Mass
kilogram (kg)
gram (g)



Volume
litre (l)
millilitre (ml)

Time
Year
month
week
day
hour
minute
second

Converting units of measurements

Length

1 km = 1000 m
1 m = 100 cm
1 cm = 10 mm

So...
If 1 km = 1000m, then
2 km = 2000m
3.4km = 3400m
etc.

Mass

1 kg = 1000 g

Volume

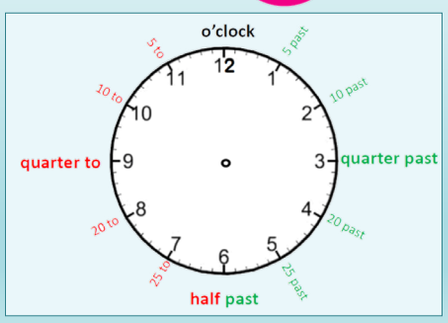
1 l = 1000 ml

Time

1 year = 52 weeks = 356 days
1 week = 7 days
1 day = 24 hours
1 hour = 60 minutes
1 minute = 60 seconds

Time

Digital → Analogue



12-hour clock
The hours go from 12 to 12 twice a day
You must use am or pm:
am is before noon
pm is after noon

24-hour clock
The hours go from 0 to 23
Time is always shown as hour digits
You don't use am or pm

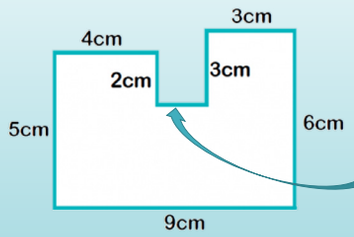
12-hour time	24-hour time
12 am (midnight)	00:00
3:30am	03:30
12 pm	12:00
4:45pm	16:45

Perimeter

The perimeter is the distance around the edge of a 2D shape.

P = 10 + 10 + 4 + 4
or
P = (2 x 10) + (2 x 4)
or
P = 2 (10 + 4)

Perimeter of a rectangle is 2(l + w)



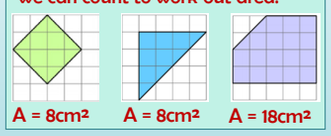
P = 9 + 5 + 4 + 2 + 2 + 3 + 3 + 3 + 6
= 37cm

Don't forget to work out any unknown sides! (In this example it's 2cm)

Area

Area is the term used to define the amount of space taken up by a 2D shape or surface. We measure area in square units : cm² or m².

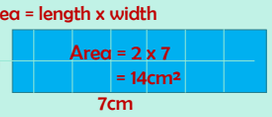
Sometimes, there are squares which we can count to work out area:



A = 8cm² A = 8cm² A = 18cm²

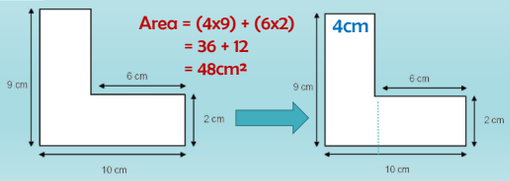
This links to squared numbers!

When calculating the area of a rectangle, we can use the formula:
Area = length x width



When calculating the area of a compound shape, divide it up into parts:

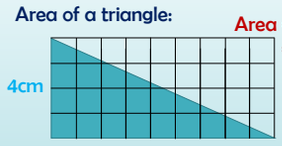
Don't forget to work out any unknown sides!



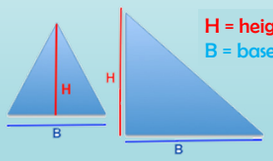
Area = (4x9) + (6x2)
= 36 + 12
= 48cm²

Area (cont.)

Area of a triangle:



Area = ½ (8 x 4)
= 16 cm²

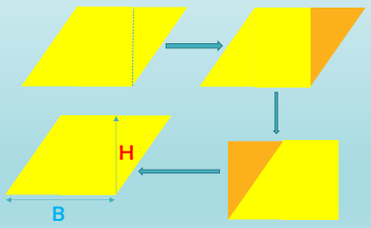


H = height
B = base

Area of a triangle = ½ base x height

Area of a parallelogram:

It might look tricky to find the area of parallelogram, but in fact it is quite easy because any parallelogram can be rearranged as a rectangle.



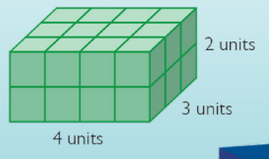
Area of a parallelogram = b x h

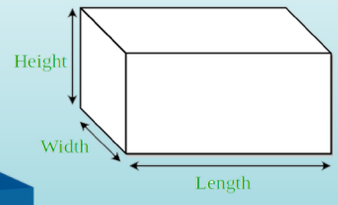
Volume

Volume is the amount of 3D space an object occupies or takes up.
We measure volume in cubic units : cm³ or m³.

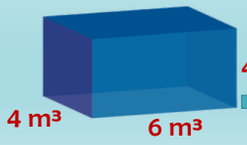
Volume = length x width x height

Volume = 24 cm ³





This links to cubed numbers!



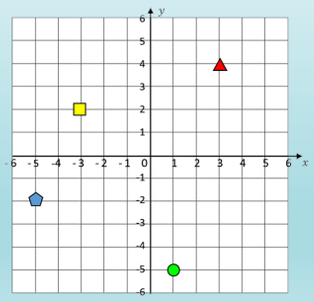
V = l x w x h
= 6 x 4 x 4
= 96 m³

Co-ordinates

Co-ordinates are numbers which determine the position of a point or shape in a particular space (a map or a graph).

Co-ordinates are always written in brackets, with the two numbers separated by a comma.

(3, 4)
(1, -5)
(-3, 2)
(-5, -2)



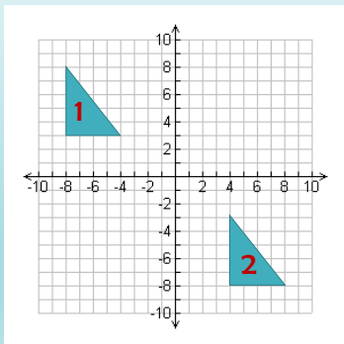
X-axis means across!

Coordinates are ordered pairs of numbers; the first number indicates the point on the x axis and the second the point on the y axis.

(x, y)

Translation

In geometry, translation means moving a shape into a different position, without changing it in any way.



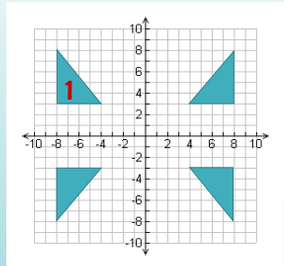
The triangle has moved from the second quadrant to the fourth quadrant.

Every point has moved the same distance in a given direction.

In this example, it has been translated:

12 right and 11 down.

Reflection in a mirror line

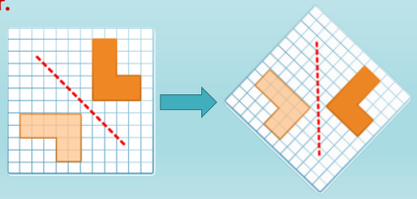


The first triangle has been reflected in both the x-axis and y-axis.

The reflection must be the same distance from the mirror line.

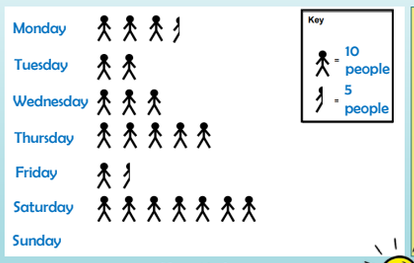
The triangle does not change size but it does flip over.

Mirror lines do not have to be only vertical or horizontal. You can always make them vertical by turning your page!

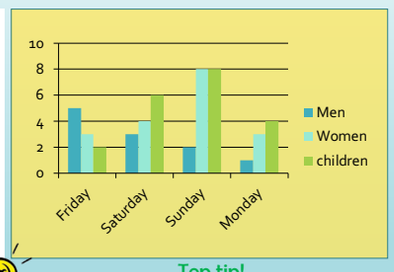


Pictograms and Bar Charts

A pictogram is a chart that uses pictures to represent data.
Pictograms are set out in the same way as bar charts, but instead of bars they use columns of pictures to show the numbers involved.



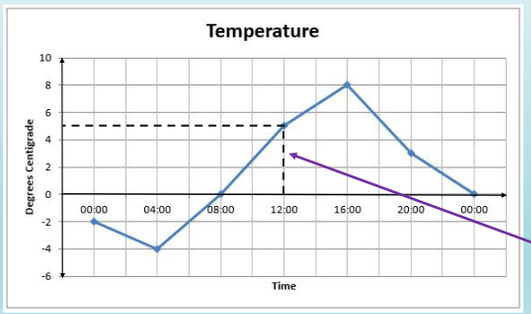
Top tip!
Make sure you read the key carefully. Look at what each picture is worth.



Top tip!
Look carefully at the y-axis. Make sure you know what the intervals are increasing by.

Line Graphs

A line graph is used to display information which changes over time. It is plotted on a graph as a series of points joined with straight lines.



Top tips!
Look carefully at the y-axis. Make sure you know what the intervals are increasing by.

Annotate your line graph. Use a ruler to draw lines to ensure that you are reading the axis accurately.

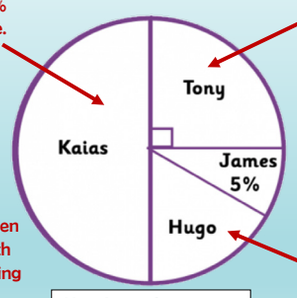
Pie Charts

Pie charts are used in data handling and are circular charts divided up into segments which each represent a value.

This part must be worth 50% because it is half of the circle.

This part must be worth 25% because it is quarter of the circle.
The right angle shows us this because 90° is ¼ of 360°

Don't forget to look carefully at what the whole is worth!



There are 360° in a full turn.

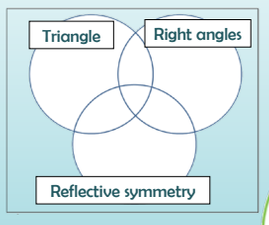
If the whole is worth 300, then you can work out what each segment is worth by calculating the percentage.
E.g. Kaias - 50% of 300 = 150

Total number = 300

Hugo must be the remaining part of the 100%
50% + 25% + 5% = 80% so Hugo must be the remaining 20%

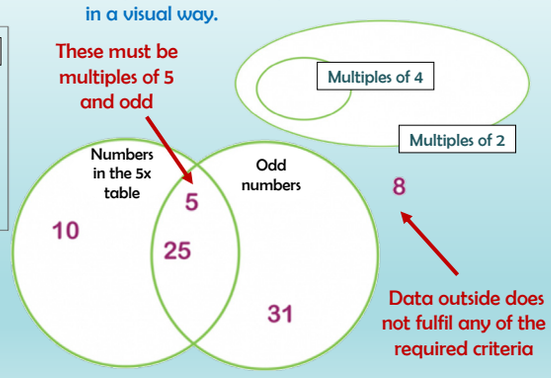
Venn Diagrams

A Venn diagram shows the relationship between a group of different things (a set) in a visual way.



All data must either fit inside the Venn or outside of it.

These must be multiples of 5 and odd



Data outside does not fulfil any of the required criteria

Carroll Diagrams

A Carroll diagram is used to organise data and group it according to whether it fits certain criteria. These groups are called sets.

To be able to read a Carroll diagram, you must read down the column and across the row to find something that matches both criteria.

Anything that does not meet this criteria...

Must meet this criteria

	Has curved lines	Has straight lines
Has more than three sides		
Has three sides or fewer		

This shape must straight lines and three sides or fewer.

Timetables

A timetable is a table of information showing when things happen.

E.g. The 0655 bus will depart Aztec West and will arrive at Filton Abbey 11 minutes later.

Departure times of each bus:

Destinations:

Aztec West, Approach Road	0655	0750	0830	0900	1535	1635	1705	1745
Filton Abbey Wood Station	0706	0804	0844	0914	1551	1651	1721	1801
Abbey Wood, MoD	0711	0809	0849	0919	1557	1657	1727	1806
UWE, Frenchay Campus [C]	0716	0814	0854	0924	1602	1702	1732	1811
Emersons Green, Science Park	0727	0828	0908	0938	1618	1718	1748	1823
Emersons Green, Sainsburys	0730	0831	0911	0941	1621	1721	1751	1826
Kingswood, Kings Chase Centre	0742	0843	0923	0953	1634	1734	1804	1838

Use a number line to calculate time intervals.

Always annotate on the timetable!

Averages - Mean

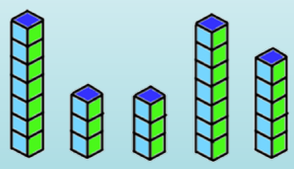
The mean is a calculated 'central' value of a set of numbers.

To calculate it: add up all the numbers and then divide by how many numbers there are.

5 22 16 29 8 13

This mean of these number is 15.5 because
(5 + 22 + 16 + 29 + 8 + 13) ÷ 6 =
93 ÷ 6 =
15.5

The mean is not always a whole number.



This mean height of these blocks is 5 because
(7 + 3 + 3 + 7 + 5) ÷ 5 = 5

How many of these do you remember? Test yourself

Date	I need to learn	