

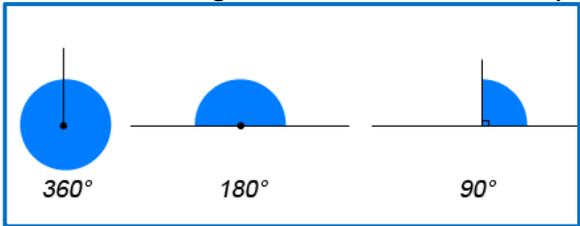
## Angle Facts & Properties of Triangles and Quadrilaterals – W/C 01/06/20

We have made it to the last half-term of this school year. What a strange couple of months we have had; it is looking increasingly likely that we will not be together in school until September, so it is so important you keep up to date and contact me if you are having any difficulties. **Let's start at the beginning.....**

### Angles – what are they?

Angles are used to measure rotation around a fixed point. They are measured in degrees, written with the degree sign  $^{\circ}$ . The maximum angle is a full rotation which is  $360^{\circ}$ , (shown below). Half of this angle is  $180^{\circ}$ , which is the angle on a straight line.

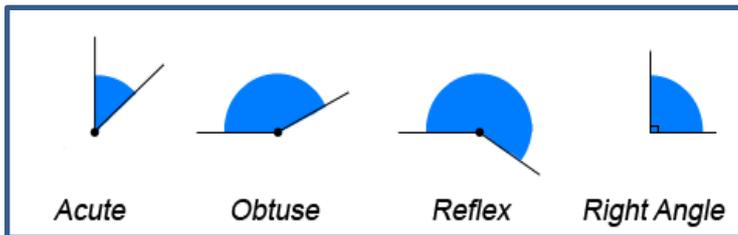
Another common angle is  $90^{\circ}$ , this is a quarter turn of a circle and is indicated by a small square in the corner of the angle. This is more commonly known as a right angle.



*Did you know? – The word angle comes from the Latin word *angulus*, meaning a corner.*

### Types of Angles

There are generally 4 types of angles you will encounter in your Maths GCSE, shown below.



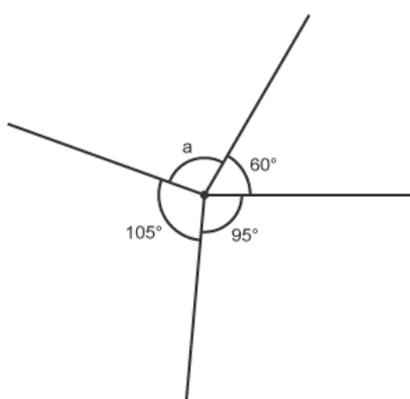
**Acute Angle** – An Acute angle is any angle less than  $90^{\circ}$ .

**Obtuse** – An Obtuse angle is an angle greater than  $90^{\circ}$  but less than  $180^{\circ}$ .

**Reflex** – A Reflex angle greater than  $180^{\circ}$  but less than  $360^{\circ}$ .

**Right Angle** – A Right Angle, as we saw above, is an angle of exactly  $90^{\circ}$ .

### Angles at a point – add up to $360^{\circ}$



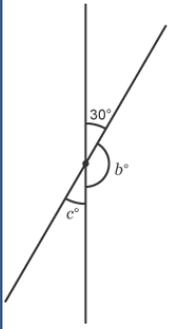
#### Example

Calculate angle  $a$

$$a = 360 - 60 - 95 - 105 = 100^{\circ}$$

*or*  $60 + 95 + 105 = 260$   
 $a = 360 - 260 = 100^{\circ}$

## Angles on a straight line – add up to 180°



### Example

Calculate the angles b and c

$$b = 180 - 30 = 150^\circ$$

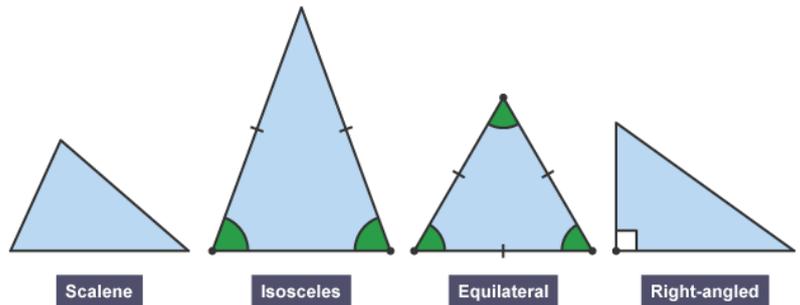
$$c = 180 - 150 = 30^\circ$$

c and 30° are called **vertically opposite angles** and are equal.

## Types of triangle

A **scalene triangle** has 3 sides of different lengths and 3 unequal angles.

An **isosceles triangle** has 2 sides of equal length. The dashes on the lines show they are equal in length. The angles at the base of the equal sides are equal.



An **equilateral triangle** has 3 sides of equal length. The dashes on the lines show they are equal in length. All of the angles are also equal.

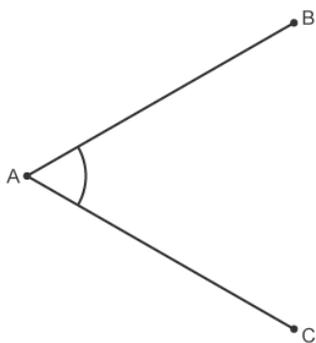
A **right-angled triangle** is a triangle that has a right angle.

## Labelling angles and sides – MORE IMPORTANT VOCABULARY AND NOTATION *Read carefully!*

Letters can be used to label angles.

AB and AC are **line segments**, and they meet at point A. AB joins the points A and B.

The angle between AB and AC is labelled BAC.



The angle can be written as Angle BAC or  $\hat{B}AC$  or  $\angle BAC$ .

### Interior and exterior angles

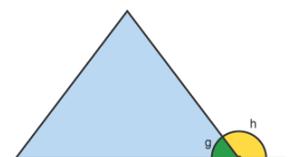
The angles inside a shape are called **interior angles**.

If the side of a triangle is extended, the angle formed outside the triangle is the **exterior angle**.

g is the interior angle and h is the exterior angle. As you can see they are on a straight line so  $g+h = 180^\circ$

The interior angle and its corresponding exterior angle always add up to 180°.

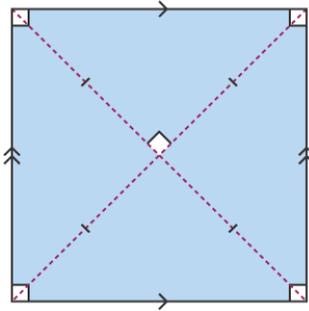
**The sum of interior angles in a triangle is 180°.**



## Types of Quadrilaterals

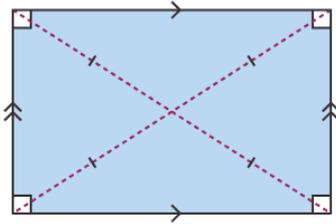
A quadrilateral is a 2D shape with four sides.

There are six special quadrilaterals with different properties (*You need to learn the properties*).



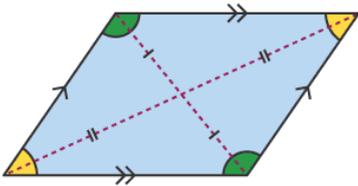
### Square

- A square has four sides of equal length.
- It has four right angles ( $90^\circ$ ).
- The opposite sides are parallel.
- The diagonals bisect each other at right angles.



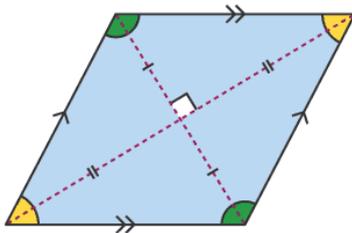
### Rectangle

- A rectangle has two pairs of equal sides.
- It has four right angles ( $90^\circ$ ).
- The opposite sides are parallel.
- The diagonals bisect each other.



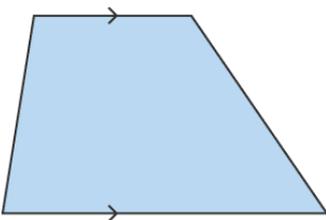
### Parallelogram

- A parallelogram has two pairs of equal sides.
- It has two pairs of equal angles.
- The opposite sides are parallel.
- The diagonals bisect each other.
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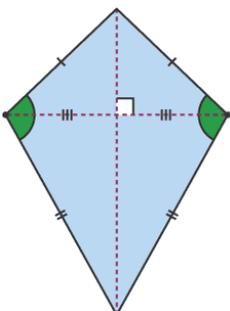
### Rhombus

- A rhombus has four sides of equal lengths.
- It has two pairs of equal angles.
- The opposite sides are parallel.
- The diagonals bisect each other at right angles.



### Trapezium

- A trapezium has one pair of parallel sides.



### Kite

- A kite has two pairs of equal sides.
- It has one pair of equal angles.
- The diagonals bisect at right angles.

**The sum of interior angles in a quadrilateral is  $360^\circ$ .**

We end this teaching bit by looking at Symmetry of quadrilaterals but first a reminder what this means:

## Lines of symmetry

A shape can be folded to see if it has a line of symmetry.

A shape has a line of symmetry when the folded part sits perfectly on top with all edges matching.

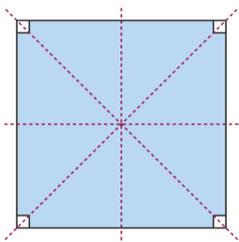
## Rotational symmetry

A shape has rotational symmetry when it can be rotated and it still looks the same.

The **order of rotational symmetry** of a shape is the number of times it can be rotated around a full circle and still look the same.

## Symmetry of quadrilaterals

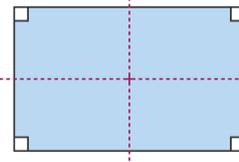
There are six special quadrilaterals with different symmetrical properties. *(As above you need to know these too!)*



### Square

A square has four lines of symmetry.

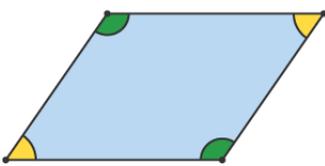
It has rotational symmetry of order four.



### Rectangle

A rectangle has two lines of symmetry.

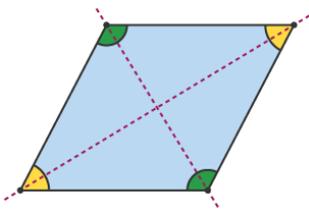
It has rotational symmetry of order two.



### Parallelogram

A parallelogram has no lines of symmetry.

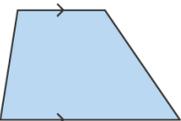
It has rotational symmetry of order two.



### Rhombus

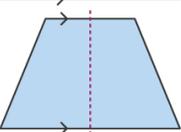
A rhombus has two lines of symmetry.

It has rotational symmetry of order two.

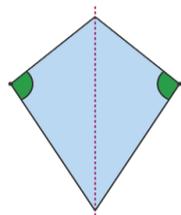


### Trapezium

A trapezium has rotational symmetry of order one.



Some trapeziums have one line of symmetry. They are called **isosceles trapeziums** as they have 2 sides of an equal length like isosceles triangles.



### Kite

A kite has one line of symmetry.

It has rotational symmetry of order one.

**Task 1:** Re-read the information above and make notes/ revision cards for later - you also need to learn it!

**Task 2:** Watch the following mathswatch clips and make any relevant notes:

Clip 45	Angles on a line and at a point
Clip 121	Angles in a triangle
Clip 122	Properties of special triangles
Clip G14 (KS3)	Properties of Quadrilaterals (you will have to change the qualification to KS3 to watch this – then change back)

**Task 3:** Complete the work sheet – which is on a separate document (see the attachments on my e-mail but also on the website). You may use a calculator but you must **show all your workings** (as per the examples). NOTE: Some questions require knowledge of Angles in Parallel lines – some of you may wish to look this up as it will become important later otherwise do NOT do questions 6, 7, 10, 12, 14, 16 and 17.

**Task 4:** Finally, can you please complete the assignment on mathswatch to check your understanding. Careful that you don't miss out on marks when it requires a reason:

For example Angle DCB =  $20^\circ$  because vertically opposite angles are equal

*By including the explanation, you will get an extra 1 mark!*

That is why it is important to also remember the names of the angles facts that you are using.

If you would like some additional help you can go to:

\*Angles in triangles: <https://corbettmaths.com/2012/08/10/angles-in-a-triangle/>

\*Angles in quadrilaterals: <https://corbettmaths.com/2013/03/17/angles-in-quadrilaterals/>