Polygons and Circles

What do you need to know?

Polygons are 2D flat shapes formed with straight lines: triangles, hexagons, pentagons and octagons are all examples of polygons.

Triangle 180°

Square 360°

Pentagon 540°

Hexagon 720°

Heptagon 900°

Octagon 1080°

Important vocabulary:

- A **right angle** is 90°.
- An **acute angle** is between 0° and 90°.
- An **obtuse angle** is between 90° and 180°.
- **Edge** is the geometrical word for the side of the shape.
- A **horizontal line** runs from left to right.
- A **vertical line** runs straight up and down.
- **Perpendicular lines** are straight lines that meet at a right angle.
- **Parallel lines** are lines that never meet.
- A **line of symmetry** is an imaginary line along which you could fold a shape exactly in half.

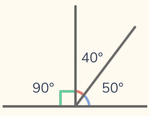
There are a few important facts you should know so that you can master polygons. For example, learning the sum of the **interior angles** (the numbers above) for different polygons will help you when you're answering questions.

Circles are **not** polygons because they are perfectly round 2D shapes

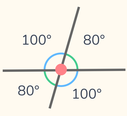
Circle 360°

You should also understand the difference between regular and irregular polygons. A **regular polygon** is a polygon in which all the sides are the same length and all the angles are equal. An **irregular polygon** has unequal sides and angles.

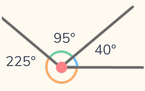
Facts about **angles** should also be part of your toolkit when you're talking about polygons:



Angles on a straight line add up to 180°.



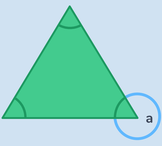
Vertically opposite angles, or angles opposite each other when two straight lines cross, are equal.



Angles at a point add up to 360°

Let's see this in action...

Imagine we need to work out the size of angle **a** in this diagram.



The triangle is a regular polygon, meaning that all its sides are the same length and all the interior angles are the same size.

We know that angles in a triangle add up to 180° and, because this is a regular polygon, that **all the interior angles will be the same.**

$180 \div 3 = 60°$

Because we also know that angles around a point add up to 360°, we can work out the size of angle a by taking away the interior angle from 360°

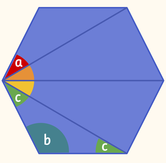
$a = 360° - 60°$

$a = 300°$

So angle a is 300°!

Let's look at a different example:

Imagine we need to work out the size of **angle a** in this regular hexagon. How can we use our knowledge of polygons and angle facts to work it out?



1) First, let's take what we know about the interior angles of a hexagon. The sum of the interior angles is 720°, so we should divide this by 6 to find the size of each interior angle.

$720 \div 6 = 120°$

2) We can see from the diagram that a is an interior angle split into four

$a = 120° \div 4$ $a = 30°$

3) We can check our answer by using what we know about triangles. There are 180° in a triangle and angles a and b form a triangle so, if our answer is correct, these angles will add up to 180°.

$a = 30°$ $b = 120°$ (the interior angle of a hexagon)

$120° + 30° + 30° = 180°$

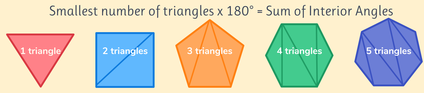
Great work! This proves that a is 30°

Tips!

Remember: learning the sum of **interior angles** for different kinds of polygons is very useful. If you've forgotten, you can work it out using either of these handy formulas:

(Number of Sides - 2) x 180° = Sum of Interior Angles

Smallest number of triangles x 180° = Sum of Interior Angles



If the polygon is regular, you can **divide** this by the **number of angles** (or sides) to find the size of each interior angle. For example, for a pentagon we calculate:

$(5 - 2) \times 180° = 540°$

$540 \div 5 = 108°$

So we know every interior angle inside a pentagon is 108°!

Warning!

Don't forget that the angles and sides of irregular polygons are not all equal, but the sum of the interior angles is still the same.