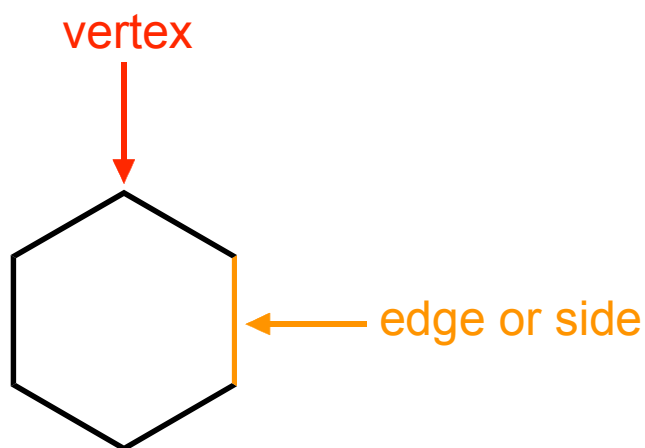# Polygons

A polygon is a shape with straight sides. It is a Greek word that literally means *many-angle*.
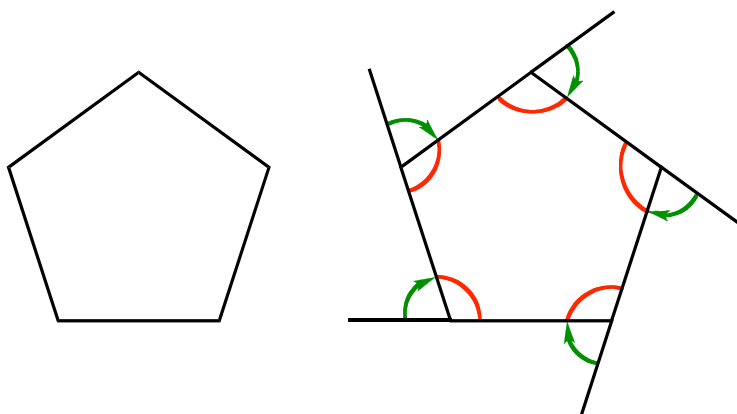
The parts of a polygon
The straight lines of a polygon are called **edges** or **sides**. The corners are called **vertices**. **Vertex** is the Latin word for corner.

Polygons contain two main types of angles, **interior angles** and **exterior angles**.
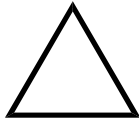
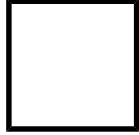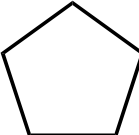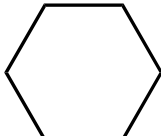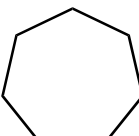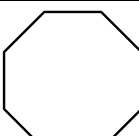Shown below is a regular pentagon. Its interior angles are displayed in red and its exterior angles are in green.

The definition of an exterior angle is the angle you have to turn through in to change your direction from one side to that of the next side.

Regular polygons

Regular polygons are polygons whose sides are all the same length, whose interior angles are all equal, and whose exterior angles are all equal.
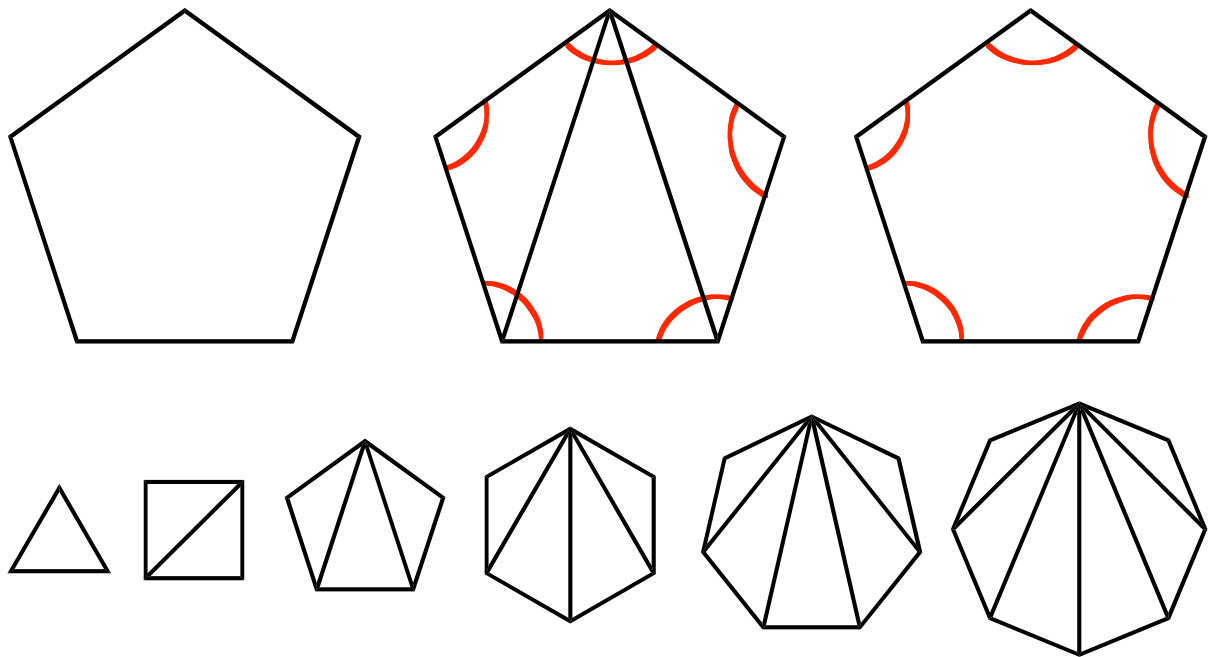
Sides	Name	Diagram	Interior angle	Sum of interior angles	Exterior angle	Sum of exterior angles
3	equilateral triangle		60°	180°	120°	360°
4	square		90°	360°	90°	360°
5	regular pentagon		108°	540°	72°	360°
6	regular hexagon		120°	720°	60°	360°
7	regular heptagon		128.6°	900°	51.4°	360°
8	regular octagon		135°	1080°	45°	360°

The **sum of interior angles** in a polygon with n sides can be calculated using the following formula:

$$\text{sum of interior angles} = 180°(n-2)$$

A simple way to prove this rule is true is to divide any polygon up into triangles. Start at a vertex. Draw lines from the starting vertex to all the other vertices. In effect, the polygon has been divided up into triangles. The sum of internal angles in a triangle is always 180°, so the sum of internal angles in a

polygon is simply 180° multiplied by the number of triangles it can be divided into.

In a regular polygon, all interior angles are equal. The formula for the **interior angle of a regular polygon** with *n* sides is:

$$\text{interior angle} = 180° \left(1 - \frac{2}{n} \right)$$

The **sum of exterior angles** in any polygon is always 360°.

This can be rationalised as follows. Suppose you are walking along the perimeter of a polygon. When you get to the end of the first side, the angle you have to turn through before you can walk along the next side is an exterior angle. You walk along the second side and at the end, you again have to turn through the exterior angle. You keep doing this until you get back to where you started, by which time you have rotated back to your original direction, having turned through a full circle of 360°.

In a regular polygon, all exterior angles are equal. The formula for the **exterior angle of a regular polygon** with *n* sides is:

$$\text{exterior angle} = \frac{360°}{n}$$

The names of polygons

Most polygons have a name ending in –gon. Most begin with a prefix based on the Greek or Latin word for how many sides they have.

Sides	Prefix	Name
3	tri–	triangle
4	quad–	quadrilateral
5	penta–	pentagon
6	hexa–	hexagon
7	hepta–	heptagon
8	octa–	octagon
9	nona–	nonagon
10	deca–	decagon
11	hendeca–	hendecagon
12	dodeca–	dodecagon