Symmetry

What exactly is symmetry?

Symmetry is a property than objects may possess. An object is symmetrical if it looks the same after a transformation is applied to it.

Reflection symmetry

A two-dimensional shape may have one or more lines of symmetry. These are mirror lines – one half of the object reflected in the line of symmetry would give the other half of the object.

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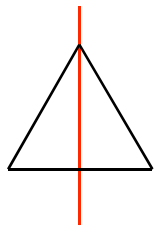
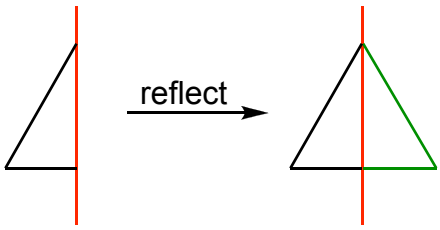
<td>  </td>
<td>The line drawn through this triangle is a line of symmetry.

If you took one half and reflected it in the line, you'd get the other half:
 
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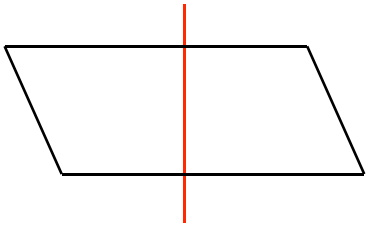
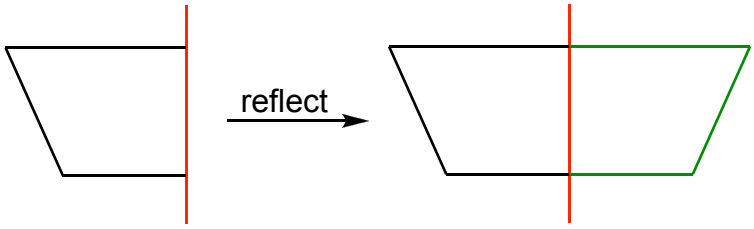
<td>  </td>
<td>The line drawn through this parallelogram is not a line of symmetry.

If you took one half and reflected it in the line, you wouldn't get the other half:
 
</td>
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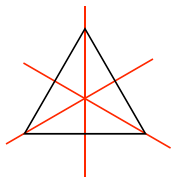
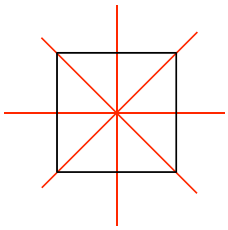
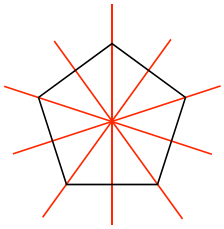
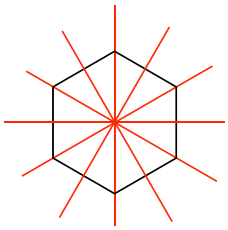
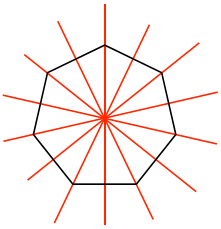
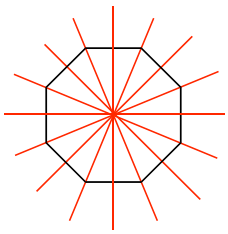
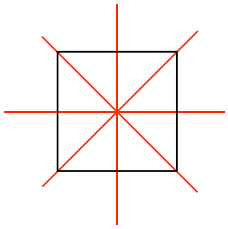
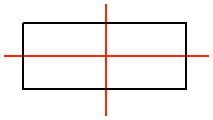
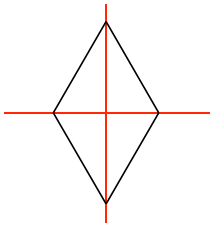
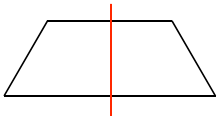
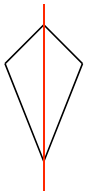
Reflection symmetry in regular polygons

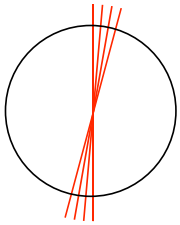
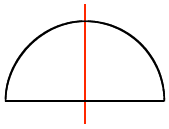
Regular polygons with *n* sides have *n* lines of symmetry.

Number of sides	Polygon	Diagram	Lines of symmetry
3	Equilateral triangle		3
4	Square		4
5	Regular pentagon		5
6	Regular hexagon		6
7	Regular heptagon		7
8	Regular octagon		8

Reflection symmetry in special quadrilaterals

Quadrilateral	Diagram	Lines of symmetry
Square		4
Rectangle		2
Rhombus		2
Trapezium		1
Kite		1
Parallelogram		0

Reflection symmetry in other shapes

Shape	Diagram	Lines of symmetry
Circle		∞ (infinity)
Semicircle		1

Rotational symmetry

A two-dimensional shape has rotational symmetry if it looks the same when rotated about a point. This point is called the point of symmetry, and is generally at the centre of the shape.

There is a number called the **order of rotational symmetry**. This is how many times the shape looks the same as it is rotated through 360°.

Shown below are the stages of rotating an equilateral triangle through 360°. Each triangle is rotated 30° clockwise from the one to its left.

Angle	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Shape													

The triangles at 0°, 120°, 240° and 360° all look the same.

This triangle therefore has rotational symmetry of order 3.

0° and 360° are the same orientation – all objects look the same when they are rotated 360°, so we only count this once. **All shapes have an order of rotation of at least 1. Only those with an order of rotation of 2 or more are said to have rotational symmetry.**

Reflection and rotational symmetry together

A shape can have no lines of symmetry, but its order of symmetry must be at least one.

For regular polygons, the number of lines of symmetry is equal to the order of rotational symmetry, and both are equal to the number of sides. For example, a pentagon has five sides, five lines of symmetry and an order of rotational symmetry of five.

The order of rotational symmetry of a shape is always equal to or greater than the number of lines of symmetry it has. Consider the shapes below. They have no lines of symmetry, but they have rotational symmetry of order 2, 3 and 4 respectively.