Learning Intention: By the end of the lesson you will be able to identify shapes having reflection and/or rotational symmetry.

Shapes

⇒ Reflection Symmetry

Exercise: Draw the lines of symmetry of the following shapes.

Remember!

Equilateral Triangle
(all sides equal, all angles equal)

3 Lines of Symmetry

Isosceles Triangle
(two sides equal, two angles equal)

1 Line of Symmetry

Scalene Triangle
(no sides equal, no angles equal)

No Lines of Symmetry
⇒ Rotational Symmetry

With Rotational Symmetry, the image is rotated (around a central point) so that it appears 2 or more times. How many times it appears is called the Order.

<table>
<thead>
<tr>
<th>Order</th>
<th>Example Shape</th>
<th>Artwork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order 2</td>
<td><img src="image1" alt="Order 2 Image" /></td>
<td><img src="image2" alt="Order 2 Artwork" /></td>
</tr>
<tr>
<td>Order 3</td>
<td><img src="image3" alt="Order 3 Image" /></td>
<td><img src="image4" alt="Order 3 Artwork" /></td>
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</tbody>
</table>

... and there is Order 4, 5, etc ...

How can you tell the order of symmetry of a shape?
The star has a rotational symmetry of 5.

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.

The minimum order of rotational symmetry a shape can have is 1.

Write the order of symmetry for the following shapes:

- Scalene – 0 lines of symmetry & order 1 of rotational symmetry
- Isosceles – 1 line of symmetry & order 1 of rotational symmetry
- Equilateral – 3 lines of symmetry & order 3 of rotational symmetry
Symmetrical properties of a Regular Polygon

Polygons can be regular or irregular. If the angles are all equal and all the sides are equal length it is a regular polygon.

A square is a regular polygon. It has four lines of symmetry and four sides.

A regular pentagon has 5 sides and 5 lines of symmetry.

The number of lines of symmetry in a regular polygon is equal to the number of sides.

There are six special quadrilaterals with different symmetrical properties:

❖ Square

Square with all its lines of symmetry highlighted. A square has four lines of symmetry. It has rotational symmetry of order four.

❖ Rectangle

Rectangle with all its lines of symmetry highlighted. A rectangle has two lines of symmetry. It has rotational symmetry of order two.
- **Parallelogram**
  Parallelogram with opposite angles highlighted. A parallelogram has no lines of symmetry. It has rotational symmetry of order one.

- **Rhombus**
  Parallelogram with opposite angles and lines of symmetry highlighted. A rhombus has two lines of symmetry. It has rotational symmetry of order two.

- **Trapezium**
  Regular and irregular trapezium. Regular trapezium shows line of symmetry.

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

A trapezium has rotational symmetry of order one.

- **Kite**
  Kite with line of symmetry and opposite angles highlighted.

A kite has one line of symmetry.

It has rotational symmetry of order one.
Triangles, squares and hexagons are the only regular shapes which tessellate by themselves. You can have other tessellations of regular shapes if you use more than one type of shape. By seeing if you can repeat it over and over again without getting any overlaps or gaps you can test if a shape can tessellate. Tessellations can be used for tile patterns, dresses, in patchwork quilts...

**Triangles** - these make pretty tessellations. Two triangles make a diamond. Six triangles make a hexagon.

**Squares** - rather obvious! By colouring them, you can build up more complicated patterns.

**Hexagons** - Bees make natural tessellations of hexagons in their honeycombs

**Squares and triangles**
Area of Tessellation

To find the area of tessellation, find the area of one shape and multiply it by the number of shapes found in the tessellation.

Dark square area

= length x breath
= 6 x 6
= 36\text{cm}^2 \times \text{number of shapes}
= 36 \times 5 = 180 \text{cm}^2

Do the same for the light squares and find the total area!

Example: Martha wants to design a blanket using tessellating shapes. Use one of the following shapes and draw a sketch of the blanket. Calculate the area she will cover if she has 20 cut shapes in total.

- triangle of length 10cm and height 7.
- Square of length 10cm and height 10cm.