Education Resources

Tessellations with Japanese Patterns

Learning Objectives:

- To introduce the concept of polygons and tessellation, in the context of Japanese designs.

Learning Outcomes:

- To realise that angles around a point sum to 360°.*
- To understand that a tessellation occurs when angles of a shape fit perfectly around a point.
- To appreciate how these patterns have been used in Japan and their cultural significance.

This can be achieved through a single shape for the lower year groups such as squares, triangles and hexagons, as well as tessellations with more than one shape which more able students can experiment with.

Curriculum Links:

This lesson is suitable for upper KS2 and lower KS3.

- Draw given angles, and measure them in degrees (Y5); draw 2-D shapes using given dimensions and angles (Y6)
- Identify: angles at a point and 1 whole turn (total 360°), angles at a point on a straight line and half a turn (total 180°), other multiples of 90° (Y5); recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles (Y6)
- Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles (KS3)

Keywords:

Tessellation, polygons, interior angle, right angle, hexagon, equilateral triangle, isosceles triangle

Resources:

Presentation: Japanese Patterns

Additional Resources:

Square and triangular isometric paper

Starter

- Ask students to look at the pattern on slide 2 of the presentation. What shapes can they see? If you prefer, this can be a paired activity. **Answers:** *triangles (equilateral and isosceles), hexagons, squares, rectangles.*
- Ask students if anyone knows the name for these shapes. Go over the definition of a polygon.
- You can also point out the shapes which represent cherry blossom (*sakura*) and pine (*matsu*).

Estimated Time: 2 -3 minutes

Task 1

- Students will learn about the 'ichimatsu' pattern and its origins. Use the information on the slides and the slide notes. If you have time, you may like to look at more images of kabuki performers and their bold costumes and make-up.
- Students then measure the interior angle of a square and realise that it is 90 degrees. They should realise that four 90 degree angles can form a 360 degree angle and hence tessellate perfectly around a point.
- Now students can draw a tessellation of squares on squared or isometric paper. Older children can design a pattern for a kabuki performer or draw a Kabuki performer wearing an Ichimatsu pattern.

Estimated Time: 10 minutes*

* The length of this activity can be adjusted as appropriate to your students. If they complete the task very quickly, move on and spend more time on the next two tasks.

Task 2

- Introduce the uroko pattern. Meaning scales of a fish, snake or other animal, the pattern is based on a tessellation of equilateral or isosceles triangles.
- Students should recognise an equilateral triangle and be able to measure one of the interior angles and hence realise that 6 triangles meeting around a point tessellate perfectly to form a combined angle of 360 degrees. More advanced students can also see how this can work with isosceles triangles to create different patterns.

Estimated Time: 15 minutes

Task 3

- Introduce the kikko pattern. Students should identify that the tessellation is made up of regular hexagons. Explain that it refers to a turtle shell pattern, and can also refer to the hexagonal metal plates used in old Japanese armour.
- Students can use the triangular isometric paper to create hexagonal tessellations and colour them in.
- They can then measure one internal angle of a regular hexagon with a protractor and should deduce that the 3 vertices (corners) of regular hexagons meet at a point to form a perfect tessellation since 3 x 120 = 360 degrees to form a full turn.

Estimated Time: 20 minutes

Plenary

- Ask if students if they can spot the designs they've just learned about in the images. You may like to ask if they can see other tessellating patterns in the classroom or think of any examples from daily life.

Estimated Time: 2-3 minutes

Extension Activities

1. Ask students to combine the shapes to create a tessellation of their own. They may like to pick an animal or a symbol of their own culture and try making a pattern to resemble it.
2. Get students to measure the angles of their own designs around a point. What do they total?