

Topics: Patterns, Polygons, Tessellations

Materials List

- ✓ Regular polygons: equilateral triangles, squares, and hexagons; suggestion: use shape with the same length side & cut out in different colors
- Rectangles, parallelograms, and rhomboids (diamonds)

This activity can be used to teach: Common Core Math:

- Classify objects (Grade K, Measurement/Data, 3)
- Identify and describe shapes (Geometry, Grade K, 1-3; Grade 4, Geometry, 2&3)
- Analyze, compare, create, classify shapes (Geometry, Grade K, 4, 6; Grade 5, 3, 5, 6)
- Shapes / attributes (Geometry, Grade 1, 1-3; Grade 2, 1; Grade 3, 1)
- Geometric measuremnt (Grade 3, Measurement/Data, 8)
- Problem Solving and Reasoning (Mathematical Practices Grades K-6)



Patterning with Polygons

Exploring Simple Tessellations





Tessellations are repeating patterns that cover a surface without any gaps, which are made of one or more shapes. Polygons provide an excellent starting point for a topic that spans art and mathematics.

To Do and Notice

- 1. Create a tessellation using only hexagons.
- 2. Looking only at the arrangement of the shapes (not the colors), how many different ways can the hexagons tessellate?
- 3. Create a tessellation using only squares.
- 4. Looking only at the shapes (not the colors), are there different ways to arrange the squares?





5. Repeat the process with triangles.





- 6. Examine the patterns. What is the sum of the angles where the polygons meet? Remember a straight line has an angle of 180°.
- 7. Repeat the process with rectangles, parallelograms, and rhomboids (diamonds).



8. Compare the angles and the sum of the angles for tessellations made of equilateral triangles, squares, hexagons, rectangles, parallelograms, and rhomboids.

The Math Behind the Activity

Tessellations may be edge-to-edge (the full edges of two shapes meet) or non edge-to-edge. One condition necessary for a collection of shapes to tessellate is that the interior angles of the points that touch each other must equal 360° . Some simple examples of shapes that satisfy this rule are equilateral triangles (six triangles with interior angles of 60°), squares (four squares with interior angles of 90°) and hexagons (three hexagons with interior angles of 120°). These are the only regular polygons (all sides and angles are equal) which will tessellate with themselves. Other polygons will tessellate, by themselves or in combination with other polygons, as long as the angles add up to 360° .

Taking it Further

- Experiment with combinations of two or more types of polygons. Which ones will tessellate together? What is the sum of the angles at the vertices?
- Work with pentagons, heptagons, and octagons. Will they tessellate with just one type of shape? If not, are there other polygons that can be added to create a tessellation?



Resources

- <u>Introduction to Tessellations</u>, by Dale Seymour and Jill Britton Provides a detailed discussion of tessellation with comprehensive background information.
- <u>Teaching Tessellating Art</u>, By Jill and Walter Britton Provides activities and transparency masters for teaching tessellating art.

Web Resources (Visit <u>www.raft.net/raft-idea?isid=515</u> for more resources!)

- Examples to illustrate the basic rules of tessellating patterns <u>http://www.coolmath4kids.com/tesspag1.html</u>
- Online pattern block activities -<u>http://www.mathplayground.com/patternblocks.html</u> and <u>http://mathtoybox.com/patblocks3/patblocks3.html#.VU1HEZOeSVo</u>
- A wide variety of artistic patterns and a great Do It Yourself section http://www.tessellations.org
- Mathematical based tessellation tutorials <u>http://mathforum.org/sum95/suzanne/tess.intro.html</u>
- M.C. Escher website <u>http://www.mcescher.com/</u>
- Geometric Patterns in Islamic Art <u>http://www.metmuseum.org/toah/hd/geom/hd_geom.htm</u>