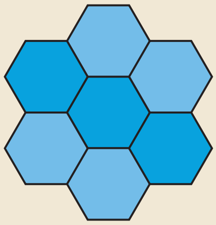
PROJECT
for Chapters 6 and 7

Investigating Tessellations

OBJECTIVE **Create tessellations using polygons.**

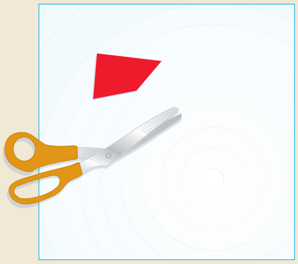
Materials: cardboard, scissors, protractor, colored pencils, file folder

A *tessellation*, or tiling, of a plane is a collection of tiles that fill the plane with no gaps or overlaps. The tiles in a *regular tessellation* are congruent regular polygons. The tessellation at the right is regular because it is made of congruent regular hexagons.

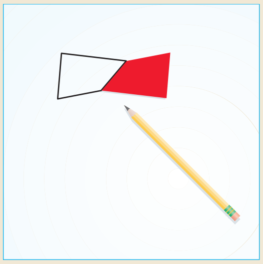


TESSELLATIONS USING ONE POLYGON

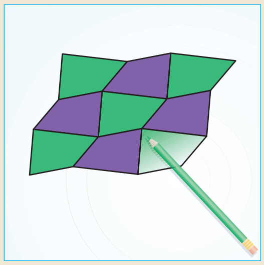
Follow these steps to make a tessellation of a quadrilateral.



1. Cut a quadrilateral that is not a rectangle from a piece of cardboard. Trace the shape on a piece of paper.



2. Rotate the quadrilateral 180° so an edge of the cardboard matches an edge of the shape on the paper. Trace the new position of the quadrilateral.



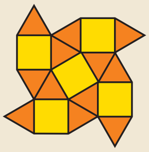
3. Continue rotating and tracing the quadrilateral to make a tessellation. Color your tessellation.

INVESTIGATION

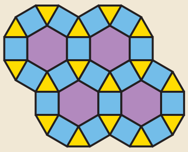
1. Is the quadrilateral tessellation a regular tessellation? Explain.
2. Suppose the quadrilateral tessellation extends forever in all directions. Describe some transformations that map the pattern onto itself.
3. Choose any vertex on your quadrilateral tessellation and measure the angles at that vertex. What is the sum of the measures of the angles? Find the sum of the measures of the angles at a different vertex. Explain why *any* quadrilateral will tessellate.
4. There are only three possible regular tessellations. The hexagonal tessellation is shown at the top of the page. Decide what other regular polygons can be used to create regular tessellations. Explain your reasoning.
5. Draw a scalene triangle on a piece of cardboard and cut it out. Use the shape to create a tessellation. Describe any transformations that can map the tessellation onto itself.

TESSELLATIONS USING MORE THAN ONE POLYGON

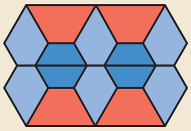
In a *semiregular tessellation*, more than one kind of regular polygon is used and the same arrangement of polygons meets at any vertex of the tessellation. You can also make nonregular tessellations with more than one kind of nonregular polygon. As with any tessellation, the sum of the measures of the angles of the polygons at any vertex should be 360°. Here are some examples.



Semiregular: squares and equilateral triangles



Semiregular: regular hexagons, squares, and equilateral triangles

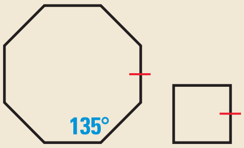


Nonregular: pentagons and isosceles trapezoids

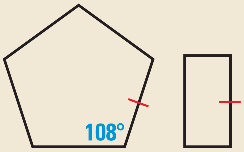
INVESTIGATION

Determine whether the shapes can be used to create a tessellation. If so, sketch the tessellation, and classify it as *semiregular* or *nonregular*.

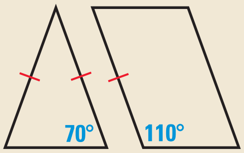
6. Regular octagon and square



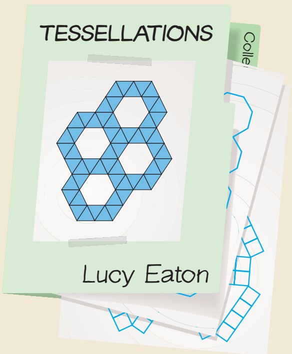
7. Regular pentagon and rectangle



8. Isosceles triangle and parallelogram



PRESENT YOUR RESULTS



Gather your drawings of tessellations and present them in a file folder.

- Include your quadrilateral tessellation.
- Include your answers to Exercises 1–8.
- Summarize what you have learned about tessellations.
- Describe how transformations can be used to map a tessellation onto itself.

EXTENSIONS

- Create your own tessellation using polygons. The sum of the measures of the angles of the polygon at any vertex should be 360°. Color your tessellation.
- Research the Dutch graphic artist M. C. Escher and find examples of tessellations in his work.