

Interior/Exterior Polygon Angles & Tessellations

Time: 90 minute block

OPTIONS:

1. If you only have 45 minutes of class, you could pair and share Activity 1 and Activity 2 or complete them in two days.
2. If you have the same number of students as computers, then you could complete each activity using Geometer's Sketchpad and the paper and pencil activities individually.
3. If your lab space allows, you could pair students at the computers and use the ***Exterior Angles in a Polygon and Polygon Angle Measure Sums*** by Key Curriculum Press, rotating the computer operator and writer for each activity.
4. If you have a limited number of computers or space the following is written specifically for you.
5. It is appropriate for applied geometry as well as theory geometry, especially if you collaborate with a special educator, who can oversee one of the activities.

Related Web Sites:

<http://www.iit.edu/~smile/ma9304.html>

http://www.studyworksonline.com/cda/content/applet/0,1033,NAV2-21_SAP241,00.html

http://mii.lps.org/MII%20handouts/fowler_t2/Investigation.html

<http://library.thinkquest.org/16661/background/polygons.html>

<http://www.geom.umn.edu/~dwiggins/conj07.html>

<http://www.coolmath.com/tesspag2.htm>

<http://www.iso.gmu.edu/~mmankus/tripoly/regpoly.htm>

<http://www.cs.purdue.edu/homes/gnf/book/webdiss.html>

IGO: G. 14: Discover the measures of angles of a polygon and connect the results to tessellating pattern.

Materials: (one for each student)

Geometer's Sketchpad loaded on computers or TI 92's

Pencil

Paper

Straightedge

Scissors

2" x 2" pieces of construction paper

Scotch tape

Previous knowledge required:

Polygon names

Angle addition postulate

Understanding of the term conjecture

Activity 1

Interior Angle Sum

Use the attached worksheet to encourage students to discover the interior sum of the angles of a polygon. The first step is reteaching and if your students don't need it, they may take the shortcut noted in the step 3.

Activity 2

Exterior Angle Sum

Use the *Exterior Angles in a Polygon* from Exploring Geometry by Key Curriculum Press.

(I use the new version for Applied Geometry and the 1995 version for Geometry. The old version expects the student to be familiar with Geometer's Sketchpad and understand that 2 points determine a line, angles are named and measured by 3 points with the vertex in the middle, and students must construct at least 3 polygons before trying to make their conjectures.)

You may need to review convex polygons before you begin.

Divide the class into at least 4 groups. Each group is to complete the construction of the polygons and measurements of a specific polygon. Example: group 1 – triangles, group 2 – quadrilaterals, group 3 pentagons, and group 4 hexagons. Groups 1 and 2 usually finish in time to try the octagon, if you wish.

Once conjectures are written and both activities are finished, discuss findings with the class. The class's discoveries should sound something like this:

The sum of the measures of a convex polygon, one angle at each vertex, is the number of sides – 2, which is the number of triangles, multiplied by 180° .

The sum of the exterior angles of any convex polygon is 360° .

Activity 3

Tessellations

You, the teacher, will complete and the script using directions from Exploring Geometry by Key Curriculum Press. Complete it at least two days prior to the students completing Activity 1 and Activity 2. Make sure it is saved properly and executes. Make sure you complete all the sketches and investigations, question the students as the presentation proceeds. Hook up a projector to the computer or presenter to your TI92 and show the presentation to the students.

After viewing the script, ask the following questions:

- 1. You have now seen which regular polygons tessellate. Using inductive reasoning, why do some tessellate and others do not?**
- 2. Can you use more than one regular polygon to tessellate a plane?**

In groups of four, students will now create 4 examples of two or more regular polygons that can tile a plane.

Each student must participate and each student must have the 4 created patterns.

You may want them to color them with colored pencils.

They must compile a list of surfaces that are tessellated in the everyday world and jobs in which tessellations are used. If time allows, have each group present their tessellations and lists to the class.

OPTION: You could show one script and have students complete other scripts – in pairs if possible; it is frustrating for students the first time.

Interior Angle Sum

Name _____

#1

- Draw any type of triangle with the straightedge on the 2" x 2" piece of construction paper.
- Cut out the triangle.
- If you already know the sum of the angles of a triangle, write it on the triangle, and skip to #2.
- If not, write W, V, and U inside the vertices.
- Tear off the three angles of the triangle with the labels showing.
- Draw a line on your paper.
- Place the three vertices on the line.

Write a conjecture about the sum of the angle of a triangle.

#2

- Use your straightedge to draw at least two different quadrilaterals.
- Choose **a** vertex.
- Draw all the diagonals you can from that vertex. (Diagonals are segments that join the vertices of polygons but are not sides.)
- **What polygon does the diagonal in both quadrilaterals create?**
- **What is the sum of the measures of the angles in the polygons created?**

Write a conjecture about the sum of the measures of the angles of a quadrilateral.

#3

- Use your straightedge to draw at least two different pentagons.
- Choose **a** vertex.
- Draw all the diagonals you can from that vertex. (Diagonals are segments that join the vertices of polygons but are not sides.)
- **What polygon does the diagonal in both pentagons create?**
- **What is the sum of the measures of the angles in the polygons created?**

Write a conjecture about the sum of the measures of the angles of a pentagon.

Repeat the process for a hexagon, heptagon, and octagon.

Use the information you found to fill in the captioned columns in the table below.

<i>Polygon</i>	<i>Number of sides</i>	<i>Number of triangles formed</i>	<i>Sum of the angle measures</i>	
Quadrilateral				
Pentagon				
Hexagon				
Heptagon				
Octagon				
Decagon				
N - gon				

Your conjectures and the table should show a pattern. Using inductive reasoning, write a conjecture about the sum of the angles of any polygon.

If the polygon were regular, equiangular and equilateral, what would be the measure of each interior angle of the polygons above?

Fill in the table.