

Lesson Plans

Geometry

Textbook: *Mathematical Ideas*, Miller, Heeren, Hornsby, 10th edition

Lesson One: Definitions (terms and vocabulary)

- A. Discuss, with notes, the following vocabulary words and definitions with examples: Line segment, parallel lines, intersecting lines, skew lines, angles (parts and properties), perpendicular lines, vertical angles, complementary angles, supplementary angles, transversal line.
- B. Assignment: *Mathematical Ideas* Page 501 #1 – 14, 70 – 78.

Lesson Two: Polygons - Classification

- A. Go over the names and classifications of polygons. Introduce the following terms: Convex polygons, concave polygons, regular polygons.
- B. Have students, in groups of two, do the following activity.
 - a. Each group will have two pieces blank white paper, an assortment of polygons (colored paper).
 - b. One of the students will create a design with any of the polygons. In the design, there should be overlapping of the polygons. That student will verbally describe his/her picture to their partner who will try to recreate the image on the second piece of paper.
 - c. The two will compare the drawing to the actual design.
 - d. Do the activity again and switch roles.
 - e. At the end of the activity, discuss the strengths and weaknesses of verbal descriptions and any difficulties in drawing the figures.
- C. Introduce the concept of symmetry. Use the following activity: Each group of two students will receive a bag of objects and a string or mirror. They are to determine if there is a line of symmetry. If there is a line of symmetry, how many. They are also to look at rotation in 90° increments. After they have collected their information, have them discuss with a partner if there is a relationship between lines of symmetry and the rotation of the objects. Have the students share the findings with the class.

- D. In the groups of two, have students draw lines of symmetry for regular polygons. (Handout of regular polygons.) Present these drawings to the class by using the board or overhead proxima. Discuss the finding of the class and how it relates to the definition of symmetry.
- E. Assignment: Alphabet Symmetry Handout. Have students complete the handout of symmetry and the alphabet.

Lesson Three: Polygons - Angles

- A. Review classification and description of polygons with the game *Polygon Capture Game*. Review the rules with the students.
- B. Students are to be in groups of three. They will explore the different angles of a polygon. They will look at the following: name of polygon, number of sides, number of diagonals from one vertex, total diagonals, line(s) of symmetry, number of triangles in decomposition, sum of the interior angles, each interior angle measure, sum of exterior angles, each exterior angle measure. They are to do this activity for triangle, quadrilateral, pentagon, hexagon, octagon, decagon, and n-gons.
- C. Present the information from each group to the class to ensure accuracy. Discuss the following:
 - a. What did you find for the sum of the measures of the interior angles?
 - b. What did you find for the sum of the measures of the exterior angles?
 - c. What can you conclude about the angle measures of a regular polygon? Will this be different for a polygon that is not regular? Why or why not?
 - d. What do you know about n-gons? Can you make some generalizations from the information obtained?
- D. Assignment: *Mathematical Ideas*, Generalizing the Angle Sum Concept, page 573.

Lesson Four: Tessellations

- A. Discuss the students' findings from their assignment. Look at the vertex angles. Formulate the way of computing the measure of a vertex, central, and exterior angle in a regular n-gon.
- B. Show examples of tessellations. Ask the students to discuss what they think tessellation means. Present their findings to the class and record on the board.
- C. Using a scalene right triangle, demonstrate a tessellation pattern. Rotate the triangle about a vertex. Also, show a tessellation by using reflection and glide transformation. Have the students draw their own tessellations with an equilateral triangle and a rectangle.
- D. Next activity, students will draw a tessellation with any quadrilateral by using the following procedure:
 - a. Trace the quadrilateral they have cut from cardstock paper. Label each vertex with a, b, c, and d.
 - b. Rotate the quadrilateral 180° around the midpoint of any side. (May have to review midpoint.) Trace the image. Be sure to label each vertex on each image.
 - c. Continue rotating the image 180° around the midpoint of each of its sides and trace the new image.
 - d. Ask the students what they can conclude about the point where all quadrilaterals are rotated from. (Looking for 360° .)
- E. Assignment: *Mathematical Ideas*, For Further Thought, page 551.
- F. Nonpolygonal figures will also tessellate. Have students begin with a square (or any parallelogram). Make a shape inside the square (it need not be a polygon) that has one side on the edge of the square. Translate this shape to the opposite side. This move can be done more than once. Have students think of a jigsaw puzzle. Have them draw the tessellation using their template they created.
- G. **Introduce the tessellation project.** Students will design their own tessellation as a project to be assessed by the instructor. Students will create a tile to tessellate using the regular polygon template. Include detail and color in the drawing. They will write a detailed description of how the template was created and tessellated. This report will include: the template, the tessellation, detailed description of the process. Students will present their work to the class.

Lesson Five: Polyhedrons

- A. Introduce students to an activity that will connect polygons to polyhedrons by bringing examples of the following to the classroom: tetrahedron, hexahedron, octahedron, dodecahedron, and icosahedron. Have students in groups of 3 discuss the following questions:
- If a polygon is defined as a simple closed curve, is there a comparable definition for a polyhedron?
 - All polygons have vertices, line segments, and angles. Do these terms work for describing component parts of polyhedron? Do we also need new terms?
 - Can we classify a polyhedron by the number of sides?
 - If there is regular polyhedron, how might they be defined?
 - If there is convex polyhedron, how might they be defined?

Have students share their finding on the board. Have each question represented on the board with students' responses to follow.

- B. Students will find the number of faces, vertices, edges for the tetrahedron, hexahedron, octahedron, dodecahedron, and icosahedron. From their investigation, students will discuss the relationship between the faces, vertices, and the edges. Use a chart handout to record the students' findings. Introduction of the Euler Formula ($F + V - E = 2$).
- C. Students, in groups of three, will create a polyhedron. The polygons to be used will be given to the students to cut from card stock. Rubber bands will bind the edges together. When they have completed the solid, they are to name the polyhedron according to its faces, count the number of faces, edges, and vertices, and determine if there are any lines of symmetry. Each group will present their solid with their findings to the class.

Lesson Six: Project of Tessellations

- Have students design their own tessellation.
- Students will create a tile to tessellate using the regular polygon template.
- Include detail and color in the drawing.
- Have the students write a detailed description of how the template was created and tessellated. This report will include:
 - the template
 - the tessellation
 - detailed description of the process
- Students will present their work to the class.

PERFORMANCE PACKAGE TASK: Project to be assessed by the instructor.

CONTENT: Tessellation

Specific Statement(s) from the Standard:

Not applicable at the Community College level. At the Community College, our objective for each course is to meet the course outcomes written for each course. At this time there is not a course in Geometry on the Liberal Arts campus.

Product(s):

The student will create a tessellation, write a report, and give a presentation describing their procedures used to construct the pattern and the tessellation.

Task Description:

The student will:

- Design a unique tessellation template.
- Use the template to tessellate a plane.
- Add color and detail.
- Write a detailed description of the process of creating the template and the tessellation.
- The written report will include the template, the tessellation, and the details involved in constructing the tessellation.
- Give a formal presentation to the class of their work.

Special Notes:

One day of class time will be given to begin the process of tessellation. The final project will be due one week from date assigned. Students will sign up for time slots to give formal presentations. These presentations should be kept to a 5 minute talk.

PERFORMANCE PACKAGE

Tessellations

FEEDBACK CHECKLIST FOR PROJECT

The purpose of the checklist is to provide feedback to the student about his/her work relative to the content standard. Have the standard available for reference.

Y=Yes

N=Needs Improvement

<u>Student</u>		<u>Teacher</u>
_____	Design a template or pattern piece.	_____
_____	Complete a tessellation.	_____
_____	Color the tessellation and add detail.	_____
_____	Write a detailed description of how the template was created and tessellated.	_____
_____	Presentation of work.	_____

Overall Comments (information about the student progress, quality of the work, next steps for teacher and student, needed adjustments in the teaching and learning processes, and problems to be addressed):