CONCEPT LESSON PLAN - Concept Development Model

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Date Created: 3/16/2014

Subject(s): Geometry - Essentials of Geometry

Topic or Unit of Study (Title): Measure and Classify Angles, Classify Polygons

Grade Level: 10th grade

Materials:
Protractor, wax paper, ruler
Graphic Organizers and Guided Notes - "Measure and Classify Angles" and "Polygons"
Worksheets with answer sheets - "Classifying Angles", "Naming Angles", "Introduction to Polygons" (*Links below)*
http://kutasoftware.com/FreeWorksheets/GeoWorksheets/2-Classifying%20Angles.pdf
http://kutasoftware.com/FreeWorksheets/GeoWorksheets/2-Naming%20Angles.pdf
http://kutasoftware.com/FreeWorksheets/GeoWorksheets/6-Introduction%20to%20Polygons.pdf
Homework with answer sheet - "The Angle Addition Postulate" *(Link Below)*
http://kutasoftware.com/FreeWorksheets/GeoWorksheets/2-The%20Angle%20Addition%20Postulate.pdf

Summary (*and Rationale*): We will now see how the lines, segments, and rays we have studied connect to create angles and shapes. Students need to understand plane figures such as different types of polygons because they are used in numerous places. We will begin to see how these figures are represented in nature, architectural designs, and common place things such as street signs.

I. Focus and Review (Establish Prior Knowledge): [5 min.]
Review concepts of angle, polygon, sides (rays for angle and segments for polygon), vertex.

ray - Part of a line that has one endpoint and continues infinitely in one direction.
segment - A line with two endpoints.
angle - Two rays that have the same endpoint. This endpoint is called the ***vertex***.

An angle is formed when two rays meet at a common endpoint, or vertex. The two sides of the angle are the rays, and the point that unites them is called the vertex.

II. Statement of Instructional Objective(s) *and Assessments*:

Objectives	**Assessments**
1) When given an angle, students will correctly name, measure, and classify the angle based on it's measurement with 80% accuracy.	1) Instructor will assess through worksheets - "Classifying Angles", "Naming Angles".
2) When given a problem involving the Angle Addition Postulate, students will be able to correctly apply the postulate to solve the problem for 16 out of 20 problems.	2) Instructor will assess through homework - "The Angle Addition Postulate".
3) When given a polygon, students will use correct terminology to name the polygon and classify the polygon based on the number of sides for 17 out of 22 problems.	3) Instructor will assess through worksheet - "Introduction to Polygons".

State the objective: [no additional time]
Assessment: [included in lesson time]

III. Teacher Input (Present tasks, information and guidance): [35 min.]
Pass out Graphic Organizers and Guided Notes - "Measure and Classify Angles" and "Polygons"
Concept Development Model: Part 1 - Present model first for angles, then follow with lesson on naming and measuring angles. Part 2 - Return to model when transitioning from angles to polygons and apply to classifying polygons.

1) Subject - Angles and Polygons

Qualities that are essential to the concept:

Part 1 - Angles - classified as ***acute***, ***right***, ***obtuse***, ***straight***, and congruency

Part 2 - Polygons - named by the number of their sides, and other ways to classify

Draw many types of angles/polygons. Ask students for help with this.

2) Ask the students to look at the examples and to examine the relationships among them, and then based on their examination to group the examples.

Part 1 - What approximate angle measurements are shown in the examples? Based on these criteria how might you group the angles?

Part 2 - Polygons are named using prefixes. These prefixes indicate the number of sides. Can you give me some examples? Examples: Triangle (3), Pentagon (5), Hexagon (6), Heptagon (7)

3) Label the groups by defining the reasons for grouping. Have the students verbally explain the reasons for their choices.

Part 1 - Can you give give me the angle measurement criteria (or limits) that go with each angle classification?

Part 2 - The more obvious relationships will be recognized first. Guide students to deeper observations which will lead into step 4.

4) Ask the students if there are items now in one group that they could place in another group or whole groups that could be combined.

Part 1 - What does it mean for segments to be congruent? Guide them to the concept of ***congruent angles*** - the measure of $\angle A$ is equal to or congruent to $\angle B$. Angles are congruent if their measures, in degrees, are equal.

Part 2 - Guide them to these concepts concerning identifying polygons:

convex - if no line that contains a side of the polygon contains a point in the interior of the polygon

concave - not convex

equilateral - all sides are congruent

equiangular - all angles in the interior of the polygon are congruent

regular - a convex polygon that is both equilateral and equiangular

5) Ask students to look over the examples, groups, and labels, and to make a general statement(s) about the concept being introduced.

Note: "Congruent" does not mean "equal." While they seem quite similar, congruent angles do not have to point in the same direction. The only way to get equal angles is by piling two angles of equal measure on top of each other.

Angles:
Demonstrate the two methods of naming an angle—by its vertex only, or by three points on the angle with the vertex listed between the other two points. Then, ask the students to name each angle on the worksheet three ways (e.g., $\angle PBK$, $\angle B$, $\angle KBP$). Important - Naming an angle by its vertex point alone, only works when there is only one angle at the vertex point. If more than one angle is formed at a vertex point, we need to specify which angle we are talking about by naming it in a different way. (Teacher Note: Students often confuse "naming" and "classifying" an angle. An effective way for them to remember the difference between the two is for them to equate this to their initials, which are most often comprised of three letters—the first

letter of their first, middle, and last names. We name angles in the same manner—with letters. We classify angles with the words—acute, obtuse, and right.)
Pass out protractors, and teach students how to use the protractor if they are not familiar with the tool. Place the protractor on the angle so that the center is on the vertex and one ray goes through 0° on the protractor. The point where the other ray of the angle meets the protractor is the measure of the angle. It is normal to have a difference of two to three degrees over or under. Once students know how to measure, have them measure each angle on the worksheet. (Teacher Note: Many students have difficulty using a protractor. They have problems knowing what numbers to use—top or bottom. Model for students the strategy of first asking, "Is this angle acute or obtuse?" before they measure. This will help them know which numbers to use. Also remind students that if the rays of the angle are short they may use a straightedge to extend them to reach the protractor measurements.)

Introduce: **Have students write the postulate on an index card.**

Angle Addition postulate

Words *If P is in the interior of ∠RST, then the measure of ∠RST is equal to the sum of the measures of ∠RSP and ∠PST.* (Note: Include a diagram.)

Symbols *If P is in the interior of ∠RST, then m∠RST = m∠RSP + m∠PST.*

In relation to the Angle Addition Postulate, tell students that a point is in the **interior** of an angle if it is between points that lie on each side of the angle.

Activity: Fold an Angle Bisector

For this activity you will need: 1 piece of wax paper, a partner, a pencil, and a ruler.
Step 1: On the piece of wax paper you've been given, use your pencil and ruler to draw an angle, ∠ABC. Remember that triangles can be ACUTE, OBTUSE, or RIGHT. Draw a different type of angle than your partner.
Step 2: Fold the paper so that the sides of the angle, ray BC is on top of ray BA. Crease the paper in the middle so that you have a line going through the center of the original angle.
Step 3: Draw a point D on the fold inside ∠ABC. Then measure ∠ABD, ∠DBC, and ∠ABC.
Think-Pair-Share: Can you identify the angles? How do the angles relate to one another? (Angle Addition Postulate)

IV. Guided Practice (Elicit performance): [40 min.]
Worksheets - "Classifying Angles", "Naming Angles", "Introduction to Polygons"

V. **Closure (Plan for maintenance):** [5 min.]
Quick review of Graphic Organizers and Guided Notes.
Remind students to be working on their unit project - Modeling Geometric Shapes.

VI. **Independent Practice:** [if there is time at the end]
Complete any worksheets not finished in class.
Homework - "The Angle Addition Postulate"

STANDARDS:
G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

HS.TT.1 Use technology and other resources for assigned tasks.

G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Plans for Individual Differences: I will provide a graphic organizer for note taking for all students. For "Measure and Classify Angles", have students draw an example of each angle classification and the accompanying angle measurement criteria (limit). For "Polygons", I have provided a graphic organizer and guided notes. During the Concept Development Model, Multiple Levels of Questions can be used to guide students through the steps in order to help students advance their problem solving skills and to draw out responses. I will need to model step 4, which is regrouping or relabeling of items, to give guidance to students who are new to the model. The Think-Pair-Share Strategy would be useful in step 5, synthesizing information, to help students with the more challenging concepts concerning identifying polygons (convex, concave, equilateral, equiangular, and regular). The Think-Pair-Share Strategy will also be used in the "Activity: Fold an Angle Bisector ". Additionally, students may work in pairs for the independent portion of the guided practice, so I will pair students who need extra help with someone who is more comfortable with the material.

References (APA style):

Virginia Department of Education. Classifying Angles. *ARI Curriculum Companion*. Retrieved Mar 16, 2014, from Commonwealth of Virginia

Infinite Geometry. (n.d.). *Free Geometry Worksheets*. Retrieved April 24, 2014, from Kuta Software LLC

Chantilly geometry tutors. (2014, January 1). *Introduction to Angles*. Retrieved April 24, 2014, from WyzAnt Resources

InterMath. (2006, April 12). *Polygons and Angles*. College of Education. University of Georgia. Retrieved April 23, 2014.

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Measure and Classify Angles

Angles:			
Acute	Right	Obtuse	Straight
____° 〈 angle measure 〈 ____°	angle measure = ____°	____° 〈 angle measure 〈 ____°	angle measure = ____°

Polygons

Polygons:	
	Number of sides
Type	
Triangle	
Quadrilateral	
Pentagon	
Hexagon	
Heptagon	
Octagon	
Nonagon	
Decagon	
Dodecagon	
n-gon	

Each endpoint of a side is a _____ of the polygon. (plural _____)

A polygon is _____ if no line that contains a side of the polygon contains a point in the interior of the polygon.

A polygon that is not _____ is called _____ . (i.e. the polygon is dented inward at one or more of its vertices)

In an ***equilateral*** polygon, all _____ are _____.

In an ***equiangular*** polygon, all _____ in the interior of the polygon are _____ .

A _____ polygon is a convex polygon that is ***both equilateral and equiangular.***

Sketch a few examples to show that you understand the above terminology.