



Group Members: _____

Amanda claims to have an amazing talent. *"Draw any polygon. Don't show it to me. Just tell me the number of sides it has and I can tell you:*

- *The sum of its interior angles!*
- *The sum of its exterior angles!*

And, if the polygon is regular, I can also tell you the measure of each interior and exterior angle! I possess an amazing gift."

Are Amanda's claims legitimate? Does she really have an amazing gift, or is it possible for anyone to do the same thing?

In this lesson, you will investigate what predictions are possible.

Getting Started: What do you know about angles?

Previously, you investigated many properties of angle measures. With your group members, list what you know about:

1. The sum of the interior angles in a triangle. <ul style="list-style-type: none"> ○ Is the sum of the interior angles of a triangle the same for every triangle, or is the sum different for different types of triangles (e.g., equilateral, isosceles, scalene)? 	
2. Angles around a common point in a plane.	
3. Angles that form a straight line.	
4. Other:	

Be prepared to justify your responses using pictures, words, or symbols.

Investigation 1. Predicting the sum of the measures of the interior angles of any convex polygon.

Use what you know about angle measures to find a formula for the sum of the interior angles of any convex polygon.

Working individually, investigate the sum of the interior angles of at least two polygons with 4, 5, 6, 7 or 8 sides. Use a straight edge to draw several polygons. Make sure that some are irregular polygons. Subdivide each polygon into triangles so you can use what you already know about angle measures to determine the sum of the interior angles of your polygon. Record your results in your Recording Sheet.

As a group, combine your results on a single recording sheet and answer these questions:

- 1) How did group members subdivide their polygons into triangles? Did everyone do it in the same way? If different, how did that affect your calculations?

- 2) Does whether the polygon is regular or irregular affect the sum of the angle measures? Why or why not?

- 3) What patterns did you notice as you explored this problem?

- 4) What is the relationship between the number of sides of the polygon and the sum of the measures of the interior angles of the polygon? Express this relationship algebraically and explain how you know that your expression will work for ANY convex polygon.

Investigation 2. Predicting the sum of the measures of the exterior angles of any convex polygon.

Use what you discovered in Investigation 1 to find a formula for the sum of the measures of the exterior angles of any convex polygon.

With your group members, investigate the sum of the measures of the exterior angles of the polygons you created in Investigation I. Use a straight edge to draw an exterior angle at each vertex. Use what you know about the angles in your drawings to determine the sum of the exterior angles of each polygon. Record your results in the appropriate column on the Recording Sheet.

As a group, answer these questions:

- 1) What patterns did you notice as you explored this problem?

- 2) Is the sum of the exterior angle measures the same for regular and irregular polygons? Why or why not?

- 3) What is the relationship between the number of sides of a convex polygon and the sum of the measures of the exterior angles of the polygon? Express this relationship algebraically and explain how you know that your expression will work for ANY convex polygon.

Investigation 3. Predicting the measure of a single interior or exterior angle of any *regular* convex polygon.

- 1) Using what you discovered in Investigations 1 and 2, is it possible to find a formula for the measure of a single interior or exterior angle of any *regular* convex polygon? If yes, what is the formula? If no, why is it not possible?

- 2) Is it possible to find a formula for the measure of individual interior or exterior angles of an *irregular* convex polygon? Why or why not?

Summary

Based on Investigations 1, 2 and 3:

- 1) How could Amanda predict the sum of measures of the interior angles of a convex polygon if she only knew the number of sides?
- 2) How could Amanda predict the sum of the exterior angles of a convex polygon if she only knew the number of sides?
- 3) What additional relationships exist for regular convex polygons?

Extension Question

What relationships exist between angle measures of *CONCAVE* polygons and the number of sides?

# of sides	Sketch and Name each polygon <ul style="list-style-type: none"> • Show how you divided it into triangles (Investigation 1) • Show exterior angles (Investigation 2) 	Regular or Irregular	# of triangles	Sum of interior angles (Investigation 1) SHOW YOUR CALCULATIONS	Sum of exterior angles (Investigation 2) SHOW YOUR CALCULATIONS
	Name: _____				
	Name: _____				

GROUP Recording Sheet (use an additional sheet if needed)

Group Members: _____

Polygon name	# of sides	Sketch of polygon	Regular or Irregular	# of triangles	Sum of interior angles (Investigation 1) (SHOW CALCULATIONS)	Sum of exterior angles (Investigation 2) (SHOW CALCULATIONS)

Patterns:

Formula(s) for sum of INTERIOR angles of ANY convex polygon:

Formula(s) for sum of EXTERIOR angles of ANY convex polygon: