Title of Lesson: Under Construction.
UFTeach Students' Names: Katie Zuefle/ Heather McNeill
Teaching Date and Time: March 14 & 15th, BHS 5th period, Karis and Rogers

Length of Lesson: 2 days, 50 minutes each day

Grade / Topic: 10/ Geometry Honors/ Area of Regular Polygons

Source of the Lesson: Use of Kuta Software worksheet, Use of student textbook, Images from Google Images.
Concepts:
Given any circle, one can inscribe a regular polygon of any number of sides within it. The reverse is also true, given any regular polygon, a circle can circumscribe it. We are able to identify relationships between the regular polygon and circle. When a regular polygon is inscribed in a circle, the center of the circle will also be the center of the regular polygon. The radius of the circle will also be the radius of the regular polygon, the distance from the center to a vertex. A central angle of a regular polygon is the angle formed by two radii drawn to consecutive vertices. The apothem of a regular polygon is the (perpendicular) distance from the center of the polygon to a side. The area of a regular polygon is equal to half the product of the apothem and the perimeter. Common formulas used to find the area of regular polygons includes: A = ½ nsa = ½ ap, where n = the number of sides on the regular polygon, s= the length of the side, a = apothem, p = perimeter.

Appropriateness for High School Students:

This lesson will be taught to a Geometry honors class. This class is familiar with working with proofs and will be asked to derive the area formula through guiding questions. The guiding questions will require students to use knowledge they gained from earlier chapters, such as circles. Once they have developed an area formula they will be challenged to find an equivalent formula, this will help them to see the connection that perimeter (p) = sn (side length x number of sides). They will then apply their new knowledge to discover the special case of a hexagon.

Florida State Standards (NGSSS) with Cognitive Complexity:

Benchmark Number	Benchmark Description	Cognitive Complexity
MA.912.G.2.5	Explain the derivation and apply formulas for perimeter and area of polygons (triangles, quadrilaterals, pentagons, etc.)	Moderate

Performance Objectives: *Students will be able to*:

- Calculate the area of a regular polygon.
- Derive the area formula for regular polygons.

Materials List and Student Handouts

- Engagement ~ Example Pictures (with images from Google Images)
- Explore Worksheet
- Day 1 Exit Ticket & Day 2 Exit ticket
- Practice~ Kuta Software Worksheet
- Elaboration Worksheet ~ Try It With a Hexagon!
- Student Textbook
- Smartboard

Advance Preparations - Make and Print worksheets
Safety - There are no safety concerns for this lesson.

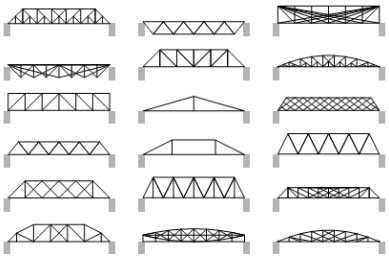
5E Lesson:

Engagement Day 1		**Time: 5 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses/Possible Misconceptions**
The teacher will display images of real world items, some examples of regular polygons, others examples of irregular polygons. Ask them questions about what are the similarities and differences between the shapes and what they think a regular polygon is.	Take a look at these images. These pictures are examples of shapes found in our everyday lives. What similarities and differences do you notice between the different pictures? What makes a shape regular or irregular?	Misconceptions may include that they think every polygon is a regular polygon so showing them the differences between the two and having them discuss these differences helps them get a better picture of this. Especially when they see how they are used in everyday life. Answers vary. Regular polygons are equilateral and equiangular. Irregular polygons are not.
Exploration Day 1		**Time: 20 minutes**
What the Teacher Will Do	Teacher Directions and Probing Questions	Student Responses/Possible Misconceptions
Hand out worksheet Circulate classroom and check on progress.	Do part one with your group and then we are going to come back together and discuss it. You have 10 minutes to do this. (A timer will be on the board) Clarifying questions for worksheet: • Check to make sure they are drawing the lines on the worksheet as they go. Drawing pictures helps! • What type of polygon is a stop sign? • How can you find the measure of the arc? Why? • What kind of triangles does the octagon subdivide into to? • How do you find the area of a triangle? • How many triangles can the octagon be divided into? • What have you found out so far?	 Regular octagon Divide 360° by 8. Isosceles A= ½ BH 8 Area of the triangle and how many triangles the octagon

		has. Multiply the two numbers together
	• What do you have to do to find the area of the octagon?	
Explanation Day 1		**Time: 20 minutes (+5 for Evaluation)**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses/Possible Misconceptions**
The teacher will probe students to begin a class discussion on what they explored.	Does anyone know the name of this height for regular polygons? Another name for the distance from the central point to a side of a regular polygon is the apothem. And it is symbolically represented as a lowercase a. Now that you all have the area of the triangle, what is the area of the entire polygon? Thinking about how you found the area of the entire polygon explain it in words and then see if you can come up with a formula for it. What pieces did you need to find the area? What formula did you come up with and why? Can you see any way in which the formula can be condensed or simplified?	No we don't. Area Height (apothem), base (side), number of sides A = ½ asn. I found this because ½ as is the area of the triangle and then multiplying it by the number of sides gives you the area of the regular polygon. Yes, sn can be changed to p (perimeter)
Students will have spent the majority of the class period exploring and creating the area formula for regular polygons. It is expected that all groups will have arrived at a formula by the end of the	Using what you learned today in class you will now complete an exit ticket. You have 5 minutes to complete the problem and turn it in to me before you go. Have a great day!	Pg 443 1-12 (homework)

period. In the final 5 minutes of the period the teacher will display the first formative assessment and have students individually answer and explain their solutions. They then turn it in before they leave.		
Engage Day 2		**Time: 10 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses/Possible Misconceptions**
The teacher will begin by having the student groups meet back up and remind one another about yesterday's task. The teacher informs the students that they will be asked to share how they answered each part of yesterday's task with the class. This activates prior knowledge.	You want to remind yourselves of yesterday's activity. What you did, why you did it and what you found. What was the formula we found yesterday and what were the steps we used to find this? You have 5 minutes to discuss with your group.	A = ½ aP. (Goes through how they found it.)
The teacher calls on specific students to share their reasoning and answers. (A whole class discussion will occur.) Both teacher and students can ask clarifying questions of the presenting student.	Why did you do that? How do you know that? Where did that come from?	(These answers will be specific to each context.)
Exploration Day 2		**Time: 15 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses/Possible Misconceptions**
Once students have a clear understanding of the concept the teacher will pass out a Kuta worksheet to provide students with practice of finding the area of regular polygons.	You will now apply your knowledge to different problems. You are to complete #1-10 multiples of 3, then #11-18. You have 15 minutes.	

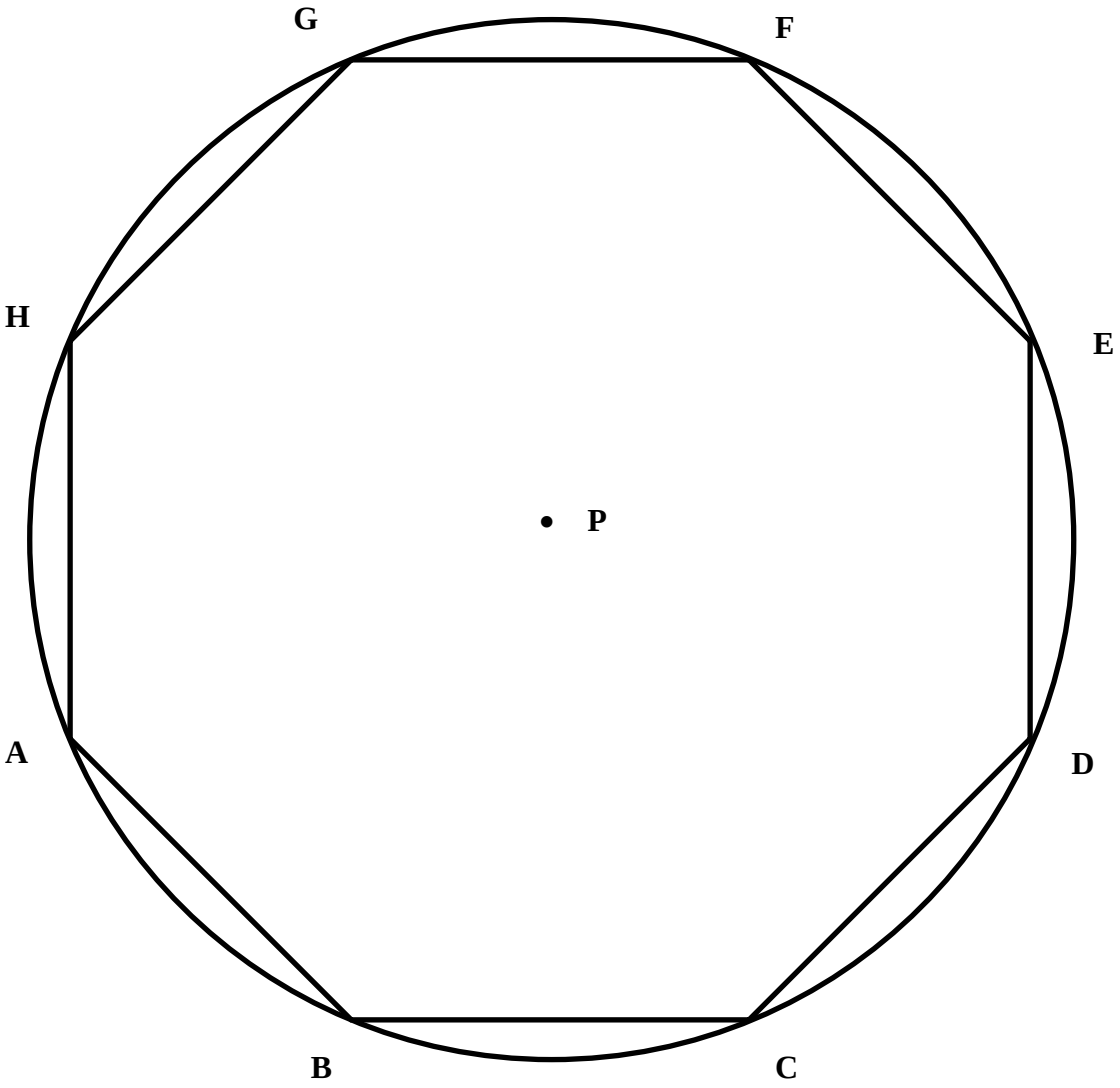
Hand out worksheet they will be using for the day.		
Explanation Day 2		**Time 10 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses/Possible Misconceptions**
Come back together and call on students to come up and show the class how they did the problem and explain.	Who would like to show the class how they did the problems?	Students share answers with explanations.
Elaboration Day 2 (or 1) ~ If and when there is "extra" time ~		**Time: 10 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses/Possible Misconceptions**
Students will next explore the special case of the hexagon. They will need to identify what makes it special. If time permits, the teacher will assign students to work on book problem #22 on page 444.	You will next elaborate on what you now know. See what you can do with these next two problems.	
Evaluation Day 2		**Time: 5 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses/Possible Misconceptions**
Hand out the day 2 exit ticket You have the last 5 minutes to do this and turn it in before you leave. Have a great day!	Day 2 Exit Ticket	




london


ADT®

Under Construction! Name:_____ Date: _____



You are a contestant on Next Great Baker and therefore, interning at Carlos' Bakery. Buddy shared with your team that your challenge for this week was to design a cake for the Department of transportation since they are to be celebrating 50 years since the development of the interstate system by President Eisenhower. Your team originally planned on making a stop sign. However, when Buddy came by to check in on the team, he wasn't too thrilled about the idea, sharing that a stop sign might have a negative connotation. This brought you and your team back to square one. Your new design will change from an octagon to a circle as to represent the Department of Transportation's logo. Your task is to find how much larger the new design will be.

Part 1

1. The center of the circle is **P**. What is the center of the octagon?

2. Using your ruler. Find the radius of the circle without going outside the octagon.

3. Find the measure of $\overset{\frown}{AB}$

4. Find the area of triangle APB, measure height of triangle

5. Find the area of the whole polygon

6. Explain how you found the area of the regular polygon. Step by step

Part 2

7. Create a formula to find the area of any regular polygon, using your explanation of finding the area of the octagon.

8. Once you found a formula that works for all regular polygons, can you condense it? Explain.

9. What role does perimeter play?

10. How much larger will the new design of your team's cake be?

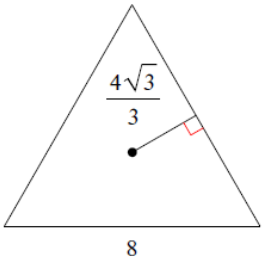
Kuta Software - Infinite Geometry Name_____

Area of Regular Polygons

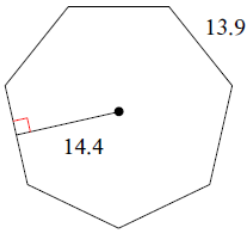
Date_____ Period____

Find the area of each regular polygon. Leave your answer in simplest form.

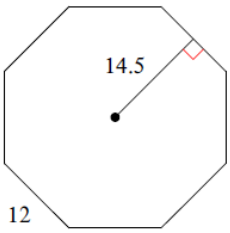
1)



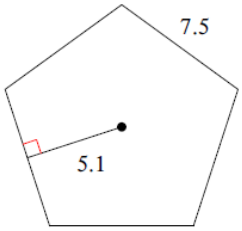
2)



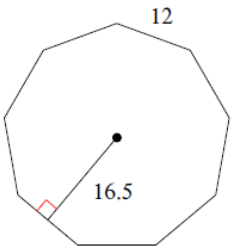
3)



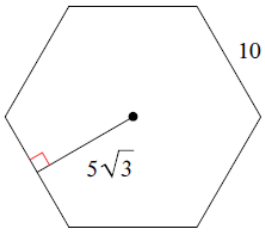
4)



5)



6)



7) pentagon
apothem = 7.3
side = 10.6

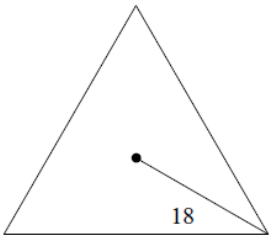
8) triangle
apothem = 14
side = $28\sqrt{3}$

9) 7-gon
apothem = 21.8
side = 21

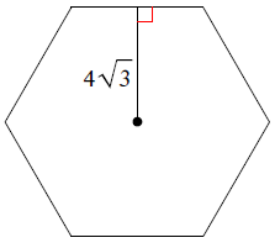
10) octagon
apothem = 14.1
side = 11.7

Use what you know about special right triangles to find the area of each regular polygon. Leave your answer in simplest form.

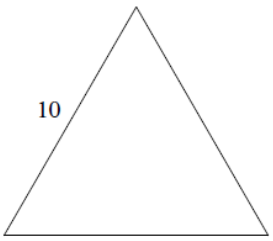
11)



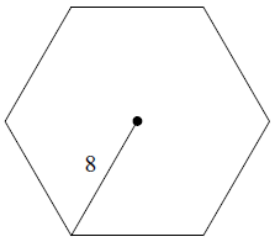
12)



13)



14)



15) quadrilateral
radius = $16\sqrt{2}$

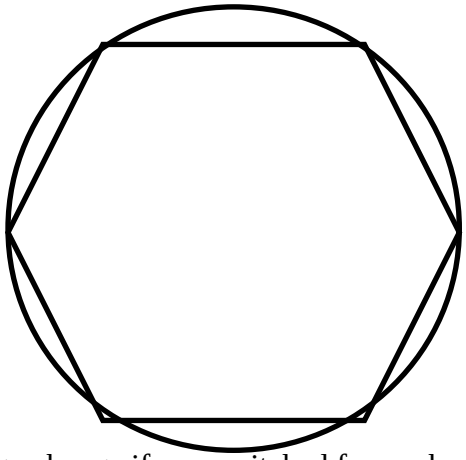
16) hexagon
side = $\frac{16\sqrt{3}}{3}$

Critical thinking questions:

17) Find the perimeter of a regular hexagon that has an area of $54\sqrt{3}$ units².

18) Can a regular octagon have an area of 10 units²?

Try It With a Hexagon! Name:_____ Date: _____



How would your DOT cake design change if you switched from a hexagon to a circle?

The diagram above is a hexagon inscribed in a circle. It has a radius of 1 (it is not drawn to scale.) Using what you learned yesterday. Find the area of the polygon. (Hint: start with a triangle.)

The radius is _____

The interior angle of one triangle is _____

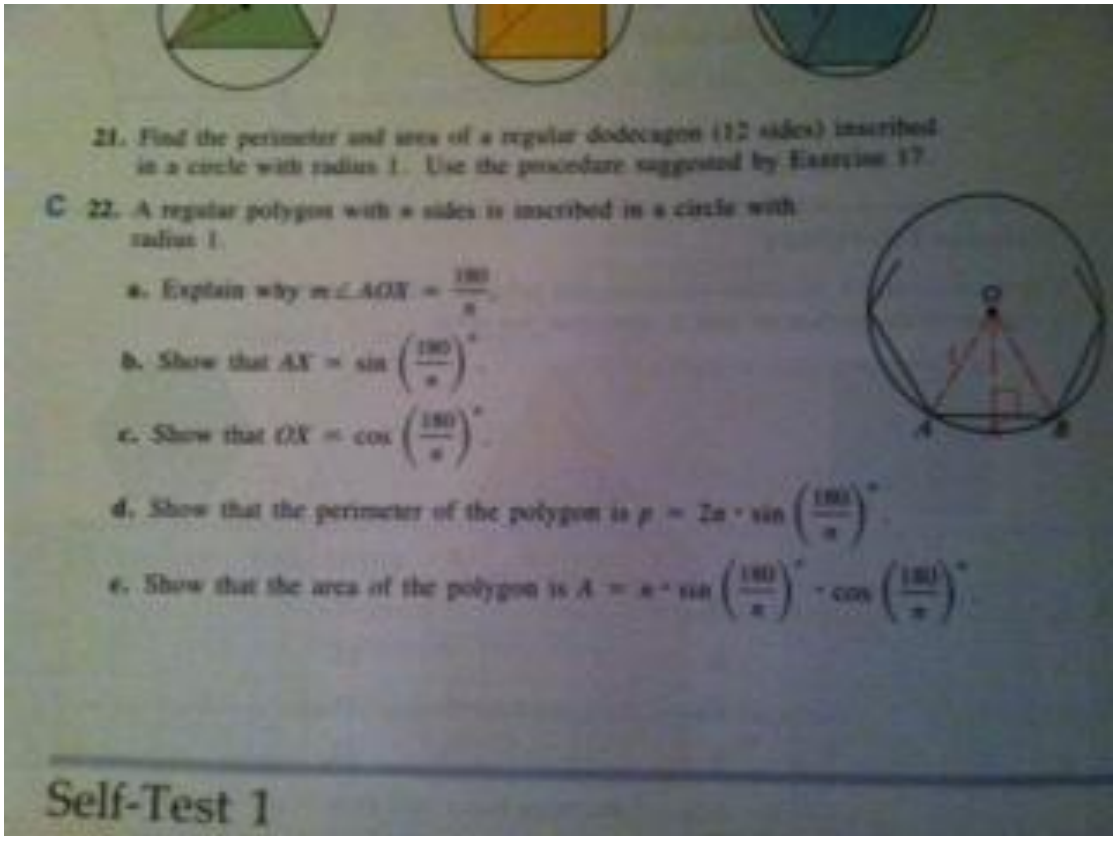
The length of one side of the is _____

The apothem is _____

The area of one of the triangles is _____

The area of the whole hexagon is _____

Was there anything different/special that you saw in this example? Explain your findings.



Formative Assessments

Day 1
A regular hexagon has a side length of 16 2/3 and an apothem of 8. The area of this hexagon is 400. How did we find this? Explain.

Day 2
Find the perimeter and area of a regular dodecagon (12-sided) inscribed in a circle, with radius one. Round to the nearest hundredth. Hints: Find angle made by two consecutive radii and then use trigonometry.

(Mrs. Weber – They are supposed to apply their trig knowledge, it is like an example in the book, also it is similar to number 14 on Kuta.)