

Lesson Title: Measuring Circles		Pre 8.3
Utah State Core Standard and Indicators Pre-algebra standard 4 Process Standards 3-5		
Summary		
Students derive the formulas for circumference and area of the circle. For circumference, they measure diameters and circumferences, create ratios and arrive at the Pi ratio. For area, they use several strategies to observe the area of a circle as related to a square.		
<p align="center">Enduring Understanding</p> <p>Geometry enables us to describe, analyze, and understand our physical world.</p>	<p align="center">Essential Questions</p> <ul style="list-style-type: none"> • Where do formulas come from? • How can we prove the formula for the area of a circle ($A = \pi r^2$)? 	
<p align="center">Skill Focus</p> <ul style="list-style-type: none"> • Develop formulas to find area of circles. • Derive the Pi relationship found in circle circumference and area. 	<p align="center">Vocabulary Focus</p> <p>“The students need to know the parts of a circle, namely the circumference and the diameter.”</p>	
Assessment		
Materials: Graph paper, Small beans, Geometer’s Sketchpad, or Patty Paper		
<p>Launch ”Some considered reading from the Sir Cumference series.”</p> <p>“We decided to have the initial launch for this lesson to take place the day before the lesson. We would explain to the students that they will need them for a special Pi-day activity and that they would have the opportunity to earn prizes on that day. For ease of measuring we felt it important to emphasize that the circular objects should not be spherical; it’s too difficult to accurately measure the diameter of a sphere.”</p>		
<p>Explore</p> <p>“The group varied about how to handle this part of the assignment. Some of us decided to have the students work as groups, some had the students work individually. Basically, each group or person measured the circumference of the circular objects provided by the class members. Some of us have access to tape measures that are long enough to measure the anticipated objects; we didn’t need the students to use the string method of measuring. Although, we felt that in some cases the string method might yield more accurate measurements. The students would then record their measurements on the worksheet. We decided that it really didn’t matter how they found their average ratio; they could either add the decimal equivalents together to average them, or they could add all the circumferences and divide that total by the sum of all the diameters. As an option, the students could discuss the pros and cons of each method.”</p>		
<p>Summarize</p> <p>“Since we have algebra students, most of them have seen the formula for area multiple times, so there isn’t much need for summary. Some of us will offer prizes to the groups or students whose average ratio was closest to pi. Some of us will have the students do pi art, and sing a pi-day song – but these activities are not very applicable if you use this activity on a day other than pi day.”</p>		
Apply		

Directions:

- 1) Collect cans or round lids for students to measure. Number the cans or lids so students can circulate the cans for measurement in groups
- 2) **An alternate activity is found in Patty Paper Geometry, the circle area formula, page 205 or 208.**
- 3) **You could also use the Sketchpad activity found on pages 127-128 of Exploring Geometry with Geometer’s Sketchpad.**
- 4) You could read the books Sir Cumference and The Knights of the Round Table and Sir Cumference and the Dragon of Pi.

Pre 8.3

Measuring Circles

- 1) **Circle Circumference.** Use string and a ruler to measure the circumference of the cans or round lids given to you by your teacher.

Record your findings below.

Circle #	Diameter	Circumference	Ratio c/d	Ratio c/d as decimal
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average Ratio				

After recording your information, one member of your group should give your decimal ratios to the teacher in order to find the average ratio of all the class ratios.

Average ratio _____.

What is the relationship of a diameter to a circumference of any circle?

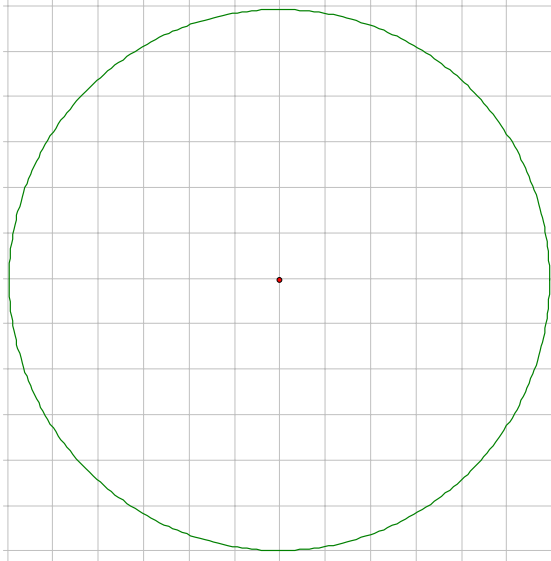
Using this information, create a formula for finding circumference of a circle. Explain your formula below.

Compare your formula to the formula given in your book.

2) Circle Area

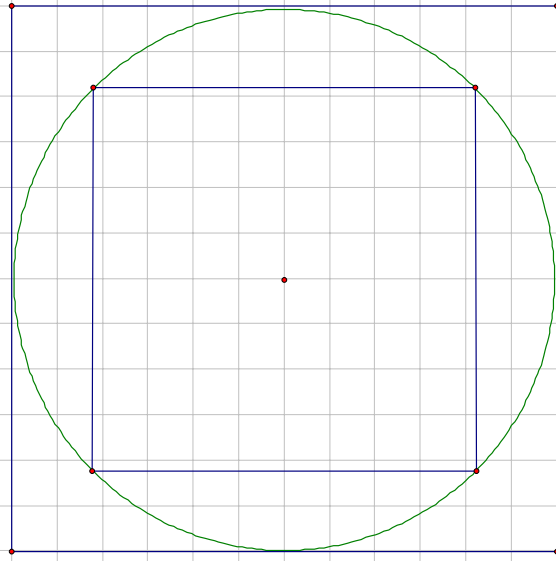
Circle area. Use the following five methods to estimate the area of a 12 centimeter diameter circle. Show all work and thinking for each method.

a) Estimate the square centimeters



Estimated area = _____

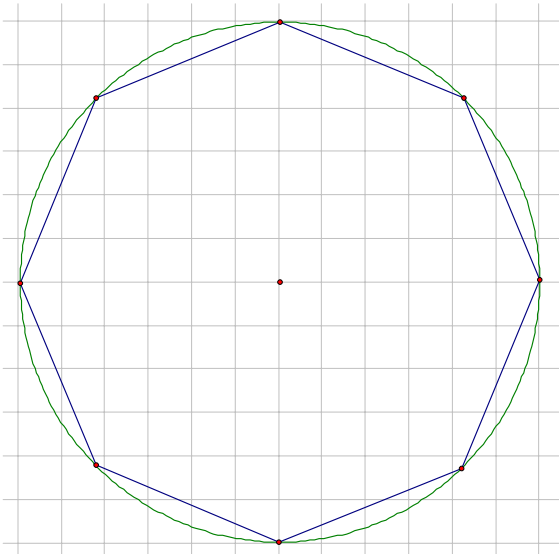
b) Average the two squares below.



Estimated area = _____

c) Estimate the area of the inscribed octagon. Estimated Area _____

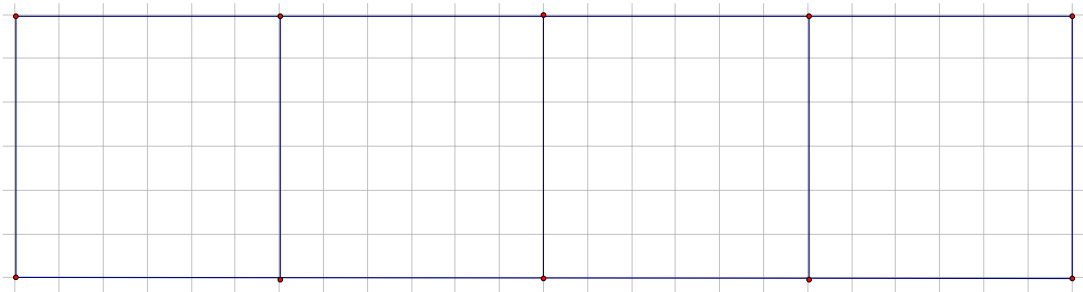
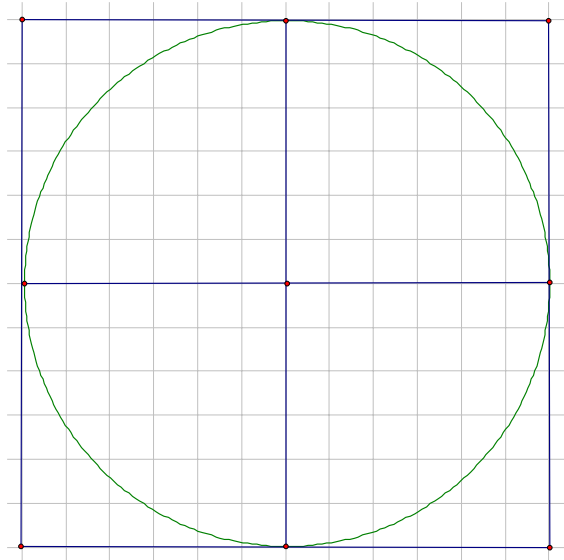
Show all estimation work below.



d) Think of the four smaller squares on the circle below as radius squares. Why can we call them radius squares? _____

Place beans on the circle below. Then transfer the beans to the rectangle below.

Estimate the area of the circle. Show all estimation work below.



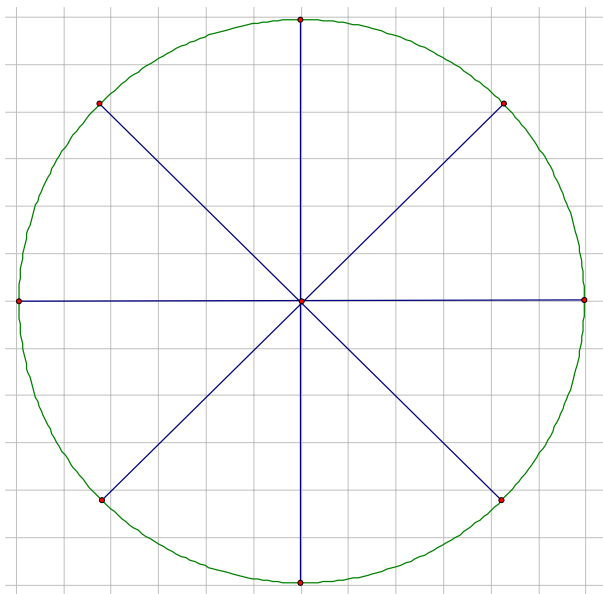
Estimated Circle Area _____

How many radius squares cover the same area as the circle? _____

How can you compare the circle the square?

What is your formula for finding the area of a circle? Explain it.

e) Cut the circle (from the cutting page) into eighths. Then fit and paste the eighths into a long line (turn the pie pieces opposite ways) to create an (almost) parallelogram.



Estimated area _____

Create your “almost” parallelogram here. Estimated area _____

What is the height of the parallelogram? _____ How does this height compare to the radius of the circle?

What part of the circle forms the base and top of the “almost” parallelogram?

How can you use the circumference formula to help you create an area formula?

Write your thoughts about the formula for the area of a circle.

Cutting Page: Give one to each student group.

