**Area of a Unit Circle**

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_

**Investigation**

On graph paper, draw a circle with a radius exactly as long as 10 graph paper spaces. Let this radius equal 1 unit. Label the radius 1. (See sample below)



What is the length of one graph paper square in terms of the unit defined above?

What is the area of one graph paper square in terms of the unit defined above?

Count the number of squares within the circle in order to estimate the area of the circle. Be careful to find ways to count the partial squares.

**Conclusions**

1. What is your best estimate of the area of a (one) unit circle?

The area is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. What does this estimate have to do with Pi and why is this so?

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3. What, then, is the area of a circle with a radius of 1?

4. Predict: What do you think the area would be of a circle with radius of 2? What about a radius of 10? What about a radius of *x*?

**Teacher Directions**

**Materials:**

One sheet of graph paper per student

String for drawing a circle (approx. 4 inches per student)

**Task:**

Guide each student to draw a set of axes on their graph paper, label to point (0,0), and then count out 10 lines in all 4 directions along the axes and mark points there. Have them label the points as (0,1), (1,0), (-1,0) and (0,-1) and draw a circle using a piece of string that has a radius of 1 unit (or 10 graph paper lines) . Ask them how long it is from the center of the circle to the point (0,1) (they should say 1). Then have them do a think-pair-share to determine how long each graph paper line is now that the radius is 1 (answer should be .1 or 1/10). Lastly, ask the students what the area of each small square now is (answer should be .01 or 1/100).

Instruct the students to find the area of this circle (called a unit circle as the radius is 1) by counting squares (as they did to derive the formula for the area of rectangles and triangles). They will need to do a good deal of estimating and it will behoove them to find ways to simplify the process, but let the students figure out their own methods.

After about 10 minutes or when most students have an estimate, have students share their estimates and record these on the board (they should be *close* to 314 squares or an area of 3.14).

Give the students 10 minutes to work on the conclusion questions independently, and then give them 5 minutes to discuss with a partner before you have a class discussion.

Note: The next lesson will be a formal deriving of the formula for the area of a circle, so do not tell this to the students (but it’s fine if some figure it out!).