**Lab: What is a Radian? *(Instructor Version)***

*This lab is a discovery lab and should be done prior to discussing radian measure in lecture. This lab will take one 50-minute class period. Students will work in groups in with a suggested group size of 3.*

**Motivation:** Most students are comfortable with degree measure for angles. However, the concept of radian measure for angles is a new concept for Precalculus students. It is important for students to understand what a radian is and to become comfortable using radians as they begin their study of Trigonometry.

**Objectives**: Students will understand the concept of radian measure for angles.

**Materials**:

1. Several circular cylinders of different radii
2. String
3. Scissors
4. Printed circles with marked center and 1 diameter
5. Straight edge for drawing lines

**Activity 1:**

*This activity will take approximately 20 minutes. Each group will choose one cylinder to work with. Each group should also have string, a pair of scissors, printed circles, and a straight edge. Each group is to answer the following questions as they follow the directions below.*

1. Cut a piece of string that is equal in length to the radius top of the cylinder.
2. Use the string from part 1 to cut 5 more pieces of string equal in length to multiples (2,3,4,5, and 6) of the radius.
3. From the point labelled zero, travel counter-clockwise along the outer edge of the cylinder a distance equal to one radius. Draw a line from the center of the circle in the direction of this point and label the point on the circle as 1. Repeat this for each piece of string (i.e. a distance around the cylinder that is double the radius will be labelled with a 2, etc).
4. Which string gets closest to half way around the circle? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Which string gets closest to all the way around the circle? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is the formula for the circumference of a circle? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. With your group, discuss why your answers for #4 make sense with respect to your answer for #5?
3. Exactly how many radii would it take to get half way around the circle? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Exactly how may radii would it take to get all the way around the circle? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A radian is defined as a circle’s central angle that corresponds to an arc length equal to one radius.

**Activity 2:**

*This activity will take approximately 20 minutes. Students should stay in the groups from Activity 1. Groups need to get a new circle of paper for this activity and adhere it to their cylinder. Use the same cylinder as Activity 1.*

1. Carefully remove the circle of paper you used in Activity 1 and adhere a new circle of paper to your cylinder.
2. Divide your circle into eight equal sectors.
3. Label each angle by its radian measure.
4. Cut two lengths of string equal to halfway around your cylinder.
5. Divide one string into thirds. Divide the other string into sixths.
6. Use the lengths of string to divide your circle into six equal sectors and twelve equal sectors.
7. Label each angle by its radian measure.
8. Label each angle by its degree measure.
9. Halfway around the circle is how many degrees? \_\_\_\_\_\_\_\_\_\_\_
10. How do you convert any radian measure to degrees?
11. How do you convert any degree measure to radians?
12. Express $37°$ in radians.