What is a radian and why would we want to measure with it?

Materials:

1. Compass
2. String
3. Protractors

1. Using a compass, draw a circle in the space below. Use string to “measure” from the center of the circle to a point on the circumference of the circle. Cut this piece of string to the appropriate length.

a. What is this distance called?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Approximately how many radiuses is the circumference of your circle?

c. What about half of the circumference?

d. Ask around? What did others determine for their measurement of the circumference in “radiuses?”

2. Lay the string (length of 1 radius) around the circumference of your circle. Mark the endpoints of this arc, formed by 1 radius. Draw the central angle that subtends this arc. Using your protractor, determine the approximate measure of this central angle (in degrees).

When you are measuring in “radiuses” you are actually measuring in radians. The central angle that you have created has the measure of 1 radian!! So, approximately what degree measure is equal to 1 radian?

It turns out, as you may have noticed, that . In fact, because for every circle  , we know that  (2. Thus, the angle formed when a ray swings all the way around the circle one time (i.e. the initial side and the terminal side are in the same location) is 2

3. What is the angle formed when we are half way around, ¼ of the way around, , ¾, etc? On the circle below, divide the circle into 8 equal parts. Then determine the angles, in radians and degrees, for each of the specified locations. Assume that the initial side of the angle is at the positive x-axis and the terminal side as at the specified locations that you determined when you divided the circle.



4. Go back to the circle and now divide the circle into twelve equal parts. Again, determine the angles. Assume the initial side at the positive x-axis and the terminal side at each of the specified locations.

5. Since a radian measure is actually measuring in radiuses, notice that there is a direct relationship between the arc length, s, the radius, r, and the central angle, . Can you write an equation that expresses this relationship?

We can also determine a direct relationship between radians and degrees. How can we convert an angle measure from degrees to radians? How do you know?

What about radians to degrees? How do you know?

Extension: Determine what 1 radian is equivalent to as a degrees measure. See how close your approximation was in #2.