**Activity 6.1.3 Learn More About Radians and Arc Lengths**

In the previous activity 6.1.2 you saw that one full rotation counterclockwise is 2π radians, and that equals 360º. In this activity, you’ll explore this fact a little more. Then you will develop equivalences between radians and degrees for the special angles.

1. The circumference of a circle is the length of the arc that goes all the way around the circle. 

a. You know two formulas for the circumference of a circle: one with diameter ‘d’ and one with radius ‘r’. Write the formula for circumference that uses ‘r’: \_\_\_\_\_\_\_\_\_\_\_

b. On your circle that has a radius that is 1 unit long, what is the arc length of the whole circle?

1. Exact length using the symbol π: \_\_\_\_\_\_\_\_\_\_
2. A decimal approximation of the length: \_\_\_\_\_\_\_\_\_\_

c. Use your special tape measure or make a sketch to count how many radii fit along the circumference of the circle. Remember that on a unit circle an arc that is 1 radius long subtends and angle that is 1 radian; and an arc length that is t radii long subtends an angle that is t radians. Now, fill in the blanks.

1. Approximately \_\_\_\_\_\_ radii fit along the circumference of the circle.
2. The central angle of a whole circle measures **approximately** \_\_\_\_\_\_ radians.
3. Exactly \_\_\_\_\_\_\_\_ radii fit along the circumference of the circle.
4. The central angle of a whole circle measures **exactly** \_\_\_\_\_\_ radians. (Do not use a decimal approximation.)
5. A central angle that indicates one revolution measures \_\_\_\_\_\_\_ degrees, and is equal to \_\_\_\_\_ radians because \_\_\_\_\_ radii fit around the circle.
6. An angle that completes 2 revolutions measures \_\_\_\_\_\_ degrees or \_\_\_\_\_ radians.

2. Since an angle measuring 360o  = 2π radians you can determine a variety of other equivalences:

1. Divide 360o = 2𝝿 radians by 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Confirm that an angle that measures 180o does indeed

equal π radians by wrapping your special tape

measure around half your circle, and counting

how many radii fit around half the circle.

Draw a sketch of your circle to the right.

Illustrate the wrapping of the tape measure to

show how many radii are in a half-circle.

Indicate the central angle subtended by half the circle.

1. Give a decimal approximation for how many radians are in half a circle. \_\_\_\_\_\_\_

3. a. Divide both sides of the equation ‘360o = 2π radians’ by 4:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. What is a decimal approximation for π/2 ?\_\_\_\_\_\_\_\_\_

1. On the circle to the right, sketch an arc that is

 π/2 radii long and the subtended central angle

 that measures π/2 radians (use standard position).

4. a. Divide both sides of the equation ‘360o = 2π radians’ by 2π

to find a decimal approximation for how many degrees are in a radian. \_\_\_\_\_\_\_\_

b. When you measured your angle of 1 radian with a protractor in the previous activity, did you get the same number of degrees? \_\_\_\_\_\_\_\_\_\_\_\_\_

**BIG IDEA**

**A central angle that makes one complete revolution measures 360° or 2**$π$ **radians**

**360° = 2**$π$ **radians**

6. Use full sentences to write a definition for “radian”.