**Activity 6.1.5 Radian Measure of Central Angles as the Ratio**

1. It is important to consider the units of measure when you write an equation. The equation for arc length when the radius is 7 cm and the central angle measures 3 radians is

21 cm = (7cm)(3)

a. What is the unit of measure on each side of the equation above?\_\_\_\_\_\_\_

Notice that the left side of the equation is equivalent to the right side of the equation. Therefore, they must have the same unit of measure.

b. Divide the equation ’21 cm = (7cm)(3)’ by 7 cm, and simplify. Be sure to show what happens to the units of measure.

c. What is the unit of measure on the left side of your equation (if one exists)? \_\_\_\_\_\_\_\_\_\_\_\_\_

d. What is the unit of measure for the 3 radians on the right side of your equation? \_\_\_\_\_\_\_\_\_\_

e. What happened to the centimeter units of measure for our problem? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The “3” counts how many radii make up or divide into the arc that is 21 cm long on a circle radius 7 cm. The “3” is the radian measure of the central angle subtended by the arc.

2. Now consider the formula for arc length ‘s units = r units·𝜽’ that has a unit of linear measure for s and r. Solve for “𝜽”. Simplify. Notice that the units of measure “cancel out”.

This last line could be another definition for radian: specifically, the radian measure for a central angle ‘𝜽’ subtended by an arc is the ratio of the arc length ‘s’ to the radius length ‘r’.

**The radian measure of the central angle counts how many “radius lengths” fit around the arc.**

It doesn’t matter what the unit of measure for the radius is or what the size of the radius is, the radian measure is the ratio of arc length to radius length.

The angle is in counterclockwise direction

For a negative angle, the radian measure is the negative of the arc length

s/r = 𝜽 and s/r is a real number with no units.

**BIG IDEA**

**𝜽 radians is a real number.**

Since radians can be thought of as a real number, we can use trigomometric functions to model all sorts of periodic behavior, even when the independent variable is not degrees.

When indicating the radian measure of an angle, it is customary to write just the number, not the unit “radian”. For example, sin(2016°) means the sine of an angle whose measure is 2016 degrees. Whereas sin(2016) means the sine of the angle whose measure is 2016 radians.

3 a. Notice there is a fraction on the left side of the equation “ s/r = 𝜽 ”. What should the radius be if we want “s = 𝜽”? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. State in words what the formula “s = 𝜽” is saying.

4. Find the missing measurements. Be sure to state the units of measure for arc length:

1. Radius : 1 cm. Central angle:5 radians. Arc Length = \_\_\_\_\_\_
2. Radius: 1 cm. Central angle: \_\_\_\_ radians. Arc Length = 8 cm\_\_\_\_
3. Radius: 1 mile. Central angle: 2π radians. Arc Length = \_\_\_\_\_\_

1. Radius: 1 foot. Central angle: \_\_\_\_\_\_\_\_ radians. Arc Length = π feet\_\_\_\_\_
2. Radius: 1 unit. Central angle: \_\_\_\_ radians. Arc Length = 3 units

To summarize: for a circle of radius 1 unit, s = 𝜽.

**BIG IDEA**

**The radian measure of an angle is the length of the arc on the unit circle subtended by the angle.**

**, provided the radius of the circle is 1.**

This is the big idea that allows us to use trigonometric functions to model all sorts of periodic behavior even if the independent variable is not an angle measured in degrees.