**Activity 6.2.3 – Working with the Circular Definition of**

**Trigonometric Functions**

1. Sketch triangles similar to the given special triangles so that the hypotenuse is 1 unit. Indicate the lengths of the 3 sides of the new scaled down triangle.



1. Sketch a unit circle and an angle that measures ‘t’ radians in standard position so that the terminal ray of the angle is in the second quadrant. Then illustrate the following underlined symbols and vocabulary words in your sketch:
	1. P(t) is the point intersection of the unit circle and the terminal ray of the central angle of measure t in standard position.
	2. W(t) is the terminal point of the arc of length t in standard position on the unit circle. Note that P(t) and W(t) are the same point. One comes from the central angle and one comes from the arc subtended by the angle. On a unit circle the arc length equals the radian measure of the angle that subtends the arc.
	3. The reference angle is the acute angle formed by the x-axis and the terminal ray of the angle.
	4. The reference triangle is the right triangle determined by the points W(t), the origin and the foot of the perpendicular from W(t) to the x-axis.
	5. Sin(t) is the y coordinate of W(t) (this is also the y coordinate of P(t).)
	6. Cos(t) is the x coordinate of W(t) (this is also the x coordinate of P(t).)
	7. Tan(t) is the ratio of the y coordinate to the x coordinate of W(t): $\frac{y}{x}$
2. For each given central angle below, measure an arc length ‘t’ on the unit circle, and:
* Sketch the angle in standard position and sketch the unit circle.
* Sketch the reference angle and label its measure.
* Sketch the reference triangle
* Label the lengths of the sides of the reference triangle.
* Find the coordinates of W(t)
* Determine the value of the trigonometric functions for the given angle measure.

**Example:** t =120°, a. sin(120°) = $\frac{\sqrt{3}}{2}$ b. cos(120°) = $\frac{-1}{2}$ c. tan(120°) = $-\frac{\sqrt{3}}{1}=-\sqrt{3}$



1. t = 45° a. sin(45°) = b. cos(45°) = c. tan(45°) =



1. t = 240° a. sin(240°) = b. cos(240°) = c. tan(240°) =



1. t = $\frac{π}{6}$ a. sin($\frac{π}{6})$ = $ $ b. cos($\frac{π}{6}$) = c. tan($\frac{π}{6}$) =



1. t = $\frac{5π}{3}$ a. sin($\frac{5π}{3})$ = $ $ b. cos($\frac{5π}{3}$) = c. tan($\frac{5π}{3}$) =



1. t = -300° a. sin(-300°) = b. cos(-300°) = c. tan(-300°) =



1. t = $\frac{-3π}{4}$ a. sin($\frac{-3π}{4})$ = $ $ b. cos($\frac{-3π}{4}$) = c. tan($\frac{-3π}{4}$) =



1. Using the length of the side of the triangle that you drew above:
2. What is the ratio of the length of the leg opposite the acute central angle to the hypotenuse?
3. What trig value is it equal to?
4. What is the ratio of the length of the leg adjacent to the acute central angle to the hypotenuse?
5. What trig value is it equal to?
6. What is the ratio of the length of the leg opposite the acute central angle to the leg adjacent to the acute central angle?
7. What trig value is it equal to?
8. For the following angle measures and arc lengths:
* Plot the point on the unit circle where the central angle’s terminal ray intersects the circle or where the arc ends.
* Label the coordinates of the point. (there is no triangle to draw.)
* Find the value of the trigonometric functions. Sometimes the tangent is undefined.
1. t = 360° a. sin(360°) = b. cos(360°) = c. tan(360°) =



1. t = $\frac{-π}{2}$ a. sin($\frac{-π}{2})$ = b. cos($\frac{-π}{2}$) = c. tan($\frac{-π}{2}$) =



1. t = 90° a. sin(90°) = b. cos(90°) = c. tan(90°) =



1. t = $3π$ a. sin($3π)$ = b. cos($3π$) = c. tan($3π$) =



1. t = $\frac{3π}{2}$ a. sin($\frac{3π}{2})$ = b. cos($\frac{3π}{2}$) = c. tan($\frac{3π}{2}$) =



1. For what angle measures is the tangent undefined?
2. For what angle measures is the tangent equal to 0?
3. For each angle measure or arc length ‘t’:
* Sketch W(t) on the unit circle.
* Find the coordinates of W(t) using special triangles, or the symmetry of the points on the circle
* Evaluate the trigonometric functions.
1. $\frac{π}{4}$, $-\frac{π}{4}$ B. $\frac{2π}{3}$, $\frac{2π}{3}+π$

  

sin ($\frac{π}{4}$) = sin ($-\frac{π}{4}$) = sin ($\frac{2π}{3}$) = sin ($\frac{2π}{3}+π$) =

cos ($\frac{π}{4}$) = cos ($-\frac{π}{4}$) = cos ($\frac{2π}{3}$) = cos ($\frac{2π}{3}+π$) =

tan ($\frac{π}{4}$) = tan($-\frac{π}{4}$) = tan ($\frac{2π}{3}$) = tan ($\frac{2π}{3}+π$) =

1. Plot the following points on the circle. Use the formula of the unit circle to find missing coordinates. Evaluate the trigonometric functions.
2. W(t) = (-0.6, -0.8) B. W(t) = ($-\frac{5}{13}$, y) in quadrant 2

  

 sin(t) = sin(-t) = sin(t) = sin(t + π) =

 cos(t) = cos(-t) = cos(t) = cos(t + π) =

 tan(t) = tan(-t) = tan(t) = tan(t + π) =

1. W(t) = ($x, \frac{2}{\sqrt{7}}$) in quadrant 1 D. W(t) = ($0.4,y$) in quadrant IV

  

 sin(t) =$ $ sin(-t) = sin(t) = sin(t + π) =

 cos(t) = cos(-t) = cos(t) = cos(t + π) =

 tan(t) = tan(-t) = tan(t) = tan(t + π) =$ $

1. W(t) = (x, .5) in quadrant II F. W(t) = ($\frac{6}{7}$, y) in quadrant 1

  

 sin(t) = sin(-t) =$ $ sin(t) = sin(t - π) =

 cos(t) = cos(-t) = cos(t) = cos(t - π) =

 tan(t) =$ $ tan(-t) = tan(t) = tan(t - π) =

1. Summarize the patterns illustrated in problems 8 - 9 by filling in the blanks with:

sin(t), cos(t), tan(t), -sin(t), -cos(t) or –tan(t).

a. sin(-t) = cos(-t) = tan(-t) =

b. sin(t + π) = cos(t + π) = tan(t + π) =

c. sin(t - π) = cos(t - π) = tan(t - π) =

1. For each angle measure or arc length ‘t’:
* Sketch W(t) on the unit circle.
* Find the coordinates of W(t) using special triangles or the symmetry of the points on the circle
* Evaluate the trigonometric functions.
1. 30°, -30° B. 30°, 30°+180°

 

sin (30°) = sin (-30°) = sin (30°) = sin (30°+180°) =

cos (30°) = cos (-30°) = cos (30°) = cos (30°+180°) =

tan (30°) = tan (-30°) = tan (30°) = tan (30°+180°) =

