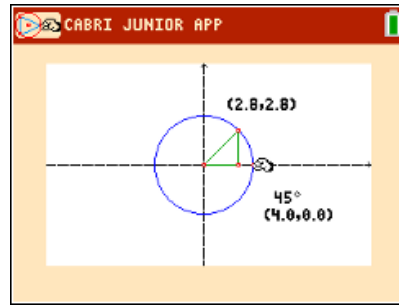# Trig Patterns
Student Activity

Name _____

Class _____

In this activity, students will use the unit circle to examine patterns in the six trigonometric functions. With the aid of the handheld and the file UNITC.8xv, students will compare angles created with the x-axis in all four quadrants and discuss with one another what is happening at each coordinate as they move the point around the circle.
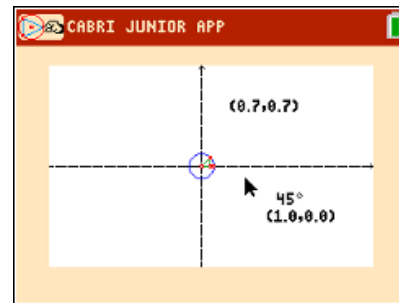

Problem 1 – Searching for Patterns

Using the unit circle, the trig functions can be defined as follows:

$$\sin \theta = \frac{y}{h} \qquad \cos \theta = \frac{x}{h} \qquad \tan \theta = \frac{y}{x}$$

Using the *Cabri Jr.* application, drag the point on the circle in the first quadrant by pressing the **ALPHA** key and recording the value for $\sin \theta, \cos \theta \ and \ \tan \theta$ using the displayed x- and y-values, and the equations above.

Use the radian conversion to fill in the second column: $\theta \cdot \frac{\pi}{180°}$

Problem 1 – Complete the Table

θ	Radian Measure	$\sin \theta$	$\cos \theta$	$\tan \theta$
0°				
30°				
45°				
60°				
90°				
120°				
135°				
150°				
180°				
210°				
225°				

240°				
270°				
300°				
315°				
330°				
360°				

Problem 2 – Searching for Patterns

Use the values in the table to respond to the following questions.

1. Find the values of θ where $\sin\theta$ is positive.

2. Find the values of θ where $\cos\theta$ is negative.

3. Find the values of θ where $\tan\theta$ is positive. Find the values of θ where $\tan\theta$ is negative. Explain.

4. Find the angle θ where $\cos\theta = \cos 30°$.

5. Name two other pairs of angles where the cosine of the angle is the same.

6. Find the angle θ where $\tan\theta = \tan 45°$.

7. Name two other pairs of angles where the tangent of the angle is the same.

8. Record all the patterns you see with the sine function.

9. Describe any other patterns you see.

10. Describe what happens at $0°, 90°, 180°, 270°, and\ 360°$.

11. Explain why the tangent function is undefined for some angle measures.

Problem 3 – Patterns in Reciprocal Functions

Using the unit circle, the reciprocal trig functions can be defined as follows:

$$\csc \theta = \frac{h}{y} \qquad \sec \theta = \frac{h}{x} \qquad \cot \theta = \frac{x}{y}$$

Complete the following table by finding the reciprocals from the computed values on the first table.

θ	$\csc \theta$	$\sec \theta$	$\cot \theta$
0°			
30°			
45°			
60°			
90°			
120°			
135°			
150°			
180°			
210°			
225°			
240°			
270°			
300°			
315°			
330°			
360°			

Use the values in the table to respond to the following questions.

1. Record any patterns that you see.

2. Discuss with a classmate if you notice if any of the functions are undefined. Find which functions and for what values of θ they are undefined.

Further IB Application

In this application, students should use one of the following trig identities and the information used in the previous three problems to answer the questions (a) and (b):

$$\cos 2\theta = cos^2\theta - sin^2\theta = 2cos^2\theta - 1 = 1 - 2sin^2\theta$$

(a) Show that the equation $\cos 2\theta = \cos \theta$ can be written in the form
$2\cos^2\theta - \cos \theta - 1 = 0$.

(b) Hence, solve $\cos 2\theta = \cos \theta$ where $0 \leq \theta \leq \pi$.