Investigating Relationship Between Dimensions

Here are some facts about the unit circle.

- The cosine of an angle is equal to the *x*-coordinate of a point on the unit circle.
- The sine of an angle is equal to the *y*-coordinate of a point on the unit circle.
- The tangent of an angle is equal to $\frac{y}{x}$ or $\frac{\sin\theta}{\cos\theta}$.

In this lesson, you will generate the graphs of the trigonometric functions $y = \sin(x)$, $y = \cos(x)$, and $y = \tan(x)$, and see how they get their shapes.

1. The unit circle on page 1.5 shows the *x*-value (*xdist*) for each point on the circle. Move the open point around the circle and record the *xdist* for all the special angles in the first two quadrants. Write the values in this table and then fill in the values in Column B on page 1.6.

angles (in degrees)	*x*dist	*y*dist	tangent
0.			
30.			
45.			
60.			
90.			
120.			
135.			
150.			
180.			
210.			
225.			
240.			
270.			
300.			
315.			
330.			
360.			

2. Repeat the process with the *y*-values (*ydist*) on page 1.8. Fill in the values in the table and then enter them on page 1.6.

a. Why are some of the table values negative?

b. What patterns do you notice?

3. On page 1.10, use the points on the circle to move the two triangles around until both angles are the same ($\theta = \theta 2$). Make sure θ remains in Quadrant I, and $\theta 2$ remains in Quadrant III.

a. What do you notice about the two triangles?

b. How can you use the information from the first two quadrants to complete all the values on the table?

4. Complete Columns B and C of the table for 180° to 360°.

Graphing

5. Now you will graph the cosine function on page 1.12.

a. Choose a scatter plot for the cosine data (*angles*, *xdist*). What window settings are needed to view all the points?

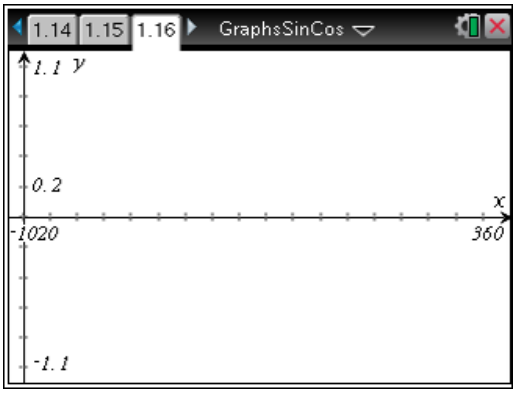
b. Graph *y* = cos(*x*) in **f1**(*x*). (Be sure the handheld is in **degree** mode.) What do you notice about the shape of the graph?

6. Now you will graph the sine function on page 1.14

a. Create a scatter plot in **s2** on page 1.14 What variables do you need to use for the *x*-values and *y*-values?

b. Graph $y = \sin(x)$ in **f2**(x). How does the shape of the graph differ from the cosine function?

7. Sketch the two functions, $y = \cos(x)$ and $y = \sin(x)$, on the same graph. Use the blank graph here, and make your graph as accurate as possible.



8. To create the graph for the tangent function, first you will need to fill in the tangent values in the table on page 1.6.

a. What formula do you need to use to find the tangent values? Enter this formula in the gray box at the top of Column D on page 1.6.

b. Use the information to graph a scatter plot of the tangent values in **s3** on page 1.16. Then, graph the function in **f3**. How does the tangent graph relate to sine and cosine graphs?