Nspire Activity: Unwrapping the Unit Circle

In this activity you will use coordinates from the unit circle to construct the graphs of the functions y = sin x and y = cos x.

Part 1: The Sine Function

1. Open the file 'sincos'. The graph at the top of the page 1.3 shows the unit circle. A point is also displayed on the circle. Answer the following questions based on previous lessons.

   What is the meaning of the x-coordinate of this point? _____

   What is the meaning of the y-coordinate of this point? _____

2. Using the unit circle diagram in #4 below, mark all places on the unit circle where sine is equal to 0 with a ■, where sine is at a maximum value with a ▲, and where sine is at a minimum value with a ●.

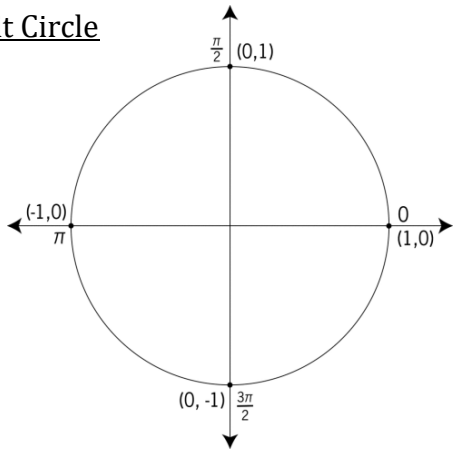
3. The point on the unit circle is connected to an animation that moves the point counter-clockwise around the unit circle. As the point moves, a scatterplot will appear in the graph area below where 'x' is equal to the angle on the unit circle (*in radians*) and 'y' is equal to the sine of the corresponding angle.

   What point is currently displayed on the scatterplot? Explain the meaning of this point below.

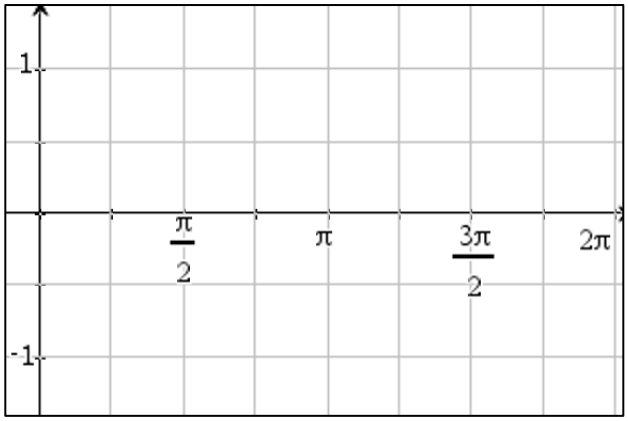
   _____

4. Press 'play' on the animation and observe the scatterplot of the sine function formed on the graph below. Then, make a sketch of the graph of the sine function (over the interval $0 \leq x \leq 2\pi$).

Unit Circle



Sine Function



5. Using the graph of the sine function above, mark all places on the graph where sine is equal to 0 with a ■, where sine is at a maximum value with a ▲, and where sine is at a minimum value with a ●.

6. Use your sketch to state the x-intercepts, minimum, and maximum values of the sine function (for the interval $0 \leq x \leq 2\pi$). Then, state the intervals where the y-values of the graph are positive and negative.

   x-intercepts: _____ *min value*: _____ *max value*: _____

   positive y-values: _____ *negative y-values*: _____

Part 2: The Cosine Function

7. Move to page 2.2 of the document. The graph at the top of the page is the same as on page 1.3. Using the unit circle diagram in #9 below, mark all places on the unit circle where cosine is equal to 0 with a ■, where cosine is at a maximum value with a ▲, and where cosine is at a minimum value with a ●.

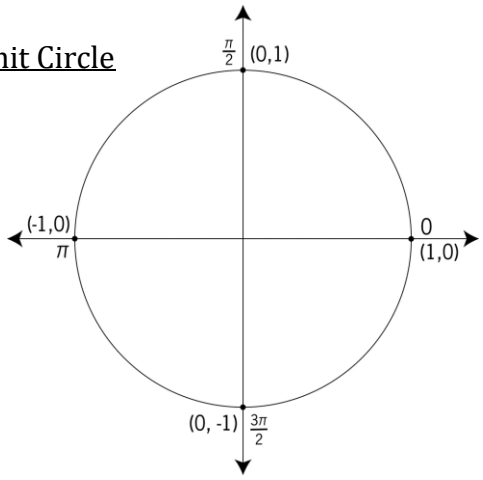
8. The point on the unit circle is again attached to an animation that will trace the point as it moves counter-clockwise around the circle. As the point traces around the circle, a scatterplot will appear in the graph area below where the 'x' values are equal to the angle in the graph above (*measured in radians*) and the 'y' values are equal to the x-values of the moving point.

   What point is currently displayed on the scatterplot? Explain the meaning of this point below.

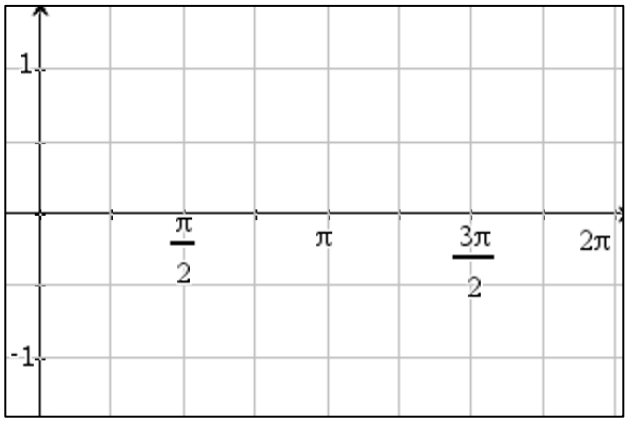
   _____

9. Press 'play' on the animation and observe the scatterplot of the cosine function formed on the graph below. Then, make a sketch of the graph of the cosine function (over the interval $0 \leq x \leq 2\pi$).

Unit Circle



Cosine Function



10. Using the graph of the cosine function above, mark all places on the graph where cosine is equal to 0 with a ■, where cosine is at a maximum value with a ▲, and where cosine is at a minimum value with a ●.

11. Use your sketch to state the x-intercepts, minimum, and maximum values of the cosine function (for the interval $0 \leq x \leq 2\pi$). Then, state the intervals where the y-values of the graph are positive and negative.

    x-intercepts: _____ *min value*: _____ *max value*: _____

    positive y-values: _____ *negative y-values*: _____