

# The Unit Circle

Student Activity



Your Passion. Our Technology. Student Success.™

7 8 9 10 11 12



TI-Nspire CAS



Investigation



Student



60min

## Aim

The aim of this investigation is to use the unit circle to generate the graphs of sine, cosine and tangent functions.

## Equipment

For this activity you will need:

- TI-nspire CAS
- TI-nspire CAS documents – Sine Curve, Cosine Curve and Tangent Curve

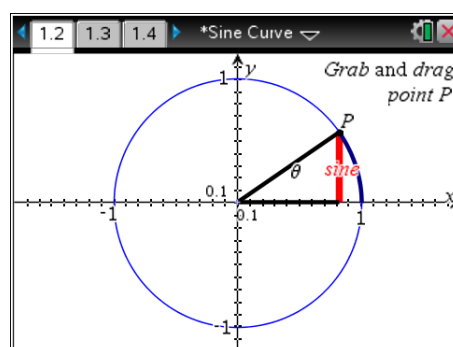
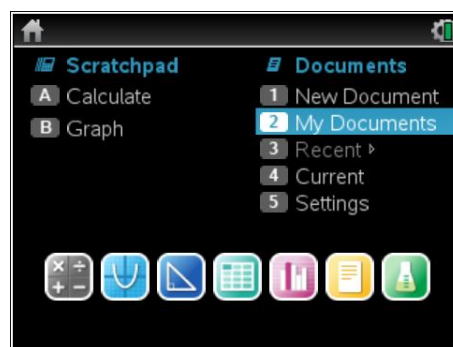
## Introduction – Setting up the calculations

This activity requires access to the “Sine Curve”, “Cosine Curve” and “Tangent Curve” TI-nspire documents. These documents should be loaded on your device before proceeding.

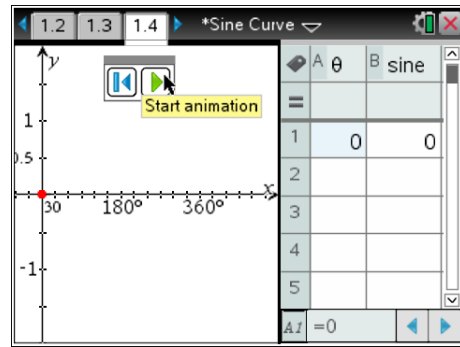
Once the document is on your handheld, press **home** and select **My Documents**. Locate the “Sine Curve” document and press **enter** to open.

Navigate to page 1.2, then grab and drag point P around the unit circle. Observe how the vertical line segment representing the **sine** changes as the point P is dragged around the unit circle.

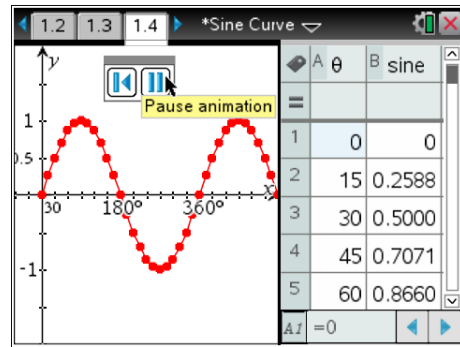
Next, we will graph these values of the sine function.



Navigate to page 1.4 and press the **start** button on the motion controller.



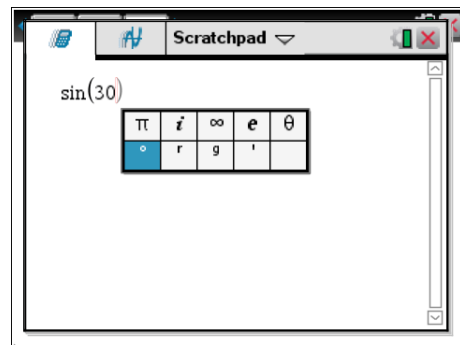
Once the sine curve has been drawn, press the **pause** button on the motion controller to stop the animation. The graph of the sine function will be drawn on the left. The values of the angle and the corresponding sine of the angle will be displayed on the right.



To swap between windows, use the **mouse** to click on a window or press **ctrl + tab**.

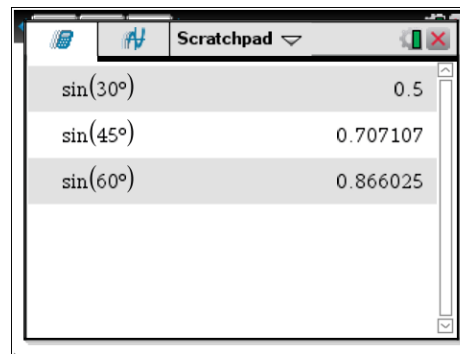


Part of in this investigation requires calculations to be performed. The Scratchpad is a place where calculations can be computed and then discarded. To access the Scratchpad press **home** and select **Scratchpad** (or press **A**). Alternatively, press the key (this key is not available on a Clickpad).



Confirm some of the sine values from the table.

Change the document setting to **Degree** or use the degree symbol (°). This can be found in the symbol palette or by pressing or to access one of the mini-palettes. On a Clickpad, press **ctrl + °**.



To find the approximate answer, change the document setting to **Approximate** or press **ctrl + enter**.

To return to the current document, press **esc**. If you are on the home page, press **Current** (or press **4**).

1. Copy and complete the table below by selecting five values from the table on page 1.4. Compare them to your own calculations using the Scratchpad (see example below).

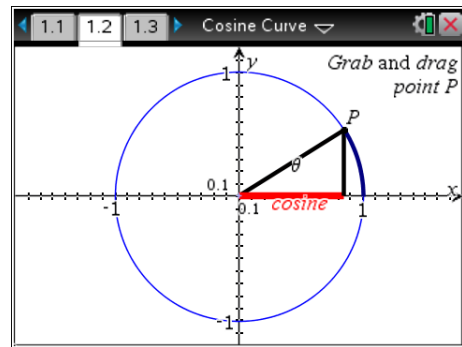
angle (θ)	45°					
sine (from table)	0.7071					
sin(θ) (from Scratchpad)	0.707107					

2. In the table on page 1.4, you will notice that many of the sine values are repeated. Copy and complete the table below by selecting five pairs of equal sine values (see example below).

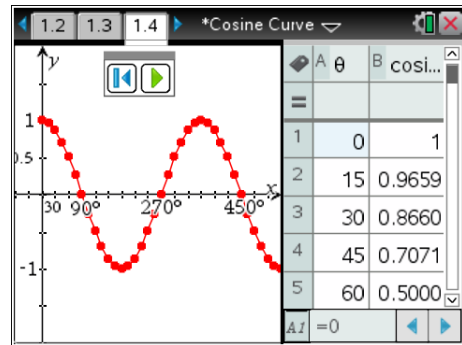
sine	0.7071					
$\theta$ (first angle)	$45^\circ$					
$\theta$ (second angle)	$135^\circ$					

Press **home** and select **My Documents**. Locate the “Cosine Curve” document and press **enter** to open.

Navigate to page 1.2, then grab and drag point P around the unit circle. Observe how the horizontal line segment representing the **cosine** changes as the point P is dragged around the unit circle.



Navigate to page 1.4 and press the **start** button on the motion controller. The graph of the cosine function will be drawn on the left. The values of the angle and the corresponding cosine of the angle will be displayed on the right.



3. Copy and complete the table below by selecting five values from the table on page 1.4. Compare them to your own calculations using the Scratchpad (see example below).

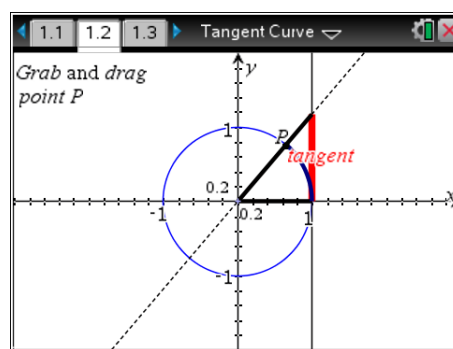
angle ( $\theta$ )	$30^\circ$					
cosine (from table)	0.8660					
$\cos(\theta)$ (from Scratchpad)	0.866025					

4. In the table on page 1.4, you will notice that many of the cosine values are repeated. Copy and complete the table below by selecting five pairs of equal cosine values (see example below).

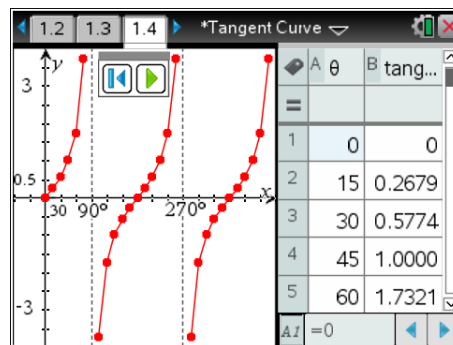
cosine	0.8660					
$\theta$ (first angle)	$30^\circ$					
$\theta$ (second angle)	$330^\circ$					

Press **home** and select **My Documents**. Locate the “Tangent Curve” document and press **enter** to open.

Navigate to page 1.2, then grab and drag point P around the unit circle. Observe how the horizontal line segment representing the **tangent** changes as the point P is dragged around the unit circle.



Navigate to page 1.4 and press the **start** button on the motion controller. The graph of the tangent function will be drawn on the left. The values of the angle and the corresponding tangent of the angle will be displayed on the right.



5. Copy and complete the table below by selecting five values from the table on page 1.4. Compare them to your own calculations using the Scratchpad (see example below).

angle ( $\theta$ )	$30^\circ$					
tangent (from table)	0.5774					
$\tan(\theta)$ (from Scratchpad)	0.57735					

6. In the table on page 1.4, you will notice that many of the tangent values are repeated. Copy and complete the table below by selecting five pairs of equal tangent values (see example below).

tangent	1.7321					
$\theta$ (first angle)	$60^\circ$					
$\theta$ (second angle)	$120^\circ$					

7. Describe the shape and key features of the sine, cosine and tangent graphs. Include features such as the initial values, the maximum and minimum values, the x-intercepts and any asymptotes (breaks in the graph).
8. Complementary angles are pairs of angles that add to  $90^\circ$ . For example,  $30^\circ + 60^\circ = 90^\circ$  so  $30^\circ$  and  $60^\circ$  are complementary angles. The cosine function is the complement of the sine function. The short way of writing 'complement of sine' is **cosine**. Therefore  $\sin(30^\circ) = \cos(60^\circ)$ . Copy and complete the table below by finding the sine and cosine values of five pairs of complementary angles (see example below).

complementary angles	$30^\circ/60^\circ$					
$\sin(\text{first angle})$	0.5					
$\cos(\text{second angle})$	0.5					