

The **Trig Tour** simulation allows students to flexibly translate between multiple representations of trig functions, discover patterns, estimate or determine exact values of trig functions, and deduce the sign (+, -, 0) of trig functions for any given angle without a calculator.

The screenshot shows the PhET Trig Tour simulation interface. At the top left, a 'Values' panel displays the current state: $(x,y) = (-0.695, -0.719)$, $\text{angle} = -494.0^\circ$, and $\cos \theta = \frac{x}{1} = -0.695$. Below this, radio buttons allow switching between 'degrees' and 'radians'. The central part of the interface features a unit circle with a red dot on the circumference and a blue arc indicating the angle θ . To the right of the circle is a control panel with radio buttons for 'cos', 'sin', and 'tan', and checkboxes for 'Special angles', 'Labels', and 'Grid'. Below the unit circle is a graph of the cosine function, $\cos \theta$, plotted against θ in degrees. The x-axis of the graph is labeled with angles: -720° , -540° , -360° , -180° , 180° , 360° , 540° , and 720° . A red dot is placed on the graph at $\theta = -540^\circ$. Three callout boxes provide instructions: 'OBSERVE the coordinates change as theta changes' points to the Values panel; 'DRAG around the circle and watch values change.' points to the unit circle; 'DRAG along the graph and watch the circle change.' points to the graph. On the right side, two more callout boxes are present: 'COMPARE different trig functions' points to the trig function selection panel, and 'SHOW exact values for special angles.' points to a panel showing the coordinates $(x,y) = (-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$, $\text{angle} = 225^\circ$, and $\cos \theta = \frac{x}{1} = -\frac{\sqrt{2}}{2}$.

Insights into Student Use

- Unless prompted, students may not notice that they can drag both the red dot along the unit circle and the red dot along the graph.
- Students can continue to rotate the red dot around the circle many times even as the graph extends outside of view.

Suggestions for Use

Sample Challenge Prompts

- Using the formula for the circumference of a circle, find the circumference of a unit circle. What is the relationship between radians and circumference?
- Minimize the Values panel and estimate the coordinates of a point on the circle. Maximize the panel to check your answer. Turn on the Grid to help you!
- What does the graph of each trig function look like beyond the view in this sim? How do you know?
- Turn on Special Angles and play with the sim. Write down any patterns you observe in the Values panel, the graph, or around the circle.

- Keep θ in the first quadrant and turn on Labels. Use your knowledge of right triangle trigonometry to explain why $\cos\theta = x$, $\sin\theta = y$, and $\tan\theta = \frac{y}{x}$. Using two functions in your function machine, find an example of when the order in which you place them matters. Describe your findings. Find a different example of when the order does not matter. Summarize when the order does and does not matter.

Sample Pre- and Post-Assessment Questions

- Determine the sign (positive or negative) for $\sin(330^\circ)$, $\cos(205^\circ)$, and $\tan(112^\circ)$.
- Determine the value of θ for the following coordinate pairs:

$$\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right), \left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right), \left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right), \left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$$

See all published activities for Trig Tour [here](#).

For more tips on using PhET sims with your students, see [Tips for Using PhET](#).