

# A Sine Wave Tracer

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**Description:** Students use points on perpendiculars, parallels, and a circle to construct an animation that traces out a sine wave. They explore the sine wave by dragging various points in their construction. Finally, students explore the relationship between a unit circle, its circumference, and the trace of a sine wave.

**Technology Strength:** By tracing a point whose horizontal movement is controlled by a point on a segment and whose vertical movement is controlled by a point on a circle, students can easily construct an animation that traces out a sine wave and use their model to explore sine waves.

**Objectives:** Construct an animation that traces out a sine wave; explore a sine wave; discover a relationship between a unit circle and the sine wave

**Prerequisites:** Familiarity with the Cartesian coordinate system

**Suggested Grade Level:** 9 to 10

**Sketchpad Level:** Intermediate

**Suggested Duration:** 45 minutes

**Suggested Classroom Setting:** Whole Class, Student Pairs. This activity, designed for use by student pairs, can be easily modified for whole-class use.

**Preparation:** Review the Activity Notes. Work through the steps on the worksheet and make a copy of the worksheet for each student. See the presentation sketch for an example of completed student work.

**Materials:** None

**Student Worksheet(s):** A Sine Wave Tracer

**Student Sketch:** None

**Presentation Sketch:** Sine Cosine Tracer Work.gsp

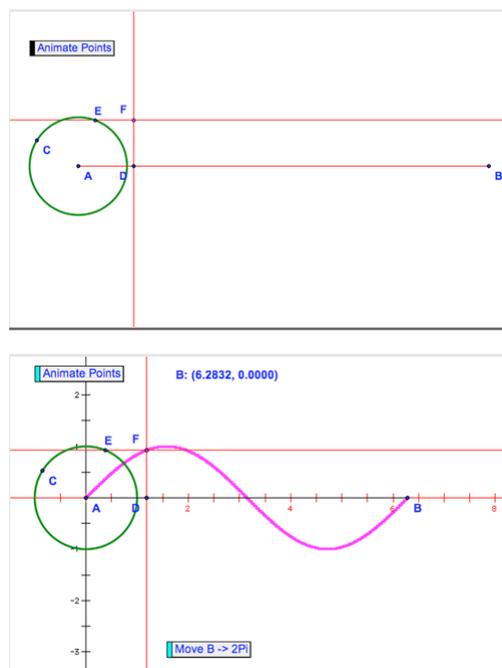
**Vocabulary:** Sine wave, periodic function, circumference

**Sketchpad Version:** GSP5

## Using the Sketch:

Students construct a horizontal segment  $AB$ , a circle  $AC$ , a point  $D$  on segment  $AB$ , and a point  $E$  on circle  $AC$ . They then construct point  $F$  at the intersection of the line perpendicular to  $AB$  through point  $D$  and the line parallel to  $AB$  through point  $E$ . Students drag point  $D$  and point  $E$  and describe what happens to point  $F$ . They make a conjecture about what point  $F$ 's path will look like if points  $D$  and  $E$  move at the same speed.

To check their conjecture, students animate point  $D$  along segment  $AB$ , and animate point  $E$  counterclockwise around the circle to trace out a sine wave. Finally, students use circle  $AC$  to define a unit circle and then use the unit circle and the trace to explore the relationship between a unit circle, its circumference, and the trace of a sine wave.



## Sketch Tips:

Sketch Tips show skills needed in this activity, and the step at which the skill is first used.

Sketch Tip	Tip Sheet or Tip Video
Step 3: Construct a point on an object with the <b>Point</b> tool	Using the Point Tool
Step 4: Construct a perpendicular line using <b>Construct   Perpendicular Line</b>	Constructing Parallels and Perpendiculars
Step 6: Construct a parallel line using <b>Construct   Parallel Line</b>	Constructing Parallels and Perpendiculars
Step 7: Construct an intersection using <b>Construct   Intersection</b>	Constructing Points
Step 8: Create an Animation button using <b>Edit   Action Buttons   Animation</b>	Animating
Step 10: Trace an object using <b>Display   Trace</b>	Tracing
Step 13: Measure the coordinates of a point using <b>Measure   Abscissa</b> , <b>Measure   Ordinate</b> , or <b>Measure   Coordinates</b>	Measuring Coordinates