

Sinusoid Curve Fitting with Fathom

Teacher Notes

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This activity is designed to work either as a discovery lesson or as reinforcement of prior material. In either case, the goal is to have students become more aware of the effects of changing the amplitude, period, phase shift, and midline on the equation of a sinusoid. Because the Fathom interface provides instant, visual feedback as students move the sliders, they may develop a more concrete understanding about how different parameters in a sinusoidal function affects its graph.

The file, sinusoidcurvefitting.ftm, can be used as a classroom demonstration before students begin exploring on their own. Doing so could also eliminate the need for the student guide.

The various included documents are:

- Sinusoidcurvefitting.ftm: the Fathom file upon which this activity is based.
- Student Guide: a brief introduction to Fathom and to this activity, designed as a double-sided sheet. If the students are familiar with Fathom, or if its use can be demonstrated beforehand, then this can be eliminated.

The major features of the Student Guide are how to rerandomize the collection and the graph simultaneously, and what to do if someone closed the inspector window for “Random Values” or if something else is being inspected.

If the inspector for “Random Values” is closed, then the collection must first be rerandomized and then the graph. The two steps are unwieldy, which is why having the inspector window open is emphasized.

- Student Worksheet: this is an open worksheet on which students can sketch the curve they are working with and then record their values for amplitude, period, phase shift, and midline for later comparison. Originally designed as a double-sided sheet, a middle page was inserted to allow for more graphs. This middle page can be removed or extended, depending on the students’ needs.

At the end of the student worksheet, students should use several sentences to describe any effect various values have upon the graph of a sinusoid. Answers obviously will vary.

It is suggested that these answers be corrected with the goal only of correcting student thought where inaccurate, rather than as part of the grade (since the goal of the activity itself is discovery).

Discovery or Reinforcement

- It is assumed from the outset that students have had exposure to the graphs of $y = \sin x$ and $y = \cos x$. A discovery lesson using this activity allows students to explore on their own the effects of changing the amplitude, period, phase shift, and midline.

After exploration, a more rigorous definition of each term can be developed, along with instruction of how phase shift differs between sine and cosine graphs.

The students should then be prepared to deal with finding the equation of any graph.

- If the activity is being used as a reinforcement of previously covered material, then a pre- and post-test situation is recommended.

Quiz the students beforehand on writing the equations of several graphs, grade and return the quizzes, and then let the students explore using Fathom. Correct their thoughts in the student worksheet, and then follow with another quiz. The latter results will hopefully show improvement where earlier there were errors.

A few important notes

- A misgiving about the structure of the activity is the fact that amplitude is allowed to be positive or negative.

The teacher may wish to emphasize the fact that, while a function itself can be positive or negative, amplitude is always positive. The approach taken in the activity was chosen to avoid the ugliness of a fifth variable that held a value from $\{-1, 0, 1\}$ and stood for the sign of the function.

- All random values are rounded to the tenths position, and the sliders only allow changes by tenths.
- There are many possible equations for each graph, and the teacher may want to emphasize finding two or three solutions for each graph.
- The random values are constrained in the following ways:

$$-6 \leq \text{Amplitude} \leq 6$$

$$0.8 \leq \text{Period} \leq 3$$

$$-\pi \leq \text{Phase Shift} \leq \pi$$

$$-6 \leq \text{Midline} \leq 6$$

These values—especially for period—were designed to produce graphs that fit well into the provided window. The exception is amplitude, which as noted in the Student Guide, can produce a graph that, due to its unfriendliness, might best be rerandomized for a new one.