Find That Sine

ID: 9733

Time required
35 minutes

Activity Overview

Students will sinusoidal regression to determine equations to model various data sets and use the equations to make inferences.

Topic: Trigonometric Functions

- *Calculate the trigonometric line of best fit to model bivariate data and use it to predict a value of one.*

Teacher Preparation and Notes

- *Prior to beginning the activity, students should download the **KANSTEMP** program to their handhelds.*
- *This investigation has students using sinusoidal regression with data sets and making inferences with the created equations.*
- *Students should already be familiar with the properties of sine graphs.*
- *This activity is intended to be teacher-led.*
- ***To download the calculator program, go to education.ti.com/exchange and enter "9733" in the quick search box.***

Associated Materials

- *PrecalcWeek28_FindSine_Worksheet_TI84.doc*
- *KANSTEMP.8xp*

Suggested Related Activities

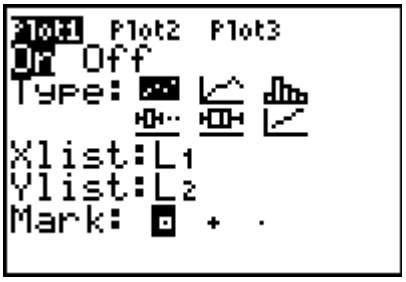
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Changes in Latitude – Modeling a Sine Function (TI-Nspire technology) — 10145*
- *What's My Sine? (TI-Nspire technology) — 10091*
- *Vertical and Phase Shifts (TI-84 Plus) — 9608*
- *The Sound of Music (TI-84 Plus and TI-Navigator) — 5549*

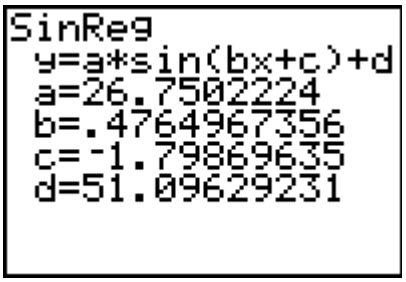
Problem 1 – Temperature graphs

Students start this activity by running the **KANSTEMP** activity to store the necessary data for this activity in lists. For Problem 1, students will only use the data in lists $\mathbf{L_1}$ and $\mathbf{L_2}$. The other lists will be used later in this activity.

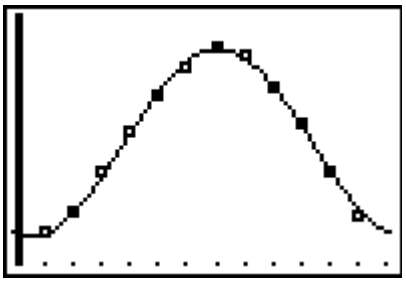
Students should plot the data using the settings shown to the right. To obtain an acceptable window, press θ and select **9:ZoomStat**.



Students will use a sinusoidal regression to find a sine function that models the data. They should store the equation in $\mathbf{Y_1}$.

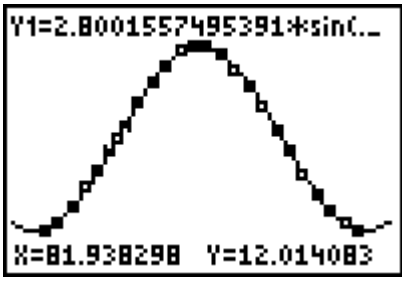


After students have determined and graphed the sine regression equation, $f(x) = 26.75 \sin(0.47x - 1.80) + 51.1$, emphasize the need to check for its reasonableness of fit when compared to the scatter plot of the data.



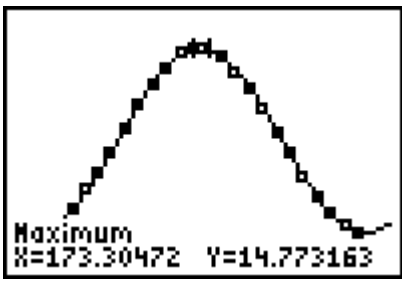
Problem 2 – Hours of Sunlight

The amount of light a location on the Earth receives from the Sun changes each day depending upon the time of year and latitude of that location. The amount of daily sunshine Kansas City experiences has been recorded in the lists where the calendar day is in $\mathbf{L_3}$, and the hours of sunlight is $\mathbf{L_4}$. Remind students to change the settings for **Plot 1** so that the **XList** is $\mathbf{L_3}$ and the **YList** is $\mathbf{L_4}$.



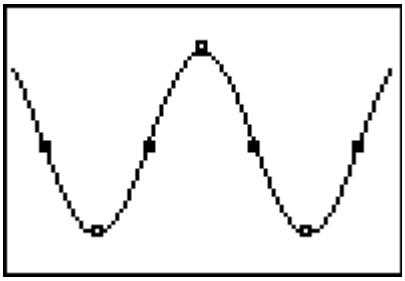
Students will again use the sinusoidal regression to find an equation to model the data.

Students will use their equation to calculate the winter and summer solstices and spring and fall equinoxes. To calculate the equinox dates, students can use **Trace** to find the *x*-values when the *y*-value is 12. To find the solstice dates, students can use the **minimum** and **maximum** functions from the Calc menu.



Problem 3 – Tides

The Bay of Fundy has the highest tides in the world. If a tape measure were attached at the water line of a peer, and the water level height were recorded over a period of eighteen hours, data like that in $\mathbf{L_5}$ and $\mathbf{L_6}$ would be generated. Remind students to change the settings for **Plot 1** so that the **XList** is $\mathbf{L_5}$ and the **YList** is $\mathbf{L_6}$.



After finding an equation to model the data, students will use the model to predict future events. Students can use the **Trace** feature, the **value** feature (students must adjust the window to include $x = 49$ on the screen), or enter $\mathbf{Y_1(49)}$ on the home screen.

Student Solutions

Problem 1

- $y = 26.75 \sin(0.47x - 1.80) + 51.10$

Problem 2

- $y = 2.8 \sin(0.02x - 1.38) + 11.97$
- Vernal Equinox – 81.94 calendar days (March 22)
- Autumnal Equinox – 264.97 calendar days (September 22)
- Summer Solstice (1^{st} maximum of the function) – 173.3 calendar days (June 22)
- Winter Solstice (1^{st} minimum of the function) – 357.76 calendar days (December 22)

Problem 3

- $y = 4.44 \sin(0.52x - 3.11) + 6.22$
- $y = 4.52$ feet

Additional Practice

$y = 150 \sin(0.52x - 2.09) + 650$