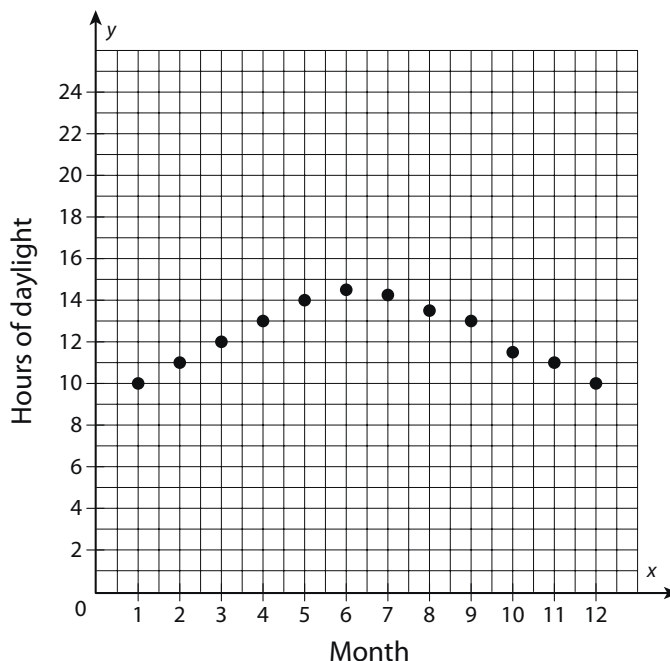


Problem-Based Task: Daytime Trends

Coaching Sample Responses

- a. Create a scatter plot for the data.



- b. Does a quadratic function or a sine function look like it might be a better fit?

The data appears to have a curve with slightly flared ends. This is a characteristic of sine functions.

- c. Find a quadratic function to model the data.

Use a calculator or other graphing software to find a quadratic regression model.

On a TI-83/84:

Step 1: Press [STAT] to bring up the statistics menu. The first option, 1: Edit, will already be highlighted. Press [ENTER].

Step 2: Arrow up to L1 and press [CLEAR], then [ENTER], to clear the list. Repeat this process to clear L2 and L3, if needed.

Step 3: Enter the ordered pairs in the L1 and L2 lists. Make sure to enter the x -coordinates in L1 and the y -coordinates in L2.

Step 4: Press [STAT]. Arrow to the CALC menu. Press 5: QuadReg.

Step 5: Press [(], then [2ND][1] to type "L1" for Xlist. Press [,], then [2ND][2] to type "L2" for Ylist. Press [)] to close the parentheses.

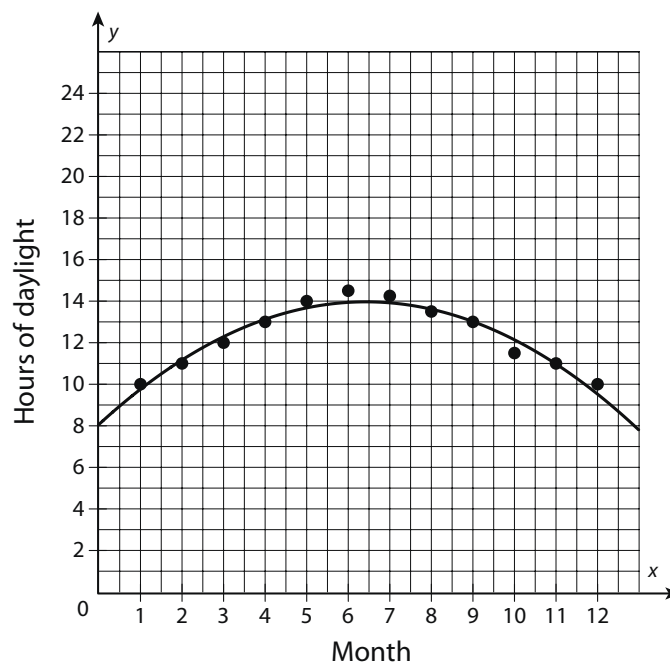
Step 6: Press [ENTER] to calculate. The parameter values will appear on the screen.

On a TI-Nspire:

- Step 1: Press [home]. Arrow over to the spreadsheet icon, the fourth icon from the left, and press [enter].
- Step 2: To clear the lists in your calculator, arrow up to the topmost cell of the table to highlight the entire column, then press [menu]. Choose 3: Data, then 4: Clear Data. Repeat for each column as necessary.
- Step 3: Arrow up to the topmost cell of the first column, labeled “A.” Press [X] [enter] to type x . Then arrow over to the second column, labeled “B.” Press [Y][enter] to type y .
- Step 4: Arrow down to cell A1 and enter the first x -value from the ordered pairs. Press [enter]. Enter the second x -value in cell A2 and so on.
- Step 5: Move over to cell B1 and enter the first y -value. Press [enter]. Enter the second y -value in cell B2 and so on.
- Step 6: To fit an equation to the data points, press [menu] and select 4: Statistics, then 1: Stat Calculations, then press 6 for quadratic regression. Select “ x ” from the X List pop-up menu. Press [tab] to move to the Y List pop-up menu, then select “ y ” from the options. Tab to “OK” and press [enter]. The parameter values will appear on the screen.

The function is $y = -0.14x^2 + 1.84x + 8.1$.

- d. Graph the quadratic function on the scatter plot.



- e. Find a sine function to model the data.

Use a calculator or other graphing software to find a quadratic regression model.

On a TI-83/84:

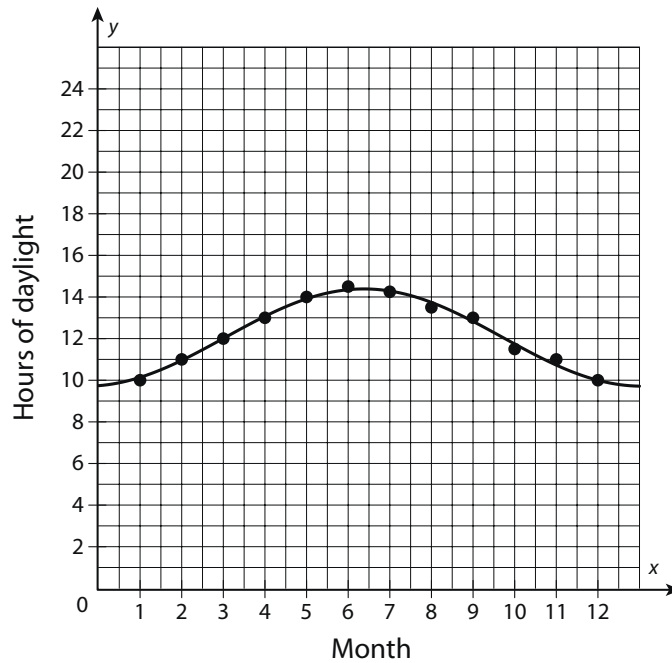
- Step 1: Press [STAT] to bring up the statistics menu. The first option, 1: Edit, will already be highlighted. Press [ENTER].
- Step 2: Arrow up to L1 and press [CLEAR], then [ENTER], to clear the list. Repeat this process to clear L2 and L3, if needed.
- Step 3: Enter the ordered pairs in the L1 and L2 lists. Make sure to enter the x -coordinates in L1 and the y -coordinates in L2.
- Step 4: Press [STAT]. Arrow to the CALC menu. Press C: SinReg.
- Step 5: Press [(], then [2ND][1] to type “L1” for Xlist. Press [,], then [2ND][2] to type “L2” for Ylist. Press [)] to close the parentheses.
- Step 6: Press [ENTER] to calculate. The parameter values will appear on the screen.

On a TI-Nspire:

- Step 1: Press [home]. Arrow over to the spreadsheet icon, the fourth icon from the left, and press [enter].
- Step 2: To clear the lists in your calculator, arrow up to the topmost cell of the table to highlight the entire column, then press [menu]. Choose 3: Data, then 4: Clear Data. Repeat for each column as necessary.
- Step 3: Arrow up to the topmost cell of the first column, labeled “A.” Press [X] [enter] to type x . Then arrow over to the second column, labeled “B.” Press [Y][enter] to type y .
- Step 4: Arrow down to cell A1 and enter the first x -value from the ordered pairs. Press [enter]. Enter the second x -value in cell A2 and so on.
- Step 5: Move over to cell B1 and enter the first y -value. Press [enter]. Enter the second y -value in cell B2 and so on.
- Step 6: To fit an equation to the data points, press [menu] and select 4: Statistics, then 1: Stat Calculations, then press C for sinusoidal regression. Select “ x ” from the X List pop-up menu. Press [tab] to move to the Y List pop-up menu, then select “ y ” from the options. Tab to “OK” and press [enter]. The parameter values will appear on the screen.

The equation is $y = 2.34 \sin(0.47x - 1.43) + 12.05$.

f. Graph the sine function on the scatter plot.



g. Which function appears to be a better fit based on the graphs?

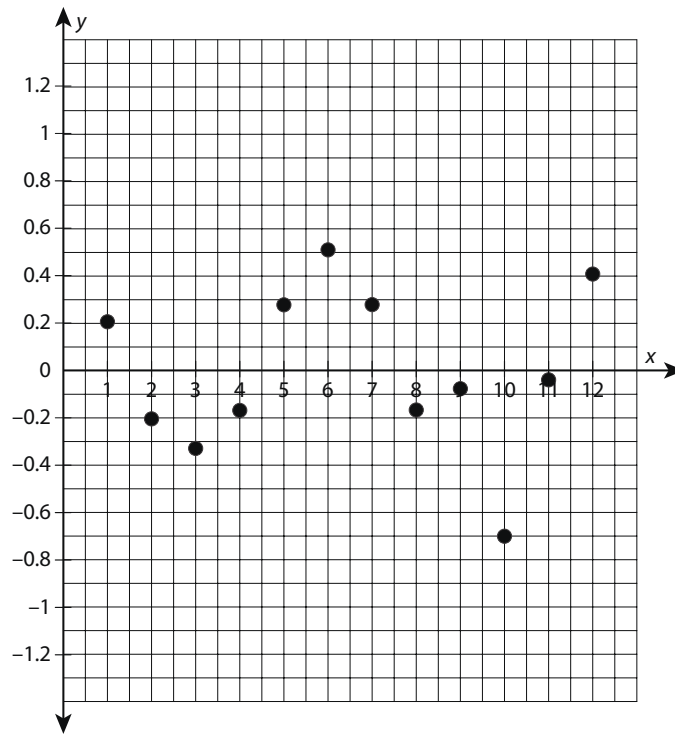
Both functions appear to be a good fit, but the sine function seems to fit slightly better.

h. Calculate the residuals for the quadratic function.

Subtract the predicted y -value from the actual y -value for each value of x .

Month	Actual hours	Predicted hours	Residual
1	10	9.8	0.2
2	11	11.22	-0.22
3	12	12.36	-0.36
4	13	13.22	-0.22
5	14	13.8	0.2
6	14.5	14.1	0.4
7	14.25	14.12	0.13
8	13.5	13.86	-0.36
9	13	13.32	-0.32
10	11.5	12.5	-1
11	11	11.4	-0.4
12	10	10.02	-0.02

i. Create a residual plot for the quadratic function.

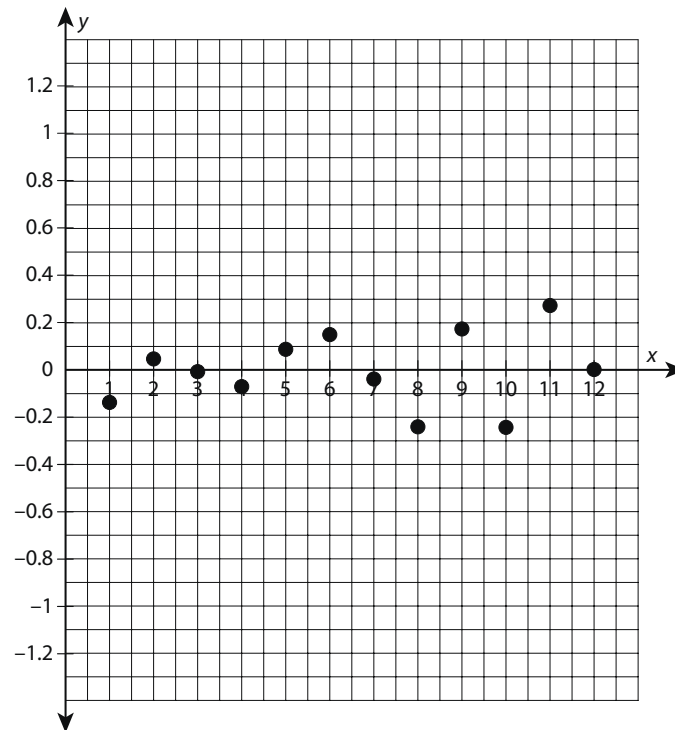


j. Calculate the residuals for the sine function.

Subtract the predicted y -value from the actual y -value for each value of x .

Month	Actual hours	Predicted hours	Residual
1	10	10.13	-0.13
2	11	10.95	0.05
3	12	12	0
4	13	13.07	-0.07
5	14	13.91	0.09
6	14.5	14.35	0.15
7	14.25	14.29	-0.04
8	13.5	13.75	-0.25
9	13	12.83	0.17
10	11.5	11.75	-0.25
11	11	10.73	0.27
12	10	10	0

- k. Create a residual plot for the sine function.



- l. Which function appears to be a better fit based on the residuals?

The residual plot for the quadratic function appears to have a distinct wave pattern, and the points lie farther from the x -axis on average. The residual plot for the sine function seems more random, and the points lie closer to the x -axis on average. The sine function is a better fit.

- m. Summarize your conclusions.

The shape of the data seemed to indicate a sine plot because it was a U-shape with a slightly flared base. A sine function is further supported because it seemed to pass slightly closer to the data than the quadratic function did. Finally, the residual plot for the sine function was both more random and closer to the x -axis. This shows that the sine function is a better fit for the data.

Recommended Closure Activity

Select one or more of the essential questions for a class discussion or as a journal entry prompt.