Graphing Calculator Lab

Casio CFX 9750G

Modeling Data Using Polynomial Functions

You can use a Casio CFX9750G graphing calculator to model data for which the curve of best fit is a polynomial function.

EXAMPLE

The table shows the distance a seismic wave can travel based on its distance from an earthquake's epicenter. Draw a scatter plot and a curve of best fit that relates distance to travel time. Then determine approximately how far from the epicenter the wave will be felt 8.5 minutes after the earthquake occurs.

Travel Time (min)	1	2	5	7	10	12	13
Distance (km)	400	800	2500	3900	6250	8400	10,000

Source: University of Arizona

Step 1 Enter the travel times in L1 and the distances in L2.

KEYSTROKES: Refer to Graphing Calculator Lab: Lines of Regression

Step 2 Graph the scatter plot.

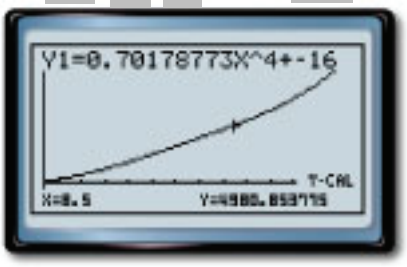
KEYSTROKES: Refer to Graphing Calculator Lab: Lines of Regression

Step 3 Compute and graph the equation for the curve of best fit. A quartic curve is the best fit for these data. You can verify this by comparing the R^2 values for each type of graph.

KEYSTROKES: F5 F5 EXE F6

Step 4 Use the [G-Solve] feature to find the value of the function for x = 8.5.

KEYSTROKES: MENU 5 F6 SHIFT F5 F6 F1 8.5 EXE



After 8.5 minutes, you would expect the wave to be felt approximately 5000 kilometers away.

EXERCISES

For Exercises 1–3, use the table that shows how many minutes out of each eight-hour workday are used to pay one day's worth of taxes.

1. Draw a scatter plot of the data. Then graph several curves of best fit that relate the number of minutes to the number of years since 1930. Try LinReg, QuadReg, and CubicReg.
2. Write the equation for the curve that best fits the data.
3. Based on this equation, how many minutes should you expect to work each day in the year 2010 to pay one day's taxes?

Year	Minutes
1940	83
1950	117
1960	130
1970	141
1980	145
1990	145
2000	160

Source: Tax Foundation

For Exercises 4–7, use the table that shows the estimated number of alternative-fueled vehicles in use in the United States per year.

Year	Estimated Alternative-Fueled Vehicles in Use in the United States
1995	333,049
1996	352,421
1997	367,526
1998	383,847
1999	411,525
2000	455,906
2001	490,019
2002	518,919

Source:eia.doe.gov

4. Draw a scatter plot of the data. Then graph several curves of best fit that relate the number of vehicles to the year. Try LinReg, QuadReg, and CubicReg. (Hint: Enter the x-values as years since 1994.)
5. Write the equation for the curve that best fits the data. Round to the nearest tenth.
6. Based on this equation before rounding, how many Alternative-Fueled Vehicles would you expect to be in use in the year 2008?
7. Find a curve of best fit that is quartic. Is it a better fit than the equation you wrote in Exercise 5? Explain.

For Exercises 8–11, use the table that shows the distance from the Sun to the Earth for each month of the year.

Month	Distance
January	0.9840
February	0.9888
March	0.9962
April	1.0050
May	1.0122
June	1.0163
July	1.0161
August	1.0116
September	1.0039
October	0.9954
November	0.9878
December	0.9837

Source:astronomycafe.net

8. Draw a scatter plot of the data. Then graph several curves of best fit that relate the distance to the month. Try LinReg, QuadReg, and CubicReg.
9. Write the equation for the curve that best fits the data.
10. Based on this equation, what is the distance from the Sun to the Earth halfway through September?
11. Would you use this model to find the distance from the Sun to Earth in subsequent years? Explain your reasoning.

Extension

For Exercises 12–15, design and complete your own data analysis.

12. Write a question that could be answered by examining data. For example, you might estimate the number of people living in your town 5 years from now or predict the future cost of a car.
13. Collect and organize the data you need to answer the question you wrote. You may need to research your topic on the internet or conduct a survey to collect the data you need.
14. Make a scatter plot and find a regression equation for your data. Then use the regression equation to answer the question.