Graphing Technology Lab

Modeling Data Using Polynomial Functions

TI-Nspire™

You can use TI-Nspire technology to model data points when a curve of best fit is a polynomial function.

EXAMPLE

The table shows the distance a seismic wave produced by an earthquake travels from the epicenter. Draw a scatter plot and a curve of best fit to show how the distance is related to time. Then determine approximately how far away from the epicenter a seismic wave will be felt 8.5 minutes after an 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

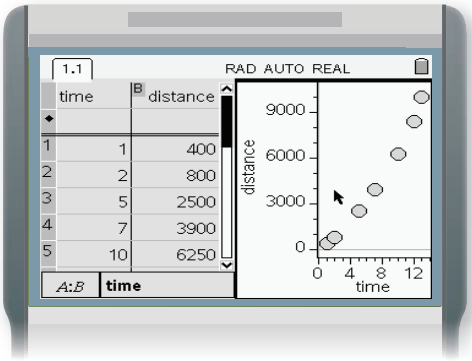
Step 1 Enter time in column A and distance in column B.

KEYSTROKES: (home) 6: New Document 3: Add Lists & Spreadsheet ▲ ▲ T I M E ▼ ▼ 1 (enter) 2 (enter) ... 13 (enter).

Use arrow keys to move the cursor to the top of column B. Then press D I S T A N C E ▼ ▼ 400 (enter) ... 10000 (enter).

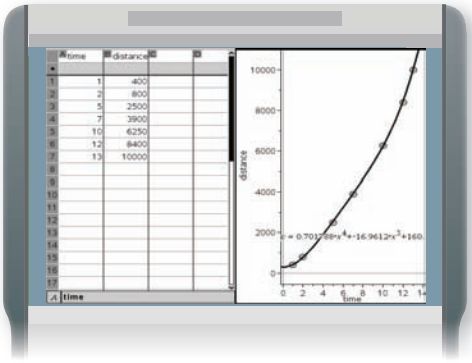
Step 2 Graph the scatter plot.

KEYSTROKES: Move the cursor to the top of column A and press ▲ to highlight the column. Select the second column also by pressing (caps) and ▶. Press (menu) 3: Data 6: Quick Graph.



Step 3 Determine and graph the equation for a curve of best fit. Use a quartic regression for the data.

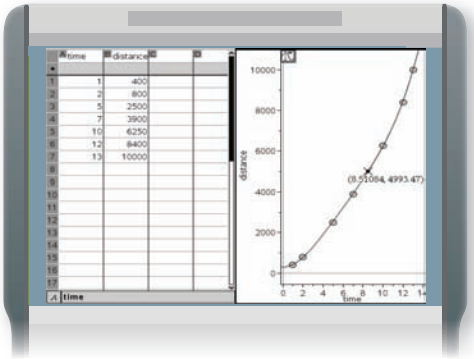
KEYSTROKES: Use the arrow keys to move the arrow over the graph. Press (menu) 4: Analyze 6: Regression 6: Show Quartic.



Step 4 Use the Graph Trace feature to find the value of the function for $x = 8.5$.

KEYSTROKES: (menu) 4: Analyze 8: Plot Value 8.5 (≈ enter)

After 8.5 minutes, the wave could be expected to be felt approximately 4980 kilometers from the epicenter.



Exercises

The table shows how many minutes out of each eight-hour work day are used to pay one day's worth of taxes.

Year	Minutes
1930	56
1940	86
1950	119
1960	134
1970	144
1980	147
1990	148
2000	163
2005	151

Source: Tax Foundation

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. Try Linear (mx+b), Quadratic, and Cubic regressions.
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 2020 to pay one day's taxes?

The table shows the estimated number of alternative-fueled vehicles in use in the United States per year.

Year	Number of Vehicles	Year	Number of Vehicles
1995	246,855	2000	394,664
1996	265,006	2001	425,457
1997	280,205	2002	471,098
1998	295,030	2003	510,805
1999	322,302	2004	547,904

Source: U.S. Department of Energy

4. Draw a scatter plot of the data. Then graph several curves of best fit that relate the distance to the month.
5. Which curve best fits the data? Is that curve best for predicting future values?
6. Use the best-fit equation you think will give the most accurate prediction for how many alternative-fuel vehicles will be in use in the year 2012.

The table shows the average distance from the Sun to Earth during each month of the year.

Month	Distance (astronomical units)
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: The Astronomy Cafe

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

Extension

11. 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.
12. 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.
13. Make a scatter plot and find a regression equation for your data. Then use the regression equation to answer the question.