Graphing Technology Lab

Sharp EL-9900C

Modeling Data Using Polynomial Functions

You can use a **Sharp EL-9900C** graphing calculator 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

Clear the calculator memory first.

KEYSTROKES: [2ndF] [OPTION] [ALPHA] [E] 2 [CL] [ENTER]

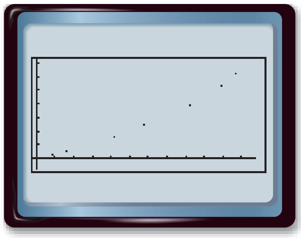
Step 1 Enter time in **L1** and distance in **L2**.

KEYSTROKES: [STAT] A: EDIT [ENTER] 1 [ENTER] 2 [ENTER] 5 [ENTER] 7 [ENTER] 10 [ENTER] 12 [ENTER] 13 [ENTER] [▶] 400 [ENTER] 800 [ENTER] 2500 [ENTER] 3900 [ENTER] 6250 [ENTER] 8400 [ENTER] 10000 [ENTER]

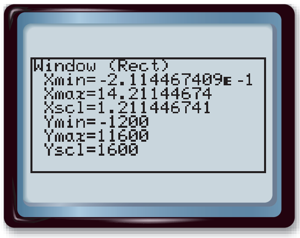
Step 2 Graph the scatter plot.

KEYSTROKES: [STAT PLOT] A: PLOT1 [ENTER] ON [ENTER] [▼] [▶] [ENTER] [ZOOM] [▶] 9: STAT [ENTER]

Press [WINDOW] to see how using the **STAT** default window adjusts the window to accommodate the data.

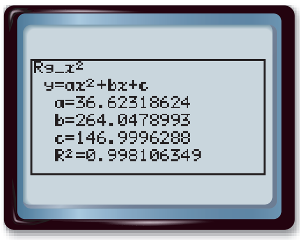


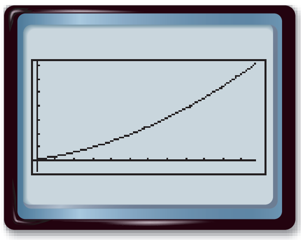
[−2.11, 14.21] scl: 1.21 by
[−1200, 11,600] scl: 1600



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

KEYSTROKES: [STAT] D: REG [▶] 04: Rg_x^2 [ENTER] [(] [2ndF] [L1] [,] [2ndF] [L2] [,] [2ndF] [VARS] A: EQVARS [ENTER] A: XY [▶] 1: Y1 [ENTER] [)] [ENTER] [GRAPH]



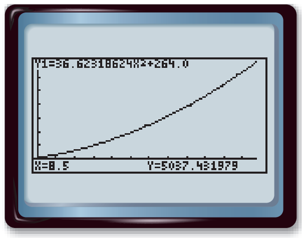


[−2.11. 14.21] scl: 1.21 by
[−1200, 11,600] scl: 1600

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

KEYSTROKES: 2ndF [CALC] ▶ 1: Value ENTER 8.5 ENTER

After 8.5 minutes, the wave could be expected to be felt approximately 5037 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 Rg_ax+b, Rg_x^2, and Rg_x^3.
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 number of vehicles to the year.
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.