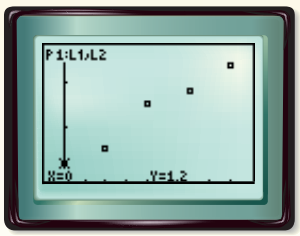
Graphing Calculator Investigation

A Follow-Up of Lesson 13-3

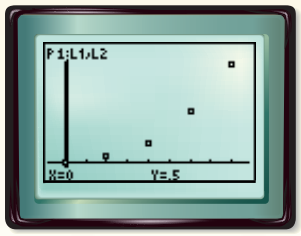
Curve Fitting

If there is a constant increase or decrease in data values, there is a linear trend. If the values are increasing or decreasing more and more rapidly, there may be a quadratic or exponential trend. The curvature of a quadratic trend tends to appear more gradual. Below are three scatter plots, each showing a different trend.

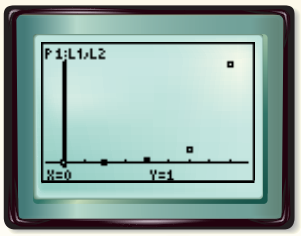
Linear Trend



Quadratic Trend



Exponential Trend



With a TI-83 Plus, you can use the LinReg, QuadReg, and ExpReg functions to find the appropriate regression equation that best fits the data.

FARMING **A study is conducted in which groups of 25 corn plants are given a different amount of fertilizer and the gain in height after a certain time is recorded. The table below shows the results.**

Fertilizer (mg)	0	20	40	60	80
Gain in Height (in.)	6.48	7.35	8.73	9.00	8.13

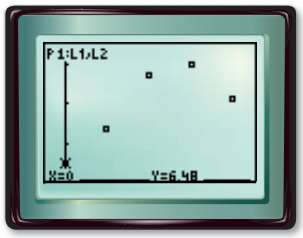
Step 1 *Make a scatter plot.*

- Enter the fertilizer in L1 and the height in L2.

  KEYSTROKES: *Review entering a list on page 204.*

- Use STAT PLOT to graph the scatter plot.

  KEYSTROKES: *Review statistical plots on page 204. Use* ZOOM *9 to graph.*



[−8, 88] scl: 5 by [6.0516, 9.4284] scl: 1

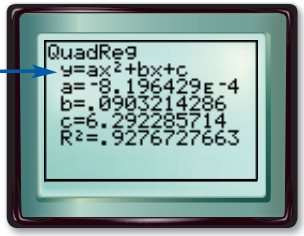
The graph appears to be a quadratic regression.

Step 2 *Find the quadratic regression equation.*

- Select QuadReg on the STAT CALC menu.

  KEYSTROKES: STAT ▶ 5 ENTER

The equation is in the form $y = ax^2 + bx + c$.



The equation is about $y = -0.0008x^2 + 0.1x + 6.3$.

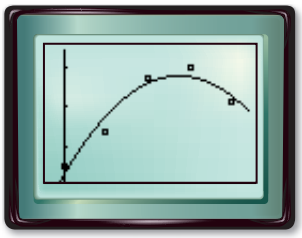
R^2 is the **coefficient of determination**. The closer R^2 is to 1, the better the model. To choose a quadratic or exponential model, fit both and use the one with the R^2 value closer to 1.

(continued on the next page)

Step 3 *Graph the quadratic regression equation.*

- Copy the equation to the Y= list and graph.

KEYSTROKES: Y= VARS 5 ▶ ▶ 1 ZOOM 9

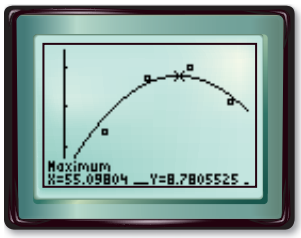


Step 4 *Predict using the equation.*

- Find the amount of fertilizer that produces the maximum gain in height.

On average, about 55 milligrams of the fertilizer produces the maximum gain.

KEYSTROKES: 2nd CALC 4



Exercises

Plot each set of data points. Determine whether to use a *linear*, *quadratic*, or *exponential* regression equation. State the coefficient of determination.

1.

x	y
0.0	2.98
0.2	1.46
0.4	0.90
0.6	0.51
0.8	0.25
1.0	0.13

2.

x	y
1	25.9
2	22.2
3	20.0
4	19.3
5	18.2
6	15.9

3.

x	y
10	35
20	50
30	70
40	88
50	101
60	120

4.

x	y
1	3.67
3	5.33
5	6.33
7	5.67
9	4.33
11	2.67

TECHNOLOGY **The cost of cellular phone use is expected to decrease. For Exercises 5–9, use the graph at the right.**

5. Make a scatter plot of the data.

6. Find an appropriate regression equation, and state the coefficient of determination.

7. Use the regression equation to predict the expected cost in 2004.

8. Do you believe that your regression equation is appropriate for a year beyond the range of data, such as 2020? Explain.

9. What model may be more appropriate for predicting cost beyond 2003?