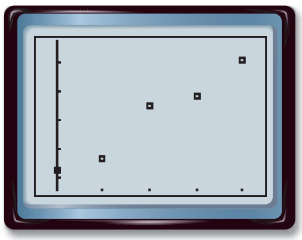
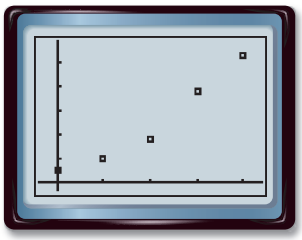
Curve Fitting

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.

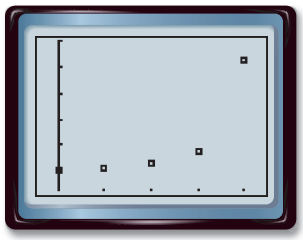
Linear Trend



Quadratic Trend



Exponential Trend



With a Sharp EL-9900C graphing calculator, you can find the appropriate regression equation.

ACTIVITY

CHARTER AIRLINE **The table shows the average monthly number of flights made each year by a charter airline that was founded in 2000.**

Year	2000	2001	2002	2003	2004	2005	2006	2007
Flights	17	20	24	28	33	38	44	50

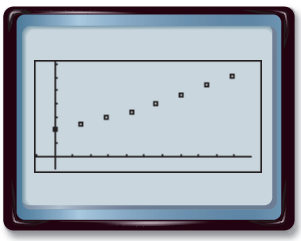
Step 1 Make a scatter plot.

- Enter the number of years since 2000 in L1 and the number of flights in L2 after the calculator memory is cleared.

KEYSTROKES: 2ndF [OPTION] ALPHA [E] 2 CL ENTER STAT A: Edit ENTER 0 ENTER 1 ENTER … 7 ENTER ▶ 17 ENTER 20 ENTER … 50 ENTER

- Use STAT PLOT to graph the scatter plot.

KEYSTROKES: STAT PLOT ENTER on ENTER XY ENTER ▼ ▼ ▼ STAT PLOT G: S.D. then 3: Scattr ☐ ZOOM ▶ 9: Stat



[0, 10] scl: 1 by [0, 60] scl: 5

- Set the viewing window.

KEYSTROKES: WINDOW 0 ENTER 10 ENTER 1 ENTER 0 ENTER 60 ENTER 5 ENTER

From the scatter plot we can see that the data has either a quadratic trend or an exponential trend.

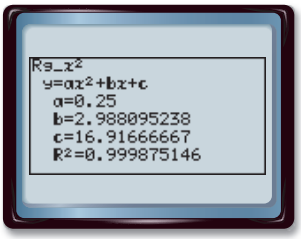
Step 2 Find the regression equation.

We will check both trends by examining their regression equations.

- Select Rg_x² on the STAT menu.

KEYSTROKES: ÷ CL STAT D: REG ▶ 04: Rg_x² ENTER (2ndF [L1] , 2ndF [L2] , 2ndF [VARS] A: EQVARS ENTER A: XY ▶ 1: Y1 ENTER) ENTER

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



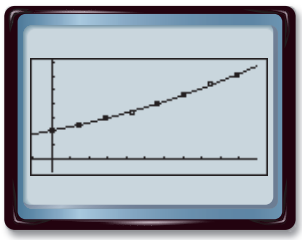
The equation is about $y = 0.25x^2 + 3x + 17$.

R^2 is the **coefficient of determination**. The closer R^2 is to 1, the better the model.

Step 3 Graph the quadratic regression equation.

- Graph the equation in the standard window.

KEYSTROKES: ZOOM ▶ 9: Stat

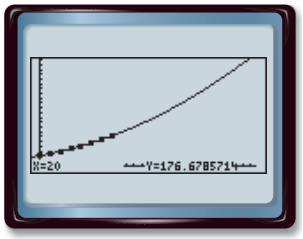


[0, 10] scl: 1 by [0, 60] scl: 5

Step 4 Predict using the equation.

If this trend continues, we can use the graph of our equation to predict the monthly number of flights the airline will make in a specific year. Find the number of flights in the year 2020. First adjust the window.

KEYSTROKES: WINDOW ▼ 25 ENTER ▼ ▼ 200 ENTER Graph 2ndF [CALC] 1: Value ENTER 20 ENTER



[0, 25] scl: 1 by [0, 200] scl: 5

There will be approximately 177 flights per month if this trend continues.

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*
1	30
2	40
3	50
4	55
5	50
6	40

2.

x	*y*
0.0	12.1
0.1	9.6
0.2	6.3
0.3	5.5
0.4	4.8
0.5	1.9

3.

x	*y*
0	1.1
2	3.3
4	2.9
6	5.6
8	11.9
10	19.8

4.

x	*y*
1	1.67
5	2.59
9	4.37
13	6.12
17	5.48
21	3.12

5. **BAKING** **Alyssa baked a cake and is waiting for it to cool so she can ice it. The table shows the temperature of the cake every 5 minutes after Alyssa took it out of the oven.**

Time (min)	Temperature (°F)
0	350
5	244
10	178
15	137
20	112
25	96
30	89

a. Make a scatter plot of the data.

b. Which regression equation has an R^2 value closest to 1? Is this the equation that best fits the context of the problem? Explain your reasoning.

c. Find an appropriate regression equation, and state the coefficient of determination. What is the domain and range?

d. Alyssa will ice the cake when it reaches room temperature (70°F). Use the regression equation to predict when she can ice her cake.