Table 2.1:
Predicting World Population

Year	1960	1965	1970	1975	1980	1985	1990	1995	2000	2011
Population (millions)	3,039	3,345	3,707	4,086	4,454	4,851	5,279	5,688	6,083	7,000

Source: U.S. Census Bureau, 2011.

Consider the world population (in millions) from 1960 through 2011. Have students create a scatterplot of the data and then use the regression capabilities of the graphic calculator or computer software to determine the best-fitting model for the data.

Comparing Mathematical Models

Throughout your study of algebra 2, you have used many types of functions to model the real world, including linear, quadratic, cubic, exponential, power, and logistic functions. You can use a graphing calculator to examine a set of data to determine the best-fitting model from a list of familiar functions.
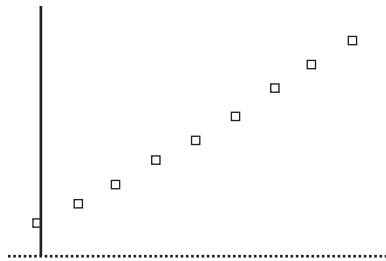
Example

The world population (in millions) from 1960 through 2000 is shown in the table. Use a graphing calculator to make a scatter plot of the data. Then use the regression capabilities of the graphing calculator to determine the best-fitting model for the data.

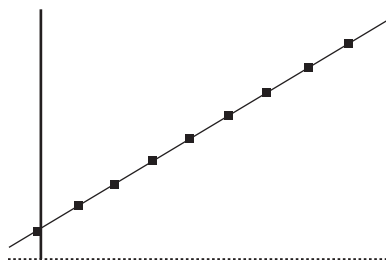| Year	1960	1965	1970	1975	1980	1985	1990	1995	2000
Population (millions)	3,039	3,345	3,707	4,086	4,454	4,851	5,279	5,688	6,083

Solution

Let $t = 0$ represent 1960. Use the graphing calculator's table feature to enter the year t in the first column and the population P in the second column. Then graph the data. The following scatter plot shows the data.
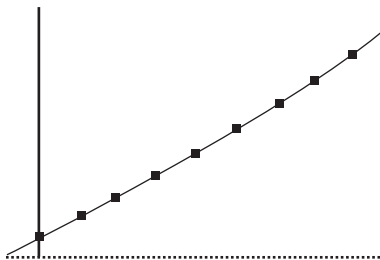

Visually, the plot appears to be linear, although you can detect a slight curvature. Using the graphing calculator's regression capabilities, fit three different models to the data: a linear model, a quadratic model, and an exponential model.
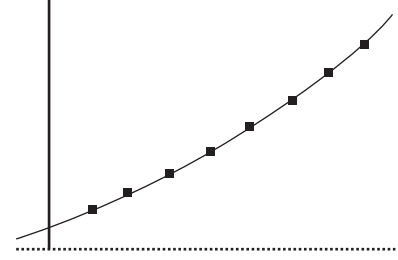
Linear model

$P = 77.05t + 2{,}963$

Quadratic model

$P = 0.25t^2 + 67.1t + 3{,}021$

Exponential model

$P = 3{,}095 + 0.018^t$

Visually, all three models appear to be reasonable *fits* over the given domain. There are other measures of goodness-of-fit besides visual inspection, which you may study in future mathematics classes. To decide which model to use, you need to consider the context of the problem, especially if the model is going to be used to extrapolate for years outside the given domain.

Exercises

1. Use the three models from the example to determine the world population in 1950. The actual world population in 1950 was 2,556,000,053. Which model's value comes closest to the actual value?

2. Use the three models from the example to predict the world population in 2020. The U.S. Bureau of the Census predicts that the world population in 2020 will be 7,584,821,144. Which model's value comes closest to this prediction?