Chapter 9 – Finding Equations of Linear Models
Section 2 – Using Two Points to Find an Equation of a Linear Model

Objectives
1. Use two points to find an equation of a linear model.

Lesson/Activity
OBJECTIVE 1 − Use two points to find an equation of a linear model.
1. Let **A** be the annual U.S. consumption (in billions of pounds) of avocados at **t** years since 2000. Find an equation of a linear model to describe the data in the following table.

Year	Consumption (billions of pounds)
2003	0.7
2005	0.9
2007	1.1
2009	1.2
2011	1.2
2012	1.6

Source: California Avocado Commission

It is a common error to skip constructing a scatterplot when we find an equation of a model.

Finding an Equation of a Linear Model

To find an equation of a linear model, given some data,
1. Construct a scatterplot of the data.
2. Determine whether there is a line that comes close to the data points. If so, choose two points (not necessarily data points) that you can use to find an equation of a linear model.
3. Find an equation of the line.
4. Use technology to verify that the graph of your equation contains the two chosen points and comes close to all the data points of the scatterplot.

2. The number of new-car dealerships are shown in the following table for various years. Let **n** be the number (in thousands) of new-car dealerships at **t** years since 1900.

Year	Number of New-Car Dealerships (thousands)
1990	24.8
1995	22.8
2000	22.3
2005	21.6
2010	18.5
2011	17.7

Source: NADA Industry Analysis Division

a. Construct a scatterplot.
b. Describe the four characteristics of the association. Compute and interpret r as part of your analysis.
c. Find an equation of a linear model to describe the data.
d. Rewrite the equation with the function name f.
e. Find f(108). What does it mean in this situation?

3. Researchers compared the mean sulfur dioxide concentrations (air pollution) and the mean deterioration rates of marble tombstones in 21 U.S. cities for the period 1893–1993 (see the following table). A microgram (g) is equal to 0.000001 gram.

Mean Sulfur Dioxide Concentration ($\mu g/m^3$)	Mean Tombstone Deterioration Rate (mm per century)	Mean Sulfur Dioxide Concentration ($\mu g/m^3$)	Mean Tombstone Deterioration Rate (mm per century)
180	1.53	239	2.51
12	0.27	48	0.84
197	2.71	94	1.21
142	1.01	102	1.09
234	1.61	142	1.90
117	1.72	91	1.78
20	0.14	178	1.98
323	3.16	20	0.33
122	1.18	224	2.41
244	2.15	92	1.08
46	0.81		

Source: Marble Tombstone Weathering and Air Pollution in North America, T.C. Meierding

Let **s** be the mean sulfur dioxide concentration (in $\mu g/m^3$) and **d** be the mean deterioration rate (in mm per century) of marble tombstones, both for the same city.

a. Describe the four characteristics of the association.
Compute and interpret **r** as part of your analysis.

b. Find an equation of a model to describe the situation.

c. Estimate the mean deterioration rate of marble tombstones during the period 1893–1993 in a city where the mean sulfur dioxide concentration was 150 g/m3) for that period.

d. A city's mean deterioration of marble tombstones for the period 1893–1993 is 2 mm. Estimate the city's mean sulfur dioxide concentration for that period.

e. Because the association is strong, a student concludes that air pollution causes tombstone deterioration. What would you tell the student?

Homework/Assessment
1, 3, 7, 9, 11, 17, 21, 25, 27, 29, 31, 33