**2-5 Study Guide and Intervention**

***Scatter Plots and Lines of Regression***

**Scatter Plots and Prediction Equations** A set of data points graphed as ordered pairs in a coordinate plane is called a **scatter plot**. A scatter plot can be used to determine if there is a relationship among the data. A **line of fit** is a line that closely approximates a set of data graphed in a scatter plot. The equation of a line of fit is called a **prediction equation** because it can be used to predict values not given in the data set.

**Example: STORAGE COSTS According to a certain prediction equation, the cost of 200 square feet of storage space is $60. The cost of 325 square feet of storage space is $160.**

**a. Find the slope of the prediction equation. What does it represent?**

Since the cost depends upon the square footage, let *x* represent the amount of storage space in square feet and *y* represent the cost in dollars. The slope can be found using the formula *m* = $\frac{y\_{2} - y\_{1}}{x\_{2} - x\_{1}}$. So, *m* = $\frac{160 - 60}{325 - 200}$ = $\frac{100}{125}$ = 0.8

The slope of the prediction equation is 0.8. This means that the price of storage increases 80¢ for each one-square-foot increase in storage space.

**b. Find a prediction equation.**

Using the slope and one of the points on the line, you can use the point-slope form to find a prediction equation.

 *y* – $y\_{1}$ = *m*(*x* – $x\_{1}$) Point-slope form

 *y* – 60 = 0.8(*x* – 200) ($x\_{1}$, $y\_{1}$) = (200, 60), *m* = 0.8

 *y* – 60 = 0.8*x* – 160 Distributive Property

 *y* = 0.8*x* – 100 Add 60 to both sides.

A prediction equation is *y* = 0.8*x* – 100.

**Exercises**

 **1. SALARIES** The table below shows the years of experience for eight technicians at Lewis Techomatic and the hourly rate of pay each technician earns.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Experience (years)** | 9 | 4 | 3 | 1 | 10 | 6 | 12 | 8 |
| **Hourly Rate of Pay** | $17 | $10 | $10 | $7 | $19 | $12 | $20 | $15 |

** a.** Draw a scatter plot to show how years of experience are related to hourly

 rate of pay. Draw a line of fit and describe the correlation.

 **b.** Write a prediction equation to show how years of experience (*x*) are

related to hourly rate of pay (*y*).

 **c.** Use the function to predict the hourly rate of pay for 15 years of experience.

**2-5 Study Guide and Intervention** *(continued)*

***Scatter Plots and Lines of Regression***

**Lines of Regression** Another method for writing a line of fit is to use a line of regression. A **regression line** is determined through complex calculations to ensure that the distance of all the data points to the line of fit are at the minimum.

**Example: WORLD POPULATION The following table gives the United Nations estimates of the world population (in billions) every five years from 1980-2005. Find the equation and graph the line of regression. Then predict the population in 2010.**

|  |  |
| --- | --- |
| **Year** | **Population (billions)** |
| 1980 | 4.451 |
| 1985 | 4.855 |
| 1990 | 5.295 |
| 1995 | 5.719 |
| 2000 | 6.124 |
| 2005 | 6.515 |
| 2010 | ? |

**
Source:** UN 2006 Revisions Population database

**Step 1** Use your calculator to make a scatter plot.

**Step 2** Find the equation of the line of regression. The equation is about *y* = 0.083*x* – 160.180.

**Step 3** Graph the regression equation.

**Step 4** Predict using the function. In 2010 the population will be approximately 6.984 billion.

**Exercise**

 **1.** The table below shows the number of women who served in the United States Congress during the years 1995-2006. Find an equation for and graph a line of regression Then use the function to predict the number of women in Congress in the 112th Congressional Session.

|  |  |
| --- | --- |
| **Congressional Session** | **Number of Women** |
| 104 | 59 |
| 105 | 65 |
| 106 | 67 |
| 107 | 75 |
| 108 | 77 |
| 109 | 83 |

 **Source:** U. S. Senate