**Write Linear Functions that Provide a Reasonable fit to Data to Estimate Solutions and Make Predictions for Real-World Problems - A.4C**

**A. Calculating the Regression Equation**

* Recall that a **linear function** is a relationship with a constant rate of change represented by a graph that forms a straight line in which each element of the input (*x*) is paired with exactly one element of the output (*y*). It can be used to make predictions about the data set.
* A **scatter plot** is:
* A graph that relates two different sets of data by displaying them as ordered pairs.
* Most scatter plots are located in the first quadrant of the coordinate plane because the data are usually positive numbers.
* Scatter plots can be used to find trends in data.
* A **trend line** is a line on a scatter plot, drawn near points, that shows a correlation.
* A **line of best fit** is a trend line that shows the relationship between two sets of data most accurately.
* **Regression equation** is an equation of the line of best fit representing a set of bivariate data. It is usually written in the form *y* = *mx* + *b*.
* The correlation coefficient (*r*-value) is used as an indicator of the reliability of the regression equation.

 Example 1: For an experiment called “That’s the Way It Rolls”, students rolled a ball down

 an incline of varying heights and measured the distance it traveled from the bottom of the

 incline. The following data was collected:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Height of****Incline (cm)** | 5 | 10 | 15 | 20 | 25 |
| **Distance****Traveled from Bottom of****Incline (cm)** | 25 | 40 | 75 | 88 | 117 |

 a. Create a scatter plot and find the correlation coefficient. Then describe the correlation.

 b. Determine the regression equation for the line of best fit.

 c. What distance would the ball have traveled if the height of the incline was 30 cm?

 d. If the ball traveled 120 cm from the bottom of the incline, what was the height of the

 incline?

2. The table below shows the attendance at various Theme Parks in the US by year.

**Attendance at U.S. Theme Parks**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | 1990 | 1992 | 1994 | 1996 | 1998 | 2000 | 2002 | 2004 | 2006 |
| **Attendance (millions)** | 253 | 267 | 267 | 290 | 300 | 317 | 324 | 328 | 335 |

 a. Create a scatter plot and find the correlation coefficient. Then describe the correlation.

 b. Determine the regression equation of the line of best fit.

 c. Estimate the attendance at U.S. theme parks in 2005.

3. The table below shows the movie tickets sold in the US by year.

**Movie Tickets Sold in U.S. by Year**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Tickets Sold (millions)** | 1289 | 1311 | 1340 | 1339 | 1406 | 1421 | 1470 | 1415 | 1472 | 1470 |

 a. Create a scatter plot and find the correlation coefficient. Then describe the correlation.

 b. Determine the regression equation for the line of best fit.

 c. Predict the number of movie tickets sold in the U.S. in 2014

4. The table below shows the height and arm span of the RYSS football team players.

**Height and Arm Span**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Height (m)** | 1.5 | 1.8 | 1.7 | 2.0 | 1.7 | 2.1 |
| **Arm Span (m)** | 1.4 | 1.7 | 1.7 | 1.9 | 1.6 | 2.0 |

 a. Create a scatter plot and find the correlation coefficient. Then describe the correlation.

 b. Determine the regression equation of the line of best fit.

 c. Estimate the arm span of someone who is 1.6 m tall.

 d. Predict the arm span of someone who is 2.2 m tall.

5. Students measured the diameters and circumferences of the tops of a variety of cylinders.

 The table below outlines the data they collected.

**Cylinder Tops**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Diameter (cm)** | 3 | 3 | 5 | 6 | 8 | 8 | 9.5 | 10 | 10 | 12 |
| **Circumference (cm)** | 9.3 | 9.5 | 16 | 18.8 | 25 | 25.6 | 29.5 | 31.5 | 30.9 | 39.5 |

 a. Create a scatter plot and find the correlation coefficient. Then describe the correlation.

 b. Determine the regression equation of the line of best fit.

 c. Estimate the diameter of a cylinder with circumference of 22 cm.