CHAPTER 2 REVIEW

Key Terms

correlation coefficient a value, r, between -1 and 1 that indicates the degree of linear correlation of variables, or how closely a regression line fits a data set.

decreasing linear function a function with a negative slope: If $f(x) = mx + b$, then $m < 0$.

extrapolation predicting a value outside the domain and range of the data

horizontal line a line defined by $f(x) = b$, where b is a real number. The slope of a horizontal line is 0.

increasing linear function a function with a positive slope: If $f(x) = mx + b$, then $m > 0$.

interpolation predicting a value inside the domain and range of the data

least squares regression a statistical technique for fitting a line to data in a way that minimizes the differences between the line and data values

linear function a function with a constant rate of change that is a polynomial of degree 1, and whose graph is a straight line

model breakdown when a model no longer applies after a certain point

parallel lines two or more lines with the same slope

perpendicular lines two lines that intersect at right angles and have slopes that are negative reciprocals of each other

point-slope form the equation for a line that represents a linear function of the form $y - y_1 = m(x - x_1)$

slope the ratio of the change in output values to the change in input values; a measure of the steepness of a line

slope-intercept form the equation for a line that represents a linear function in the form $f(x) = mx + b$

vertical line a line defined by $x = a$, where a is a real number. The slope of a vertical line is undefined.

***x*-intercept** the point on the graph of a linear function when the output value is 0; the point at which the graph crosses the horizontal axis

***y*-intercept** the value of a function when the input value is zero; also known as initial value

Key Equations

slope-intercept form of a line $f(x) = mx + b$

slope $m = \dfrac{\text{change in output (rise)}}{\text{change in input (run)}} = \dfrac{\Delta y}{\Delta x} = \dfrac{y_2 - y_1}{x_2 - x_1}$

point-slope form of a line $y - y_1 = m(x - x_1)$

Key Concepts

2.1 Linear Functions

- The ordered pairs given by a linear function represent points on a line.
- Linear functions can be represented in words, function notation, tabular form, and graphical form. See **Example 1**.
- The rate of change of a linear function is also known as the slope.
- An equation in the slope-intercept form of a line includes the slope and the initial value of the function.
- The initial value, or y-intercept, is the output value when the input of a linear function is zero. It is the y-value of the point at which the line crosses the y-axis.
- An increasing linear function results in a graph that slants upward from left to right and has a positive slope.
- A decreasing linear function results in a graph that slants downward from left to right and has a negative slope.
- A constant linear function results in a graph that is a horizontal line.

- Analyzing the slope within the context of a problem indicates whether a linear function is increasing, decreasing, or constant. See **Example 2**.
- The slope of a linear function can be calculated by dividing the difference between y-values by the difference in corresponding x-values of any two points on the line. See **Example 3** and **Example 4**.
- The slope and initial value can be determined given a graph or any two points on the line.
- One type of function notation is the slope-intercept form of an equation.
- The point-slope form is useful for finding a linear equation when given the slope of a line and one point. See **Example 5**.
- The point-slope form is also convenient for finding a linear equation when given two points through which a line passes. See **Example 6**.
- The equation for a linear function can be written if the slope m and initial value b are known. See **Example 7**, **Example 8**, and **Example 9**.
- A linear function can be used to solve real-world problems. See **Example 10** and **Example 11**.
- A linear function can be written from tabular form. See **Example 12**.

2.2 Graphs of Linear Functions

- Linear functions may be graphed by plotting points or by using the y-intercept and slope. See **Example 1** and **Example 2**.
- Graphs of linear functions may be transformed by using shifts up, down, left, or right, as well as through stretches, compressions, and reflections. See **Example 3**.
- The y-intercept and slope of a line may be used to write the equation of a line.
- The x-intercept is the point at which the graph of a linear function crosses the x-axis. See **Example 4** and **Example 5**.
- Horizontal lines are written in the form, $f(x) = b$. See **Example 6**.
- Vertical lines are written in the form, $x = b$. See **Example 7**.
- Parallel lines have the same slope.
- Perpendicular lines have negative reciprocal slopes, assuming neither is vertical. See **Example 8**.
- A line parallel to another line, passing through a given point, may be found by substituting the slope value of the line and the x- and y-values of the given point into the equation, $f(x) = mx + b$, and using the b that results. Similarly, the point-slope form of an equation can also be used. See **Example 9**.
- A line perpendicular to another line, passing through a given point, may be found in the same manner, with the exception of using the negative reciprocal slope. See **Example 10** and **Example 11**.
- A system of linear equations may be solved setting the two equations equal to one another and solving for x. The y-value may be found by evaluating either one of the original equations using this x-value.
- A system of linear equations may also be solved by finding the point of intersection on a graph. See **Example 12** and **Example 13**.

2.3 Modeling with Linear Functions

- We can use the same problem strategies that we would use for any type of function.
- When modeling and solving a problem, identify the variables and look for key values, including the slope and y-intercept. See **Example 1**.
- Draw a diagram, where appropriate. See **Example 2** and **Example 3**.

- Check for reasonableness of the answer.
- Linear models may be built by identifying or calculating the slope and using the y-intercept.
- The x-intercept may be found by setting $y = 0$, which is setting the expression $mx + b$ equal to 0.
- The point of intersection of a system of linear equations is the point where the x- and y-values are the same. See **Example 4**.
- A graph of the system may be used to identify the points where one line falls below (or above) the other line.

2.4 Fitting Linear Models to Data

- Scatter plots show the relationship between two sets of data. See **Example 1**.
- Scatter plots may represent linear or non-linear models.
- The line of best fit may be estimated or calculated, using a calculator or statistical software. See **Example 2**.
- Interpolation can be used to predict values inside the domain and range of the data, whereas extrapolation can be used to predict values outside the domain and range of the data. See **Example 3**.
- The correlation coefficient, r, indicates the degree of linear relationship between data. See **Example 5**.
- A regression line best fits the data. See **Example 6**.
- The least squares regression line is found by minimizing the squares of the distances of points from a line passing through the data and may be used to make predictions regarding either of the variables. See **Example 4**.