Solution

The estimated linear model is given by the following equation.

$$\hat{y} = -7.647 + 0.431x$$

If the value of the independent variable "x" is increased by one unit, we have

$$\begin{aligned}\hat{y} &= -7.647 + 0.431(x+1)\\ &= 7.647 + 0.431x + 0.431\\ &= \text{Previous value of } \hat{y} + 0.431\end{aligned}$$

Thus, the value of $\hat{y}$ is increased by 0.431, the value of the slope, when x is increased by one unit.

12.R.3 Exercises

Practice

Find the slope of the line determined by each pair of points.

1. $(1,-2);(1,4)$

2. $(-3,7);(4,-1)$

Determine whether the equation $x = -3$ represents a horizontal line or a vertical line and give its slope.

3. $x = -3$

Write each equation in slope-intercept form. Find the slope and y-intercept, and then use them to draw the graph.

4. $y = 2x - 1$

5. $3y - 9 = 0$

Find an equation in slope-intercept form for the line passing through (0,3) with the slope $m = -\frac{1}{2}$.

6. $(0,3)$; $m = -\frac{1}{2}$

Applications

Solve.

7. ***Purchases:*** John bought his new car for $35,000 in the year 2014. He knows that the value of his car has depreciated linearly. If the value of the car in 2017 was $23,000, what was the annual rate of depreciation of his car? Show this information on a graph. (When graphing, use years as the *x*-coordinates and the corresponding values of the car as the *y*-coordinates.)

8. ***Cell Phones:*** The number of people in the United States with mobile cellular phones was about 198 million in 2011 and about 232 million in 2016. If the growth in the usage of mobile cellular phones was linear, what was the approximate rate of growth per year from 2011 to 2016. Show this information on a graph. (When graphing, use years as the *x*-coordinates and the corresponding numbers of users as the *y*-coordinates.)[1]

1 Source: https://www.statista.com/statistics/231612/number-of-cell-phone-users-usa/

9. ***Test Scores:*** The least squares regression line for a data set representing students' scores on a state achievement test based on the number of hours they spent playing video games, x, during the two weeks before the test is shown below.

$$\hat{y} = 243 - 11x$$

Using that model:

a. What would be the effect on a student's test score if they played 1 additional hour of video games?

b. Interpret the value of the y-intercept.

10. ***Thread Count:*** The least squares regression line for a data set representing the price of bedsheets in dollars based on the thread count of the sheets in hundreds.

$$\hat{y} = 2 + 10x$$

Using that model:

a. What would be the effect on the price of the bedsheets for each additional 100 thread count?

b. Interpret the value of the y-intercept.

Writing & Thinking

11. a. Explain in your own words why the slope of a horizontal line must be 0.

b. Explain in your own words why the slope of a vertical line must be undefined.