

Chapter 6

For each example:

1. Identify the explanatory and response variables.
 2. Which variable should be on the horizontal axis?
 3. Do you think the association is positive or negative? Why?
5. Let n be the number of hours a student studies for a quiz, and let s be the student's score (in points) on the quiz.
 6. Let n be the number of office parties an employer hosts per year, and let p be the percentage of employees who say they enjoy working at the company.
 7. Let h be the height (in inches) of a girl, and let a be the age (in years) of the girl.
 8. Let p be the percentage of colleges that would accept a student whose grade point average (GPA) is G points.

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1. If the points of a scatterplot lie close to (or on) a line, we say there is a(n) ____ association.
2. If r is positive, then there is a(n) ____ association.
3. If $r =$ ____, the points lie exactly on a line and the association is negative.
4. *True or False:* A strong association between two variables means that a change in the explanatory variable will cause a change in the response variable.

Chapter 6

For each example:

1. Identify the explanatory and response variables.
2. Which variable should be on the horizontal axis?
3. Do you think the association is positive or negative? Why?

- 13.** Let T be the increase in height (in feet) of a tree one year after n experimental fertilizer stakes were driven into the ground 10 feet from the tree's trunk.
- 14.** A person cooks a potato in an oven for an hour and then removes the potato and allows it to cool. Let t be the number of minutes since the potato was removed from the oven, and let F be the temperature (in degrees Fahrenheit) of the potato.
- 15.** Let t be the number of seconds after a baseball is hit upward, and let h be the baseball's height (in feet).
- 16.** Let p be the percentage of people at age a years who own a computer.

Chapter 6

For each example:

1. Identify the explanatory and response variables.
2. Write the numbers in the example as an ordered pair (in the correct order)!
3. Do you think the association is positive or negative? Why?

17. Let T be the total number of T-shirts (in thousands) a hip-hop group sells at C concerts per year. A group sells a total of 29.4 thousand T-shirts at 98 concerts in a year.

18. Let p be the asking price (in thousands of dollars) of a home with b bedrooms. The asking price of a 3-bedroom home is \$152 thousand.

19. Let B be the bonus (in thousands of dollars) a car dealership pays a salesperson if the salesperson makes a quota of selling at least 15 cars in a month, and let n be the number of salespeople who make the quota. A dealership offers a bonus of \$3 thousand for making the quota, and 4 salespeople make the quota.

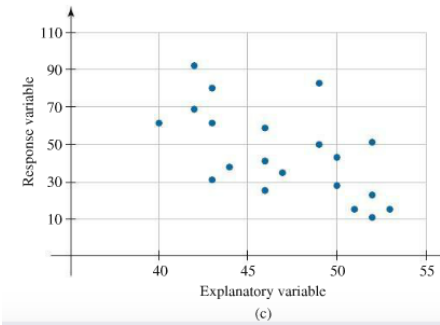
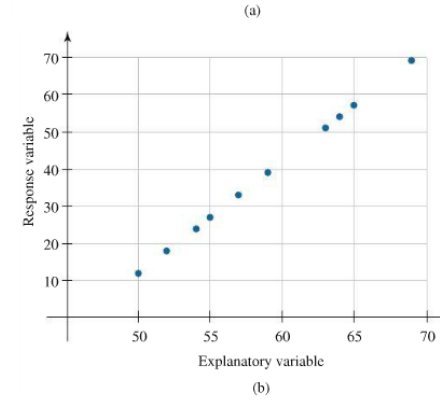
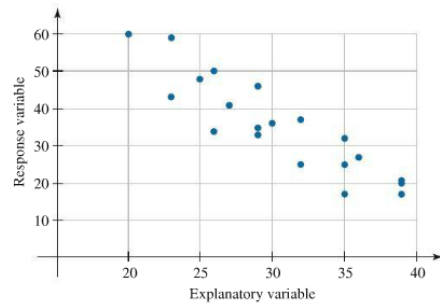
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For Exercises 10–12, match the given information to the appropriate scatterplot in Fig. 100.

10. $r = -0.6$

11. $r = -0.9$

12. $r = 1$



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- 23.** Let p be the number of ounces of a new protein shake a weight lifter drinks daily for six months, and let n be the number of times the weight lifter can bench-press 200 pounds after those six months. What does the ordered pair $(16, 8)$ mean in this situation?
- 24.** Let s be the mean number of times a television salesperson compliments customers per day, and let c be the mean number of televisions the salesperson sells per month. What does the ordered pair $(72, 39)$ mean in this situation?
- 25.** Let p be the percentage of Americans at age A years who say they volunteer. What does the ordered pair $(21, 38)$ mean in this situation?

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38. The scatterplot in Fig. 19 compares the temperatures and relative humidities in Atlanta, Georgia, for every hour, from 12:52 A.M. to 11:52 P.M. on June 1, 2014.

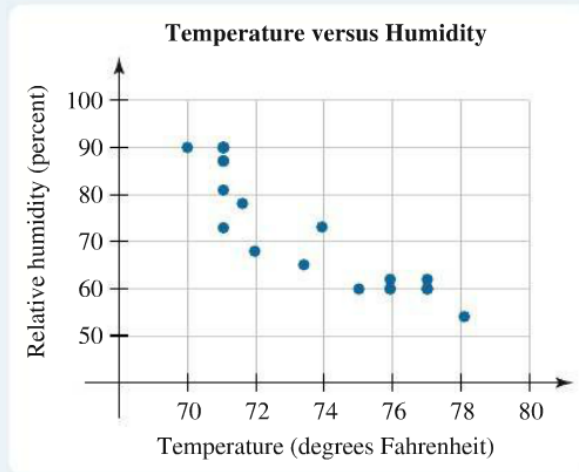


Figure 19 Exercise 38

(Source: Weatherbase)

- There were 24 pairs of temperatures and relative humidities recorded. Why are there only 15 dots in the scatterplot?
- Identify the explanatory and response variables.
- Is the association positive, negative, or neither? What does that mean in this situation?
- On the basis of the scatterplot, a student concludes that the relative humidity generally decreased throughout the day. What would you tell the student?
- The temperature decreased from 12:52 A.M. to 4:53 A.M. Did the humidity generally increase or decrease in that period? Explain.

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46.  The mean hourly manufacturing pay is shown in Table 15 for various years.

Table 15 Mean Hourly Manufacturing Pay

Year	Mean Hourly Pay (dollars)
1970	3.24
1980	7.15
1990	10.78
2000	14.32
2010	18.61
2015	19.71

Source: *Bureau of Labor Statistics*

Let p be the mean hourly manufacturing pay (in dollars) at t years since 1970.

- Construct a scatterplot.
- Is the association positive, negative, or neither? What does that mean in this situation?
- Estimate the *annual* pay for a specific employee who worked 40 hours per week for 50 weeks in 2010 at a car plant. Give at least two reasons why your estimate may be in error.
- The mean price of all goods and services increased by a factor of 6.05 from 1970 to 2010 (Source: *Bureau of Labor Statistics*). Did the mean hourly manufacturing pay fall behind, approximately keep up with, or grow faster than the increase in the mean price of goods and services for that period? Explain.

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27.  A study was based on the records of 6789 patients in 369 hospitals in which the patients' hearts stopped because of conditions that could have been reversed by an electrical shock from a defibrillator. The percentages of patients who survived at least until being discharged from the hospital are shown in Table 27 for various delays in the hospital staff giving the shock.

Table 27 Delays in Using Defibrillator versus Percentages of Patients Who Survived

Delay (minutes)	Percent
1	39
2	38
3	34
4	23
5	25
6	18
7	14

Source: *New England Journal of Medicine*

Let p be the percentage of patients who survived a delay of d minutes before receiving treatment from a defibrillator.

- Construct a scatterplot.
- Is there a linear association, a nonlinear association, or no association?
- Compute r . On the basis of the scatterplot and r , describe the strength of the association.
- Expert guidelines say the shock should be given within 2 minutes after the heart stops. Explain why this cutoff makes sense.

Chapter 6


49.  Several inventions are listed in Table 18, along with the years they were invented and how long it took for one-quarter of the U.S. population to use them (“mass use”).

Table 18 Number of Years until Inventions Reached Mass Use

Invention	Year Invented	Years until Mass Use
Electricity	1873	46
Telephone	1876	35
Gasoline-Powered Automobile	1886	55
Radio	1897	31
Television	1923	29
Microwave Oven	1953	36
VCR	1965	13
Personal Computer	1975	16
Mobile Phone	1985	11
CD Player	1985	8
World Wide Web	1991	7
DVD Player	1997	5

Source: *Newsweek*

Let M be the number of years elapsed until an invention reached mass use if it was invented at t years since 1870.

- Construct a scatterplot.
- Is the association positive, negative, or neither? What does that mean in this situation? In your opinion, why does that make sense?
- Does the point for the microwave oven fit the overall pattern you described in part (b)? Explain.
- For a while after the microwave oven was invented, many people feared it would cause radiation poisoning, blindness, or impotence. Discuss the impact of these fears in terms of your response to part (c).
- Explain why the point for the gasoline-powered automobile does not fit the overall pattern you described in part (b). Why do you think this happened? We say that the point is an *outlier*.

Chapter 6


28.  The probability that a randomly selected newborn is a boy is actually more than $\frac{1}{2}$. The number of newborn boys for every 100 newborn girls is called the *sex ratio at birth*. The *birth order* of a first child is 1, the birth order of a second child is 2, and so on. The sex ratios at birth are shown in Table 28 for various birth orders.

Table 28 Birth Orders versus Sex Ratios at Birth

Birth Order	Sex Ratio at Birth
1	105.8
2	105.1
3	104.8
4	104.4
5	104.0
6	103.4

Source: *U.S. Centers for Disease Control and Prevention*

Let r be the sex ratio at birth for newborns whose birth order is n .

- Construct a scatterplot.
- Is there a linear association, a nonlinear association, or no association?
- Compute r . On the basis of the scatterplot and r , determine the strength of the association.
- Find the *probability* that a randomly selected firstborn is a boy.
- China limits the number of babies a couple can have to one or two babies. Chinese parents tend to want to have boys rather than girls (Source: *NBC News*). The sex ratio at birth in China in 2010 was 120 (Source: *United Nations*). Give a possible reason why the sex ratio at birth might have been so high.

Section 6.3

For Exercises 5–10, refer to Fig. 93.

5. Find y when $x = 4$.
6. Find y when $x = 2$.
7. Find x when $y = 1$.
8. Find x when $y = 5$.
9. What is the x -intercept of the line?
10. What is the y -intercept of the line?

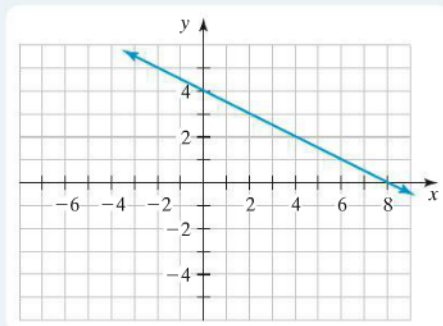


Figure 93 Exercises 5–10

For Exercises 11–16, refer to Fig. 94.

11. Find y when $x = -3$.
12. Find y when $x = -6$.
13. Find x when $y = 1$.
14. Find x when $y = 0$.
15. What is the y -intercept of the line?
16. What is the x -intercept of the line?

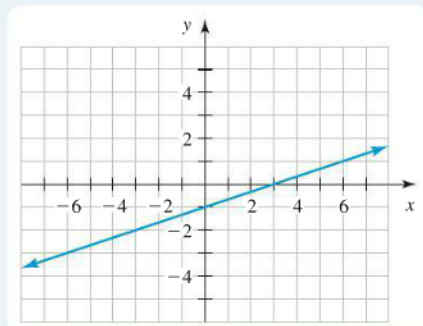


Figure 94 Exercises 11–16

Section 6.3 -

18. Some ordered pairs are listed in Table 47.

Table 47 Some Ordered Pairs

x	y
2	4
3	6
5	6
7	11
10	13

- Construct a scatterplot by hand.
 - Is there a linear association, a nonlinear association, or no association?
 - Draw a line that comes close to the points in your scatterplot.
 - Which point on your line has x -coordinate 6?
 - Which point on your line has y -coordinate 12?
19. Some ordered pairs are listed in Table 48.

Table 48 Some Ordered Pairs

x	y
-8	-5
-5	-3
-2	4
1	5
3	9

- Construct a scatterplot by hand.
- Is there a linear association, a nonlinear association, or no association?
- Draw a line that comes close to the points in your scatterplot.
- What is the x -intercept of your line?
- What is the y -intercept of your line?

Section 6.3

21. Let n be the number (in thousands) of ride-related injuries at fixed-site amusement parks in the year that is t years since 2000. A scatterplot of some data and a linear model are sketched in Fig. 95.

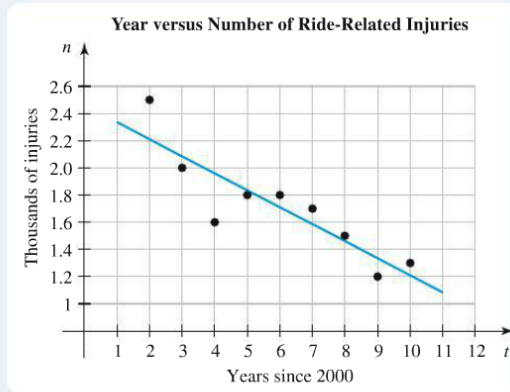


Figure 95 Exercises 21 and 22

(Source: National Safety Council)

- a. Use the linear model to estimate the number of ride-related injuries in 2004.
- b. What was the actual number of ride-related injuries in 2004?
- c. Is your result in part (a) an underestimate or an overestimate? Explain how you can tell this from the graph of the scatterplot and the sketch of the model. Calculate the error in the estimate.
22. Refer to Exercise 21, including Fig. 95.
- a. Use the linear model to estimate the number of ride-related injuries in 2002.
- b. What was the actual number of ride-related injuries in 2002?
- c. Is your result in part (a) an underestimate or an overestimate? Explain how you can tell this from the graph of the scatterplot and the sketch of the model. Calculate the error in the estimate.

Section 7.1

Find the y -intercept. Also, graph the equation by hand.

9. $y = x + 2$

10. $y = x + 4$

11. $y = x - 4$

12. $y = x - 6$

13. $y = 2x$

14. $y = 5x$

15. $y = -3x$

16. $y = -4x$

17. $y = x$

18. $y = -x$

19. $y = \frac{1}{3}x$

20. $y = \frac{1}{2}x$

Section 7.1

Find the y -intercept and graph:

21. $y = -\frac{5}{3}x$

22. $y = -\frac{3}{2}x$

23. $y = 2x + 1$

24. $y = 3x + 2$

25. $y = 5x - 3$

26. $y = 4x - 1$

27. $y = -3x + 5$

28. $y = -2x + 4$

29. $y = -2x - 3$

Section 7.1

57. The graph of an equation is sketched in Fig. 21. Create a table of ordered-pair solutions of this equation. Include at least five ordered pairs.

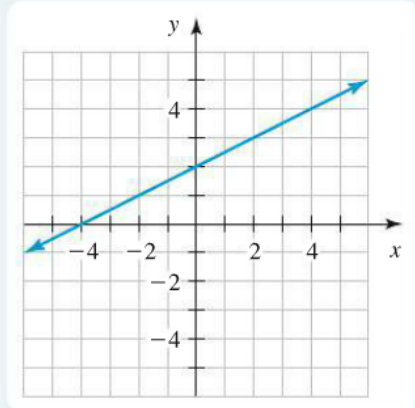


Figure 21
Exercise 57

58. The graph of an equation is sketched in Fig. 22. Create a table of ordered-pair solutions of this equation. Your table should contain at least five ordered pairs.

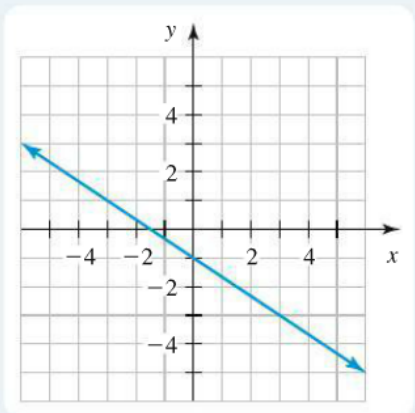


Figure 22
Exercise 58

Section 7.1

For Exercises 59–66, refer to the graph sketched in Fig. 23.

59. Find y when $x = -4$.

60. Find y when $x = 0$.

61. Find y when $x = 2$.

62. Find y when $x = -2$.

63. Find x when $y = -1$.

64. Find x when $y = 0$.

65. Find x when $y = 2$.

66. Find x when $y = 3$.

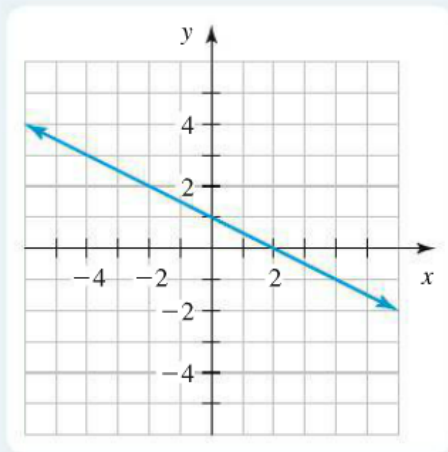


Figure 23 Exercises 59–66

Section 7.2

14. The percentage of Americans who say they or their spouses have saved money for retirement decreased approximately steadily from 75% in 2009 to 66% in 2012 (Source: *Employee Benefit Research Institute*). Find the approximate rate of change of this percentage.
15. For the fall semester 2014, in-district students at Triton College paid \$972 for 9 hours (units) of classes and \$1296 for 12 hours of classes (Source: *Triton College*). Find the rate of change of the total cost of classes with respect to the number of hours of classes.
16. In Manhattan, the mean price of a two-bedroom house is \$1,694,547, and that of a four-bedroom house is \$6,315,496 (Source: *Trulia*). Find the approximate rate of change of mean price with respect to the number of bedrooms.

Section 7.2

18. For 29 pizzas made by six of the leading pizza companies, there are 246 calories in a pizza with 28 carbohydrates and there are 549 calories in a pizza with 64 carbohydrates (Source: *Domino's, Little Caesar's, Papa John's, Pizza Hut, DiGiorno Frozen, Kashi Frozen*). Find the approximate rate of change of the number of calories with respect to the number of carbohydrates.
19. In order for a family living in New York to qualify for the health insurance program Family Health Plus, the family's annual income must be less than a maximum level. In 2012, the maximum income level of a three-person family was \$28,635 and the maximum income level of a seven-person family was \$52,395 (Source: *New York State Department of Health*). Find the approximate rate of change of maximum income level with respect to family size.
20. A person stacks some cups of uniform shape and size (one placed inside the next). The height of 3 stacked cups is 17.5 centimeters and of 5 stacked cups is 23.0 centimeters. Find the rate of change of the height of the stacked cups with respect to the number of cups.

Section 7.2

31. The scatterplot and the model in Fig. 62 compare the maximum weights (in pounds) with the mean life expectancies (in years) for 16 dog breeds.

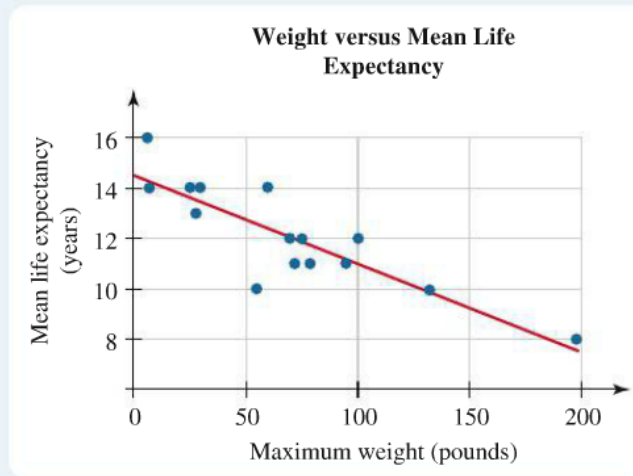


Figure 62 Exercise 31

(Source: *FindTheBest*)

- Is the association positive, negative, or neither? What does it mean in this situation?
- Estimate the slope of the model. What does it mean in this situation?
- If the mean weight of a dog breed is 40 pounds greater than the mean weight of another dog breed, estimate how much less the mean life expectancy is for the heavier dog breed than for the lighter dog breed.
- On the basis of the scatterplot, a student concludes that if a dog gains weight, the dog will not live as long. What would you tell the student?

Section 7.2

Problem number 92:

7.2 Rate of Change and Slope of a Line 461

- a. By hand, carefully sketch the lines that pass through the origin $(0, 0)$ and that have slopes 5, 1, and $\frac{1}{5}$.
- b. Sketch the lines that pass through the origin $(0, 0)$ and that have slopes $\frac{2}{5}$, 1, and $\frac{5}{2}$.
- c. Sketch the lines that pass through the origin $(0, 0)$ and that have slopes $\frac{3}{4}$, 1, and $\frac{4}{3}$.
- d. What pattern do you notice from your graphs in parts (a)–(c)?
- e. A line with slope m is sketched in Fig. 69. Sketch a line with slope $\frac{1}{m}$ that passes through the origin $(0, 0)$. Assume both axes are scaled the same.

Section 7.3

For Exercises 19–40, determine the slope and the y-intercept. Then use the slope and the y-intercept to graph the equation by hand.

- | | | |
|-----------------------------|----------------------------|-----------------------------|
| 19. $y = \frac{2}{3}x - 1$ | 20. $y = \frac{1}{5}x + 2$ | 21. $y = -\frac{1}{3}x + 4$ |
| 22. $y = -\frac{3}{2}x - 1$ | 23. $y = \frac{4}{3}x + 2$ | 24. $y = \frac{5}{2}x - 3$ |

Section 7.3

- 68.** For the 60 players picked in the 2014 draft for NBA basketball, let h be the height (in inches) of a player and let w be the weight (in pounds) of a player. For heights between 72 and 87 inches, inclusive, a reasonable model is $w = 6.54h - 301.81$ (Source: *nbadraft.net*).
- What is the slope? What does it mean in this situation?
 - What is the w -intercept? What does it mean in this situation?
 - Graph the model by hand.
 - Predict the weight of draft-pick Shabazz Napier, who is 6 feet tall.

Section 7.3

- 70.** As of February 1, a garage band knows 5 songs. Each week, the band members learn 2 more songs. Let n be the number of songs that the band knows at t weeks since February 1.
- Identify the explanatory and response variables.
 - Find the slope and the n -intercept of a linear model.
 - Find an equation of the model.
 - Graph the model by hand.
 - How many songs will the band know on March 22 (7 weeks after February 1)?