$$\begin{aligned}\hat{y} &= -0.084x + 8.722 \\ &= -0.084(64.1) + 8.722 \\ &= -5.3844 + 8.722 \\ &= 3.3376\end{aligned}$$

So, when a child's weight is 64.1 pounds, we can predict that his or her self-esteem score would be around 3.3.

Skill Check Answers

1. Answers will vary. Examples may include: The number of candy bars consumed daily and weight gain or the distance between two locations and the length of time it takes to drive between the two.

d. The weight of 45.0 pounds is outside of the range of the original data since it is smaller than any of the other data pieces, so it is not appropriate to use the regression line for prediction.

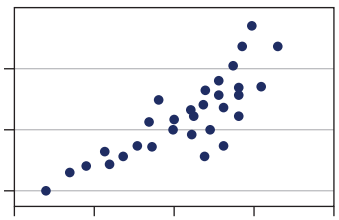
e. Once again it is not appropriate to use the regression line for predictions in this case. The study included only children between the ages of 9 and 11. A 13-year-old is not in the same population as the study and cannot be assumed to have the same characteristics.

2.5 EXERCISES

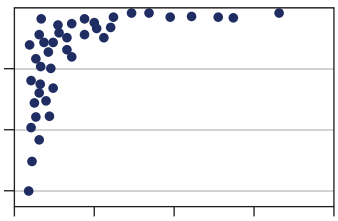
PRACTICE

In each scatter plot, determine whether there appears to be a positive linear correlation, a negative linear correlation, or no linear correlation.

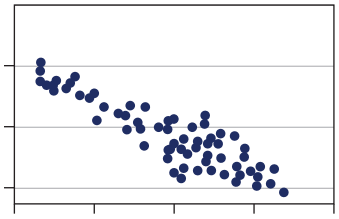
1.



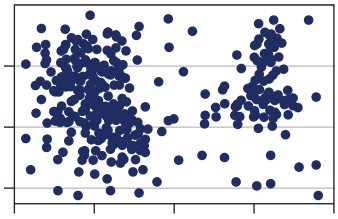
2.



3.



4.



Consider each set of variables and predict whether the variables would have a weak negative relationship, a strong negative relationship, a weak positive relationship, a strong positive relationship, or no relationship at all.

5. Body weight and hours of exercise per week

6. A person's height and their self-esteem

7. Vision ability and IQ

8. Number of hours spent studying for a test and the grade on the test

Determine whether each correlation coefficient is statistically significant at the specified level of significance for the given sample size.

9. $r = 0.703, \quad \alpha = 0.01, \quad n = 12$

10. $r = 0.403, \quad \alpha = 0.05, \quad n = 25$

11. $r = 0.378, \quad \alpha = 0.05, \quad n = 29$

12. $r = 0.809, \quad \alpha = 0.01, \quad n = 8$

Use the linear regression model $\hat{y} = ax + b$, to predict the y-value for each value of x.

13. $\hat{y} = 28.01x + 17.83$

a. $x = 21$

b. $x = 31$

c. $x = 40$

14. $\hat{y} = -16.5x + 230.55$

a. $x = 5$

b. $x = 13$

c. $x = 35$

APPLICATIONS

For each data set, find the following.

a. Estimate the correlation in words as positive, negative, or no correlation.

b. Calculate the correlation coefficient r. Round your answer to the nearest thousandth.

c. Determine whether r is statistically significant at the 0.01 level of significance.

15. The following table gives the number of hours a student watches TV per week and his or her overall GPA.

Hours of TV per Week and Overall GPA									
TV Hours	20	10	25	15	14	13	21	9	5
GPA	2.0	2.46	2.3	2.9	3.0	3.2	3.5	3.3	3.7

16. The following table gives a sample of annual income and number of years of education.

Annual Income and Years of Education						
Annual Income	$21,000	$39,000	$40,000	$39,500	$42,000	$55,500
Years of Education	12	12	14	16	16	16
Annual Income	$61,000	$45,000	$100,000	$142,000	$240,000	$205,000
Years of Education	17	16	16	20	22	21

17. The following table shows the diastolic blood pressure reading and the stress test score for 20 adults.

Diastolic Blood Pressure Reading and Stress Test Score			
Stress Test Score	**Diastolic Blood Pressure Reading**	**Stress Test Score**	**Diastolic Blood Pressure Reading**
51	67	78	79
59	66	79	83
62	71	83	81
63	76	84	83
64	73	88	85
68	77	87	90
71	77	89	82
70	76	91	80
72	80	90	86
82	82	90	88

18. The following table shows the heights of identical twins in centimeters.

Heights of Identical Twins	
Sibling 1	**Sibling 2**
110.5	109.5
116.6	115.6
122.6	121.6
128.2	127.4
133.5	133.5
138.8	140.2
145.0	146.7
152.3	151.9
159.6	155.0
165.1	156.6
168.3	157.1
169.9	157.6
170.7	158.0

Solve each problem.

19. The following table gives the data for the number of cigarettes women smoked in their third trimester of pregnancy and the number of nonviolent crime arrests for their male babies.

Number of Cigarettes and Number of Arrests for Sons										
# of Cigarettes	0	5	3	10	22	19	30	15	8	12
# of Arrests	1	4	0	5	9	12	10	0	4	9

a. Determine the regression line $\hat{y} = ax + b$. Round the slope and y-intercept to the nearest thousandth.
b. Determine if the regression equation is appropriate, at the 0.05 level of significance, to use for making predictions. If so, answer part **c.**
c. If a mother smokes eight cigarettes in her third trimester, make a prediction for the number of times her son will be arrested for a nonviolent crime, if appropriate.

20. The following table shows students' test grades on the first two tests in an introductory literature class.

Test Grades in Introductory Literature Class												
Test 1 (x)	61	45	71	81	89	55	84	91	95	59	77	88
Test 2 (y)	67	79	68	80	87	68	87	90	97	71	77	74

a. Determine the regression line $\hat{y} = ax + b$. Round the slope and y-intercept to the nearest thousandth.
b. Determine if the regression equation is appropriate, at the 0.05 level of significance, to use for making predictions. If so, answer part **c.**
c. If a student scored a 70 on his first test, make a prediction for his score on the second test, if appropriate.

21. The following table shows the results on evaluations measuring self-esteem and perceived family support from 10 adolescents.

Self-Esteem and Perceived Family Support Evaluation Results										
Self-Esteem	30	31	31	28	27	26	15	32	27	33
Family Support	13	13	19	21	8	4	10	12	7	17

a. Determine the regression line $\hat{y} = ax + b$. Round the slope and y-intercept to the nearest thousandth.
b. Determine if the regression equation is appropriate, at the 0.05 level of significance, to use for making predictions. If so, answer part **c.**
c. If an adolescent had a self-esteem score of 22, make a prediction for his perceived family support score, if appropriate.

22. A medical equipment company wishes to show that a new device works with the same degree of accuracy and precision as an earlier model to perform an electrocardiogram. One of the measurements tested was the change in radio electric waves during a cardiac cycle. The following results were collected from both healthy adults and those with cardiovascular problems.

Change in Radio Electric Waves during Cardiac Cycle	
# of 5 mm Squares between R Waves	
Old	**New**
2	2
3	3
4	4.5
3	3
6	6
4	4.5
3	3
5	5
3	3.5
2	2
6	6
4	4
6	6
5	5
3	3
2	2

a. Determine the regression line $\hat{y} = ax + b$. Round the slope and y-intercept to the nearest thousandth.

b. Determine if the regression equation is appropriate, at the 0.01 level of significance, to use for making predictions. If so, answer part **c.**

c. If the old machine had a reading of 5.5, make a prediction for the new machine reading, if appropriate.