12.3 Exercises

CONCEPT CHECK

1. A scatter plot is a graph that shows the _____ between two variables.

2. When data points in a scatter plot appear to follow an upward trend, there is a _____ linear correlation between the variables.

3. Once the relationship between two variables is determined to be statistically significant, a _____ can be fit to the data set to model the situation.

4. True or False: The Pearson correlation coefficient is always a positive value.

5. True or False: The level of confidence is the probability that assertions made about the data are incorrect.

PRACTICE

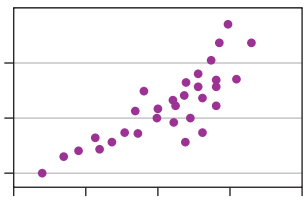
Use the linear regression model $\hat{y} = ax + b$ to predict the y-value for each value of x.

6. $\hat{y} = 28.01x + 17.83$
   - **a.** $x = 21$
   - **b.** $x = 31$
   - **c.** $x = 40$

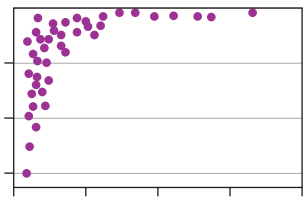
7. $\hat{y} = -16.5x + 230.55$
   - **a.** $x = 5$
   - **b.** $x = 13$
   - **c.** $x = 35$

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

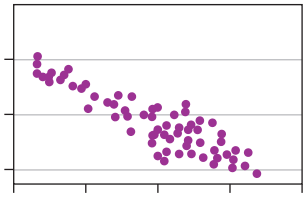
8.



9.



10.



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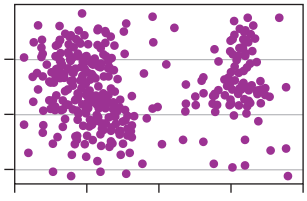
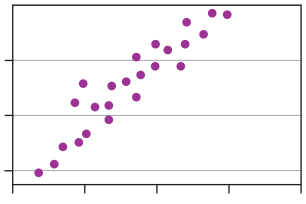
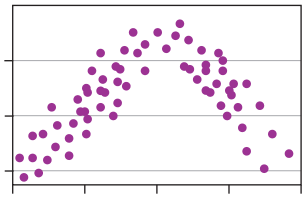


12.



13.



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.

14. Body weight and hours of exercise per week

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

16. Vision ability and IQ

17. 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.

18. $r = 0.703, \ \alpha = 0.01, \ n = 12$

19. $r = 0.403, \ \alpha = 0.05, \ n = 25$

20. $r = 0.378, \ \alpha = 0.05, \ n = 29$

21. $r = 0.809, \ \alpha = 0.01, \ n = 8$

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, if necessary.

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

22. 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

23. 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

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

Blood Pressure Reading and Stress Test Score

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

25. 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

APPLICATIONS

Use the provided table to create a scatter plot of the data. Remember to label both axes as well as the graph itself. Describe whether the scatter plot indicates there appears to be a positive linear correlation, negative linear correlation, or no correlation.

26. Allied Technologies is trying to determine how well the different locations are utilizing the TFS system to track their work. The following table shows the data collected regarding the number of employees and the approximate percentage of their workload that had been accounted for in TFS.

Sample of TFS Usage by Allied Technologies

Number of Employees	12	8	15	16	9	11	7	13
% of Workload Accounted for in TFS	76	64	85	88	67	73	61	79

27. A group of hikers decided to record the temperature at various heights along their climb. Consider the following data they collected regarding their height above sea level and the temperature.

Sample of Temperatures at Different Elevations

Height Above Sea Level (m)	500	800	1000	2000	1500	3000	1200	2500
Temperature (°C)	26	25	24	14	20	10	23	15

28. Casandra made several trips from college to home. She often brought friends which meant additional luggage as well. She has been keeping track of her fuel consumption. The following table shows the approximate additional weight per trip and the fuel consumption in miles per gallon.

Sample of Fuel Consumption per Trip

Additional Weight in Vehicle (lb)	500	1000	750	600	850	900
Fuel Consumption (Miles per Gallon)	45	42	43	44	42	43

29. Melissa started exercising for 30 minutes per day and she recorded her weight every morning for a week, as shown in the following table.

Sample of Weight per Day

Day	1	2	3	4	5	6
Weight (lb)	178	177	178	176	179	177

30. The following table gives the data for the number of months students have taken piano lessons and the number of songs they can play from memory.

Number of Months and Number of Songs

# of Months	0	5	3	10	22	19	30	15	8	12
# of Songs	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 student has taken eight months of piano lessons, make a prediction for the number of songs they can play from memory, if appropriate.

31. 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.

32. The following 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.

33. 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.