

**Solution**

Recall that the coefficient of determination tells us the amount of variation in the response variable (number of cups of hot chocolate) that is associated with the variation in the explanatory variable (temperature). Thus, the coefficient of determination for the relationship between the number of cups of hot chocolate and the temperature will tell us the proportion or percentage of the variation in cups of hot chocolate that can be associated with the variation in temperature. Also, recall that the coefficient of determination is equal to the square of the correlation coefficient. Since we know that the correlation coefficient for these data is  $r = -0.65$ , we can calculate the coefficient of determination as  $r^2 = (-0.65)^2 = 0.4225$ . Thus, approximately 42.3% of the variation in the number of cups of hot chocolate sold can be associated with the variation in the average temperature that evening.

**12.1 Section Exercises****Type and Strength of a Linear Relationship**

*Predict the type and strength of the linear relationship between each pair of variables: weak negative, strong negative, weak positive, strong positive, or no linear relationship at all.*

1. Height and shoe size
2. Cholesterol level and IQ
3. Hours of physical activity per week and body fat percentage
4. Number of fruits and vegetables eaten per day and risk of heart disease
5. Number of pets owned and household income
6. Employee satisfaction and their salaries.

**Statistical Significance of Correlation Coefficients**

*Determine whether the correlation coefficient is statistically significant at the specified level of significance for the given sample size. Assume that a scatter plot of the data shows a linear pattern.*

- |   |   |
|---|---|
| 7. $r = 0.731$ , $\alpha = 0.01$ , $n = 11$   | 8. $r = 0.638$ , $\alpha = 0.05$ , $n = 11$   |
| 9. $r = -0.499$ , $\alpha = 0.01$ , $n = 26$  | 10. $r = -0.443$ , $\alpha = 0.01$ , $n = 30$ |
| 11. $r = -0.462$ , $\alpha = 0.05$ , $n = 18$ | 12. $r = 0.305$ , $\alpha = 0.05$ , $n = 45$  |

## Scatter Plots and Correlation

Complete the following objectives for each data set.

- Draw a scatter plot.
  - Estimate the correlation in words (that is, positive, negative, or no correlation).
  - Calculate the correlation coefficient,  $r$ .
  - Determine whether  $r$  is statistically significant at the 0.01 level of significance.
13. Consider the relationship between the number of bids an item on eBay receives and the item's selling price. The following is a sample of 10 items sold through auctions on eBay.

Numbers of Bids and Selling Prices										
Number of Bids, $x$	7	18	32	11	20	1	5	4	2	1
Price (in Dollars), $y$	106.00	100.00	129.99	176.00	200.00	25.00	20.50	36.00	36.50	49.99

14. The following data represent the number of hours 10 students spent studying and their corresponding grades on their midterm exams.

Hours Spent Studying and Midterm Grades										
Hours Studying, $x$	0	0	0.5	1.5	2	3	3.5	3.5	4.5	6
Midterm Grade, $y$	64	83	72	74	85	89	79	93	98	95

15. The following table gives the average number of hours 12 junior high students were left unsupervised each day and their corresponding overall grade averages.

Hours Unsupervised and Overall Grade Averages												
Hours Unsupervised, $x$	0	0	0.5	1.0	1.0	1.5	2.0	3.0	3.0	4.0	4.5	5.5
Overall Grade Average, $y$	96	91	88	92	94	91	87	85	81	80	77	72

16. The following data represent the completion percentages and interception percentages of eight NFL quarterbacks.

Completion Percentages and Interception Percentages									
Completion %, $x$	62.5	67.0	60.2	65.4	57.8	57.5	59.1	59.2	
Interception %, $y$	1.8	1.8	2.3	4.5	4.2	2.3	1.5	3.6	

17. The following table gives the weeks of gestation and corresponding birth weights (in pounds) for a sample of 14 babies.

Weeks of Gestation and Birth Weights														
Weeks of Gestation, $x$	34	35	37	37	38	38	39	39	39	40	40	40	41	41
Weight (in Pounds), $y$	4.8	5.9	5.3	6.7	5.6	7.3	7.7	8.4	8.2	9.5	7.6	8.6	8.9	9.4

18. A study on bone density at a local hospital produced the following results.

Ages and Bone Density Levels					
Age (in Years), $x$	34	43	49	51	65
Bone Density (in $\text{mg}/\text{cm}^2$ ), $y$	946	875	804	723	691

## Correlation Coefficients and Coefficients of Determination

Complete the following objectives for each data set.

- Calculate the correlation coefficient,  $r$ .
  - Determine if  $r$  is statistically significant at the 0.05 level of significance.
  - Calculate the coefficient of determination,  $r^2$ .
  - Interpret the meaning of  $r^2$  for the given set of data.
19. The following table contains data from 16 former elementary statistics students, where  $x$  represents the number of absences a student had for the semester and  $y$  represents the student's final class average.

Number of Absences and Class Average	
Absences, $x$	2 2 3 10 3 7 9 1 12 9 1 1 13 1 10 3
Class Average, $y$	86 83 81 53 92 71 68 79 53 78 77 85 62 97 54 79

20. The following table gives data collected on the birth weights of mothers and the birth weights of their babies. (**Hint:** To do calculations on these data, first convert the data to a single unit of measurement.)

Mothers' Birth Weights and Babies' Birth Weights		
Mother, $x$	lb	6 6 7 8 7 7 7 6 9 6 9 8 6 5 6 5
	oz	6 2 9 10 6 15 7 5 3 10 3 9 1 0 1 0
Baby, $y$	lb	5 6 7 7 10 5 9 5 8 7 9 8 5 7 7 8
	oz	11 14 10 2 0 13 0 9 13 11 10 6 8 15 2 5

21. Many universities use a student's ACT score to help with admission decisions as well as placement decisions. From a sample of 20 students, the following data are obtained.

ACT Scores and College GPAs	
ACT Score, $x$	College GPA, $y$
16	1.85
18	2.20
24	2.80
25	3.50
34	4.00
27	3.18
29	3.90
25	2.90
30	4.00
21	2.60
17	2.50
21	3.65
28	3.10
31	3.72
35	3.24
18	2.30
17	1.70
26	3.10
28	3.50
23	2.76

22. The following table contains information on the number of hours spent marketing per week and the number of new customers brought in that week for several multi-level marketing professionals.

Time Spent on Marketing and Number of New Customers	
Time Spent on Marketing (in Hours per Week), $x$	Number of New Customers, $y$
10	3
11	3
11	4
12	5
5	3
13	4
15	6
17	5
7	3
10	5