10-2 Analyzing Scatter Plots

Check Skills You'll Need

1. **Vocabulary Review** The number that describes the steepness of a line is the ___?___.

Find the slope of the line that passes through each pair of points.

2. (1, 2) and (4, 5)
3. (0, 3) and (−6, 3)
4. (−3, −4) and (−6, 8)
5. (7, 1) and (7, −5)

GO for Help Lesson 4-1

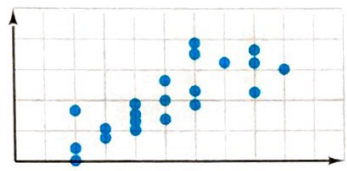
What You'll Learn

To describe patterns in scatter plots, such as clustering, outliers, positive or negative association, linear association, or nonlinear association

New Vocabulary clustering, outlier, positive association, negative association, no association

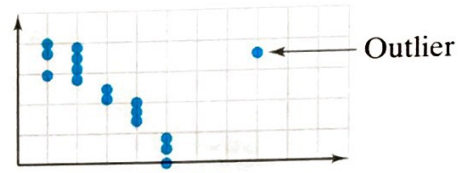
Why Learn This?

When you graph data on a scatter plot, the scatter plot may show important features about the data. The scatter plots below show two features that the data may have.



Clustering

The data points are grouped closely together.



Outlier

One data point is far away from other data points.

CONTENT STANDARD 8.SP.2

EXAMPLE 1 Identifying Clustering and Outliers

Make a scatter plot for the data in the table at the left. Use the scatter plot to identify any clustering or outliers in the data.

Step 1 Plot the data as ordered pairs.

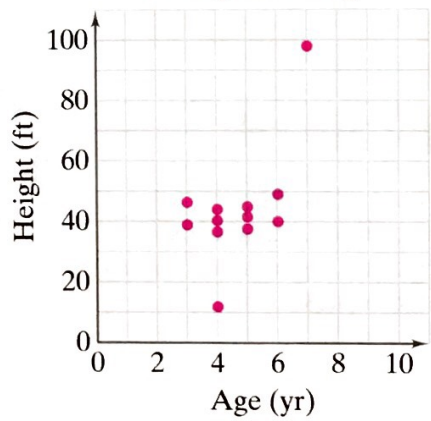
Step 2 Look for clustering. Notice that most of the data points are grouped closely together, between ages 3 and 6 and between heights 37 ft and 49 ft.

Step 3 Look for any outliers. Notice that two points, (4, 12) and (7, 98), are far from the other points. So (4, 12) and (7, 98) are outliers.

Tree Age and Height

Age (yr)	Height (ft)
5	42
4	12
5	43
6	41
5	45
4	40
4	37
7	98
3	39
4	44
3	46
5	38
6	49

Tree Age and Height



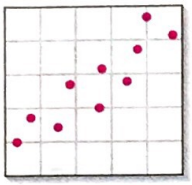
Quick Check

1. Make a scatter plot for the data in the table. Use the scatter plot to identify any clustering or outliers.

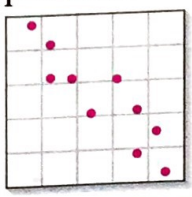
Age of Students and 1-mi Finishing Time

Age (yr)	13	12	13	14	13	12	12	15	11	12	11	13	14
Time (min)	10.2	12	11	10	10.6	11	11.3	9	13.5	6.5	12.5	9.5	18

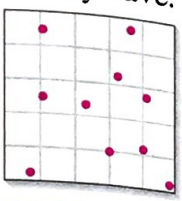
The scatter plots below show types of associations data sets may have.



Positive association
As one set of values increases, the other set tends to increase.



Negative association
As one set of values increases, the other set tends to decrease.



No association
The points show no relationship.

Time Spent Studying and Grade Earned

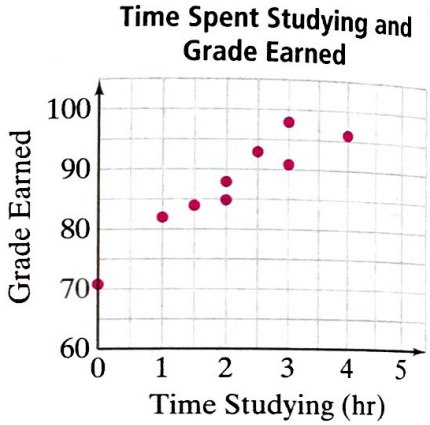
Time (hr)	Grade
2.5	93
3	91
1	82
1.5	84
0	71
2	85
4	96
3	98
2	88

EXAMPLE 2 Describing Associations in Scatter Plots

Make a scatter plot for the data in the table at the left. Describe the pattern of association that the scatter plot shows.

Plot the data as ordered pairs.

As the number of hours a student studies increases, the grade he or she earns tends to increase. So the data have a positive association.



Quick Check

2. Make a scatter plot for the data in the table. Describe the pattern of association that the scatter plot shows.

Maximum Daily August Temperatures in Northern Latitudes

Latitude (°N)	0	32	12	15	22	20	45	37	49
Temperature (°F)	95	75	98	90	88	85	63	79	59

You can also describe data as having a linear or nonlinear association.

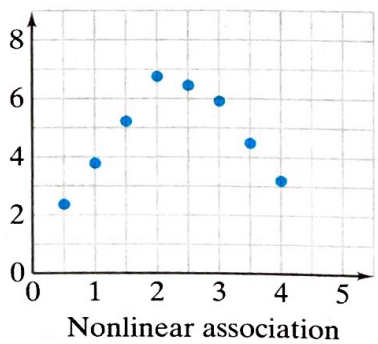
GO for Help

For help with nonlinear functions, go to Lesson 3-5, Examples 1 and 2.

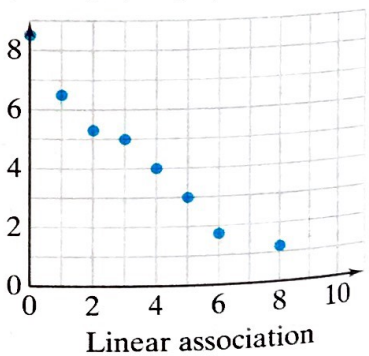
EXAMPLE 3 Identifying Linear Association

Make a scatterplot for each set of data. Tell whether the data have a linear association or a nonlinear association.

a. (1.5, 5.3), (0.5, 2.5), (4, 3.2), (3, 5.9), (2, 6.7), (2.5, 6.5), (3.5, 4.5), (1, 3.7)



b. (5, 3), (1, 6.5), (3, 5), (6, 1.75), (2, 5.3), (4, 4), (0, 7.5), (8, 1.2)



Quick Check

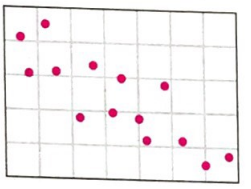
3. Make a scatter plot of the data. Tell whether the data show a linear association or a nonlinear association.

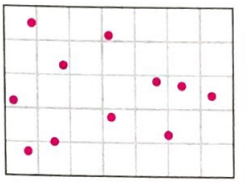
$(0, 3), (6, 55), (2, 9), (1, 2.5), (3, 10), (5, 27), (4, 15), (5.5, 40)$

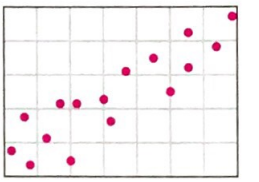
Check Your Understanding

1. **Reasoning** Given two sets of data, how would you decide whether the data contains an outlier?

Match each scatter plot with an association: *positive, negative,* or *no association.*

2. 

3. 

4. 

Homework Exercises

For more exercises, see Extra Skills and Word Problems.

GO for Help

Exercise	See Examples
5–6	1
7–8	2
9–10	3

Make a scatter plot for the data in each table. Use the scatter plot to identify any clustering or outliers in the data.

5. Value of Home Over Time

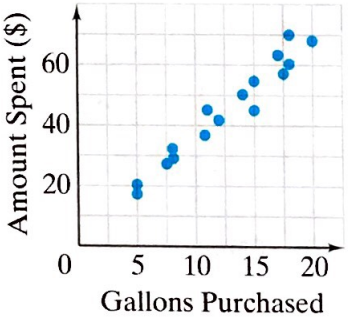
Number of Years Owned	Value (1,000s of $)
0	80
3	84
6	86
9	88
12	89
15	117
18	119
21	86

6. Number of Smoothies Sold

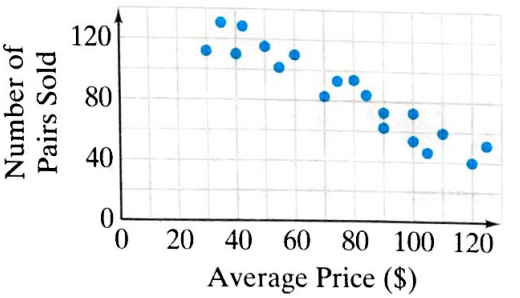
Hour	Number Sold
1	45
2	48
3	50
4	42
5	47
6	55
7	48
8	44
9	5

Describe each scatter plot as showing a *positive association,* a *negative association,* or *no association.*

7. Amount Spent on Gasoline



8. Sneakers Sales



Make a scatter plot for each set of data. Tell whether the data show a linear association or a nonlinear association.

9. $(1,2), (7,9.5), (4,7), (2,4.2), (6,8.25), (3,5.8), (5,8), (8,10), (0,0)$

10. $(0,25), (7,3), (2,10), (5,5), (6,3), (1,18), (3,7), (4,\ 5.5), (8,3)$

GPS

11. **Guided Problem Solving** The *strength* of a scatter plot refers to how "scattered" its points are. If the points are widely scattered, the relationship between the two sets of data is weak. If the points are clustered, then the relationship between the two sets of data is strong. Describe the strength of the data in the table below.

Average Monthly High Temperature for Prague, Czech Republic

Month of Year	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (°F)	34	36	46	54	64	69	72	73	65	54	41	36

- **Make a Plan** First make a scatter plot for the data. Then decide how scattered the points are.

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For each topic, decide which type of association a scatter plot of the data would likely show. Explain your choice.

12. age of owner and number of pets currently owned

13. outdoor temperature and layers of clothing

14. **Writing in Math** Describe two real-world situations: one that has linear association and one that has nonlinear association.

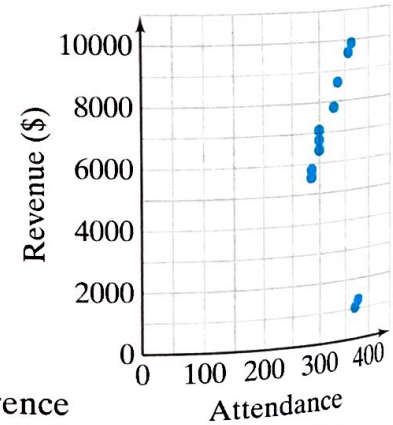
15. **Challenge** As the number of working women increased, the record time in the women's 200-m run decreased. Does this negative association mean that one set of data *caused* the other to occur? Explain.

Test Prep and Mixed Review

Practice

Multiple Choice

16. Which of the descriptions correspond to the data in the scatter plot?



I. Clustered Data
II. Outliers
III. Negative Association

Ⓐ I only
Ⓑ II only
Ⓒ I and II only
Ⓓ I, II, and III

GO for Help

Exercise	See Lesson
17	9-4

17. A baseball is required to have a circumference of no less than 9 in. and no more than 9.25 in. To the nearest square inch, what is the surface area of a baseball with radius 1.5 in.?