Scatter Plots and Correlation

Name: _____	Date: _____	Score: _____ / 26

Quick Review

A **scatter plot** shows paired data (x, y) as points. **Correlation** describes the direction and strength of the relationship: **positive** (both increase together), **negative** (one up, one down), or **none** (no clear pattern). **Strong** correlation = points cluster close to a line; **weak** = scattered. The **correlation coefficient** r ranges from -1 to 1: $r = 1$ perfect positive, $r = -1$ perfect negative, $r = 0$ none. **Important**: correlation $\neq$ causation. Two variables can correlate without one causing the other (they might both depend on a third factor).

PRACTICE

Identify correlation type or strength.

1. A scatter plot of study hours and test scores has $r = 0.90$. Describe the direction and strength. _____

2. A scatter plot of car age and resale value has $r = -0.85$. Describe the correlation. _____

3. A scatter plot of minutes spent stretching and race time has $r = 0.10$. Describe the correlation. _____

4. A scatter plot comparing shoe size and algebra quiz score has $r = 0$. What does that suggest? _____

5. A scatter plot of outside temperature and hot-chocolate sales has $r = -0.30$. Describe the trend. _____

6. A data set has $r = 1$ for distance traveled at constant speed and time. What kind of relationship is this? _____

7. In a class survey, taller students generally have larger shoe sizes. What direction of correlation would you expect? _____

8. A homeowner records colder outdoor temperatures and higher heater use. What direction of correlation is shown? _____

9. A scatter plot compares shoe size and test score, and the points look scattered with no pattern. What is the correlation? _____

10. A sleep study shows students who sleep more hours tend to report higher alertness. What direction is the correlation? _____

11. A used-car lot compares car age and value. Older cars usually have lower values. What direction is the correlation? _____

12. Ice cream sales and swimming accidents both rise in summer. Does this prove ice cream causes accidents? _____

13. Two scatter plots have $r = 0.82$ and $r = -0.45$. Which one has the stronger linear relationship? _____

14. A cyclist rides at a constant speed, so distance is exactly proportional to time. What correlation should the scatter plot have? _____

15. Sample size affects r? _____

16. Causation requires... _____

17. A scatter plot has $r = 0.50$. Describe the relationship. _____

18. A scatter plot has $r = -0.99$. Describe the relationship. _____

19. One data point is far away from the rest of a scatter plot. What can that outlier do to r? _____

20. A scatter plot has points scattered randomly with no upward or downward pattern. What is r approximately? _____

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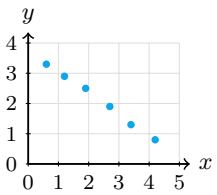
♦ VISUAL PRACTICE

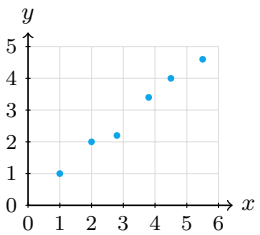
Use the graph, table, chart, or diagram to answer the question.

21. Describe the association shown by the scatter plot.



Answer: _____

22. Describe the association shown by the scatter plot.



Answer: _____

♦ Word Problems

23. A study finds $r = 0.92$ between math practice hours and test score. Describe and interpret. _____

24. A survey of students gives $r = -0.4$ between weekly TV hours and course grades. Describe the relationship, and be careful about what the correlation does and does not prove. _____

25. Researchers find higher coffee drinkers also have more wrinkles, $r = 0.5$. Does coffee cause wrinkles? _____

26. You plot test scores vs. number of pets. The points are scattered randomly. What's r approximately? _____

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Answer Keys

1. strong positive
2. strong negative
3. weak positive
4. no correlation
5. weak negative
6. perfect positive
7. positive
8. negative
9. none
10. positive
11. negative
12. no; correlation is not causation
13. $r = 0.82$
14. perfect positive
15. not directly
16. controlled experiment
17. moderate positive
18. very strong negative
19. it can change r a lot
20. $r \approx 0$
21. negative association
22. positive association
23. strong positive
24. moderate negative
25. no, correlation only
26. $r \approx 0$

Step-by-Step Tutor Notes

1. Because r is positive, the trend goes upward. Because 0.90 is close to 1, the relationship is strong.
2. The negative sign means the trend goes downward. The value is close to -1, so the relationship is strong.
3. The coefficient is slightly positive but very close to 0, so the upward trend is weak.
4. Focus on the main idea of the problem, then simplify carefully. A value near 0 means there is no clear linear pattern in the points. So the answer is no correlation.
5. The sign is negative, so the trend slopes downward, but 0.30 is not close to 1, so it is weak.
6. This is a good place to slow down, check the notation, and simplify cleanly. An r value of 1 means all points fall exactly on an increasing line. So the answer is perfect positive.
7. Take it one clear step at a time and keep the original question in mind. As height increases, shoe size tends to increase too, so the direction is positive. So the answer is positive.
8. When temperature goes down, heater use goes up. One variable increases as the other decreases, so the correlation is negative.
9. There is no sensible upward or downward trend, so the data show little or no correlation.
10. This is a good place to slow down, check the notation, and simplify cleanly. Both quantities tend to increase together, so the relationship is positive. So the answer is positive.
11. Start with the definition the problem is testing, then apply it directly. Age increases while value tends to decrease, which is a negative relationship. So the answer is negative.
12. The variables may both be connected to warm weather. A correlation alone does not prove that one variable causes the other.
13. This is a good place to slow down, check the notation, and simplify cleanly. Strength is based on $|r|$. Since $|0.82| > |-0.45|$, the first relationship is stronger. So the answer is $r = 0.82$.
14. Take it one clear step at a time and keep the original question in mind. The points would lie on an increasing straight line, so the correlation is perfect positive. So the answer is perfect positive.
15. The formula for r does not use sample size by itself. What sample size changes is how much trust we place in the pattern: a larger sample usually gives a more reliable estimate.
16. Start with the definition the problem is testing, then apply it directly. Correlation alone can't establish causation. So the answer is controlled experiment.
17. The value is positive and not close to 0, but it is also not close to 1. That makes it moderate positive.
18. Take it one clear step at a time and keep the original question in mind. The value is almost -1, so the points are very close to a decreasing line. So the answer is very strong negative.
19. The correlation coefficient is sensitive to extreme points, so one outlier can make the relationship look stronger or weaker.
20. Take it one clear step at a time and keep the original question in mind. When there is no linear pattern, the correlation coefficient is close to 0. So the answer is $r \approx 0$.
21. Focus on the main idea of the problem, then simplify carefully. The points trend downward from left to right, so the association is negative. So the answer is negative association.
22. Use the clue in the question first, then let the arithmetic finish the job. The points rise from left to right, so the association is positive. So the answer is positive association.
23. Strong positive correlation: more practice tends to mean higher scores. But correlation alone doesn't prove practice causes higher scores — motivated students might both practice more and score higher.
24. Moderate negative: more TV tends to mean lower grades, but the relationship isn't strong — many exceptions exist.
25. Could be that both relate to age, sun exposure, or stress. Correlation doesn't establish causation.
26. First identify the feature of the graph or equation that matches the wording of the question. No pattern means no linear relationship, r near zero. That leads to $r \approx 0$.

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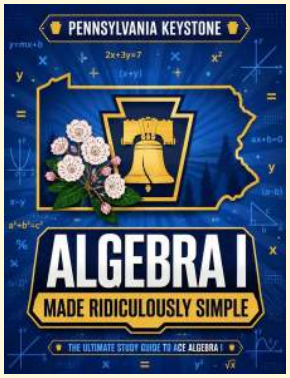

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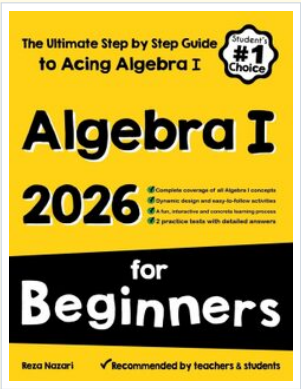

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