Correlation Coefficient

Use this key to check answers and read the explanations.

1. A classroom data set pairs the thickness of a book with its mass. The sample has Pearson’s r = 0.74. What direction does r describe?

A. Positive
B. Negative
C. Exactly zero
D. Undefined

Correct answer: A. Positive
The coefficient is above zero, so the observed linear association is positive.

2. A student copies four results from a calculator. Which value cannot be a Pearson correlation coefficient?

A. 0
B. −0.88
C. 1.13
D. 1

Correct answer: C. 1.13
Pearson’s r ranges from −1 through 1, with both endpoints included.

3. Which reported value describes the strongest linear association in its own sample?

A. 0.78
B. −0.93
C. −0.62
D. 0.49

Correct answer: B. −0.93
Strength depends on how close the absolute value is to 1. The largest magnitude is 0.93.

4. A mock survey of shops gives r = −0.66 between delivery fee and number of orders. What does the negative sign indicate?

A. Order counts must all be negative
B. Higher fees tend to occur with more orders
C. Every fee matches the same order count
D. Higher fees tend to occur with fewer orders

Correct answer: D. Higher fees tend to occur with fewer orders
A negative coefficient indicates that larger observed values of one variable tend to come with smaller values of the other.

5. Every recorded pair lies exactly on a rising straight line. Both variables vary. What is Pearson’s r?

A. 0.5
B. 1
C. 0
D. −1

Correct answer: B. 1
The fit is perfect and rises as x increases, giving r = 1 regardless of the positive slope’s size.

6. More visitors buy iced drinks on warmer days, and the two measurements have a positive r. What can r alone establish?

A. There is a positive linear association in the sample
B. The drink purchases caused the days to be warmer
C. Temperature caused every purchase
D. There is no other factor affecting purchases

Correct answer: A. There is a positive linear association in the sample
The sign describes the sample association. The coefficient alone cannot identify a causal effect or rule out other factors.

7. The points (−2, 4), (−1, 1), (0, 0), (1, 1), and (2, 4) have Pearson’s r = 0. What explains this?

A. A zero r prevents a relationship of any kind
B. The variables are both constant
C. The data have a perfectly negative linear trend
D. The U-shaped pattern has no net linear trend

Correct answer: D. The U-shaped pattern has no net linear trend
Opposite x values have equal y values here. Their centered cross products cancel, even though y follows x squared.

8. A report gives r = 0.63 for distance and travel time. Every distance is converted from kilometers to meters. What is the new r?

A. −0.63
B. 0.00063
C. 0.63
D. The new value cannot be computed

Correct answer: C. 0.63
Multiplying all distances by 1,000 scales both the covariance and the distance standard deviation by the same positive factor. Those factors cancel.

9. An analyst adds 5 to all y measurements to align two scales. The x measurements stay the same. What happens to r?

A. It stays the same
B. It increases by 5
C. It changes sign
D. It becomes zero

Correct answer: A. It stays the same
Adding a constant also shifts the mean by that constant, so every deviation from the mean remains the same.

10. A least-squares line has slope −2.4 and both variables have positive standard deviations. What must be true of r?

A. It is exactly zero
B. It is equal to −2.4
C. It is positive
D. It is negative

Correct answer: D. It is negative
The slope is r multiplied by the positive ratio of the y and x standard deviations. The slope and r have the same sign.

11. Four tests all use exactly 12 volts but record different currents. What happens when you calculate Pearson’s r for voltage and current?

A. It is 1 because the voltage never changes
B. It is exactly zero because current varies
C. It is undefined because voltage has zero standard deviation
D. It is negative because current changes

Correct answer: C. It is undefined because voltage has zero standard deviation
The formula divides by a term that includes the voltage standard deviation. That term is zero, so r is undefined.

12. The measured relationship between x and y has r = 0.71. A second analyst uses −2y everywhere in place of y and leaves x unchanged. What is the new coefficient?

A. 0.71
B. −0.71
C. −1.42
D. 0.355

Correct answer: B. −0.71
Multiplication by −2 reverses the sign of the covariance and doubles the y standard deviation. The magnitude of r is unchanged while the sign reverses.

13. A sample has r = −0.57 with all points and r = 0.88 after removing one distant observation. What is the strongest conclusion from those results?

A. The sample size alone determines the sign of r
B. The observation is proven to be a data-entry error
C. The remaining data prove that one variable causes the other
D. The reported r is sensitive to that observation

Correct answer: D. The reported r is sensitive to that observation
The observation changes both the sign and the magnitude of r. Inspect it before deciding whether there is a valid reason to exclude it.

14. A four-pair sample has r = 0.66 and a 100-pair sample also has r = 0.66. If both samples meet the usual test assumptions, which statement is correct?

A. The larger sample can provide stronger evidence even though the sample coefficients match
B. The two samples must have the same significance result
C. The smaller sample necessarily has a stronger linear association in its sample
D. Sample size is irrelevant to testing the population correlation

Correct answer: A. The larger sample can provide stronger evidence even though the sample coefficients match
The correlation test uses both the observed coefficient and the sample size. Identical sample coefficients can give different significance results.

15. The centered data pairs are (−2, −1), (−1, −2), (0, 0), (1, 2), and (2, 1). Their cross products sum to 8, and each variable’s squared values sum to 10. What is r?

A. 0.64
B. −0.80
C. 0.80
D. 1.25

Correct answer: C. 0.80
Both means are zero. Divide the cross-product sum, 8, by the square root of 10 × 10, which is 10. The result is 0.80.