

Spot the Trend

Read direction and strength from lines of fit and residuals.

HIGH SCHOOL • MA.912.DP.2.6

MA.912.DP.2.6 "Given a scatter plot with a line of fit and residuals, determine the strength and direction of the correlation. Interpret strength and direction within a real-world context."

NAME _____

DATE _____

DIRECTION AND STRENGTH

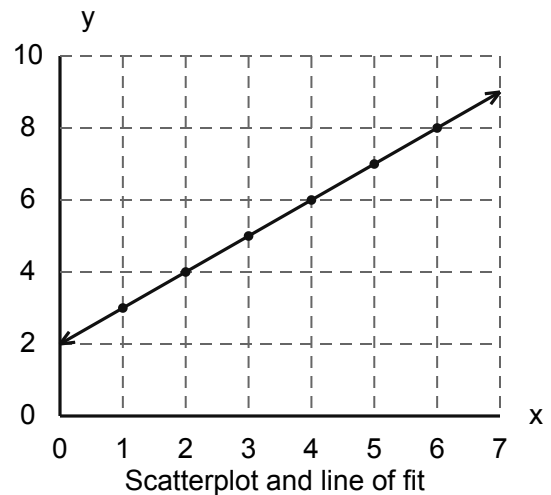
Slope gives direction: positive means positive association, negative means negative association. Judge strength from clustering around the line and residual size relative to y-variation. Small numbers alone mean little without units and scale. A scatterplot does not establish cause and effect.

WORKED EXAMPLE

The graph has line $y=x+2$. Its residuals for $x=1,\dots,6$ are all 0. Describe direction and strength.

1. The slope is positive: y tends to increase as x increases.
2. Every point lies on the line, so every residual is zero.

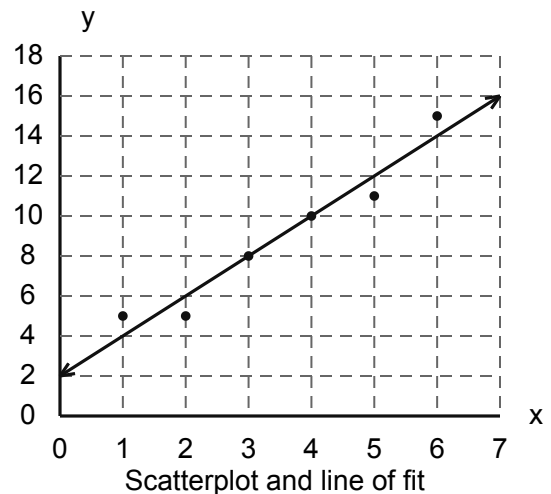
Answer: Perfect positive linear association.



PRACTICE 4 problems

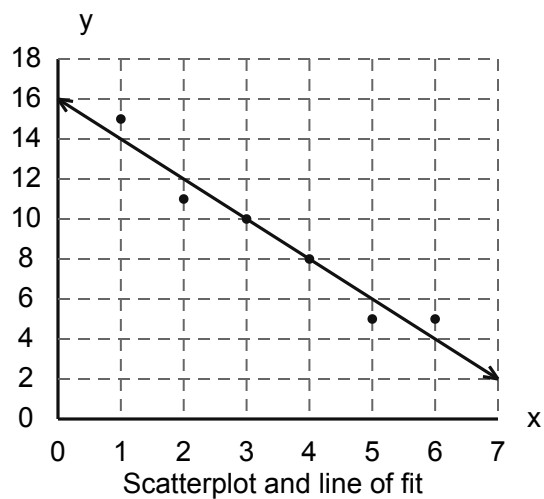
- 1** The line is $y=2x+2$. Residuals in x order are 1,-1,0,0,-1,1. State direction and strength; cite the graph and residual scale.

ANSWER _____



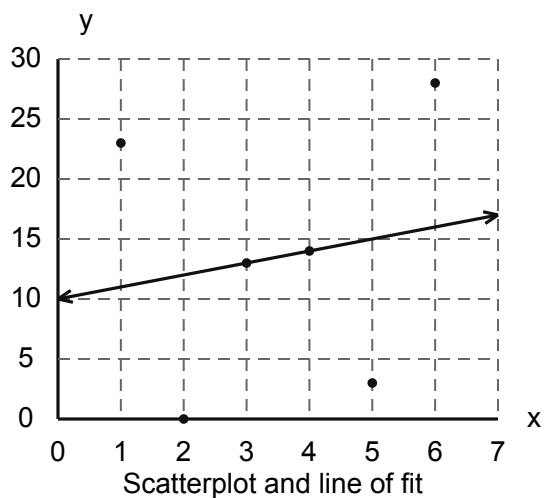
- 2 The line is $y = -2x + 16$. Residuals in x order are 1, -1, 0, 0, -1, 1. State direction and strength with evidence.

ANSWER _____



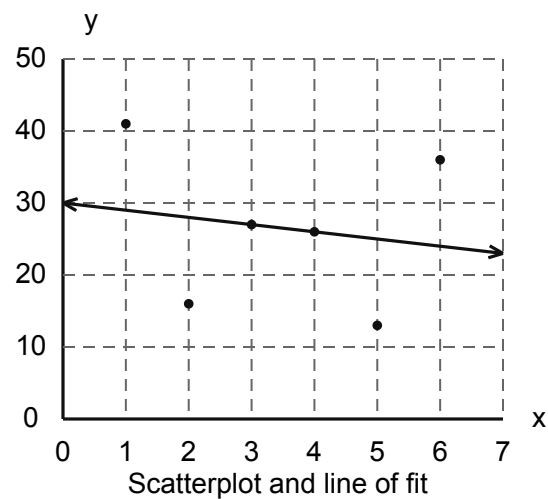
- 3 The line is $y = x + 10$. Residuals in x order are 12, -12, 0, 0, -12, 12. State direction and strength. Why do two zero residuals not settle the question?

ANSWER _____



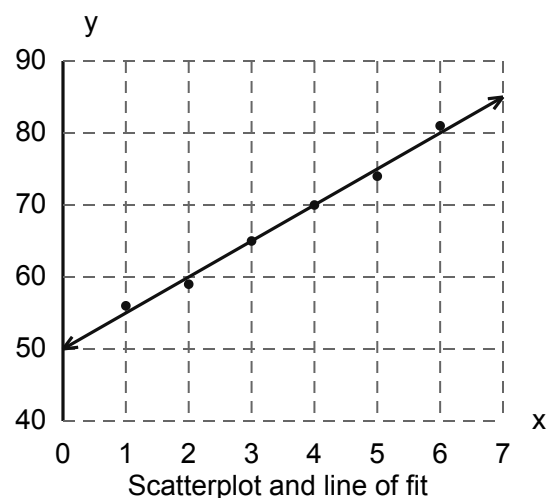
- 4** The line is $y = -x + 30$. Residuals in x order are 12, -12, 0, 0, -12, 12. State direction and strength. Support both parts separately.

ANSWER _____



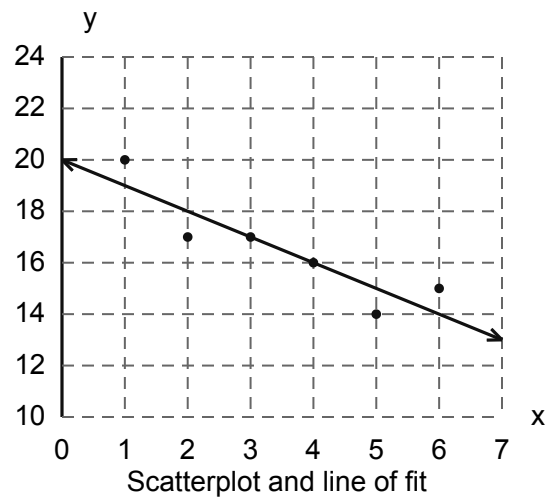
APPLY IT Show your work

- 1** A class records study time x (hours) and test score y (points). The line is $y = 5x + 50$; residuals are 1, -1, 0, 0, -1, 1. Interpret direction and strength in context. Does the graph prove that extra study causes a higher score?



2

A class measures a cooling tank after x hours; y is temperature in degrees Celsius. The line is $y = -x + 20$; residuals are 1, -1, 0, 0, -1, 1. Interpret direction and strength, including the residual at $x = 2$.

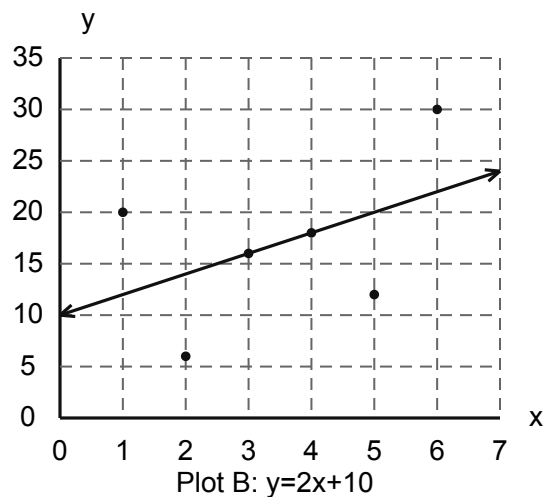
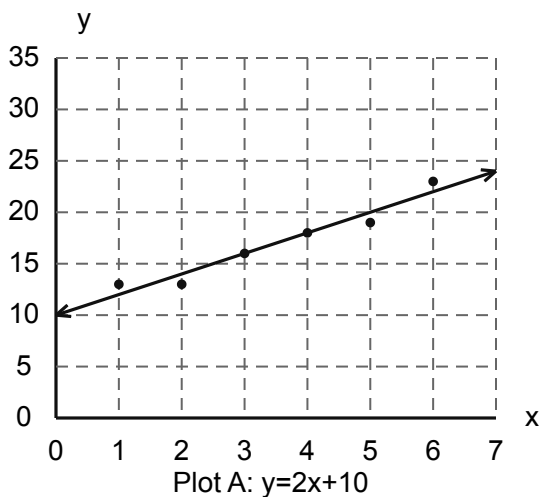


CHALLENGE

One step up

A and B use the same x -values, axes and line $y = 2x + 10$. Residuals: A has 1, -1, 0, 0, -1, 1; B has 8, -8, 0, 0, -8, 8. Compare direction and strength. Would changing only the units of y change the actual strength of either association?

WORK SPACE AND ANSWER



PRACTICE 1

Strong positive association: positive slope; residuals within ± 1 compared with y-values from 5 to 15.

PRACTICE 2

Strong negative association: negative slope; points stay close to the line, with residuals within ± 1 .

PRACTICE 3

Weak positive association. The positive trend is small relative to the broad scatter; two on-line points do not describe the whole data set.

PRACTICE 4

Weak negative association. Negative slope gives direction; large residuals relative to the trend show weak strength.

APPLY IT 1

Strong positive association: more study hours tend to accompany higher scores. The graph alone does not prove causation.

Residuals are small compared with the score variation, and the fitted slope is positive. Other influences are not controlled.

APPLY IT 2

Strong negative association: later measurements tend to be cooler. At $x=2$, temperature is 1 degree below the line prediction.

Use the negative slope for direction and small residuals relative to the temperature variation for strength.

CHALLENGE

Both positive; A is stronger because it clusters much more tightly around the same trend. Changing units alone rescales both data and residuals, not strength.

Accept informal strong/weak judgments supported by the displayed scatter and residuals. No correlation-coefficient calculation is required. Residual units must be interpreted relative to variation; changing units does not change correlation. Association is not by itself evidence of causation.