LESSON MAKER PRO

Slope and Strength

Connect correlation to the rate of change of a best-fit line.

HIGH SCHOOL · FA.S.44

FA.S.44 "Justify the relationship between the correlation coefficient and the rate of change for the line of best fit."

NAME _____ DATE _____

THE CONNECTION

The slope of a line of best fit is $b = r(s_y/s_x)$, where r is the correlation coefficient and s_x and s_y are the standard deviations. Because standard deviations are positive, r and the slope have the same sign. The size of the slope also depends on the standard deviations, so a larger r does not always mean a steeper line.

WORKED EXAMPLE

A data set has $r = 3/4$, $s_x = 8$, and $s_y = 12$. Find the slope of its line of best fit.

1. Use $b = r(s_y/s_x)$.
2. Substitute: $b = (3/4)(12/8)$.
3. Simplify: $b = (3/4)(3/2) = 9/8$.

Answer: The slope is 9/8.

PRACTICE 6 problems

1 For $r = 1/2$, $s_x = 2$, and $s_y = 6$, find the slope. Does the line rise or fall from left to right?

ANSWER _____

2 For $r = -2/3$, $s_x = 3$, and $s_y = 9$, find the slope. Does the line rise or fall from left to right?

ANSWER _____

3 For $r = 0$, $s_x = 5$, and $s_y = 7$, find the slope of the line of best fit.

ANSWER _____

4 A line of best fit has slope 2. If $r = 1/2$ and $s_y = 4$, find s_x.

ANSWER _____

5 Use the table. Which model has the greater slope, and by how much?

TWO BEST-FIT MODELS

Model	r	s_x	s_y
A	1/2	2	6
B	1/4	3	6

ANSWER _____

6 A line of best fit has slope -3/2, with $s_x = 2$ and $s_y = 5$. Find r.

ANSWER _____

APPLY IT Show your work

1 A student compares hours spent on their phone after school with hours of sleep that night. The data have r = -1/2, s_x = 3 hours of phone time, and s_y = 4 hours of sleep. Find the slope of the line of best fit. What does that slope predict for one additional hour of phone time?

WORK SPACE

ANSWER _____

2 A basketball team compares practice hours with free-throw percentage. The data have r = 2/3, s_x = 3 hours, and s_y = 9 percentage points. Find the slope of the line of best fit. What does it predict for one additional hour of practice?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student claims, "The model with the greater r must have the steeper line." Use the table to calculate both slopes and explain why this claim is false.

COMPARING TWO MODELS

Model	r	s_x	s_y
A	4/5	5	1
B	1/2	2	4

WORK SPACE AND ANSWER

Slope and Strength

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For r = 1/2, s_x = 2, and s_y = 6, find the slope. Does the line rise or fall from left to right?	**The slope is 3/2. The line rises.**
2	For r = -2/3, s_x = 3, and s_y = 9, find the slope. Does the line rise or fall from left to right?	**The slope is -2. The line falls.**
3	For r = 0, s_x = 5, and s_y = 7, find the slope of the line of best fit.	**0**
4	A line of best fit has slope 2. If r = 1/2 and s_y = 4, find s_x.	**1**
5	Use the table. Which model has the greater slope, and by how much?	**Model A has the greater slope. Its slope is 3/2, compared with 1/2 for Model B, so it is greater by 1.**
6	A line of best fit has slope -3/2, with s_x = 2 and s_y = 5. Find r.	**-3/5**

PART 2 · APPLY IT

1. **The slope is -2/3. The line predicts 2/3 hour less sleep for one additional hour of phone time.** Compute b = (-1/2)(4/3) = -2/3 hours of sleep per hour of phone time. Interpret the negative slope as a predicted decrease, not proof that phone time causes less sleep.
2. **The slope is 2 percentage points per hour. The line predicts a free-throw percentage 2 percentage points higher for one additional hour of practice.** Compute b = (2/3)(9/3) = 2 percentage points per hour. This is a prediction from the line, not a guaranteed improvement.

CHALLENGE

Model A has slope (4/5)(1/5) = 4/25. Model B has slope (1/2)(4/2) = 1. Although Model A has the greater r, Model B has the steeper line because slope also depends on s_y/s_x.

Accept equivalent fractions or decimals and descriptions of a positive slope as rising and a negative slope as falling. For comparisons, check that students use both r and the ratio of standard deviations.