LESSON MAKER PRO

Trend Line Toolkit

Use linear models to make and judge predictions.

HIGH SCHOOL · HSS-ID.B

CCSS.Math.Content.HSS-ID.B "Summarize, represent, and interpret data on two categorical and quantitative variables"

NAME _____ DATE _____

READ THE MODEL

A line of best fit can be written as y = mx + b, where m tells how much predicted y changes when x increases by 1. Substitute an x-value into the equation to find a prediction. A residual equals actual y minus predicted y, so its sign shows whether the actual value was above or below the model.

WORKED EXAMPLE

A line of best fit goes through (6, 15) and (10, 23). Write its equation and predict y when x = 12.

1. Find the slope: (23 - 15) / (10 - 6) = 8 / 4 = 2.
2. Use y = mx + b with (6, 15): 15 = 2(6) + b, so b = 3.
3. Write y = 2x + 3. Substitute x = 12: y = 2(12) + 3 = 27.

Answer: y = 2x + 3; when x = 12, predicted y = 27.

PRACTICE 6 problems

1 For the line y = 4x + 5, what does the slope mean?

ANSWER _____

2 Use y = -4x + 20 to predict y when x = 7.

ANSWER _____

3 A model predicts y = 32, but the actual value is y = 41. Find the residual.

ANSWER _____

4 Find the equation of the line through (7, 14) and (9, 24).

ANSWER _____

5 A data set has correlation coefficient r = -0.82. Describe the association.

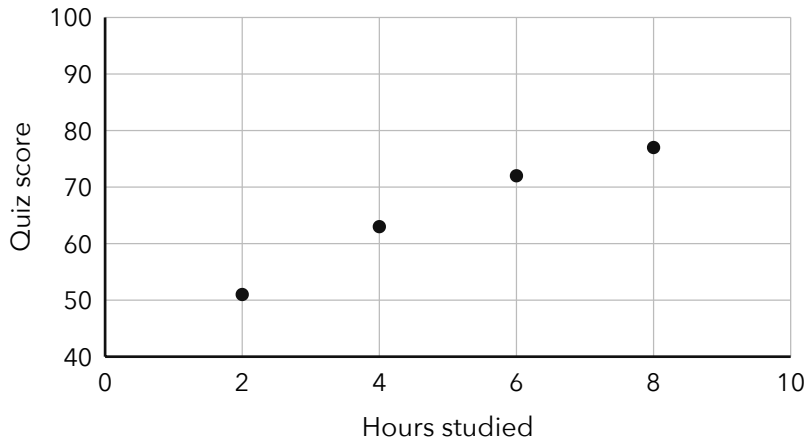
ANSWER _____

6 A linear model was created from data with x-values from 30 through 70. Is a prediction at x = 80 interpolation or extrapolation?

ANSWER _____

APPLY IT Show your work

1 These simulated study data are shown: (2,51),(4,63),(6,72),(8,77). On the scatterplot, draw the proposed line y=5x+42 over x=2 through 8. Find and interpret the residual at x=8. Do the residuals −1,+1,0,−5 suggest equally good fit throughout this small range?



2 For a basketball player, the model y = 4x + 36 relates x extra practice sessions to y free-throw percentage. After 11 sessions, the player makes 75% of free throws. Find the predicted percentage and the residual.

CHALLENGE One step up

A gaming league compares two models for weekly points y based on practice hours x. Model A is y = 4x + 14, and Model B is y = 8x - 9. A player practices 7 hours and earns 46 points. Find each model's residual. Which model is more accurate for this player? Explain using the residuals.

Trend Line Toolkit

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For the line y = 4x + 5, what does the slope mean?	**For each increase of 1 in x, predicted y increases by 4.**
2	Use y = -4x + 20 to predict y when x = 7.	**-8**
3	A model predicts y = 32, but the actual value is y = 41. Find the residual.	**9**
4	Find the equation of the line through (7, 14) and (9, 24).	**y = 5x - 21**
5	A data set has correlation coefficient r = -0.82. Describe the association.	**A strong negative linear association.**
6	A linear model was created from data with x-values from 30 through 70. Is a prediction at x = 80 interpolation or extrapolation?	**Extrapolation**

PART 2 · APPLY IT

1. **At x=8 the prediction is 82 and residual 77−82=−5 points. The first three residuals are close to 0; the last is farther below the line, so fit is weaker there. Four points are insufficient to establish a general relationship.** Require the learner-drawn line through e.g. (2,52),(4,62),(6,72),(8,82), correct vertical residual and cautious fit comparison.
2. **Predicted percentage: 80%. Residual: -5 percentage points.** Substitute 11 for x to get 4(11) + 36 = 80. Compute 75 - 80 = -5 percentage points.

CHALLENGE

Model A predicts 42, so its residual is 4. Model B predicts 47, so its residual is -1. Model B is more accurate because its residual has the smaller absolute value, 1.

Accept equivalent equation forms that simplify to y = 5x - 21. Residuals should be calculated as actual value minus predicted value; a negative residual means the actual value is below the model.