

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

A tutoring app uses the model $y = 5x + 42$, where x is hours studied and y is a quiz score. For a student who studies 8 hours, find the predicted score. The student's actual score is 77. Find and interpret the residual.

WORK SPACE

ANSWER _____

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.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

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.

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

- Predicted score: 82. Residual: -5, so the actual score was 5 points below the model's prediction.** Substitute 8 for x to get $5(8) + 42 = 82$. Compute $77 - 82 = -5$, so the actual score is below the prediction.
- 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.