

Residual Reality Check

Use residuals to judge how well a model fits data.

HIGH SCHOOL • HSS-ID.B.6b

CCSS.Math.Content.HSS-ID.B.6b "Informally assess the fit of a function by plotting and analyzing residuals."

NAME _____

DATE _____

READ THE RESIDUALS

A residual is the actual y-value minus the y-value predicted by a model. Plot residuals as (x, residual). A model fits well when residuals are scattered close to 0 with no clear pattern.

WORKED EXAMPLE

A model is $y = 7x + 5$. When $x = 6$, the actual y-value is 48. Find the residual.

1. Find the predicted value: $y = 7(6) + 5$.
2. The predicted value is 47.
3. Subtract predicted from actual: $48 - 47 = 1$.

Answer: The residual is 1.

PRACTICE 6 problems

- 1** A model is $y = 4x + 3$. When $x = 2$, the actual y-value is 13. Find the residual.

ANSWER _____

- 2** When $x = 9$, the actual y-value is 31 and a model predicts 34. Find the residual.

ANSWER _____

- 3** The residuals at $x = 10, 12$, and 14 are $-2, 0$, and 2 . Do these residuals support a good linear fit? Explain.

ANSWER _____

- 4** The residuals at $x = 11, 13, 15$, and 17 are $-3, 3, -3$, and 3 . Do the residuals show a pattern?

ANSWER _____

- 5** A model predicts 40, but the actual value is 36. What does the residual tell you about the model?

ANSWER _____

- 6** Model A has residuals $-2, 2, -2, 2$. Model B has residuals $-6, 6, -6, 6$. Which model has residuals closer to 0?

ANSWER _____

APPLY IT Show your work

1

A music app models the number of songs downloaded, y , after x days with $y = 3x + 4$. The actual downloads were 36 after 10 days, 35 after 11 days, and 42 after 12 days. Find the three residuals. Based on these residuals, does the model seem to fit reasonably well?

WORK SPACE

ANSWER _____

2

A student council models the number of people who attend an event, y , based on the number of posters, x , with $y = 2x + 15$. With 8, 10, and 12 posters, the actual attendance was 27, 35, and 43. Find the residuals. Does the residual pattern suggest that the linear model is a good fit?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

For the same data set, Model A has residuals -9, 0, and 9 at $x = 20, 30$, and 40. Model B has residuals -3, 0, and 3 at those same x -values. Which model is better? Is either model an ideal fit? Explain your reasoning.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A model is $y = 4x + 3$. When $x = 2$, the actual y -value is 13. Find the residual.	Predicted $y = 11$, so the residual is $13 - 11 = 2$.
2	When $x = 9$, the actual y -value is 31 and a model predicts 34. Find the residual.	$31 - 34 = -3$
3	The residuals at $x = 10, 12$, and 14 are $-2, 0$, and 2 . Do these residuals support a good linear fit? Explain.	No. The residuals increase as x increases, so they show a pattern instead of random scatter around 0.
4	The residuals at $x = 11, 13, 15$, and 17 are $-3, 3, -3$, and 3 . Do the residuals show a pattern?	Yes. The residuals alternate between -3 and 3.
5	A model predicts 40, but the actual value is 36. What does the residual tell you about the model?	The residual is -4, so the model overpredicts by 4.
6	Model A has residuals $-2, 2, -2, 2$. Model B has residuals $-6, 6, -6, 6$. Which model has residuals closer to 0?	Model A

PART 2 • APPLY IT

- The residuals are 2, -2, and 2. Yes, the model seems to fit reasonably well because the residuals are close to 0 and do not show a clear trend.** The predicted values are 34, 37, and 40. Subtract each prediction from its actual value: $36 - 34$, $35 - 37$, and $42 - 40$.
- The residuals are -4, 0, and 4. No, the residuals show an increasing pattern, so the model is not a good fit.** The predicted attendance values are 31, 35, and 39. The residuals are $27 - 31$, $35 - 35$, and $43 - 39$.

CHALLENGE

Model B is better because its residuals are closer to 0. Neither model is ideal because both sets of residuals increase as x increases, showing a pattern.

Accept equivalent wording for overpredicts, underpredicts, residual trend, and random scatter. For fit judgments, students should connect residuals close to 0 and no pattern with a better fit.