Fitting a Line to Data

Spot mistakes, reason, and work backward

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Distinguish observations from points deliberately chosen on a fitted line. Use the line points to recover its equation, then compare predictions with observations. A residual is $y - \hat{y}$: positive is above the line and negative below. When choosing between two candidates, a stated criterion such as total absolute vertical error makes the comparison reproducible rather than purely visual.

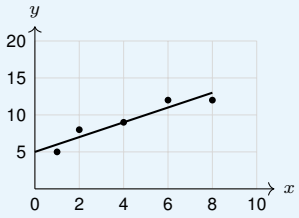
Worked example

Example for form 2: recover the selected line. Use the fitted line through $(0, 5)$ and $(8, 13)$.

1. The selected line has slope $m = (13 - 5)/(8 - 0) = 8/8 = 1$ and intercept $b = 5$.

2. Its equation is $\hat{y} = 1x + 5$. The scattered observations need not lie exactly on this fitted line.

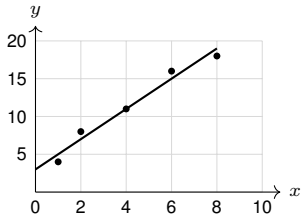
Answer: $\hat{y} = 1x + 5$



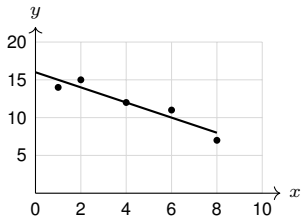
Practice Problems

Show your thinking.

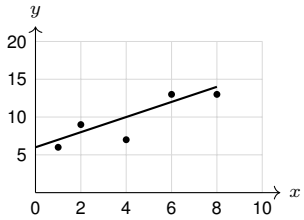
1. Check a claimed intercept against the selected anchors. A learner proposes $\hat{y} = 2x + 6$. Correct the rule. Use the fitted line through $(0, 3)$ and $(8, 19)$.



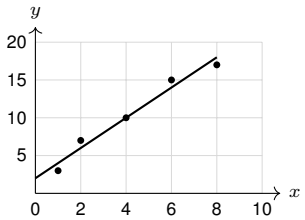
2. Correct a claimed rule for a decreasing pattern. A learner proposes $\hat{y} = -1x + 19$. Correct the rule. Use the fitted line through $(0, 16)$ and $(8, 8)$.



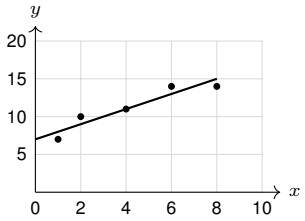
3. A learner subtracts observed from predicted. Calculate the residual in the correct order. At $x = 4$, an observed output is 7. Find observed minus predicted. Use the fitted line through $(0, 6)$ and $(8, 14)$.



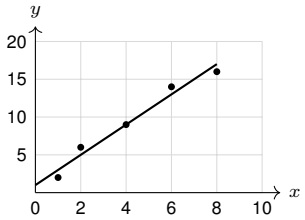
4. A learner insists a fit must hit every point. Compare these candidates by error instead. Compare line A, $\hat{y} = 2x + 2$, with line B, $\hat{y} = 2x + 5$, using total absolute vertical error. Use the fitted line through $(0, 2)$ and $(8, 18)$.



5. Work backward rather than substituting the output as an input. At what input does the model predict 13? Use the fitted line through $(0, 7)$ and $(8, 15)$.



6. Check an estimate using the line, not a nearby isolated measurement. Predict the output at $x = 7$. Use the fitted line through $(0, 1)$ and $(8, 17)$.



Answer Key

1. $\widehat{y} = 2x + 3$
2. $\widehat{y} = -1x + 16$
3. Residual -3.
4. Line A; total errors 4 versus 15.
5. $x = 6$
6. $\widehat{y}(7) = 15$

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. At the anchor input $x = 0$, the claimed rule gives 6 instead of the required 3. The intercept is wrong by 3.

2. The selected line has slope $m = (19 - 3)/(8 - 0) = 16/8 = 2$ and intercept $b = 3$. Therefore use $\widehat{y} = 2x + 3$; at $x = 8$ it gives 19, matching the other anchor.

Problem 2

1. At the anchor input $x = 0$, the claimed rule gives 19 instead of the required 16. The intercept is wrong by 3.

2. The selected line has slope $m = (8 - 16)/(8 - 0) = -8/8 = -1$ and intercept $b = 16$. Therefore use $\widehat{y} = -1x + 16$; at $x = 8$ it gives 8, matching the other anchor.

Problem 3

1. The selected line has slope $m = (14 - 6)/(8 - 0) = 8/8 = 1$ and intercept $b = 6$.

2. The prediction is $1(4) + 6 = 10$. Subtract predicted from observed: $7 - (10) = -3$. The observation lies below the line.

Problem 4

1. For line A, absolute errors at inputs $1, 2, 4, 6, 8$ are $1, 1, 0, 1, 1$, totaling 4.

2. For line B they are $4, 2, 3, 2, 4$, totaling 15. Since $4 < 15$, line A fits better by this stated criterion.

Problem 5

1. The selected line has slope $m = (15 - 7)/(8 - 0) = 8/8 = 1$ and intercept $b = 7$.

2. Solve $13 = 1x + 7$: $6 = 1x$, so $x = 6/1 = 6$. Substituting gives the required predicted output 13.

Problem 6

1. The selected line has slope $m = (17 - 1)/(8 - 0) = 16/8 = 2$ and intercept $b = 1$.

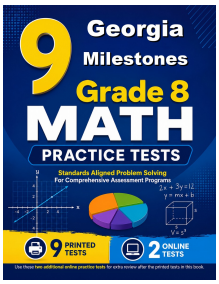
2. Substitute the requested input: $\widehat{y}(7) = 2(7) + 1 = 15$. This is a model estimate, not a guaranteed observation.

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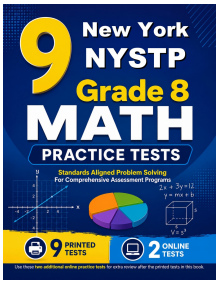
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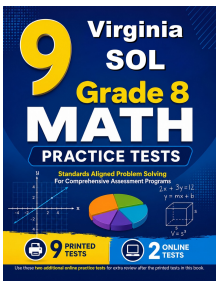
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