

Writing Linear Equations and Scatter Plots: practice solutions, Grade 9 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Slope-intercept form



(a) $y = mx + b$ with $m = 4$ and $b = -3$: $y = 4x - 3$.

(b) $y = -\frac{1}{2}x + 6$.

(c) For (a): $4(6) - 3 = 21$. For (b): $-\frac{1}{2}(6) + 6 = -3 + 6 = 3$.

2 Point-slope practice



(a) $y - 4 = 2(x - 1)$, so $y - 4 = 2x - 2$ and $y = 2x + 2$. Check: $2(1) + 2 = 4$.

(b) $y - 5 = -3(x + 2)$, so $y - 5 = -3x - 6$ and $y = -3x - 1$. Check: $-3(-2) - 1 = 5$.

3 Two easy points



$m = \frac{10 - 2}{5 - 1} = \frac{8}{4} = 2$. Then $y - 2 = 2(x - 1)$, so $y = 2x$.

Check with the other point: $2(5) = 10$. The equation is $y = 2x$.

4 Name the correlation



- (a) **Negative:** as it gets warmer, fewer cups are sold.
- (b) **Positive:** taller people tend to wear larger shoes.
- (c) **None:** a birthday date has no connection to a score.

5 Find a residual



- (a) Predicted: $3(4) + 10 = 22$. Residual: $25 - 22 = 3$. The point is 3 above the line.
- (b) Predicted: $3(6) + 10 = 28$. Residual: $26 - 28 = -2$. The point is 2 below the line.

6 True or false?



- (a) **True.** Residual = actual – predicted = 0 means the actual and predicted values are equal.
- (b) **False.** A strong correlation shows the variables move together, but a lurking variable may explain both. Correlation does not prove causation.

7 Evaluate piecewise and absolute value functions



$f(-4)$: $-4 < 0$, so $-4 + 2 = -2$.

$f(0)$: $0 \geq 0$, so $3(0) = 0$. $f(5) = 3(5) = 15$.

$g(-1) = |-4| = 4$; $g(3) = |0| = 0$; $g(7) = |4| = 4$.

8 Filling a pool



(a) The point is $(2, 30)$ and the slope is 12: $V - 30 = 12(t - 2)$, so $V = 12t + 6$. The pool held 6 gallons at the start.

(b) $V = 12(10) + 6 = 126$ gallons.

(c) $12t + 6 = 150$, so $12t = 144$ and $t = 12$. The pool holds 150 gallons after 12 minutes.

9 Taxi fare



(a) $m = \frac{19.50 - 9.50}{8 - 3} = \frac{10}{5} = 2$. Then $F - 9.5 = 2(x - 3)$, so $F = 2x + 3.5$. Check: $2(8) + 3.5 = 19.5$.

(b) The starting fee is \$3.50 (the intercept). The slope means \$2.00 per mile.

(c) $F = 2(12) + 3.5 = 27.5$, so the ride costs \$27.50.

10 Residual table



Predicted values: $2(2) + 1 = 5$, $2(4) + 1 = 9$, $2(6) + 1 = 13$, $2(8) + 1 = 17$.

Residuals (actual - predicted): $4 - 5 = -1$; $10 - 9 = 1$; $12 - 13 = -1$; $19 - 17 = 2$.

The residuals are small and have mixed signs with no pattern, so the line is a reasonable model.

11 Reading r



(a) $r = -0.92$: strong negative. $r = 0.15$: very weak positive, almost no linear relationship. $r = 0.97$: very strong positive.

(b) A linear model fits best when $|r|$ is close to 1: the plots with $r = 0.97$ and $r = -0.92$.

12 Bike rental model



(a) The slope 0.4 means each additional mile costs \$0.40. The intercept 25 is a \$25 flat fee (the cost for 0 miles).

(b) $0.4(120) + 25 = 48 + 25 = 73$, so \$73.

(c) $0.4x + 25 = 65$, so $0.4x = 40$ and $x = 100$ miles.

13 Interpolation or extrapolation



(a) $4.5(4.5) + 51 = 20.25 + 51 = 71.25$. Since 4.5 is between 1 and 8, this is **interpolation**.

(b) $4.5(12) + 51 = 105$. This is **extrapolation**, and it is not reliable: a score of 105 is impossible on a 100-point quiz, so the linear trend cannot continue that far.

14 Parking fees



(a) $1.5 \leq 2$, so $P(1.5) = 4$. For $h = 5$: $4 + 3(3) = 13$, so \$13.

(b) $4 + 3(h - 2) = 4 + 3h - 6 = 3h - 2$.

(c) $3h - 2 = 19$, so $h = 7$. Check: $4 + 3(5) = 19$. You can stay 7 hours.

15 A negative slope



(a) $m = \frac{8 - (-1)}{-4 - 2} = \frac{9}{-6} = -\frac{3}{2}$. Then $y + 1 = -\frac{3}{2}(x - 2)$, so $y = -\frac{3}{2}x + 3 - 1 = -\frac{3}{2}x + 2$. Check with $(-4, 8)$: $6 + 2 = 8$.

(b) Set $y = 0$: $\frac{3}{2}x = 2$, so $x = \frac{4}{3}$.

16 Standard form from intercepts



$$m = \frac{-4 - 0}{0 - 6} = \frac{2}{3} \text{ and the y-intercept is } -4, \text{ so } y = \frac{2}{3}x - 4.$$

Multiply by 3: $3y = 2x - 12$, so $2x - 3y = 12$. Check: $2(6) - 0 = 12$ and $0 - 3(-4) = 12$.

17 Missing coordinate



$$\frac{13 - k}{6 - 2} = \frac{3}{2}, \text{ so } 13 - k = 6 \text{ and } k = 7.$$

Then $y - 13 = \frac{3}{2}(x - 6)$, so $y = \frac{3}{2}x - 9 + 13 = \frac{3}{2}x + 4$. Check: $\frac{3}{2}(2) + 4 = 7$.

18 A pattern in the residuals



(a) The predicted value is always 7, so the residuals are $10 - 7 = 3$, $6 - 7 = -1$, $4 - 7 = -3$, $4 - 7 = -3$, $6 - 7 = -1$, $10 - 7 = 3$.

(b) The residuals go $3, -1, -3, -3, -1, 3$, a U shape. A curved pattern means the data are not linear, so a line is a poor model (a curve such as a parabola would fit better).

19 Fit a line through two data points



(a) $m = \frac{32 - 8}{8 - 0} = 3$ and the y-intercept is 8, so $y = 3x + 8$.

(b) Predicted: 8, 14, 20, 26, 32. Residuals: 0, $15 - 14 = 1$, $18 - 20 = -2$, $27 - 26 = 1$, 0.

(c) $3(5) + 8 = 23$, so about 23 thousand downloads (interpolation).

20 Hidden cause

- (a) No. The strong correlation does not prove causation.
- (b) Hot, sunny weather is a lurking variable: on sunny days more people buy ice cream, and more people also spend time in the sun and get sunburned. The weather drives both variables.

21 Equation of a V graph

The vertex is $(3, -2)$, so $h = 3$ and $k = -2$. Substitute $(5, 2)$: $2 = a|2| - 2$, so $2a = 4$ and $a = 2$. The function is $y = 2|x - 3| - 2$.

x-intercepts: $2|x - 3| = 2$, so $|x - 3| = 1$ and $x = 2$ or $x = 4$.

22 Write a piecewise function

(a) First piece: $m = \frac{6 - 2}{4 - 0} = 1$ and the intercept is 2, so $y = x + 2$. Second piece:
 $m = \frac{0 - 6}{8 - 4} = -\frac{3}{2}$, so $y - 6 = -\frac{3}{2}(x - 4)$ and $y = -\frac{3}{2}x + 12$. Check: $-12 + 12 = 0$ at $x = 8$.

The function is $y = x + 2$ for $x \leq 4$ and $y = -\frac{3}{2}x + 12$ for $x > 4$.

(b) $f(2) = 2 + 2 = 4$ and $f(6) = -\frac{3}{2}(6) + 12 = 3$.

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