

Slope and Graphing Linear Functions: practice solutions, Grade 9 – download the PDF

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

1 Shrinking candle



a. Rate = $\frac{9 - 18}{4 - 1} = \frac{-9}{3} = -3$ cm per hour.

b. The negative sign means the height decreases: the candle loses 3 cm every hour.

c. From hour 4 to hour 6 there are 2 more hours, so the candle loses $2 \times 3 = 6$ cm:
 $9 - 6 = 3$ cm. After 6 hours the candle is 3 cm tall (about 1.2 inches).

2 Four slopes



a. $m = \frac{11 - 3}{6 - 2} = \frac{8}{4} = 2$.

b. $m = \frac{-12 - 4}{5 - (-3)} = \frac{-16}{8} = -2$.

c. The x -values are equal, so the run is 0: the line is vertical and the slope is undefined.

d. $m = \frac{0 - 0}{0 - (-5)} = 0$: the line is horizontal.

3 Read the slope and intercept



- a. $m = 5, b = -7$.
- b. $m = -\frac{3}{4}, b = 2$.
- c. Rewrite as $y = -x + 6$: $m = -1, b = 6$.
- d. Rewrite as $y = \frac{1}{2}x + 0$: $m = \frac{1}{2}, b = 0$.

4 Write the equation



- a. $y = -2x + 9$.
- b. $y = \frac{1}{3}x - 4$.
- c. $y = 0x + 5$, that is $y = 5$: a horizontal line.

5 Find the intercepts



- a. If $y = 0$: $2x = 8, x = 4$. If $x = 0$: $y = 8$. Intercepts: $(4, 0)$ and $(0, 8)$.
- b. If $y = 0$: $x = 9$. If $x = 0$: $-3y = 9$, so $y = -3$. Intercepts: $(9, 0)$ and $(0, -3)$.

6 Direct variation or not?



- a. Yes, $k = 7$.
- b. No: the line does not go through the origin (when $x = 0, y = 1$).
- c. Yes, $k = -\frac{1}{3}$.
- d. No: this is not of the form $y = kx$, since x is in the denominator.

7 Read a graph



a. A to B : $m = \frac{1 - (-2)}{0 - (-2)} = \frac{3}{2}$. B to C : $m = \frac{4 - 1}{2 - 0} = \frac{3}{2}$. Both agree, so the slope is $\frac{3}{2}$.

b. The line crosses the y -axis at $B(0, 1)$, so $b = 1$ and $y = \frac{3}{2}x + 1$.

8 Into standard form



a. Multiply by 5: $5y = 2x - 15$. Move the x -term: $-2x + 5y = -15$. Multiply by -1 so that A is positive: $2x - 5y = 15$. Slope $= -\frac{2}{-5} = \frac{2}{5}$. Check with $(0, -3)$: $0 + 15 = 15$.

b. Multiply by 4: $4y = -3x + 24$, so $3x + 4y = 24$. Slope $= -\frac{3}{4}$. Check with $(0, 6)$: $24 = 24$.

9 Slope and a point



$y - (-2) = 5(x - 3)$, so $y + 2 = 5x - 15$ and $y = 5x - 17$.

Check: for $x = 3$, $5 \cdot 3 - 17 = -2$. The line goes through the point.

10 Through two points



Slope: $m = \frac{-2 - 6}{3 - (-1)} = \frac{-8}{4} = -2$.

Point-slope with $(-1, 6)$: $y - 6 = -2(x + 1)$, so $y - 6 = -2x - 2$ and $y = -2x + 4$.

Check with $(3, -2)$: $-2 \cdot 3 + 4 = -2$. Correct.

11 Parallel, perpendicular, or neither?



- a. Same slope **3**, different intercepts: parallel.
- b. $3 \times \left(-\frac{1}{3}\right) = -1$: perpendicular.
- c. The first slope is $-\frac{2}{3}$. Solving the second for y : $-2y = -3x + 8$, $y = \frac{3}{2}x - 4$, slope $\frac{3}{2}$. Product: $-\frac{2}{3} \times \frac{3}{2} = -1$, so the lines are perpendicular.
- d. Slopes **2** and **-2**: not equal, and the product is **-4**, not **-1**. Neither.

12 Gym membership



- a. $C = 18m + 25$.
- b. The slope 18 is the monthly price (dollars per month); the y -intercept 25 is the sign-up fee paid at the start ($m = 0$).
- c. $C = 18 \times 8 + 25 = 144 + 25 = 169$ dollars.
- d. $18m + 25 = 277$, so $18m = 252$ and $m = 14$. After 14 months.

13 Fuel economy



- a. $k = \frac{128}{4} = 32$ miles per gallon, so $d = 32g$.
- b. $d = 32 \times 9 = 288$ miles.
- c. $32g = 400$, so $g = \frac{400}{32} = 12.5$ gallons.

14 Graph with intercepts

a. If $y = 0$: $4x = 12$, $x = 3$. If $x = 0$: $3y = 12$, $y = 4$. Plot $(3, 0)$ and $(0, 4)$ and draw the line through them.

b. $m = -\frac{4}{3}$.

c. $4 \cdot 6 + 3 \cdot (-4) = 24 - 12 = 12$. Yes, the point lies on the line.

15 Find the missing coordinate

a. $\frac{9 - 3}{5 - k} = 2$, so $5 - k = 3$ and $k = 2$.

b. $\frac{6 - k}{-2 - 4} = -\frac{3}{2}$, so $6 - k = -6 \times \left(-\frac{3}{2}\right) = 9$ and $k = -3$. Check:
 $\frac{6 - (-3)}{-6} = -\frac{3}{2}$.

16 A perpendicular line

The given line has slope $-\frac{3}{4}$ (since $4y = -3x + 8$). The perpendicular slope is the opposite reciprocal, $\frac{4}{3}$.

Point-slope: $y - 1 = \frac{4}{3}(x - 6)$, so $y = \frac{4}{3}x - 8 + 1 = \frac{4}{3}x - 7$.

Multiply by 3: $3y = 4x - 21$, so $4x - 3y = 21$. Check with $(6, 1)$: $24 - 3 = 21$.

17 A parallel line

The slope is $-\frac{2}{5}$. Point-slope: $y - 2 = -\frac{2}{5}(x - 5)$, so $y = -\frac{2}{5}x + 2 + 2 = -\frac{2}{5}x + 4$.

Multiply by 5: $5y = -2x + 20$, so $2x + 5y = 20$. Check with $(5, 2)$: $10 + 10 = 20$.

18 A right triangle?



$$m_{AB} = \frac{4-2}{5-1} = \frac{1}{2}, m_{BC} = \frac{8-4}{3-5} = -2, m_{AC} = \frac{8-2}{3-1} = 3.$$

$m_{AB} \times m_{BC} = \frac{1}{2} \times (-2) = -1$, so $AB \perp BC$. The other products are $\frac{1}{2} \times 3 = \frac{3}{2}$ and $-2 \times 3 = -6$, neither equal to -1 . The triangle has a right angle at B only.

19 Taxi fare



a. Rate = $\frac{26 - 12.5}{10 - 4} = \frac{13.5}{6} = 2.25$ dollars per mile. Starting fee:

$$12.5 - 2.25 \times 4 = 12.5 - 9 = 3.5 \text{ dollars.}$$

b. $C = 2.25m + 3.5$. Check: $2.25 \times 10 + 3.5 = 26$.

c. $2.25m + 3.5 \leq 40$, so $2.25m \leq 36.5$ and $m \leq 16.2 \dots$. The longest whole-number ride is 16 miles (cost $36 + 3.5 = 39.5$ dollars; a 17-mile ride costs 41.75 dollars).

20 Fahrenheit and Celsius



a. $m = \frac{212 - 32}{100 - 0} = \frac{180}{100} = \frac{9}{5}$. The intercept is $b = 32$, so $F = \frac{9}{5}C + 32$.

b. $F = \frac{9}{5} \times 35 + 32 = 63 + 32 = 95^\circ\text{F}$. For 68°F : $68 = \frac{9}{5}C + 32$, so $\frac{9}{5}C = 36$ and $C = 20^\circ\text{C}$.

c. Set $C = \frac{9}{5}C + 32$: $-\frac{4}{5}C = 32$, so $C = -40$. Both scales read -40 .

d. Multiply $F = \frac{9}{5}C + 32$ by 5: $5F = 9C + 160$, so $9C - 5F = -160$.

21 Where two lines meet



The slope of ℓ_2 is $-\frac{1}{2}$, so $\ell_2: y = -\frac{1}{2}x + 9$.

Set the two expressions equal: $2x - 1 = -\frac{1}{2}x + 9$, so $\frac{5}{2}x = 10$ and $x = 4$. Then $y = 2 \cdot 4 - 1 = 7$.

The lines cross at $(4, 7)$. Check in ℓ_2 : $-2 + 9 = 7$.

22 True or false?



- a. False. It is linear, but it crosses the y -axis at 3, not at the origin.
- b. True. If $y = kx$ then $k(2x) = 2(kx) = 2y$.
- c. True. The slope is $\frac{15 - 6}{5 - 2} = 3$, and $3 \times 2 = 6$, $3 \times 5 = 15$, so $y = 3x$ fits both points and the line passes through the origin.
- d. False. A vertical line has an undefined slope; a horizontal line has slope 0.



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