

# Slope and Intercepts

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Quick Review

**Slope** measures steepness:  $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$  — rise over run. Pick any two points on the line; the answer is the same. A positive slope climbs left to right, a negative slope falls, slope 0 is a flat horizontal line, and an undefined slope is a vertical line (division by zero in the run). **Slope-intercept form** is  $y = mx + b$ , where  $m$  is the slope and  $b$  is the  $y$ -intercept (the place the graph crosses the  $y$ -axis, written as the point  $(0, b)$ ). The  **$x$ -intercept** is the place the graph crosses the  $x$ -axis — set  $y = 0$  and solve. Watch out: the point  $(-3, 0)$  is on the  $x$ -axis (an  $x$ -intercept), not on the  $y$ -axis. To convert standard form  $Ax + By = C$  to slope-intercept, solve for  $y$  — and *divide every term* by the coefficient of  $y$ , including the constant. Parallel lines share the same slope; perpendicular lines have slopes that are negative reciprocals ( $m_1 \cdot m_2 = -1$ ). ALEKS also pairs these line skills with quick coordinate-geometry checks: midpoint averages coordinates, and distance uses the Pythagorean theorem. **Table check.** A slope table makes the pattern visible before you calculate: every time  $x$  increases by 1,  $y$  increases by 3, so the slope is 3.

|     |    |    |    |   |   |
|-----|----|----|----|---|---|
| $x$ | -2 | -1 | 0  | 1 | 2 |
| $y$ | -7 | -4 | -1 | 2 | 5 |

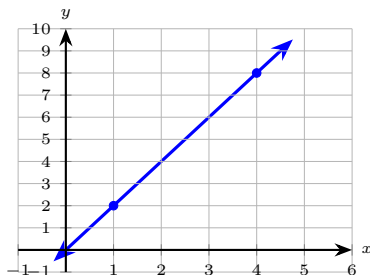
**Intercept check.** Put the intercepts in a tiny table so the graph starts from two reliable anchor points.

| Equation       | $x$ -intercept | $y$ -intercept |
|----------------|----------------|----------------|
| $2x + 3y = 12$ | $(6, 0)$       | $(0, 4)$       |
| $5x - 2y = 10$ | $(2, 0)$       | $(0, -5)$      |

## PRACTICE

Find the requested slope, intercept, or equation.

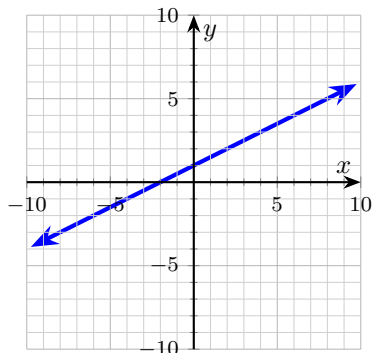
1. Find the slope of the line through  $(1, 2)$  and  $(4, 8)$  shown below. \_\_\_\_\_



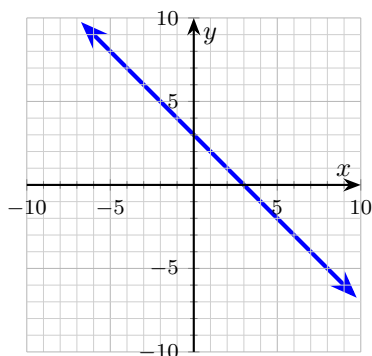
- 2.  $y$ -intercept of  $y = -3x + 7$  \_\_\_\_\_
- 3. Slope-intercept form of  $4x - 2y = 10$  \_\_\_\_\_
- 4.  $x$ -intercept of  $3x + 2y = 12$  \_\_\_\_\_
- 5. Slope through  $(-2, 3)$  and  $(4, -3)$ . \_\_\_\_\_
- 6. Parallel to  $y = \frac{1}{2}x - 4$  through  $(6, 1)$ . \_\_\_\_\_
- 7. Equation through  $(2, -1)$  and  $(-3, 14)$ . \_\_\_\_\_
- 8. Perpendicular to  $y = \frac{2}{3}x + 1$  through  $(0, 4)$ . \_\_\_\_\_
- 9. Slope-intercept form of  $5x - 4y = 20$  \_\_\_\_\_
- 10.  $x$ -intercept of  $y = \frac{2}{3}x - 4$  \_\_\_\_\_
- 11. Slope of a horizontal line through  $(3, -2)$  \_\_\_\_\_
- 12. Slope of a vertical line through  $(5, 1)$  and  $(5, 4)$ . \_\_\_\_\_



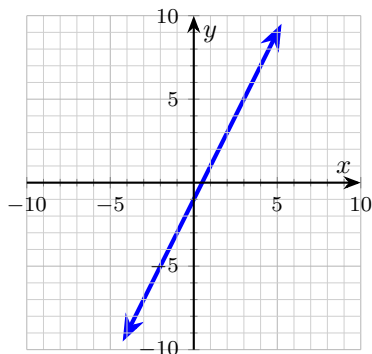
13. Find the slope of the line graphed below. \_\_\_\_\_



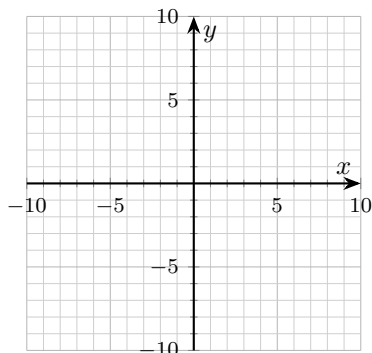
14. Find both intercepts of the line graphed below. \_\_\_\_\_



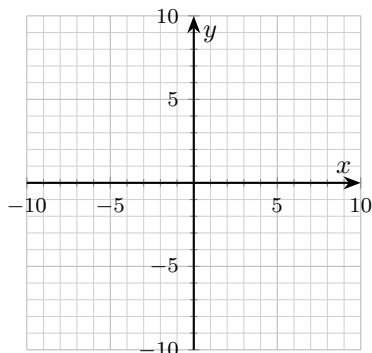
15. Write the equation of the line graphed below in  $y = mx + b$  form. \_\_\_\_\_



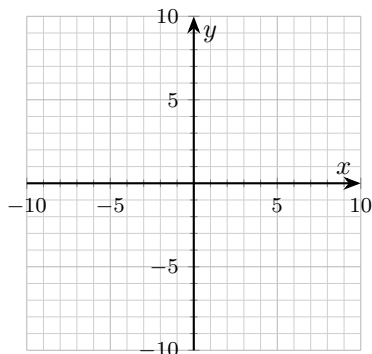
16. Sketch  $y = \frac{1}{2}x - 2$  on the plane below.



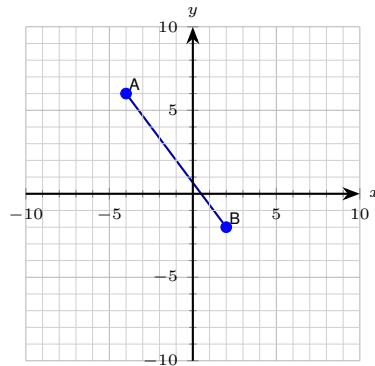
17. Sketch  $y = -2x + 4$  on the plane below.



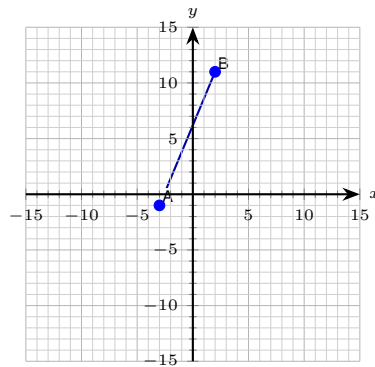
18. Sketch  $2x + 3y = 6$  on the plane below.



19. Find the midpoint of the segment with endpoints  $(-4, 6)$  and  $(2, -2)$ . \_\_\_\_\_



20. Find the distance between  $(-3, -1)$  and  $(2, 11)$ . \_\_\_\_\_



◆ Word Problems

21. A water tank starts with 120 gallons and drains at a constant rate of 8 gallons per minute. The model is  $W = -8t + 120$ . What does the  $y$ -intercept tell you in context? \_\_\_\_\_

22. A phone plan costs \$25 plus \$0.10 per minute. Write a linear equation for the monthly cost  $C$  in terms of minutes  $m$ , and identify the slope and the  $C$ -intercept. \_\_\_\_\_

23. A line passes through  $(0, -2)$  and  $(4, 6)$ . Find the slope and write the equation in slope-intercept form. \_\_\_\_\_

24. Find the equation of the line that is parallel to  $3x - y = 7$  and passes through the point  $(1, 4)$ . \_\_\_\_\_



## Answer Keys

1.  $m = 2$

2.  $(0, 7)$

3.  $y = 2x - 5$

4.  $(4, 0)$

5.  $m = -1$

6.  $y = \frac{1}{2}x - 2$

7.  $y = -3x + 5$

8.  $y = -\frac{3}{2}x + 4$

9.  $y = \frac{5}{4}x - 5$

10.  $(6, 0)$

11.  $m = 0$

12. undefined

13.  $m = \frac{1}{2}$

14.  $x$ -int  $(3, 0)$ ,  $y$ -int  $(0, 3)$

15.  $y = 2x - 1$

16.  $y = \frac{1}{2}x - 2$

17.  $y = -2x + 4$

18.  $y = -\frac{2}{3}x + 2$

19.  $(-1, 2)$

20. 13

21. The tank starts with 120 gallons.

22.  $C = 0.10m + 25$ ; slope 0.10, intercept  $(0, 25)$

23.  $m = 2$ ,  $y = 2x - 2$

24.  $y = 3x + 1$

## Step-by-Step Explanations

1. A careful way to see it:  $m = \frac{8-2}{4-1} = \frac{6}{3} = 2$ . (Rise 6, run 3, so slope 2 — not  $\frac{1}{2}$ . Always rise over run.) That gives a quick check on the answer.

2. In  $y = mx + b$ ,  $b = 7$  is the  $y$ -intercept. Write it as a point:  $(0, 7)$ . (Don't grab the  $-3$  — that's the slope.)

3. Subtract  $4x$ :  $-2y = -4x + 10$ . Divide every term by  $-2$ :  $y = 2x - 5$ . (The sign flips both on the slope and on the constant when you divide by a negative.)

4. Set  $y = 0$ :  $3x = 12$ , so  $x = 4$ . Point:  $(4, 0)$ . (At any  $x$ -intercept the  $y$ -coordinate is zero, not the other way around.)

5. A careful way to see it:  $m = \frac{-3-3}{4-(-2)} = \frac{-6}{6} = -1$ . The trick is the double negative in the denominator:  $4 - (-2) = 4 + 2 = 6$ , not  $4 - 2 = 2$ . That gives a quick check on the answer.

6. Parallel means same slope,  $m = \frac{1}{2}$ . Plug  $(6, 1)$ :  $1 = \frac{1}{2}(6) + b$ , so  $1 = 3 + b$  and  $b = -2$ . (Parallel  $\neq$  perpendicular — don't flip-and-negate the slope.)

7. Slope:  $m = \frac{14 - (-1)}{-3 - 2} = \frac{15}{-5} = -3$ . Use  $(2, -1)$ :  $-1 = -3(2) + b$ , so  $b = 5$ . Equation:  $y = -3x + 5$ .

8. Perpendicular slope is the negative reciprocal:  $-\frac{3}{2}$ . The new  $y$ -intercept is the given point's  $y$ -value because  $x = 0$ :  $b = 4$ .

9. Subtract  $5x$  from both sides:  $-4y = -5x + 20$ . Now divide every term by  $-4$ :  $y = \frac{5}{4}x - 5$ . The two negatives cancel on the  $x$ -term, and  $20 \div (-4) = -5$ .

Slope  $\frac{5}{4}$ ,  $y$ -intercept  $(0, -5)$ .

10. An  $x$ -intercept sits on the  $x$ -axis, so set  $y = 0$ :  $0 = \frac{2}{3}x - 4$ . Add 4:  $\frac{2}{3}x = 4$ .

Multiply by  $\frac{3}{2}$  (the reciprocal):  $x = 6$ . Point:  $(6, 0)$ .

11. On a horizontal line,  $y$  never changes. Rise = 0, run  $\neq 0$ , so  $m = \frac{0}{\text{anything}} = 0$ .

12. Run is  $5 - 5 = 0$ , and division by zero is undefined. (A vertical line is the one place slope isn't a number.)

13. Pick two clean lattice points the line passes through, like  $(0, 1)$  and  $(2, 2)$ , then use rise over run:  $m = \frac{2-1}{2-0} = \frac{1}{2}$ . The line goes up 1 for every 2 it moves right — a gentle climb, so the slope is less than 1.

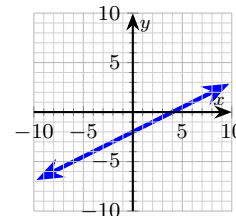
14. Read where the line meets each axis. It crosses the  $x$ -axis at  $(3, 0)$  and the  $y$ -axis at  $(0, 3)$ . The trick to keep them straight: an  $x$ -intercept always has  $y = 0$ , and a  $y$ -intercept always has  $x = 0$  — don't swap the zeros into the wrong slot.

15. Find  $b$  first: the line crosses the  $y$ -axis at  $(0, -1)$ , so  $b = -1$ . Then count the slope from two lattice points: from  $(0, -1)$  to  $(1, 1)$  is rise 2 over run 1, so  $m = 2$ . Drop both into  $y = mx + b$  to get  $y = 2x - 1$ .

16. Start at the  $y$ -intercept  $(0, -2)$ . From there, rise 1 and run 2 (slope  $\frac{1}{2}$ ) to land at  $(2, -1)$ , then  $(4, 0)$  — there's the  $x$ -intercept. Draw the line through these

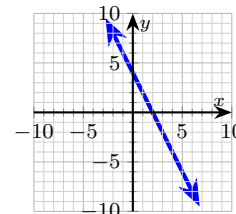
points.

## Answer graph



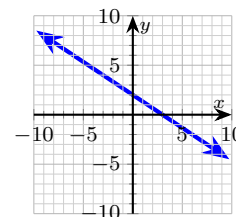
17. Plot the  $y$ -intercept first at  $(0, 4)$ . The slope  $-2$  means go down 2 for every 1 you move right: from  $(0, 4)$  step to  $(1, 2)$ , then  $(2, 0)$ . Connect them — a negative slope makes the line fall as you read left to right.

## Answer graph



18. Use the intercepts to plot quickly.  $x$ -intercept: set  $y = 0 \Rightarrow x = 3$ , point  $(3, 0)$ .  $y$ -intercept: set  $x = 0 \Rightarrow y = 2$ , point  $(0, 2)$ . Draw the line through those two points.

## Answer graph



19. ALEKS-style midpoint questions average the coordinates:  
 $\left(\frac{-4+2}{2}, \frac{6+(-2)}{2}\right) = (-1, 2)$ .

20. Start with the key idea: Use the distance formula:  $d = \sqrt{(2-(-3))^2 + (11-(-1))^2} = \sqrt{5^2 + 12^2} = \sqrt{169} = 13$ . That gives a quick check on the answer.

21. The  $y$ -intercept is the output value when  $t = 0$ . Here  $W(0) = 120$ , which is the starting amount of water. (The slope  $-8$  is the rate of draining; the intercept is the initial value.)

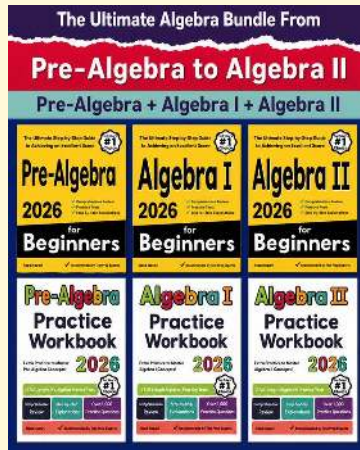
22. Per-minute rate is the slope: 0.10 dollars per minute. The flat \$25 is what you pay with zero minutes, so it's the  $C$ -intercept. Plug in  $m = 0$  to confirm:  $C = 25$ .

23. Slope:  $m = \frac{6-(-2)}{4-0} = \frac{8}{4} = 2$ . The  $y$ -intercept is the point with  $x = 0$ , which is  $(0, -2)$ , so  $b = -2$ . Equation:  $y = 2x - 2$ .

24. First rewrite the given line in slope-intercept form:  $-y = -3x + 7 \Rightarrow y = 3x - 7$ . Slope is 3. Parallel means same slope. Plug  $(1, 4)$ :  $4 = 3(1) + b = 3 + b$ , so  $b = 1$ . Equation:  $y = 3x + 1$ . (Quick check:  $(1, 4)$  satisfies  $y = 3x + 1$  since  $3(1) + 1 = 4$ .)



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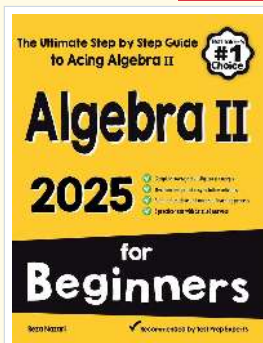
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