

# Slope and the Equations of a Line

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

## Q Quick Review

The **slope-intercept form** of a line is  $y = mx + b$ . Here  $m$  is the **slope** (steepness) and  $b$  is the  **$y$ -intercept** — the spot where the line crosses the  $y$ -axis. To graph it, start by plotting  $(0, b)$ , then use the slope as  $\frac{\text{rise}}{\text{run}}$  to step to the next point. To read an equation, the number multiplied by  $x$  is  $m$ , and the lone constant is  $b$ . Any equation in this form makes a straight line.

◇ **Example:** Write the equation of the line with slope 3 that passes through  $(0, -4)$ .

⇒ We want the form  $y = mx + b$ , so we need two numbers: the slope  $m$  and the  $y$ -intercept  $b$ . The slope is handed to us — it's 3. And the point  $(0, -4)$  is special because its  $x$ -value is 0, which means it sits right on the  $y$ -axis. So  $b = -4$ . Drop both values into the form:  $y = 3x + (-4)$ , which we tidy up as  $y = 3x - 4$ .

**Answer:**  $y = 3x - 4$

## PRACTICE

Write each line in slope-intercept form, or identify  $m$  and  $b$ .

- |   |       |                                       |       |
|---|-------|---------------------------------------|-------|
| 1. slope 2, $y$ -intercept 5              | _____ | 11. In $y = 7 - 4x$ , $b = ?$         | _____ |
| 2. slope 4, $y$ -intercept $-1$           | _____ | 12. slope $-\frac{2}{3}$ , $y$ -int 4 | _____ |
| 3. slope $-3$ , $y$ -intercept 6          | _____ | 13. In $y = 8$ , $m = ?$              | _____ |
| 4. slope $\frac{1}{2}$ , $y$ -intercept 0 | _____ | 14. In $y = 8$ , $b = ?$              | _____ |
| 5. slope 1, $y$ -intercept $-7$           | _____ | 15. slope 6, through $(0, 0)$         | _____ |
| 6. In $y = 5x + 2$ , $m = ?$              | _____ | 16. In $2y = 6x + 10$ , $y = ?$       | _____ |
| 7. In $y = 5x + 2$ , $b = ?$              | _____ | 17. In $y - 4 = 2x$ , $y = ?$         | _____ |
| 8. In $y = -2x - 9$ , $m = ?$             | _____ | 18. In $y + 3 = -x$ , $y = ?$         | _____ |
| 9. In $y = -2x - 9$ , $b = ?$             | _____ | 19. slope 0, $y$ -intercept $-2$      | _____ |
| 10. In $y = 7 - 4x$ , $m = ?$             | _____ | 20. In $3y = 9x - 12$ , $y = ?$       | _____ |

## ◆ Word Problems

21. A gym charges a \$20 sign-up fee plus \$5 per visit. Write an equation for the total cost  $y$  after  $x$  visits, and find the cost of 7 visits. \_\_\_\_\_

22. A water tank starts with 50 liters and is drained at 8 liters per minute. Write an equation for the water  $y$  left after  $x$  minutes. \_\_\_\_\_

23. A phone plan costs \$30 per month with no extra fees. Write the equation for total cost  $y$  after  $x$  months and state the slope and  $y$ -intercept. \_\_\_\_\_

24. A line passes through  $(0, 9)$  with slope  $-2$ . Write its equation, then find  $y$  when  $x = 4$ . \_\_\_\_\_



## Answer Keys

- |                             |                                    |
|-----------------------------|------------------------------------|
| 1. $y = 2x + 5$             | 13. $m = 0$                        |
| 2. $y = 4x - 1$             | 14. $b = 8$                        |
| 3. $y = -3x + 6$            | 15. $y = 6x$                       |
| 4. $y = \frac{1}{2}x$       | 16. $y = 3x + 5$                   |
| 5. $y = x - 7$              | 17. $y = 2x + 4$                   |
| 6. $m = 5$                  | 18. $y = -x - 3$                   |
| 7. $b = 2$                  | 19. $y = -2$                       |
| 8. $m = -2$                 | 20. $y = 3x - 4$                   |
| 9. $b = -9$                 | 21. $y = 5x + 20$ ; \$55           |
| 10. $m = -4$                | 22. $y = -8x + 50$                 |
| 11. $b = 7$                 | 23. $y = 30x$ ; $m = 30$ , $b = 0$ |
| 12. $y = -\frac{2}{3}x + 4$ | 24. $y = -2x + 9$ ; $y = 1$        |

### Step-by-Step Explanations

- |  |  |
|--|--|
| <p>1. Put <math>m = 2</math> and <math>b = 5</math> into <math>y = mx + b</math>.</p> <p>2. With <math>m = 4</math> and <math>b = -1</math>, the line is <math>y = 4x - 1</math>.</p> <p>3. A negative slope is fine: <math>y = -3x + 6</math>.</p> <p>4. With <math>b = 0</math> the line passes through the origin: <math>y = \frac{1}{2}x</math>.</p> <p>5. Slope 1 is just written as <math>x</math>: <math>y = x - 7</math>.</p> <p>6. The number multiplied by <math>x</math> is the slope, so <math>m = 5</math>.</p> <p>7. The lone constant is the <math>y</math>-intercept, so <math>b = 2</math>.</p> <p>8. The coefficient of <math>x</math> is <math>-2</math>, so <math>m = -2</math>.</p> <p>9. The constant term is <math>-9</math>, so <math>b = -9</math>.</p> <p>10. Reorder to <math>y = -4x + 7</math>; the slope is <math>-4</math>.</p> <p>11. Reordered as <math>y = -4x + 7</math>, the <math>y</math>-intercept is 7.</p> <p>12. Place <math>m = -\frac{2}{3}</math> and <math>b = 4</math> into the form.</p> <p>13. There is no <math>x</math> term, so the slope is 0 — a horizontal line.</p> <p>14. The line crosses the <math>y</math>-axis at 8, so <math>b = 8</math>.</p> | <p>15. Through the origin means <math>b = 0</math>, so <math>y = 6x</math>.</p> <p>16. Divide every term by 2: <math>y = 3x + 5</math>.</p> <p>17. Add 4 to both sides: <math>y = 2x + 4</math>.</p> <p>18. Subtract 3 from both sides: <math>y = -x - 3</math>.</p> <p>19. A slope of 0 drops the <math>x</math> term, leaving <math>y = -2</math>.</p> <p>20. Divide each term by 3: <math>y = 3x - 4</math>.</p> <p>21. The per-visit rate is the slope (<math>m = 5</math>) and the sign-up fee is the intercept (<math>b = 20</math>): <math>y = 5x + 20</math>. At <math>x = 7</math>: <math>y = 5(7) + 20 = 55</math>.</p> <p>22. It loses water, so the slope is <math>-8</math>, and it starts at 50 liters, so <math>b = 50</math>. The equation is <math>y = -8x + 50</math>.</p> <p>23. There's no start-up fee, so <math>b = 0</math>, and the monthly rate is the slope <math>m = 30</math>. So <math>y = 30x</math>.</p> <p>24. The point <math>(0, 9)</math> gives <math>b = 9</math>, and the slope is <math>-2</math>, so <math>y = -2x + 9</math>. At <math>x = 4</math>: <math>y = -2(4) + 9 = 1</math>.</p> |
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