

# 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.  $y = 2x + 5$

2.  $y = 4x - 1$

3.  $y = -3x + 6$

4.  $y = \frac{1}{2}x$

5.  $y = x - 7$

6.  $m = 5$

7.  $b = 2$

8.  $m = -2$

9.  $b = -9$

10.  $m = -4$

11.  $b = 7$

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

13.  $m = 0$

14.  $b = 8$

15.  $y = 6x$

16.  $y = 3x + 5$

17.  $y = 2x + 4$

18.  $y = -x - 3$

19.  $y = -2$

20.  $y = 3x - 4$

21.  $y = 5x + 20$ ; \$55

22.  $y = -8x + 50$

23.  $y = 30x$ ;  $m = 30$ ,  $b = 0$

24.  $y = -2x + 9$ ;  $y = 1$

### Step-by-Step Explanations

1. Put  $m = 2$  and  $b = 5$  into  $y = mx + b$ .2. With  $m = 4$  and  $b = -1$ , the line is  $y = 4x - 1$ .3. A negative slope is fine:  $y = -3x + 6$ .4. With  $b = 0$  the line passes through the origin:  $y = \frac{1}{2}x$ .5. Slope 1 is just written as  $x$ :  $y = x - 7$ .6. The number multiplied by  $x$  is the slope, so  $m = 5$ .7. The lone constant is the  $y$ -intercept, so  $b = 2$ .8. The coefficient of  $x$  is  $-2$ , so  $m = -2$ .9. The constant term is  $-9$ , so  $b = -9$ .10. Reorder to  $y = -4x + 7$ ; the slope is  $-4$ .11. Reordered as  $y = -4x + 7$ , the  $y$ -intercept is 7.12. Place  $m = -\frac{2}{3}$  and  $b = 4$  into the form.13. There is no  $x$  term, so the slope is 0 — a horizontal line.14. The line crosses the  $y$ -axis at 8, so  $b = 8$ .15. Through the origin means  $b = 0$ , so  $y = 6x$ .16. Divide every term by 2:  $y = 3x + 5$ .17. Add 4 to both sides:  $y = 2x + 4$ .18. Subtract 3 from both sides:  $y = -x - 3$ .19. A slope of 0 drops the  $x$  term, leaving  $y = -2$ .20. Divide each term by 3:  $y = 3x - 4$ .21. The per-visit rate is the slope ( $m = 5$ ) and the sign-up fee is the intercept ( $b = 20$ ):  $y = 5x + 20$ . At  $x = 7$ :  $y = 5(7) + 20 = 55$ .22. It loses water, so the slope is  $-8$ , and it starts at 50 liters, so  $b = 50$ . The equation is  $y = -8x + 50$ .23. There's no start-up fee, so  $b = 0$ , and the monthly rate is the slope  $m = 30$ . So  $y = 30x$ .24. The point  $(0, 9)$  gives  $b = 9$ , and the slope is  $-2$ , so  $y = -2x + 9$ . At  $x = 4$ :  $y = -2(4) + 9 = 1$ .

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