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8–5 Determining an Equation of a Line

Objective: To find an equation of a line given the slope and one point on the line, or given two points on the line.

Vocabulary

***x*-intercept** The x-coordinate of the point where a line crosses the x-axis.

Example 1 Write an equation of a line that has slope 3 and y-intercept 2.

Solution Substitute 3 for m and 2 for b in $y = mx + b$.
The equation is $y = 3x + 2$.

Write an equation in slope-intercept form of each line described.

1. slope 2; y-intercept 3 **$y = 2x + 3$**
2. slope -4; y-intercept 2 **$y = -4x + 2$**
3. slope $\frac{1}{2}$; y-intercept 5 **$y = \frac{1}{2}x + 5$**
4. slope $\frac{1}{3}$; y-intercept 6 **$y = \frac{1}{3}x + 6$**
5. slope $-\frac{1}{2}$; y-intercept 4 **$y = -\frac{1}{2}x + 4$**
6. slope $-\frac{1}{4}$; y-intercept 4 **$y = -\frac{1}{4}x + 4$**
7. slope $\frac{2}{3}$; y-intercept -6 **$y = \frac{2}{3}x - 6$**
8. slope 3; y-intercept -7 **$y = 3x - 7$**
9. slope -5; y-intercept 2 **$y = -5x + 2$**
10. slope $-\frac{2}{5}$; y-intercept -1 **$y = -\frac{2}{5}x - 1$**

Example 2 Write an equation of a line that has slope -2 and passes through $(5, 0)$.

Solution
1. Substitute -2 for m in $y = mx + b$
$y = -2x + b$
2. To find b, substitute 5 for x and 0 for y in $y = -2x + b$.
$y = -2x + b$
$0 = -2(5) + b$
$0 = -10 + b$
$10 = b$

The equation is $y = -2x + 10$.

Write an equation in slope-intercept form of each line described.

11. slope 2; passes through $(3, -1)$ **$y = 2x - 7$**
12. slope 3; passes through $(-1, 2)$ **$y = 3x + 5$**
13. slope -4; passes through $(2, 3)$
14. slope -2; passes through $(-3, 1)$
15. slope $\frac{2}{3}$; passes through $(0, 3)$ **$y = \frac{2}{3}x + 3$**
16. slope $-\frac{4}{3}$; passes through $(1, 0)$ **$y = -\frac{4}{3}x + \frac{4}{3}$**
17. slope $-\frac{3}{5}$; passes through $(-1, -4)$
18. slope -1; passes through $(3, 1)$ **$y = -x + 4$**
19. slope 0; passes through $\left(\frac{1}{4}, 2\right)$ **$y = 2$**
20. slope 0; passes through $\left(-2, \frac{3}{8}\right)$ **$y = \frac{3}{8}$**

13. $y = -4x + 11$
14. $y = -2x - 5$
17. $y = -\frac{3}{5}x - \frac{23}{5}$

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Example 3 Write an equation of the line passing through the points $(-3, 2)$ and $(1, -2)$.

Solution
1. Find the slope: $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 2}{1 - (-3)}$
$= \frac{-4}{4} = -1$
Substitute -1 for m in $y = mx + b$.
$y = -x + b$
2. Choose one of the points, say $(-3, 2)$.
Substitute -3 for x and 2 for y.
$y = -x + b$
$2 = -(-3) + b$
$2 = 3 + b$
$-1 = b$
The equation is $y = -x - 1$.

Write an equation in slope-intercept form of the line passing through the given points.

21. $(4, 5), (2, 1)$ **$y = 2x - 3$**
22. $(-1, 2), (4, 7)$ **$y = x + 3$**
23. $(1, 2), (4, 4)$ **$y = \frac{2}{3}x + \frac{4}{3}$**
24. $(3, 4), (4, 6)$ **$y = 2x - 2$**
25. $(3, 1), (5, 2)$ **$y = \frac{1}{2}x - \frac{1}{2}$**
26. $(0, -2), (-3, 2)$ **$y = -\frac{4}{3}x - 2$**
27. $(0, -1), (-2, 3)$ **$y = -2x - 1$**
28. $(6, 4), (2, 1)$ **$y = \frac{3}{4}x - \frac{1}{2}$**
29. $(-2, 8), (1, 2)$ **$y = -2x + 4$**
30. $(0, 3), (-1, 0)$ **$y = 3x + 3$**
31. $(-1, 3), (2, 0)$ **$y = -x + 2$**
32. $(1, -7), (2, -1)$ **$y = 6x - 13$**

Write an equation in slope-intercept form for each line described.

33. y-intercept -1; x-intercept 4 **$y = \frac{1}{4}x - 1$**
34. y-intercept -4; x-intercept 1 **$y = 4x - 4$**
35. x-intercept -4; y-intercept -3
36. horizontal line through $(-1, -2)$ **$y = -2$**
37. horizontal line through $(2, 4)$ **$y = 4$**
38. vertical line through $(-1, -2)$ **$x = -1$**

35. $y = -\frac{3}{4}x - 3$

Mixed Review Exercises

Simplify.

1. $\left(\frac{2}{5}t^2\right)(10t^3)$ **$4t^5$**
2. $\frac{1}{3}(6s^2 - 9st)$ **$2s^2 - 3st$**
3. $(6pq^2)^2$ **$36p^2q^4$**
4. $(-2m^2n^3)^4$ **$16m^8n^{12}$**
5. $2 \cdot 5 - 3^2$ **1**
6. $(2a^2b^3)(-3ab^2)$ **$-6a^3b^5$**
7. $2 \cdot (6 - 1)^2$ **50**
8. $(6x + 2y) - (x + y)$ **$5x + y$**