NAME _____   DATE _____

8–4 The Slope-Intercept Form of a Linear Equation

Objective: To use the slope-intercept form of a linear equation.

Vocabulary

y-intercept The y-coordinate of a point where a graph intersects the y-axis. Since the point is on the y-axis, its x-coordinate is 0.

Slope-intercept form of an equation The equation of a line in the form $y = mx + b$, where m is the slope and b is the y-intercept.

Parallel lines Lines in the same plane that do not intersect. Lines with the same slope and different y-intercepts are parallel.

Example 1   Find the slope and y-intercept of each line: **a.** $y = \frac{5}{2}x + 4$ **b.** $y = \frac{5}{2}x$ **c.** $y = 4$

Solution   Use the slope-intercept form, $y = mx + b$.

a. $y = \frac{5}{2}x + 4$

$y = \frac{5}{2}x + 4$
$\quad \uparrow \qquad \uparrow$
$\quad m \qquad b$

The slope is $\frac{5}{2}$ and the y-intercept is 4.

b. $y = \frac{5}{2}x$

$y = \frac{5}{2}x + 0$
$\quad \uparrow \qquad \uparrow$
$\quad m \qquad b$

The slope is $\frac{5}{2}$ and the y-intercept is 0.

c. $y = 4$
$y = 0x + 4$
$\quad \uparrow \qquad \uparrow$
$\quad m \qquad b$

The slope is 0 and the y-intercept is 4.
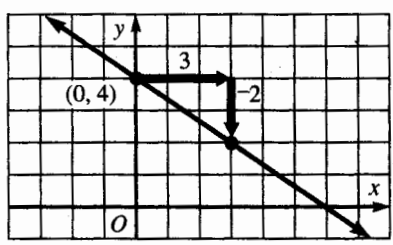
Find the slope and the y-intercept.

1. $y = x - 3$ **2.** $y = 2x + 3$ **3.** $y = -2$ **4.** $y = \frac{1}{3}x + 4$

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

9. $y = -x + 5$ **10.** $y = x - 9$ **11.** $y = 3x - 2$ **12.** $y = 3$

Example 2   Use only the slope and y-intercept to graph $y = -\frac{2}{3}x + 4$.

Solution

1. Since the y-intercept is 4, plot $(0, 4)$.

2. Since the slope $m = -\frac{2}{3} = \frac{-2}{3} = \frac{\text{rise}}{\text{run}}$, move 3 units to the right of $(0, 4)$ and 2 units down to locate a second point.

3. Draw a line through the points.

Use only the slope and y-intercept to graph each equation. You may wish to verify your graphs on a computer or a graphing calculator.

13. $y = \frac{2}{3}x - 4$ **14.** $y = \frac{3}{4}x - 3$ **15.** $y = -\frac{1}{2}x$ **16.** $y = -\frac{3}{4}x - 1$

17. $y = -x + 3$ **18.** $y = 2x + 1$ **19.** $y = -3$ **20.** $y = 5$

8–4 The Slope-Intercept Form of a Linear Equation (continued)

Example 3   Use only the slope and y-intercept to graph $2x - 3y = 6$.

Solution $2x - 3y = 6$ $\left\{\begin{array}{l}\text{Solve for } y \text{ to transform the equation}\\ \text{into the form } y = mx + b.\end{array}\right.$
$-3y = -2x + 6$

$y = \frac{2}{3}x - 2$

1. Since $b = -2$, plot $(0, -2)$.

2. Since $m = \frac{2}{3}$, move 3 units to the right and 2 units up to locate a second point.

3. Draw a line through the points.

Use only the slope and y-intercept to graph each equation. You may wish to verify your graphs on a computer or a graphing calculator.
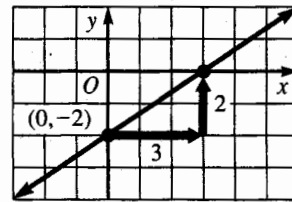
21. $2x + y = 4$ **22.** $3x + y = 6$ **23.** $2x - y = -6$ **24.** $3x - y = 3$

25. $x + 2y = -2$ **26.** $2x - 3y = 6$ **27.** $4x - 3y = 12$ **28.** $x + 4y = 4$

Example 4   Determine whether the lines with equations $4x + 5y = 20$ and $4x + 5y = 10$ are parallel.

Solution   Write each equation in slope-intercept form:

$4x + 5y = 20$ $4x + 5y = 10$
$5y = -4x + 20$ $5y = -4x + 10$
$y = -\frac{4}{5}x + 4$ $y = -\frac{4}{5}x + 2$
slope $= -\frac{4}{5}$ y-intercept $= 4$ slope $= -\frac{4}{5}$ y-intercept $= 2$

Since both lines have the same slope and different y-intercepts, they are parallel.

Determine whether the lines whose equations are given are parallel.

29. $2x - y = 5$ **30.** $x - 3y = 2$ **31.** $2x - y = 6$
  $2x - y = 8$ $-2x + 6y = 12$ $2y - x = 6$

32. $3x - y = 2$ **33.** $\frac{1}{2}x - \frac{1}{2}y = 4$ **34.** $4x + \frac{1}{4}y = 2$
  $-6x + 2y = 8$ $2x - 2y = 3$ $4x + 4y = 2$

Mixed Review Exercises

Find the slope of the line through each pair of given points.

1. $(-2, 1), (-1, 2)$ **2.** $(1, 2), (3, -2)$ **3.** $(-3, 4), (-1, -2)$ **4.** $(1, 5), (2, 8)$

Factor.

5. $2x^2 + 7x + 6$ **6.** $2x^2 - 4x + 2$ **7.** $4y^2 - 25z^2$ **8.** $m^2 - 3mn - 10n^2$