GOAL **Write linear equations in point-slope form.**

Vocabulary

The **point-slope form** of the equation of the nonvertical line through a given point (x_1, y_1) with a slope of m is $y - y_1 = m(x - x_1)$.

Key Concept

If you know the slope of a line and a point on the line or two points on a line, you can use the point-slope form $y - y_1 = m(x - x_1)$ to write an equation of the line.

Common Student Errors

- Substituting values for x instead of x_1 and for y instead of y_1

  Tip Stress that a variable with a subscript, such as x_1 or y_1, represents a specific point and its coordinate value must be substituted in the equation. The final equation must contain only the variables x and y.

  Example: $m = -2$ through $(1, -4)$

  Student equation: $-4 - y_1 = -2(1 - x_1)$ ✗

  Correct equation: $y - (-4) = -2(x - 1)$ ✓

- Not accounting for negative signs when the point (x_1, y_1) has negative coordinates

  Tip Have students use parentheses when substituting coordinates into the point-slope form.

  Example: $m = 3$ through $(-2, -5)$

  $y - (-5) = 3[x - (-5)]$

EXAMPLE 1 **Write an equation in point-slope form**

Write an equation in point-slope form of the line that passes through the point (5, 1) and has a slope of −3.

Solution

$y - y_1 = m(x - x_1)$ Write point-slope form.

$y - 1 = -3(x - 5)$ Substitute -3 for m, 5 for x, and 1 for y.

Exercises for Example 1

Write an equation in point-slope form of the line that passes through the given point and has the given slope.

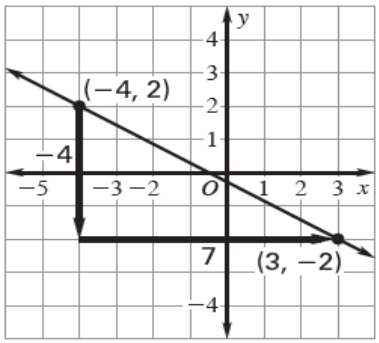
1. $(-3, -2)$; $m = 5$
2. $(1, 4)$; $m = -4$
3. $(6, -8)$; $m = -\frac{4}{9}$

EXAMPLE 2 **Graph an equation in point-slope form**

Graph the equation $y - 2 = -\frac{4}{7}(x + 4)$.

Solution

Because the equation is in point-slope form, you know that the line has a slope of $-\frac{4}{7}$ and passes through the point $(-4, 2)$. Plot the point $(-4, 2)$. Find a second point on the line using the slope. Draw a line through the two points.

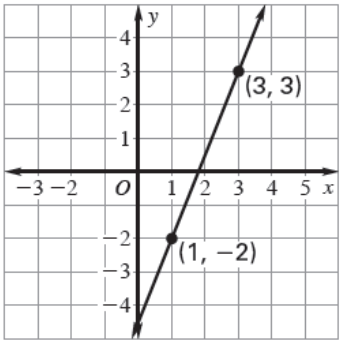


Exercise for Example 2

4. Graph the equation $y + 3 = 4(x + 2)$.

EXAMPLE 3 Use point slope form to write an equation

Write an equation in point-slope form of the line shown.



Solution

STEP 1 **Find** the slope of the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{3 - (-2)}{3 - 1}$$

$$= \frac{5}{2}$$

STEP 2 **Write** the equation in point-slope form. You can use either point.

Method 1 Use (3, 3).

$$y - y_1 = m(x - x_1)$$

$$y - 3 = \frac{5}{2}(x - 3)$$

Method 2 Use (1, −2).

$$y - y_1 = m(x - x_1)$$

$$y + 2 = \frac{5}{2}(x - 1)$$

CHECK **Check** that the equations are equivalent by writing them in slope-intercept form.

$$y - 3 = \frac{5}{2}(x - 3)$$

$$y = \frac{5}{2}x - \frac{9}{2}$$

$$y + 2 = \frac{5}{2}(x - 1)$$

$$y = \frac{5}{2}x - \frac{9}{2}$$

Exercises for Example 3

5. Write an equation in point-slope form of the line that passes through the points (−3, 8) and (4, −13).

6. Write an equation in point-slope form of the line that passes through the points (10, −6), (−6, 8).