

### 5-4 Point-Slope Form



#### Point-Slope Form of a Linear Equation

You know the formula for slope is:

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

If you multiply both sides of the equation by  $(x_2 - x_1)$  and then remove the point (2) labels, you get the point-slope form of an equation:

$$y_2 - y_1 = m(x_2 - x_1)$$

$$\downarrow \quad \downarrow \quad \downarrow$$

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

#### Example 1: Writing an Equation in Point-Slope Form (given the slope and one point)

1. Write an equation in point-slope form that has slope, -3, that passes through the point  $(-1, 7)$ . Then change the equation to slope-intercept form ( $y = mx + b$ ).

Step 1: Substitute -3 for  $m$ , and  $(-1, 7)$  for  $(x_1, y_1)$

Step 2: Distribute -3

Step 3: Add 7 to both sides.

$$m = -3$$

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

$$y - 7 = -3(x - -1)$$

$$y - 7 = -3(x + 1)$$

$$y - 7 = -3x - 3$$

$$y = -3x + 4$$

$$m = 2/3$$

2. Write an equation in point-slope form that has slope,  $\frac{2}{3}$ , that passes through the point  $(-6, 2)$ . Then change the equation to slope-intercept form ( $y=mx+b$ ).

Step 1:  $x_1, y_1$

Step 2: same

Step 3:

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

$$y - 2 = \frac{2}{3}(x - -6)$$

$$y - 2 = \frac{2}{3}(x + 6)$$

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

$$y = \frac{2}{3}x + 6$$

### ✓ Understanding Check:

Write an equation in point-slope form that has the given slope, and passes through the given point. Then change each to slope-intercept form of the line.

1. slope: 2, passing through  $(10, 8)$

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

$$y - 8 = 2(x - 10)$$

2. slope: 4, passing through  $(-3, -8)$

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

$$y + 8 = 4(x + 3)$$

3. slope: -2, passing through  $(2, -3)$

4. slope: -1, passing through  $(-3, -5)$

7. slope:  $\frac{1}{2}$ , passing through  $(-4, 5)$

8. slope:  $\frac{2}{3}$ , passing through  $(6, -9)$

### ✓ Understanding Check:

1. slope: 2, passing through  $(10, 8)$   
 $x, y$

$$\begin{array}{r} y - 8 = 2(x - 10) \\ y - 8 = 2x - 20 \\ \quad \quad \quad \quad \quad + 8 \\ \hline y = 2x - 12 \end{array}$$

2. slope: 4, passing through  $(-3, -8)$

$$\begin{array}{r} y - -8 = 4(x - -3) \\ y + 8 = 4(x + 3) \\ y + 8 \neq 4x + 12 \\ \quad \quad \quad \swarrow \searrow \\ \quad \quad \quad \quad -8 \\ \hline y = 4x + 4 \end{array}$$

3. slope: -2, passing through (2, -3)  
 $x, y$

$$\begin{array}{r} y - 3 = -2(x - 2) \\ y + 3 = -2x + 4 \\ \underline{\phantom{y} - 3} \phantom{= -2x +} \\ y = -2x + 1 \end{array}$$

4. slope: -1, passing through  $(-3, -5)$

$$\begin{array}{r} y - 5 = -(x - 3) \\ y + 5 = -(x + 3) \\ y + 5 \neq -x - 3 \\ \quad \quad \quad \rightarrow \quad \quad \quad -5 \\ \hline y = -x - 8 \end{array}$$

7. slope:  $\frac{1}{2}$ , passing through  $(-4, 5)$   
 $x, y,$

$$\begin{aligned} y - 5 &= \frac{1}{2}(x - (-4)) \\ y - 5 &= \frac{1}{2}(x + 4) \\ y - 5 &= \frac{1}{2}x + 2 \\ \quad \downarrow \rightarrow &\quad +5 \\ \hline y &= \frac{1}{2}x + 7 \end{aligned}$$

8. slope:  $\frac{2}{3}$ , passing through  $(6, -9)$   
 $x, y,$

$$y - -9 = \frac{2}{3}(x - 6)$$
$$y + 9 = \frac{2}{3}x - 4$$
$$\begin{array}{rcll} y + 9 & = & \frac{2}{3}x - 4 \\ \downarrow & & \rightarrow & -9 \end{array}$$

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$$y = \frac{2}{3}x - 13$$

Homework:

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