

13-7 Writing Linear Equations

In the previous section, you were given a linear equation and asked to draw its graph. In this section you will be given information about a graph and asked to find an equation of the line described.

Example 1 Find an equation of each line described.

- Slope = $-\frac{5}{3}$, y-intercept = 4
- x-intercept = -6, y-intercept = 3

Solution

a. $y = mx + b$

$$y = -\frac{5}{3}x + 4$$

- b. Because the y-intercept is 3, you have $b = 3$.

Because the points $(-6, 0)$ and $(0, 3)$ lie on the line,

$$\text{slope} = \frac{3 - 0}{0 - (-6)} = \frac{3}{6} = \frac{1}{2}.$$

Since the slope is $\frac{1}{2}$, you have $m = \frac{1}{2}$.

Now substitute into the equation $y = mx + b$ to get

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

Both linear equations in Example 1 were written in slope-intercept form. This form is very easy to use if the y-intercept is given. If the y-intercept is not given, the *point-slope form* can be used.

Theorem 13-8 Point-Slope Form

An equation of the line that passes through the point (x_1, y_1) and has slope m is

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

Proof:

Let (x, y) be any point on the line. Since the line also contains the point (x_1, y_1) the slope must, by definition, equal

$$\frac{y - y_1}{x - x_1}.$$

$$\text{From } m = \frac{y - y_1}{x - x_1},$$

we get

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

