

## 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

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

