1-5

Study Guide

Writing Equations of Parallel and Perpendicular Lines

- Two nonvertical lines in a plane are **parallel** if and only if their slopes are equal and they have no points in common.
- Graphs of two equations that represent the same line are said to **coincide**.
- Two nonvertical lines in a plane are **perpendicular** if and only if their slopes are negative reciprocals.

Example 1 **Determine whether the graphs of each pair of equations are *parallel*, *coinciding*, or *neither*.**

a. $2x - 3y = 5$
$6x - 9y = 21$

b. $12x + 6y = 18$
$4x = -2y + 6$

Write each pair of equations in slope-intercept form.

a. $2x - 3y = 5$ $\quad 6x - 9y = 21$
$y = \frac{2}{3}x - \frac{5}{3}$ $\quad y = \frac{2}{3}x - \frac{7}{3}$

The lines have the same slope but different y-intercepts, so they are parallel.

b. $12x + 6y = 18$ $\quad 4x = -2y + 6$
$y = -2x + 3$ $\quad y = -2x + 3$

The equations are identical, so the lines coincide.

Example 2 **Write the standard form of the equation of the line that passes through the point at (3, −4) and is parallel to the graph of $x + 3y - 4 = 0$.**

Any line parallel to the graph of $x + 3y - 4 = 0$ will have the same slope. So, find the slope of the graph of $x + 3y - 4 = 0$.

$$m = -\frac{A}{B}$$
$$= -\frac{1}{3} \quad A = 1, B = 3$$

Use the point-slope form to write the equation of the line.

$$y - y_1 = m(x - x_1)$$
$$y - (-4) = -\frac{1}{3}(x - 3) \quad x_1 = 3, y_1 = -4, m = -\frac{1}{3}$$
$$y + 4 = -\frac{1}{3}x + 1$$
$$3y + 12 = -x + 3 \quad \textit{Multiply each side by 3.}$$
$$x + 3y + 9 = 0 \quad \textit{Write in standard form.}$$