

## Lesson 5-6

### Example 1 Parallel Line Through a Given Point

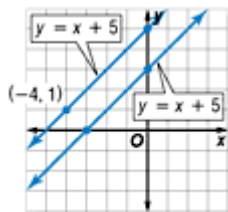
Write the slope-intercept form of an equation for the line that passes through  $(-4, 1)$  and is parallel to the graph of  $y = x + 3$ .

The line parallel to  $y = x + 3$  has the same slope, 1. Replace  $m$  with 1, and  $(x_1, y_1)$  with  $(-4, 1)$  in the point-slope form.

$y - y_1 = m(x - x_1)$	Point-slope form
$y - 1 = 1(x - (-4))$	Replace $m$ with 1, $y_1$ with 1, and $x_1$ with $-4$ .
$y - 1 = 1(x + 4)$	Simplify
$y - 1 = x + 4$	Distributive Property
$y - 1 + 1 = x + 4 + 1$	Add 1 to each side.
$y = x + 5$	Write equation in slope-intercept form.

Therefore, the equation is  $y = x + 5$ .

**Check:** You can check your result by graphing both equations. The lines appear to be parallel. The graph of  $y = x + 5$  passes through  $(-4, 1)$ .



### Example 2 Determine Whether Lines are Perpendicular

Determine whether  $y = -\frac{2}{3}x + 1$  and  $y = \frac{3}{2}x - 2$  are perpendicular.

Find the slope of each line.

The slope of  $y = -\frac{2}{3}x + 1$  is  $-\frac{2}{3}$ .

The slope of  $y = \frac{3}{2}x - 2$  is  $\frac{3}{2}$ .

The lines are perpendicular because  $-\frac{2}{3} \left(\frac{3}{2}\right) = \frac{-6}{6}$  or  $-1$ .

### Example 3 Perpendicular Line Through a Given Point

Write the slope-intercept form for an equation of a line that passes through  $(-3, 4)$  and is perpendicular to the graph of  $9x - 6y = 3$ .

**Step 1:** Find the slope of the given line.

$$\begin{aligned}9x - 6y &= 3 && \text{Original equation} \\9x - 6y - 9x &= 3 - 9x && \text{Subtract } 9x \text{ from each side.} \\-6y &= -9x + 3 && \text{Simplify.} \\ \frac{-6y}{-6} &= \frac{-9x + 3}{-6} && \text{Divide each side by } -6. \\ y &= \frac{3}{2}x - \frac{1}{2} && \text{Simplify.}\end{aligned}$$

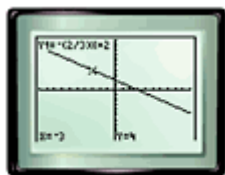
**Step 2:** The slope of the given line is  $\frac{3}{2}$ . So, the slope of the line perpendicular to this line is the opposite reciprocal of  $\frac{3}{2}$ , or  $-\frac{2}{3}$ .

**Step 3:** Use the point-slope form to find the equation.

$$\begin{aligned}y - y_1 &= m(x - x_1) && \text{Point-slope form} \\ y - 4 &= -\frac{2}{3}(x - (-3)) && (x_1, y_1) = (-3, 4) \text{ and } m = -\frac{2}{3} \\ y - 4 &= -\frac{2}{3}(x + 3) && \text{Simplify} \\ y - 4 &= -\frac{2}{3}x + (-2) && \text{Distributive Property} \\ y - 4 + 4 &= -\frac{2}{3}x + (-2) + 4 && \text{Add 4 to each side.} \\ y &= -\frac{2}{3}x + 2 && \text{Simplify.}\end{aligned}$$

Therefore, the equation of the line is  $y = -\frac{2}{3}x + 2$ .

**Check:** You can check your result by graphing both equations on a graphing calculator. Use the CALC menu to verify that  $y = -\frac{2}{3}x + 2$  passes through  $(-3, 4)$ .



#### Example 4 Perpendicular Line Through a Given Point

Write the slope-intercept form for an equation of a line perpendicular to the graph of  $y = \frac{5}{6}x - 5$  and passes through the y-intercept of that line.

**Step 1:** Find the slope of the perpendicular line. The slope of the given line is  $\frac{5}{6}$ , therefore, a

perpendicular line has slope  $-\frac{6}{5}$  because  $\frac{5}{6} \cdot -\frac{6}{5} = -1$ .

**Step 2:** Find the y-intercept of the given line.

$$y = \frac{5}{6}x - 5 \quad \text{Original equation.}$$

$$y = \frac{5}{6}(0) - 5 \quad \text{Replace } x \text{ with } 0.$$

$$y = -5 \quad \text{Simplify.}$$

The y-intercept is at (0, -5).

**Step 3:** Substitute the slope and the given point into the slope-intercept form of an equation since you have both the slope and y-intercept.

$$y = mx + b \quad \text{Slope-intercept form}$$

$$y = -\frac{6}{5}x + (-5) \quad m = -\frac{6}{5} \text{ and } b = -5$$

$$y = -\frac{6}{5}x - 5 \quad \text{Simplify.}$$

Therefore, the equation of the line is  $y = -\frac{6}{5}x - 5$ .