5-6 Geometry: Parallel and Perpendicular Lines *(Pages 292–297)*

Parallel Lines	Lines in the same plane that never intersect are called **parallel lines**. If two nonvertical lines have the same slope, then they are parallel. All vertical lines are parallel.
Perpendicular Lines	Lines that intersect at right angles are called **perpendicular lines**. If the product of the slopes of two lines is -1, then the lines are perpendicular. The slopes of two perpendicular lines are negative reciprocals of each other. In a plane, vertical lines and horizontal lines are perpendicular.

Examples

a. Determine whether the graphs of $2y = -3x + 4$ and $3y = 2x - 9$ are *parallel*, *perpendicular*, or *neither*.

Rewrite each line in slope-intercept form to identify its slope.

$2y = -3x + 4$ $\qquad$ $3y = 2x - 9$

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

$m = -\frac{3}{2}$ $\qquad\qquad$ $m = \frac{2}{3}$

Since $-\frac{3}{2} \cdot \frac{2}{3} = -1$, these lines are perpendicular.

b. Write an equation in slope-intercept form of the line that is parallel to the graph of $x + 6y = -12$ and has an x-intercept of 9.

Find the slope of the line given.

$6y = -x - 12$ $\Rightarrow$ $y = -\frac{1}{6}x - 2$

A line parallel to this line will have the same slope, or $-\frac{1}{6}$. An x-intercept of 9 means the new line passes through (9, 0).

$y - y_1 = m(x - x_1)$ $\quad$ *Point-slope form*

$y - 0 = -\frac{1}{6}(x - 9)$ $\quad$ $m = -\frac{1}{6}, (x_1, y_1) = (9, 0)$

$y = -\frac{1}{6}x + \frac{3}{2}$ $\quad$ *Slope-intercept form*

Practice

Determine whether the graphs of each pair of equations are *parallel*, *perpendicular*, or *neither*.

1. $x = 4y + 12$
$4y = x + 8$

2. $y = -x + 8$
$x + 2y = 8$

3. $2y = 5x + 6$
$2x + 5y = 5$

Write an equation in slope-intercept form of the line having the following properties.

4. is perpendicular to the graph of $y = \frac{1}{2}x + 6$ and passes through $(6, 8)$

5. is parallel to the graph of $y = \frac{1}{6}x - 2$ and passes through the origin

6. passes through $(1, 0)$ and is parallel to the graph of $3x - 3y = 5$

7. passes through $(0, -7)$ and is perpendicular to the graph of $x - 2y = 7$

8. is parallel to the x-axis and passes through $(4, 5)$

9. is perpendicular to the graph of $x - 3y = 6$ and passes through $(7, -5)$

10. **Standardized Test Practice** What is the slope of a line perpendicular to $y + 3x = 2$?

A -3 $\qquad$ **B** $-\frac{1}{3}$ $\qquad$ **C** $\frac{1}{3}$ $\qquad$ **D** 3

Answers: 1. parallel **2.** neither **3.** perpendicular **4.** $y = -2x + 20$ **5.** $y = \frac{1}{6}x$ **6.** $y = x - 1$ **7.** $y = -2x - 7$ **8.** $y = 5$ **9.** $y = -3x + 16$ **10.** C