

Parallel and Perpendicular Lines

(Pages 322–327)

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. In a plane, vertical lines are perpendicular to horizontal lines.

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.

$$\begin{aligned} 2y &= -3x + 4 & 3y &= 2x - 9 \\ y &= -\frac{3}{2}x + 2 & y &= \frac{2}{3}x - 3 \\ m &= -\frac{3}{2} & m &= \frac{2}{3} \end{aligned}$$

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 passes through the point at $(9, 0)$.

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 $-\frac{1}{6}$.

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope Form}$$

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

$$y = -\frac{1}{6}x + \frac{3}{2} \quad \text{Slope-Intercept Form}$$

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 that is parallel to the graph of each equation and passes through the given point.

4. $y = 3x + 4$; $(2, 4)$

5. $y = \frac{1}{6}x - 2$; $(0, 0)$

6. $3x - 3y = 5$; $(1, 0)$

Write an equation in slope-intercept form of the line that is perpendicular to the graph of each equation and passes through the given point.

7. $x - 2y = 7$; $(0, -7)$

8. $y = \frac{1}{2}x + 6$; $(6, 8)$

9. $x - 3y = 6$; $(7, -5)$



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

A -3

B $-\frac{1}{3}$

C $\frac{1}{3}$

D 3

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