2-3 Study Guide and Intervention (continued)

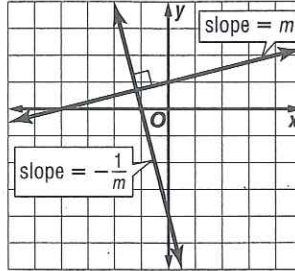### Slope

Parallel and Perpendicular Lines

In a plane, nonvertical lines with the same slope are **parallel**. All vertical lines are parallel.	In a plane, two oblique lines are **perpendicular** if and only if the product of their slopes is -1. Any vertical line is perpendicular to any horizontal line.
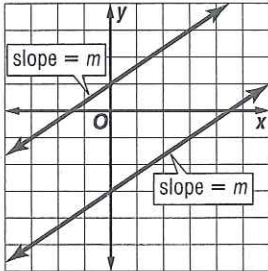
Example Are the line passing through (2, 6) and (−2, 2) and the line passing through (3, 0) and (0, 4) parallel, perpendicular, or neither?

Find the slopes of the two lines.

The slope of the first line is $\dfrac{6-2}{2-(-2)} = 1$.

The slope of the second line is $\dfrac{4-0}{0-3} = -\dfrac{4}{3}$.

The slopes are not equal and the product of the slopes is not -1, so the lines are neither parallel nor perpendicular.

Exercises

Are the lines parallel, perpendicular, or neither?

1. the line passing through (4, 3) and (1, −3) and the line passing through (1, 2) and (−1, 3)

    Perpendicular

2. the line passing through (2, 8) and (−2, 2) and the line passing through (0, 9) and (6, 0)

    neither

3. the line passing through (3, 9) and (−2, −1) and the graph of $y = 2x$

    Parallel

4. the line with x-intercept −2 and y-intercept 5 and the line with x-intercept 2 and y-intercept −5

    parallel

5. the line with x-intercept 1 and y-intercept 3 and the line with x-intercept 3 and y-intercept 1

    neither

6. the line passing through (−2, −3) and (2, 5) and the graph of $x + 2y = 10$

    Perpendicular

7. the line passing through (−4, −8) and (6, −4) and the graph of $2x - 5y = 5$

    parallel

Lesson 2-3

2-4 Study Guide and Intervention (continued)

Writing Linear Equations

Parallel and Perpendicular Lines Use the slope-intercept or point-slope form to find equations of lines that are parallel or perpendicular to a given line. Remember that parallel lines have equal slope. The slopes of two perpendicular lines are negative reciprocals, that is, their product is -1.

Example 1 Write an equation of the line that passes through $(8, 2)$ and is perpendicular to the line whose equation is $y = -\frac{1}{2}x + 3$.

The slope of the given line is $-\frac{1}{2}$. Since the slopes of perpendicular lines are negative reciprocals, the slope of the perpendicular line is 2.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$ Point-slope form
$y - 2 = 2(x - 8)$ $(x_1, y_1) = (8, 2)$, $m = 2$
$y - 2 = 2x - 16$ Distributive Prop.
$y = 2x - 14$ Add 2 to each side.

An equation of the line is $y = 2x - 14$.

Example 2 Write an equation of the line that passes through $(-1, 5)$ and is parallel to the graph of $y = 3x + 1$.

The slope of the given line is 3. Since the slopes of parallel lines are equal, the slope of the parallel line is also 3.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$ Point-slope form
$y - 5 = 3(x - (-1))$ $(x_1, y_1) = (-1, 5)$, $m = 3$
$y - 5 = 3x + 3$ Distributive Prop.
$y = 3x + 8$ Add 5 to each side.

An equation of the line is $y = 3x + 8$.

Exercises

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

1. passes through $(-4, 2)$, parallel to the line whose equation is $y = \frac{1}{2}x + 5$

$y = \frac{1}{2}x + 4$

2. passes through $(3, 1)$, perpendicular to the graph of $y = -3x + 2$

$y = \frac{1}{3}x$

3. passes through $(1, -1)$, parallel to the line that passes through $(4, 1)$ and $(2, -3)$

$y = 2x - 3$

4. passes through $(4, 7)$, perpendicular to the line that passes through $(3, 6)$ and $(3, 15)$

$y = 7$

5. passes through $(8, -6)$, perpendicular to the graph of $2x - y = 4$

$y = -\frac{1}{2}x - 2$

6. passes through $(2, -2)$, perpendicular to the graph of $x + 5y = 6$

$y = 5x - 12$

7. passes through $(6, 1)$, parallel to the line with x-intercept -3 and y-intercept 5

$y = 5/3 x - 9$

8. passes through $(-2, 1)$, perpendicular to the line $y = 4x - 11$

$y = -\frac{1}{4}x + \frac{1}{2}$