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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. $2x - 3y = 5$ **b. $12x + 6y = 18$**
  ** $6x - 9y = 21$**   ** $4x = -2y + 6$**

Write each pair of equations in slope-intercept form.

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

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

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

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 $x + 3y - 4 = 0$.

$m = -\frac{A}{B}$

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

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

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

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Practice

Writing Equations of Parallel and Perpendicular Lines

Determine whether the graphs of each pair of equations are parallel, perpendicular, coinciding, or none of these.

1. $x + 3y = 18$
$3x + 9y = 12$

2. $2x - 4y = 8$
$x - 2y = 4$

3. $-3x + 2y = 6$
$2x + 3y = 12$

4. $x + y = 6$
$3x - y = 6$

5. $4x + 8y = 2$
$2x + 4y = 8$

6. $3x - y = 9$
$6x - 2y = 18$

Write the standard form of the equation of the line that is parallel to the graph of the given equation and that passes through the point with the given coordinates.

7. $2x + y - 5 = 0; (0, 4)$ **8.** $3x - y + 3 = 0; (-1, -2)$ **9.** $3x - 2y + 8 = 0; (2, 5)$

Write the standard form of the equation of the line that is perpendicular to the graph of the given equation and that passes through the point with the given coordinates.

10. $2x - y + 6 = 0; (0, -3)$ **11.** $2x - 5y - 6 = 0; (-4, 2)$ **12.** $3x + 4y - 13 = 0; (2, 7)$

13. ***Consumerism***   Marillia paid \$180 for 3 video games and 4 books. Three months later she purchased 8 books and 6 video games. Her brother guessed that she spent \$320. Assuming that the prices of video games and books did not change, is it possible that she spent \$320 for the second set of purchases? Explain.