Name _____ Date ____

4.3 Notetaking with Vocabulary

I can identify and write equations of parallel lines.
I can identify and write equations of perpendicular lines.
I can use linear equations to solve real-life problems (mathematical modeling).

Write the meaning of each vocabulary term.

parallel lines

perpendicular lines

Core Concepts

Parallel Lines and Slopes

Two lines in the same plane that never intersect are parallel lines ||.

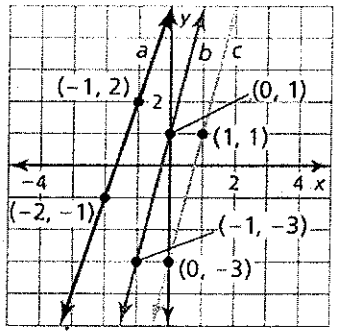
Two distinct nonvertical lines are parallel if and only if (iff) they have the same slope.

All vertical lines are parallel.

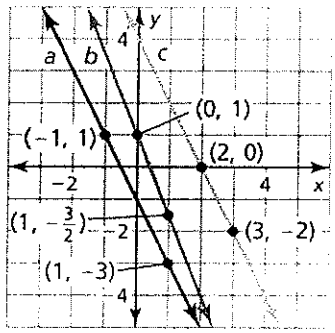
Practice

In Exercises 1–6, determine which of the lines, if any, are parallel. Explain.

1.



2.



$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

3. Line a passes through $(-4, -1)$ and $(2, 2)$.
Line b passes through $(-5, -3)$ and $(5, 1)$.
Line c passes through $(+2, -3)$ and $(2, -1)$.

$m_a = \frac{2+(+1)}{2+(+4)} = \frac{3}{6} = \frac{1}{2}$

$m_b = \frac{1+(+3)}{5+(+5)} = \frac{4}{10} = \frac{2}{5}$

$m_c = \frac{-1+(+3)}{2+(+2)} = \frac{2}{4} = \frac{1}{2}$

4. Line a passes through $(-2, 5)$ and $(2, 1)$.
Line b passes through $(-4, 3)$ and $(3, 4)$.
Line c passes through $(-3, 4)$ and $(2, -6)$.

Lines a and c are parallel because they have the same slope.

5. Line a: $4x = -3y + 9$
Line b: $8y = -6x + 16$
Line c: $4y = -3x + 9$

Line a
$4x = -3y + 9$
$-9 \quad -9$
$\frac{4x - 9}{-3} = \frac{-3y}{-3}$
$-\frac{4}{3}x + 3 = y$

Line b
$\frac{8y}{8} = \frac{-6x}{8} + \frac{16}{8}$
$y = -\frac{3}{4}x + 2$

6. Line a: $5y - x = 4$
Line b: $5y = x + 7$
Line c: $5y - 2x = 5$

Line c: $\frac{4y}{4} = -\frac{3x}{4} + \frac{9}{4}$
$y = -\frac{3}{4}x + \frac{9}{4}$

Lines b and c are parallel because they have the same slope.

In Exercises 7 and 8, write an equation of the line that passes through the given point and is parallel to the given line.

7. $(3, -1)$; $y = \frac{1}{3}x - 3$

$m_{\parallel} = \frac{1}{3}$

① $y - y_1 = m(x - x_1)$
$y - (-1) = \frac{1}{3}(x - 3)$
$y + 1 = \frac{1}{3}x - 1$
$-1 \quad -1$
$y = \frac{1}{3}x - 2$

8. $(1, -2)$; $y = -2x + 1$

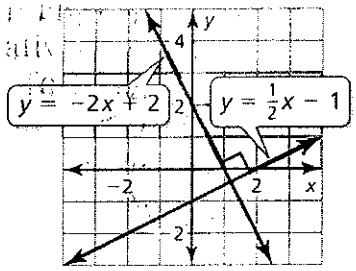
② $y = mx + b$ / solve for b
$-1 = (\frac{1}{3})(3) + b$
$-1 = 1 + b$
$-1 \quad -1$
$-2 = b$
$y = \frac{1}{3}x - 2$

Name _____ Date _____

4.3 Notetaking with Vocabulary (continued)

Perpendicular Lines and Slopes

Two lines in the same plane that intersect to form right angles are 90° perpendicular lines.



Nonvertical lines are perpendicular if and only if their slopes are opposite reciprocals

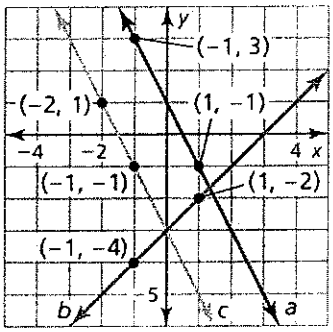
Vertical lines are perpendicular to _____.

2 $-\frac{1}{2}$ } opp. recip. $-\frac{4}{3}$ $\frac{3}{4}$ } opposite recip. "flipp'n opposites"

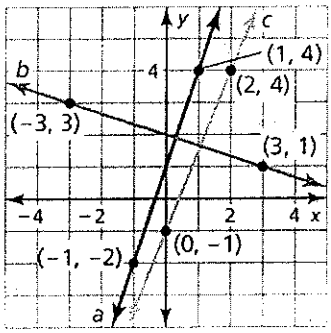
For Geo! If the product of slopes = −1, then lines are ⊥.

In Exercises 9–14, determine which of the lines, if any, are parallel or perpendicular. Explain.

9.



10.



$m_a = \frac{4-(-2)}{1-(-1)} = \frac{6}{2} = 3$

$m_b = \frac{1-3}{3-(-3)} = \frac{-2}{6} = -\frac{1}{3}$

$m_c = \frac{4-(-1)}{2-0} = \frac{5}{2}$

Lines a and b are perpendicular because their slopes are opposit reciprocals.

11. Line a passes through $(-2, 4)$ and $(1, 1)$.
Line b passes through $(2, 1)$ and $(4, 4)$.
Line c passes through $(1, -2)$ and $(-1, 4)$.

$m_a = \frac{1-4}{1-(-2)} = \frac{-3}{3} = -1$

$m_b = \frac{4-1}{4-2} = \frac{3}{2}$

None of the lines are parallel or perpendicular.

$m_c = \frac{4-(-2)}{-1-1} = \frac{6}{-2} = -3$

12. Line a passes through $(-2, -4)$ and $(-1, -1)$.
Line b passes through $(-1, -4)$ and $(1, 2)$.
Line c passes through $(2, 3)$ and $(4, 2)$.

13. Line a: $y = \frac{3}{4}x + 1$
Line b: $-3y = 4x - 3$
Line c: $4y = -3x + 9$

Line b $\frac{-3y}{-3} = \frac{4x}{-3} - \frac{3}{-3}$

$y = \frac{4}{3}x + 1$

Line c $\frac{4y}{4} = \frac{-3x}{4} + \frac{9}{4}$

$y = \frac{-3}{4}x + \frac{9}{4}$

14. Line a: $5y - 2x = 1$
Line b: $y = \frac{5}{2}x - 1$
Line c: $y = \frac{2}{5}x + 3$

Lines a and b are perpendicular because their slopes are opposite reciprocals.

In Exercises 15 and 16, write an equation of the line that passes through the given point and is perpendicular to the given line.

15. $(-2, 2)$; $y = \frac{2}{3}x + 2$
x_1, y_1

$m_\perp = \frac{-3}{2}$

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

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

$y = \frac{-3}{2}x - 1$

16. $(3, 1)$; $\frac{2y}{2} = \frac{4x}{2} - \frac{3}{2}$

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

$m_\perp = \frac{-1}{2}$

$y = mx + b$

$1 = \frac{-1}{2}(3) + b$

$1 = \frac{-3}{2} + b$
$+\frac{3}{2} \qquad +\frac{3}{2}$

$\frac{5}{2} = b$

$y = \frac{-1}{2}x + \frac{5}{2}$

$2\frac{1}{2}$