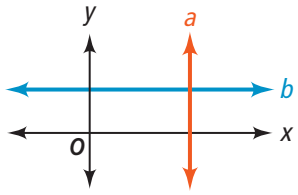
3-8 Slopes of Parallel and Perpendicular Lines

Vocabulary

Review

Use the graph at the right for Exercises 1–4. Write *parallel* or *perpendicular* to complete each sentence.



1. Line b is _?_ to line a. _____
2. Line b is _?_ to the x-axis. _____
3. Line a is _?_ to the y-axis. _____
4. The x-axis is _?_ to the y-axis. _____

Write the *converse, inverse,* and *contrapositive* of the statement below.

If a polygon is a triangle, then the sum of the measures of its angles is 180.

5. **CONVERSE** If the sum of the measures of the angles of a polygon is 180, then _?_.

_____

6. **INVERSE** If a polygon is *not* a triangle, then _?_.

_____

7. **CONTRAPOSITIVE** If the sum of the measures of the angles of a polygon is *not* 180, then _?_.

_____

Vocabulary Builder

The **reciprocal** of x is $\frac{1}{x}$.

reciprocal (noun) **rih SIP ruh kul**

Other Word Forms: reciprocate (verb)

Definition: The **reciprocal** of a number is a number such that the product of the two numbers is 1. The **reciprocal** of $\frac{\text{numerator}}{\text{denominator}}$ is $\frac{\text{denominator}}{\text{numerator}}$.

Use Your Vocabulary

Complete each statement with *reciprocal* or *reciprocate*. Use each word only once.

8. VERB After your friend helps you with your homework, you ? by helping your friend with his chores.

9. NOUN The ? of $\frac{2}{3}$ is $\frac{3}{2}$.

take note

Key Concept Slopes of Parallel Lines

- If two nonvertical lines are parallel, then their slopes are equal.
- If the slopes of two distinct nonvertical lines are equal, then the lines are parallel.
- Any two vertical lines or horizontal lines are parallel.

Circle the correct statement in each exercise.

10.
- A vertical line is parallel to any other vertical line.
- A vertical line is parallel to any horizontal line.

11.
- Any two nonvertical lines have the same slope.
- Any two nonvertical lines that are parallel have the same slope.

Problem 1 Checking for Parallel Lines

Got It? **Line ℓ_3 contains $A(-13, 6)$ and $B(-1, 2)$. Line ℓ_4 contains $C(3, 6)$ and $D(6, 7)$. Are ℓ_3 and ℓ_4 parallel? Explain.**

12. To determine whether lines ℓ_3 and ℓ_4 are are parallel check whether the lines have the same ? .

13. Find the slope of each line.

slope of ℓ_3

$$\frac{2 - 6}{-1 - (-13)} = \frac{\quad}{\quad} = \quad$$

slope of ℓ_4

14. Are the slopes equal? Yes / No

15. Are lines ℓ_3 and ℓ_4 parallel? Explain.

Problem 2 Writing Equations of Parallel Lines

Got It? **What is an equation of the line parallel to $y = -x - 7$ that contains $(-5, 3)$?**

16. The slope of the line $y = -x - 7$ is _____.

17. The equation of the line parallel to $y = -x - 7$ will have slope $m =$ _____.

18. Find the equation of the line using point-slope form. Complete the steps below.

$y - y_1 =$		Write in point-slope form.
$y - 3 =$		Substitute point and slope into equation.
$y - 3 =$		Simplify.
$y =$		Add 3 to both sides.

take note

Key Concept Slopes of Perpendicular Lines

- If two nonvertical lines are perpendicular, then the product of their slopes is -1.
- If the slopes of two lines have a product of -1, then the lines are perpendicular.
- Any horizontal line and vertical line are perpendicular.

Write T for *true* or F for *false*.

____ **19.** The second bullet in the Take Note is the contrapositive of the first bullet.

____ **20.** The product of the slopes of any horizontal line and any vertical line is -1.

Problem 3 Checking for Perpendicular Lines

Got It? **Line ℓ_3 contains $A(2, 7)$ and $B(3, -1)$. Line ℓ_4 contains $C(-2, 6)$ and $D(8, 7)$. Are ℓ_3 and ℓ_4 perpendicular? Explain.**

21. Find the slopes and multiply them.

$m_3 =$ _____ $m_4 =$ _____

$m_3 \times m_4 =$ _____

22. Underline the correct words to complete the sentence.

Lines ℓ_3 and ℓ_4 are / are not perpendicular because the product of their slopes does / does not equal -1.

Problem 4 Writing Equations of Perpendicular Lines

Got It? What is an equation of the line perpendicular to $y = -3x - 5$ that contains $(-3, 7)$?

23. Complete the reasoning model below.

Think	Write
I can identify the slope, m_1, of the given line.	$y = -3x - 5$ is in point-slope form, so $m_1 =$ ____.
I know that the slope, m_2, of the perpendicular line is the negative reciprocal of m_1.	m_2 is $\frac{\quad}{\quad}$ because ____ $\times \frac{\quad}{\quad} = -1$.
I can use m_2 and $(-3, 7)$ to write the equation of the perpendicular line in point-slope form.	$y - y_1 = m(x - x_1)$

Lesson Check • Do you UNDERSTAND?

Error Analysis Your classmate tries to find an equation for a line parallel to $y = 3x - 5$ that contains $(-4, 2)$. What is your classmate's error?

slope of given line = 3

slope of parallel line = $\frac{1}{3}$

$y - y_1 = m(x - x_1)$

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

24. Parallel lines have the same / different slopes.

25. Show a correct solution in the box below.

Math Success

Check off the vocabulary words that you understand.

☐ slope ☐ reciprocal ☐ parallel ☐ perpendicular

Rate how well you *understand perpendicular lines.*

Need to review 0 2 4 6 8 10 Now I get it!