LESSON OVERVIEW

Lesson 12
Understand the Slope-Intercept Equation for a Line

CCSS Focus

Domain
Expressions and Equations

Cluster
B. Understand the connections between proportional relationships, lines, and linear equations.

Standard
8.EE.B.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

Additional Standards
8.EE.B.5, 8.F.B.4 (See page B3 for full text.)

Standards for Mathematical Practice (SMP)
4 Model with mathematics.

Lesson Objectives

Content Objectives
- Understand that similar triangles have proportional side lengths.
- Use the slope and y-intercept to derive an equation for a linear function.

Language Objectives
- Demonstrate understanding of the definitions of *slope-intercept form* and *similar triangles* by paraphrasing.
- Discuss how to find a general equation for all proportional relationships using the terms *origin*, *slope*, *non-vertical*, *proportional relationships*, and *point*.
- Compare equations to determine if they are linear equations that can be written in the form $y = mx$.
- Explain in writing how to find the slope of a line by analyzing data recorded on a table.

Prerequisite Skills
- Graph an equation.
- Write an equation for a graph.
- Identify the slope of a line.
- Identify the y-intercept of a graph.

Lesson Vocabulary
- **similar triangles** triangles that are scale drawings of one another—they have the same shape but may have a different size.
- **slope** the ratio of the vertical change to the horizontal change.
- ***y*-intercept** the y-coordinate of the point where a line crosses the y-axis.

Review the following key terms.
- **corresponding sides and angles** sides and angles that have the same position in two different figures.
- **isolate** to set something apart.

Learning Progression

In Grade 7 students worked extensively with proportional relationships, including graphing them and solving problems. They applied the concept of proportionality to scale drawings and scale factors. **Earlier in Grade 8** students were informally introduced to the idea that linear functions are defined by the equations $y = mx$ and $y = mx + b$.

In this lesson students use similar triangles to formally connect slope and y-intercept to equations. Although slope is the focus of the lesson, students will also be introduced to similarity. Here they discover that similar triangles have proportional side lengths.

Lesson Pacing Guide

Whole Class Instruction

Day 1 *45–60 minutes*	**Toolbox: Interactive Tutorial*** *Linear Equations and Slope* **Introduction** • Think It Through Question *5 min* • Think *10 min* • Think *10 min* • Think *10 min* • Reflect *10 min*	**Practice and Problem Solving** Assign pages 133–134.
Day 2 *45–60 minutes*	**Guided Instruction** **Think About Writing a Linear Equation in Slope-Intercept Form** • Let's Explore the Idea *15 min* • Let's Talk About It *20 min* • Try It Another Way *10 min*	**Practice and Problem Solving** Assign pages 135–136.
Day 3 *45–60 minutes*	**Guided Practice** **Connect Ideas About Writing a Linear Equation in Slope-Intercept Form** • Compare *10 min* • Analyze *10 min* • Verify *5 min* **Independent Practice** **Apply Ideas About Writing a Linear Equation in Slope-Intercept Form** • Put It Together *10 min* • Intervention, On-Level, or Challenge Activity *10 min*	**Practice and Problem Solving** Assign pages 137–138.
	Toolbox: Lesson Quiz Lesson 12 Quiz	

*We continually update the Interactive Tutorials. Check the Teacher Toolbox for the most up-to-date offerings for this lesson.

Small Group Differentiation

Teacher-Toolbox.com

Reteach
Ready Prerequisite Lessons *45–90 min*

Grade 7
- Lesson 10 Understand Proportional Relationships
- Lesson 11 Equations for Proportional Relationships

Grade 8
- Lesson 11 Represent Proportional Relationships

Teacher-led Activities
Tools for Instruction *15–20 min*

Grade 8
- The Equation of a Line
- Identify Properties of Functions from Descriptions
- Building Linear Equations

Personalized Learning

i-Ready.com

Independent
i-Ready Lessons* *15–20 min*

Grade 8
- Linear Equations and Slope

ELL English Language Development

Prepare for Day 1: Use with *Think It Through*

Math Term: *Corresponding sides and angles* are sides and angles that have the same position in two different figures.

ELP Levels 1–3

Reading/Speaking Rewrite the ***Think It Through*** information using shorter sentences. Display and read it to students:

The format for linear equations is $y = mx + b$. This equation is in slope-intercept form. The slope is (m) in the equation. The y-intercept is (b) in the equation. If the y-intercept is 0, the equation is $y = mx$.

Similar triangles are triangles that have the same shape but can have different sizes. The sides are proportional. The corresponding angles have equal measures.

Have students use the ***In Your Own Words*** routine to reread and restate the problem.

ELP Levels 2–4

Reading/Speaking Read the two ***Think It Through*** paragraphs to students. Pause after each sentence, then restate the information or call on a student to do so. For example, after the first sentence, say: *One format for linear equations is $y = mx + b$.* Have partners reread the paragraphs. Ask them to use the ***In Your Own Words*** routine to restate the information. Ask questions to check comprehension:

- *What is an example of an equation written in slope-intercept form?*
- *What are similar triangles?*
- *What common characteristics do similar triangles have?*

ELP Levels 4–5

Reading/Speaking Have students read the ***Think It Through*** information. Have pairs of students use the ***In Your Own Words*** routine to record and discuss the key information. Form small groups from two pairs of students. Ask groups to discuss ***Think It Through***. Have them answer these questions to organize their ideas and then add any other information they think is important:

- *What is an example of an equation written in slope-intercept form?*
- *What are similar triangles?*
- *What common characteristics do similar triangles have?*

Prepare for Day 2: Use with *Think About, Problem 8*

Math Term: To *isolate* is to set something apart. To isolate y, set y apart so it is on one side of the equation.

ELP Levels 1–3

Speaking/Writing Read aloud ***Think About*** problem 8. Display and clarify the meanings of the terms *line, equation, point, same, slope,* and *slope formula.* Have students use some of the terms to complete the following sentence frames:

- The slope between any two points on a non-vertical line is the same.
- Use (x, y) to represent a point on the line.
- Use (0, 0) and (x, y) with the slope formula to find the slope, m.
- The general equation of a proportional relationship is $y = mx$.

Encourage students to use the sentence frames in their written responses.

ELP Levels 2–4

Speaking/Writing Choral-read ***Think About*** problem 8. Display and clarify the meanings of the terms *line, equation, origin, point, slope,* and *slope formula.* Ask students to use some of the terms to verbally answer the following questions:

- *How do you know a graph represents a proportional relationship?*
- *What do (x, y) represent on the line?*
- *What formula is used to find the slope?*
- *What does $y = mx$ represent?*

Remind students to use some of the terms as they write their reasoning.

ELP Levels 4–5

Speaking/Writing Have partners read ***Think About*** problem 8. Ask them to verbalize their reasoning before writing responses. Display the following terms: *line, origin, slope, non-vertical, proportional relationships, point, slope formula,* and *equation*. Encourage partners to use the terms in their discussions. Have students write their responses to the problem individually. Remind them to use the terms in their written responses. When they have completed the task, have them read their written responses to partners.

Prepare for Day 3: Use with *Connect, Problem 18*

ELP Levels 1–3

Listening/Writing Display the equation $y = mx + b$ and the terms *slope* and *y-intercept*. Call on students to show parts of the equation that represent the slope and the *y*-intercept. Then have students use these frames to discuss responses to problem 18. Provide support as needed.

- To find the slope from the equation, I _____ .
- To find the *y*-intercept, I _____ .
- To create the graph, first I will _____ .
- Then I will _____ .
- The graph verifies that the *y*-intercept is _____ and the slope is _____ .

Have students work with a partner to create written responses to problem 18.

ELP Levels 2–4

Listening/Writing Display the equation $y = mx + b$ and the terms *slope* and *y-intercept*. Call on students to show parts of the equation that represent the slope and the *y*-intercept. Then have students ***Turn and Talk*** to discuss their responses to ***Connect***, problem 18 before creating a written response in their Student Books. Provide these sentence frames:

- To find the slope from the equation, I _____ .
- To find the *y*-intercept, I _____ .
- To create the graph, first I will _____ .
- Then I will _____ .
- The graph verifies that the *y*-intercept is _____ and the slope is _____ .

ELP Levels 4–5

Listening/Writing Ask partners to write the following terms on an index card: *slope, y-intercept, equation, intersects, x-coordinate, y-coordinate,* and *y-axis*. Have partners take turns verbalizing their explanations for finding the slope and *y*-intercept by looking at the equation using the terms. As Partner A thinks aloud, Partner B listens and puts a check mark next to each term when it is used. Partners then switch roles. Then ask students to write their responses in the Student Book independently. Remind them to use appropriate math terms in their written responses. When students have written their responses, ask them to listen to their partners read their explanations.

Introduction

At A Glance

Students explore slopes and similar triangles to understand the slope-intercept form for the equation of a line. They are shown that the corresponding sides of similar triangles are proportional and the corresponding angles have equal measure. Then they explore how the uniqueness of the slope of a line can be justified by similar triangles.

Step By Step

- Introduce the Question at the top of the page.
- Students may not see a connection between the question and the contents on the page, so inform students that the connection will be made on the following pages.
- Review with students what a scale drawing is. Use familiar examples, such as maps.

▶ Mathematical Discourse 1

- Ask: *What is the scale factor from the triangle on the left to the triangle on the right?* [2]
- Then ask: *What is the scale factor from the triangle on the right to the triangle on the left?* $\left[\frac{1}{2}\right]$
- Be sure students understand that corresponding angles and sides are paired and unique.
- Have protractors available so students can measure the corresponding angles and see that they have equal measures.
- Point out that all the ratios of the corresponding side lengths, $\frac{AB}{DE}$, $\frac{BC}{EF}$, and $\frac{AC}{DF}$, are equal to $\frac{1}{2}$.

▶ Concept Extension

▶ Mathematical Discourse 2

Understand the Slope-Intercept Equation for a Line

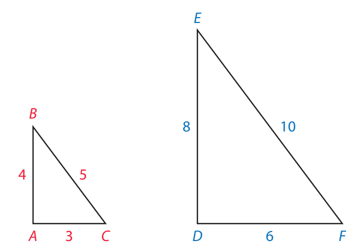
Think It Through

How can you show that an equation in the form $y = mx + b$ defines a line?

You have discovered in previous lessons that linear equations follow the format $y = mx + b$. These equations are written in **slope-intercept form**, because you can identify the slope (m) and the y-intercept (b) from the equation. If the y-intercept (b) is 0, then the equation simplifies to $y = mx$. Now you will see why linear equations can be written this way by examining slopes and similar triangles.

Think How does slope relate to triangles?

To understand slope, it helps to understand similar triangles. **Similar triangles** are scale drawings of one another—they have the same shape but can have a different size. The corresponding sides of similar triangles are proportional, and the corresponding angles have equal measures. Triangles *ABC* and *DEF* are similar triangles.



$m\angle A = m\angle D$ $\qquad$ $m\angle B = m\angle E$ $\qquad$ $m\angle C = m\angle F$

$\frac{AB}{DE} = \frac{4}{8}$, or $\frac{1}{2}$ $\qquad$ $\frac{BC}{EF} = \frac{5}{10}$, or $\frac{1}{2}$ $\qquad$ $\frac{AC}{DF} = \frac{3}{6}$, or $\frac{1}{2}$

Each side of triangle *ABC* is half the length of the corresponding side of triangle *DEF*. Each side of triangle *DEF* is twice the length of the corresponding side of triangle *ABC*.

▶ Mathematical Discourse

1 *What does it mean for two shapes to be proportional?*

Student responses may include the phrase *constant of proportionality* or *constant ratio*. Make sure students discuss what the word *constant* means.

2 *How would you show that two shapes are proportional and how would you know if two shapes are not proportional?*

Student responses should show an understanding of correspondence and taking measurements. Students should demonstrate the use of a constant ratio between corresponding measurements of length and understand that corresponding angle measures are the same. Students may recognize that *similar* and *proportional* mean the same thing in this context.

▶ Concept Extension

Extend understanding of the ratios of corresponding side lengths in similar triangles.

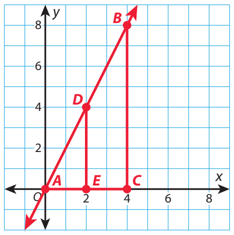
To extend students' understanding that the ratio of two side lengths in a triangle is the same as the ratio of the corresponding side lengths in a similar triangle, follow these steps.

- Have students find the ratio of *AB* to *AC* $\left[\frac{4}{3}\right]$ and the ratio of *DE* to *DF* $\left[\frac{8}{6} \text{ or } \frac{4}{3}\right]$. Students should recognize that they are the same.
- Ask students to find the ratio of any two side lengths in the triangle on the left and then find the ratio of the corresponding two side lengths in the triangle on the right. Students should see they are the same, but not the same as the ratio of *AB* to *AC*.

Think A coordinate grid can be used to compare similar triangles.

You can examine the corresponding sides and angles of similar triangles drawn along a non-vertical line on a coordinate grid.

Both triangles *ABC* and *ADE* contain $\angle DAE$, and $m\angle DAE = m\angle DAE$. Because $\angle BCE$ and $\angle DEA$ are both right angles, their measures are also equal. The sum of the angle measures in any triangle is 180°. So the measures of $\angle ADE$ and $\angle ABC$ must also be equal.



Since all three corresponding angles have the same measure, the triangles are similar. That means that the sides are proportional: $\frac{DE}{BC} = \frac{AE}{AC}$. The $\frac{\text{rise}}{\text{run}}$ is also proportional: $\frac{DE}{AE} = \frac{BC}{AC}$.

You could draw other triangles like these along the line. The $\frac{\text{rise}}{\text{run}}$ ratio will always be equal and the triangles will always be similar.

Think You can calculate the slope (m) of a line using any two points on the line.

Use the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$ with different pairs of points.

$A(0, 0)$ and $D(2, 4)$: $\frac{4 - 0}{2 - 0} = \frac{4}{2}$, or 2

$D(2, 4)$ and $B(4, 8)$: $\frac{8 - 4}{4 - 2} = \frac{4}{2}$, or 2

$A(0, 0)$ and $B(4, 8)$: $\frac{8 - 0}{4 - 0} = \frac{8}{4}$, or 2

Reflect

1 What do the similar triangles tell you about the slope of a line segment between any two points on a non-vertical line?

The slope of a segment between any two points on a non-vertical line is the same.

117

Step By Step

English Language Learners

- Read the first **Think** with students.
- Be sure that students see the corresponding parts in triangles *ABC* and *ADE*.
- Explain that having two triangles with all corresponding angles of equal measure is sufficient to conclude that the two triangles are similar.
- Call on students to explain how they know that angles *B* and *D* have the same measure.

Mathematical Discourse 3 and 4

- Ask: *What are the rise and run in triangle ABC?* [8 and 4] *What are the rise and run in triangle ADE?* [4 and 2]
- Read the second **Think** with students.
- Have students choose any pair of points on the line not used on the page and calculate the slope.
- Have students read and reply to the **Reflect** directive.

Hands-On Activity

Ready Mathematics PRACTICE AND PROBLEM SOLVING

Assign *Practice and Problem Solving* **pages 133–134** after students have completed this section.

Hands-On Activity

Show that only two pairs of equal angle measures are needed to make similar triangles.

Materials: paper, pencil, straightedge, protractor

- Have students draw a line of any length on a sheet of paper.
- Direct students to measure and draw angles from each end of the line to form a triangle.
- Instruct students to repeat with another line of a different length but using the same angle measures.
- Have students measure the sides of their two triangles and compute the ratio of the corresponding side lengths. Ask them if the two triangles are similar.

Mathematical Discourse

3 *How do you determine the rise and run of a line?*

Students should indicate that the rise is the vertical distance between two points on the line and the run is the horizontal distance between the same two points.

4 *Given a line, how would you decide which points to use to find the slope?*

Student responses may include points with integer coordinates or points that lie on an axis so that one of the coordinates is zero.

English Language Learners

Review the meaning of *non-vertical* and have students draw examples of *non-vertical* lines. Use the coordinate grid to illustrate the meanings of *rise* and *run*.

Guided Instruction

At A Glance

Students answer the questions on the page to better understand the slope of a line that passes through the origin. Then they use similar triangles to explore the slope of a line that does not pass through the origin. This line has the same slope as the line in the introduction but has a different y-intercept.

Step By Step

Let's Explore the Idea

- Tell students that they will have time to work individually on the problems on this page and then share their responses in groups. You may choose to work through the first problem together as a class.
- As students work individually, circulate among them. This is an opportunity to assess student understanding and address student misconceptions. Use the Mathematical Discourse questions to engage student thinking.

▶ Mathematical Discourse 1 and 2

- Write the slope formula $m = \frac{y_2 - y_1}{x_2 - x_1}$ on the board to remind students.
- For students needing help, point out that $(0, 0)$ is (x_1, y_1) and (x, y) is (x_2, y_2).
- To help students with problem 4, remind them that the same operation has to be done on both sides of the equation to maintain equality.
- To answer problem 7, students can look back to the previous lesson.
- Take note of students who are still having difficulty and wait to see if their understanding progresses as they work in their groups during the next part of the lesson.

Student Misconception Alert
Some students may divide the difference of the x-coordinates by the difference of the y-coordinates to find the slope. Encourage these students to use "rise over run" to remember that "rise" implies up and down, or vertical, and "run" implies across, or horizontal.

Think About **Writing a Linear Equation in Slope-Intercept Form**

Let's Explore the Idea **Follow the directions to write the equation of a line through the origin. Fill in the blanks as you go.**

2 You learned on the previous page that the slope between any two points on a non-vertical line is the same. Let m = slope and (x, y) = any point on the line. Fill in the blanks to show how to find the slope of the line using $(0, 0)$ and (x, y).

2. $m = \frac{y - \boxed{0}}{\boxed{x} - 0}$

3 Simplify the equation.

3. $m = \frac{\boxed{y}}{\boxed{x}}$

4 What is the next step in rewriting the equation if you want to isolate y on one side?

Multiply both sides by x.

4. $m \cdot \boxed{x} = \frac{\boxed{y} \cdot \boxed{x}}{\boxed{x}}$

5 Simplify.

5. $\boxed{mx} = \boxed{y}$

6 Rewrite the equation with y on the left side.

6. $\boxed{y} = \boxed{mx}$

7 How do you know that the graph on the previous page represents a proportional relationship?

Possible answer: It is a straight line that passes through (0, 0).

8 Explain the reasoning used in problems 2–6 to find a general equation for all proportional relationships.

Possible answer: The graph of all proportional relationships is a line that goes through the origin, and the slope between any two points on the line is the same. So, you can use (x, y) to represent any point on the line. Then you can use $(0, 0)$ and (x, y) with the slope formula $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$ to find the slope m. The general equation is $y = mx$.

▶ Mathematical Discourse

1 *How do you remember the formula for the slope of a line, given two points?*

Students should indicate that the rise is the vertical distance between two points on the line and the run is the horizontal distance between the same two points.

2 *How do you find the slope for a proportional relationship?*

Students should recognize that the ratio of the y-coordinate to the x-coordinate of any point in the relationship other than the origin will give the slope. Some students may demonstrate understanding that the slope comes from using the origin as the first point in the slope formula.

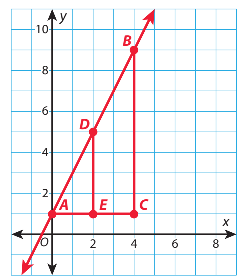
Let's Talk About It Solve the problems below as a group.

9 What is the slope of the line in this diagram? **2** What is the y-intercept? **1**

10 Compare the slope and y-intercept of this diagram with the one in the introduction. How are they similar? How are they different?

In both diagrams, the slope of the line is 2.

In this diagram the y-intercept is 1, not 0 like the first diagram.



11 Write the coordinates for each labeled point in the diagram.

***A* (0, 1)** ***B* (4, 9)** ***C* (4, 1)** ***D* (2, 5)** ***E* (2, 1)**

12 Compare these coordinates to the ones in the diagram in the introduction. What do you notice? How does this affect the position of the line and triangles on the grid?

The x-coordinates are all the same, but each y-coordinate is one more than the corresponding y-coordinate in the first diagram. The line and triangles in this diagram are 1 unit up from the x-axis, or 1 unit up from the corresponding point on the first diagram.

13 How do you know that the graph on this page represents a linear function that is not a proportional relationship? **Possible answer: It is a straight line that passes through the y-axis, but not at the origin.**

Try It Another Way

14 Use the y-intercept $(0, b)$ and any other point on the line (x, y) to derive the general form of a linear equation $y = mx + b$. Look at the steps in *Explore It* to guide you.

$m = \frac{y-b}{x-0}$; $m = \frac{y-b}{x}$; $mx = y - b$; $mx + b = y$; $y = mx + b$

15 How is your equation in problem 14 different from $y = mx$? What does this mean?

Possible answer: This equation adds b to mx, so the y-intercept could be a value other than 0.

▶ Mathematical Discourse

3 *Describe the steps you would take to write an equation of a line given the graph.*

Some students may mention finding the slope and the y-intercept. Other students may mention using the slope formula as in problem 14.

4 *Why can't you use a slope-intercept equation to describe a graphed vertical line on a coordinate grid?*

Listen for responses that show understanding that in a vertical line, the run is equal to 0 and division by 0 is undefined.

Step By Step

Let's Talk About It

- Organize students into pairs or groups. You may choose to work through the first **Let's Talk About It** problem together as a class.
- Walk around to each group, listen to, and join in on discussions at different points. Use the Mathematical Discourse questions to help support or extend students' thinking.

▶ Mathematical Discourse 3 and 4

- For students having difficulty with problem 12, have them write the coordinates for points *A* through *E* from this page on one line and then write the coordinates for points *A* through *E* from the introduction directly below, so the coordinates line up.

SMP TIP Model with Mathematics
Students model with mathematics when they connect graphical and symbolic representations of slope. Regularly ask students to sketch graphs for linear relationships and to explain how they can identify proportional and non-proportional relationships from graphs. *(SMP 4)*

Try It Another Way

- Direct the group's attention to **Try It Another Way**.
- Guide students to use the slope formula $m = \frac{y_2 - y_1}{x_2 - x_1}$ as a start to problem 14.
- Have a volunteer from each group come to the board to explain the group's solutions to problems 14 and 15.

Ready Mathematics PRACTICE AND PROBLEM SOLVING

Assign *Practice and Problem Solving* **pages 135–136** after students have completed this section.

Guided Practice

At A Glance

Students demonstrate their understanding of slope and the slope-intercept equation, then show different ways to find the slope given points in a table and a graph.

Step By Step

- Discuss each **Connect** problem as a class using the discussion points outlined below.

Compare

- Have students work in groups of three, each on a different equation.
- Students may need to be reminded to apply operations to both sides of the equation.
- For the second and third equations, ask students to identify the slope. [1]

Analyze

- Students should recognize that in the slope formula, the y-coordinates are subtracted in the numerator and the x-coordinates are subtracted in the denominator.
- Read the problem together. Have students work in pairs to discuss Alana's mistake.
- Begin discussion by having students write down the slope formula. $\left[m = \frac{y_2 - y_1}{x_2 - x_1}\right]$

Verify

- Ask students to give the general slope-intercept equation. [$y = mx + b$]
- Have students identify the slope in the general equation by circling m, the coefficient of x.
- Have students identify the y-intercept by underlining b, the constant term.
- Explain that this can be done with any equation written in that form. Have students circle the slope and underline the y-intercept in the equation in the problem.

SMP TIP Construct Arguments
Students construct arguments and critique arguments of others as they analyze Alana's work and verify their own answers to problem 18. *(SMP 3)*

▶ **Concept Extension**

Connect Writing a Linear Equation in Slope-Intercept Form

Talk through these problems as a class, then write your answers below.

16 Compare Look at these equations. Do you think they are all linear equations? Can they all be written in the form $y = mx + b$? If so, show how.

$y = 2x - 3$	$y - 2 = x + 2$	$3x = 9 + 3y$
$y = 2x + -3$	$y = x + 2 + 2$	$\frac{3x}{3} = \frac{9 + 3y}{3}$
	$y = x + 4$	$x = 3 + y$
		$x - 3 = y$
		$y = x - 3$

All are linear equations; all can be written in the form $y = mx + b$.

17 Analyze Alana used the table of values to find the slope of the graph for this function. Analyze her work and explain why you do or don't agree with her.

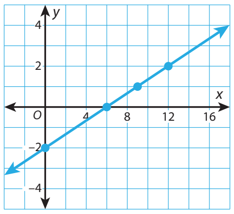
x	2	4	6	8
y	4	5	6	7

$m = \frac{6 - 2}{6 - 4} = \frac{4}{2}$, or 2

Possible answer: I don't agree. She used the points (2, 4) and (6, 6) but she subtracted the x-coordinates in the numerator and the y-coordinates in the denominator.

18 Verify Explain how to find the slope and y-intercept by just looking at the equation $y = \frac{1}{3}x - 2$. Then graph the equation and verify your answers.

Possible answer: The slope is $\frac{1}{3}$, or the coefficient of x. The y-intercept is -2, or the constant. Use the points (6, 0) and (9, 1) to find the slope: $\frac{1-0}{9-6} = \frac{1}{3}$. The line intersects the y-axis at -2, so -2 is the y-intercept.



▶ Concept Extension

Extend understanding of linear and nonlinear equations.

To extend students' understanding of the connection between linear equations and the slope-intercept form $y = mx + b$, follow these steps:

- Write $x^2 + y = 3$ and $3xy = 9$ on the board.
- Ask students to solve both equations for y.
  [$y = 3 - x^2$ and $y = 3 \div x$]
- Discuss the characteristics of the equations and how they are not of the form $y = mx + b$, and therefore are not linear functions.

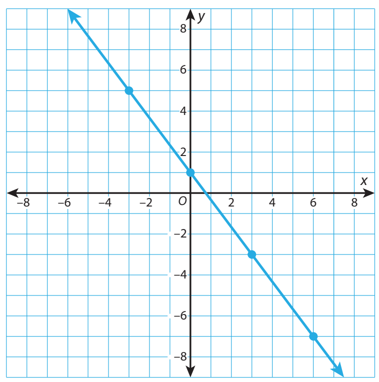
Apply Writing a Linear Equation in Slope-Intercept Form

19 Put It Together Use what you have learned to complete this task.

Part A Show how to find the slope of a line that passes through the points in the table.

x	−3	0	3	6
y	5	1	−3	−7

Possible answer: Use the coordinates for two different points in the table: (0, 1) and (3, −3). Slope is $\frac{-3-1}{3-0} = -\frac{4}{3}$



Part B Graph the data in the table. Using the graph, show how to find the slope in a different way than you did in part A.

Possible answer: I looked at the rise and run for $x = 0$ to $x = 3$ on the graph. The rise is down 4 and the run is 3. The slope is $-\frac{4}{3}$.

Part C Show how to write an equation for the table and graph. Verify that the equation works with the table and the graph.

Possible answer: I know that the equation is in the form $y = mx + b$. The slope is $-\frac{4}{3}$, so I can replace m with $-\frac{4}{3}$. 1 is the y-intercept, so I can replace b with 1. The equation is $y = -\frac{4}{3}x + 1$. To verify the equation works with the table, I can substitute x values from the table into the equation.

When $x = -3$, $y = -\frac{4}{3}(-3) + 1$, so $y = 5$; $(-3, 5)$ is in the table.

When $x = 0$, $y = -\frac{4}{3}(0) + 1$, so $y = 1$; $(0, 1)$ is in the table.

When $x = 3$, $y = -\frac{4}{3}(3) + 1$, so $y = -3$; $(3, -3)$ is in the table.

When $x = 6$, $y = -\frac{4}{3}(6) + 1$, so $y = -7$; $(6, -7)$ is in the table.

These points all appear on the graph, so the equation works with the graph.

Step By Step

Put It Together

- Direct students to complete the **Put It Together** task on their own.
- Make sure students understand to use their graphs to find the slope in part B.
- As students work on their own, walk around to assess their progress and understanding, to answer their questions, and to give additional support, if needed.
- If time permits, have students share their slopes and equation.

Ready Mathematics PRACTICE AND PROBLEM SOLVING

Assign *Practice and Problem Solving* **pages 137–138** after students have completed this section.

Scoring Rubrics

See student facsimile page for possible student answers.

Part A

Points	Expectations
2	Student correctly uses the slope formula with two points from the table.
1	Student understands to use the slope formula but does not correctly apply it.
0	There is no answer given or no application of the slope formula.

Part B

Points	Expectations
2	The data is graphed correctly, the rise and run are shown, or a triangle is drawn to reflect rise and run. Rise over run is used to compute the slope.
1	The data is graphed, but the slope is incorrect or not well explained. Or, the data is graphed incorrectly, but student correctly demonstrates how to find the slope using rise over run.
0	There is no graph with no work shown for the slope.

Part C

Points	Expectations
2	The y-intercept is correctly identified from the table or graph, both slope and the y-intercept are correctly used to write the equation of the line, and work is shown to verify that the points in the table fit the equation.
1	Effort is shown to use the slope-intercept equation and work is shown to use the equation to verify the points in the table.
0	No response is given, or the work does not show understanding of the slope-intercept equation.

Differentiated Instruction

▶ Intervention Activity

Construct similar triangles to verify that corresponding angles have the same measure and corresponding sides are in proportion.

Materials: paper, pencil, ruler, protractor, scissors

Have students draw a triangle of any size and cut it out. Then have them cut several more triangles of the same size using the first triangle as a template. Students can make similar triangles from the same-size triangles by cutting parallel to any side.

Instruct students to take angle measures of the different triangles and compare them. Then have students measure the side lengths of any pair of similar triangles and compute the ratios of the corresponding sides.

Students should be able to verify the properties of similar triangles.

▶ On-Level Activity

Find the slope-intercept equation of a line in more than one way.

Materials: graph paper, straightedge

In this activity, students think of more than one way to find the slope-intercept equation.

Have students find the slope-intercept equation of the line that passes through the points (0, 2) and (3, 4).

$\left[y = \frac{2}{3}x + 2\right]$

Encourage students to work with just the numbers and then to use a graph. Students should be able to identify that the point (0, 2) is the location of the *y*-intercept and should be able to find the slope using the slope formula. Make sure to have graph paper available so they can accurately plot the points and draw the line through them. Check that students understand how to find the rise and run from the graph. Some students may draw a triangle.

▶ Challenge Activity

Find the slope-intercept equation of a line.

For this activity, have students work in pairs to find the slope-intercept equation for the line that passes through the points (−2, 0) and (4, 3) without graphing. $\left[y = \frac{1}{2}x + 1\right]$

Students should be able to find the slope but recognize that the *y*-intercept is not immediately identifiable. Some students may incorrectly use −2 as the *y*-intercept. Point out that the −2 is the *x*-intercept for the line.

If needed, guide students to use the slope formula with the point (−2, 0) and (*x, y*). Refer to **Try It Another Way** problem 14 as a hint. After finding the equation, have students plot the two points and draw a line through them to confirm their answer.

Teacher Notes

LESSON QUIZ

Lesson 12
Understand the Slope-Intercept Equation for a Line

Overview

Assign the Lesson 12 Quiz and have students work independently to complete it.

Use the results of the quiz to assess students' understanding of the content of the lesson and to identify areas for reteaching. See the Lesson Pacing Guide at the beginning of the lesson for suggested instructional resources.

Tested Skills

Assesses 8.EE.B.6

Problems on this assessment form require students to write an equation based on given coordinates, compare and write slopes using graphs, and determine whether numerical data shows a linear relationship.

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Lesson 12 Quiz

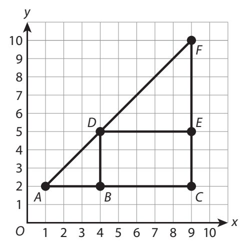
Solve the problems.

1 What is the equation of a line that passes through the points (0, 5) and (4, 8)? Write your answer in slope-intercept form.

Show your work.

Answer: ______________________________

2 In the diagram below, triangle *ACF* is similar to triangle *ABD*.



Part A

Between which pairs of points are the slopes the same?

Choose all that apply.

A *A* and *B*; *C* and *E*

B *A* and *B*; *A* and *C*

C *A* and *D*; *D* and *F*

D *B* and *C*; *A* and *B*

E *B* and *C*; *E* and *F*

F *D* and *F*; *A* and *F*

Part B

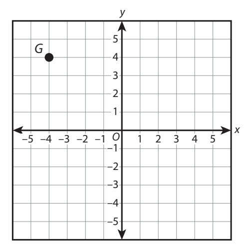
The slope of line segment *AD* is the same as the slope of line segment *AF*.

Write the name of a segment in each box of the proportion to show this.

$$\frac{\square}{AB} = \frac{CF}{\square}$$

Lesson 12 Quiz continued

3 Point *G* is plotted on the coordinate plane.



Roland correctly wrote the equation of a line through point *G* as $y = mx - 4$.

What is the value of *m* in Roland's equation?

A −4

B −2

C 2

D 4

4 The table shows values for points on the graph of a function.

Point	*P*	*Q*	*R*	*S*
x	−3	−2	−1	1
y	5	2	−1	−3

Can this function be represented by a straight line? Explain.

Show your work.

Common Misconceptions and Errors

Errors may result if students:

- divide the difference between *x*-coordinates by the difference between *y*-coordinates.
- apply the slope formula incorrectly.
- confuse the *x*-axis and the *y*-axis.

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Lesson 12 Quiz Answer Key

1. $y = \frac{3}{4}x + 5$
DOK 2

2. ***Part A:***
B, C, D, F
DOK 2

Part B:
BD; *AC*
DOK 2

3. B
DOK 2

4. No. Possible explanation: For the function to be represented by a straight line, the slope between each pair of points must be equal. The slope of segment *PQ* is $\frac{2 - 5}{-2 - (-3)} = \frac{-3}{1}$, or -3, but the slope of segment *RS* is $\frac{-3 - (-1)}{1 - (-1)} = \frac{-2}{2}$, or -1.
DOK 3