TEACHER'S GUIDE Overview *continued*

i-Ready Classroom Mathematics lessons consist of three types of sessions: Explore, Develop, and Refine. The following is a walkthrough of the planning and support features within the Teacher's Guide for a Develop session. You will find many of the same features in the Explore and Refine sessions.

Lesson Overview provides information for use in planning whole class instruction, small group differentiation, and independent learning opportunities.

Math Focus sets learning expectations for students' conceptual understanding and how they demonstrate that understanding.

Content Objectives identify the mathematical learning goals for the lesson, while **Language Objectives** indicate the language students are expected to understand and produce as they work on those goals.

Prior Knowledge are opportunities to monitor understanding and identify students' learning needs.

Math Vocabulary is defined in the context of lessons, and academic words can be explored using the **Academic Vocabulary** Routine.

Learning Progression sets context for the mathematics of the lesson, providing information on how the content fits across and within grade levels—what students previously learned, what they are learning now, and what they will be learning next.

LESSON 8

Overview | Graph Proportional Relationships and Define Slope

MATH FOCUS

Focus Standards

8.EE.B.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

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.

See Unit 3 Overview for developing and applied standards.

STANDARDS FOR MATHEMATICAL PRACTICE (SMP)

SMP 1, 2, 3, 4, 5, and 6 are integrated into the Try-Discuss-Connect framework.*

This lesson provides additional support for:

2 Reason abstractly and quantitatively.

7 Look for and make use of structure.

* See page 1s to learn how every lesson includes these SMP.

Objectives

Content Objectives

- Understand that a proportional relationship is a linear relationship with an equation of the form $y = mx$ and a graph that goes through the origin.
- Interpret the unit rate of a proportional relationship as the slope of its graph.
- Understand that slope is the same between any two distinct points on a line.
- Find the slope of a line from two points by dividing the vertical change by the horizontal change or by using the slope formula.

Language Objectives

- Explain that the graph of a proportional relationship is a line through the origin.
- Describe a unit rate as the value of y when $x = 1$ in a proportional relationship where $y = mx$. Explain that the unit rate represents the rate of change.
- Describe the slope of a line using the term *constant* and different forms of the verb *to change* in speaking and writing.
- Describe different ways to find the slope of a line in partner or class discussion.
- Interpret word problems about slope and justify solutions to a partner.

Prior Knowledge

- Identify and model proportional relationships in tables, diagrams, equations, graphs, and descriptions.
- Know that the constant of proportionality is the unit rate of a proportional relationship.

Vocabulary

Math Vocabulary

rate of change in a linear relationship between x and y, it tells how much y changes when x changes by 1.

slope for any two points on a line, the $\frac{\text{rise}}{\text{run}}$ or $\frac{\text{change in } y}{\text{change in } x}$. It is a measure of the steepness of a line.

Review the following key terms.

congruent (≅) same size and shape. Two figures are congruent if there is a sequence of rigid transformations that maps one figure onto the second.

constant of proportionality the unit rate in a proportional relationship.

proportional relationship the relationship between two quantities where one quantity is a constant multiple of the other quantity.

right triangle a triangle with one right angle.

scale factor a factor that relates the corresponding side lengths of a figure and a scale drawing (or scale copy) of the figure.

similar (~) having the same shape. Two figures are similar if there is a sequence of rigid transformations and/or dilations that maps one figure onto the second.

unit rate the numerical part of a rate. For example, the rate 3 miles per hour has a unit rate of 3.

Academic Vocabulary

constant staying the same.

Learning Progression

In Grade 7, students learned how to tell whether quantities are in a proportional relationship. They showed proportional relationships with tables, diagrams, equations, descriptions, and graphs.

Earlier in Grade 8, students learned that similar triangles have corresponding angles that are congruent and corresponding sides that are proportional. They know that dilations produce similar figures.

In this lesson, students interpret the unit rate of a proportional relationship as the slope of its graph. They find that slope is the same between any two points on a line, or between two related pairs of values in a table of values. They find slope by writing a quotient of the vertical change and the horizontal change and by using the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$.

Later in Grade 8, students will explore lines that do not go through the origin. They will derive the equations $y = mx$ and $y = mx + b$ and graph linear equations of the form $y = mx + b$. They will learn about negative slopes, slopes of 0, and undefined slopes and see how the slopes of parallel lines are related.

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Pacing Guide session-by-session pacing is used to plan daily instruction and practice.

Additional Practice is for use as in-class small group work, after class work, or at-home learning.

LESSON 8

Overview

Pacing Guide

Items marked with are available on the **Teacher Toolbox**.

	MATERIALS	DIFFERENTIATION
SESSION 1 **Explore** Proportional Relationships and Slope (35–50 min)		
• **Start** (5 min) • **Try It** (5–10 min) • **Discuss It** (10–15 min) • **Connect It** (10–15 min) • **Close: Exit Ticket** (5 min) **Additional Practice** (pages 179–180)	**Math Toolkit** graph paper, straightedges Presentation Slides	**PREPARE** Interactive Tutorial **RETEACH or REINFORCE** Visual Model **Materials** For display: 8 nickels, Activity Sheet *Coordinate Plane: First Quadrant*
SESSION 2 **Develop** Showing That the Slope of a Line Is Constant (45–60 min)		
• **Start** (5 min) • **Try It** (10–15 min) • **Discuss It** (10–15 min) • **Connect It** (15–20 min) • **Close: Exit Ticket** (5 min) **Additional Practice** (pages 185–186)	**Math Toolkit** graph paper, straightedges Presentation Slides	**RETEACH or REINFORCE** Hands-On Activity **Materials** For each student: 1 tangram triangle, Activity Sheet *Coordinate Plane: First Quadrant* **REINFORCE** Fluency & Skills Practice **EXTEND** Deepen Understanding
SESSION 3 **Develop** Finding the Slope of a Line (45–60 min)		
• **Start** (5 min) • **Try It** (10–15 min) • **Discuss It** (10–15 min) • **Connect It** (15–20 min) • **Close: Exit Ticket** (5 min) **Additional Practice** (pages 191–192)	**Math Toolkit** graph paper, straightedges Presentation Slides	**RETEACH or REINFORCE** Hands-On Activity **Materials** For each pair: 20 unit cubes, Activity Sheet *1-Centimeter Grid Paper* **REINFORCE** Fluency & Skills Practice **EXTEND** Deepen Understanding
SESSION 4 **Refine** Graphing Proportional Relationships and Defining Slope (45–60 min)		
• **Start** (5 min) • **Monitor & Guide** (15–20 min) • **Group & Differentiate** (20–30 min) • **Close: Exit Ticket** (5 min)	**Math Toolkit** Have items from previous sessions available for students. Presentation Slides	**RETEACH** Hands-On Activity **Materials** For each pair: 1 geoboard, 5 rubber bands **REINFORCE** Problems 4–7 **EXTEND** Challenge i-Ready **Personalized Instruction**
Lesson 8 Quiz or **Digital Comprehension Check**		**RETEACH** Tools for Instruction **REINFORCE** Math Center Activity **EXTEND** Enrichment Activity

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Prepare students for the lesson content with *Interactive Tutorials*.

Reinforce understanding with *Fluency & Skills Practice*, *Apply It* problems, and differentiated *Math Center Activities*. *Hands-On Activities* and *Visual Models* may also be useful in reinforcing mathematical concepts.

Reteach mathematical concepts using *Hands-On Activities* and *Visual Models*. Tools for Instruction also provide targeted skills instruction.

Extend mathematical concepts with *Deepen Understanding*, *Challenge Activities*, and *Enrichment Activities*.

Optional Add-On: **Personalized Instruction** resources provide students with opportunities to strengthen grade-level skills by working on their personalized path.

The **Lesson Quiz** or **Digital Comprehension Check** assesses students' progress toward mastery of lesson content and is a way to identify where reteaching is needed.

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TEACHER'S GUIDE **Overview** *continued*

Purpose provides a roadmap of what students will be learning and doing across the session.

Start establishes a clear and accessible entry point for each session, engaging students mathematically with prerequisite content. It frequently is an opportunity to have students engage in a math talk.

Develop Academic Language provides language support for all students and is especially useful in helping EL students use and produce academic language.

Support Partner Discussion provides teachers with prompts to help students engage in meaningful peer discourse.

Make Sense of the Problem uses a language routine to help students understand the problem. See the Language Routines section on the Teacher Toolbox (under the Program Implementation tab) for suggestions on how to integrate language routines, teacher moves, and conversation tips during instruction.

LESSON 8 | SESSION 3 ■■■□

Develop Finding the Slope of a Line

Purpose

- **Develop** strategies for finding the slope of a line from tables and graphs of proportional relationships.
- **Recognize** that any two points on a line can be used to find its slope.

START CONNECT TO PRIOR KNOWLEDGE

Same and Different

12 cups flour to 3 cups water	cups flour : cups water 9 : 3
4 cups flour per cup water	1 cup flour for every $\frac{1}{3}$ cup water

A | B
C | D

Possible Solutions

All are ratios of flour to water.

A and C have the same unit rate.

B and D have the same unit rate.

C and D compare the amount of one item to 1 cup of the other.

WHY? Support students' facility with recognizing unit rates.

DEVELOP ACADEMIC LANGUAGE

WHY? Support students as they justify their strategies and solutions for Try It.

HOW? Tell students that one way to justify a solution to a problem is to tell why it is reasonable and why it makes sense for the problem. Have them use the word *represent* as they offer their justifications for what the slope represents. Encourage students to refer to their models or diagrams as they explain their strategy to the larger group.

TRY IT SMP 1, 2, 4, 5, 6

Make Sense of the Problem

See ***Connect to Culture*** to support student engagement. Before students work on Try It, use **Co-Craft Questions** to help them make sense of the problem. Display the Try It scenario and graph without the two questions. After students engage in Co-Crafting Questions, display the questions and have students compare the questions they generated with the Try It questions to find similarities.

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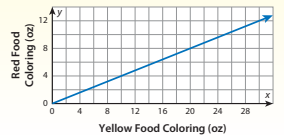
LESSON 8 | SESSION 3 ■■■□

Develop Finding the Slope of a Line

Holi Festival–a festival of color to welcome spring

➤ **Read and try to solve the problem below.**

Ashwini's family is getting ready for the local Holi festival. Ashwini mixes yellow and red food coloring to make orange food coloring. She uses the graph to find how many ounces of yellow and red to mix. What is the slope of the line? What does the slope represent?



TRY IT **Math Toolkit** graph paper, straightedges

Possible work:

SAMPLE A

(0, 0) and (10, 4) are points on the line.

$\frac{\text{vertical change}}{\text{horizontal change}} = \frac{4}{10}$

The slope is $\frac{4}{10}$, or $\frac{2}{5}$.

The slope represents the quotient of ounces of red food coloring and ounces of yellow food coloring to mix to make a certain orange color.

SAMPLE B

The slope is the same as the unit rate. For every 4 ounces of red that Ashwini uses, she uses 10 ounces of yellow. This means that Ashwini uses $\frac{2}{5}$ ounce of red for every 1 ounce of yellow to mix the same color of orange.

The slope is $\frac{2}{5}$.

DISCUSS IT

Ask: How do you know your slope is reasonable?

Share: In my solution . . . represents . . .

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DISCUSS IT SMP 2, 3, 6

Support Partner Discussion

After students work on Try It, have them explain their work and then respond to Discuss It with a partner. If students need support in getting started, prompt them to ask each other questions such as:

- *What quotient describes slope?*
- *What does the slope mean in the context of this problem?*

Common Misconception Listen for students who do not understand that in a proportional relationship, the slope (unit rate) can be a fraction less than 1. As students share their strategies, have them compare the line from the Try It to a line such as $y = 2x$. Lead a discussion comparing the steepness of the lines and their slopes. Both lines have positive slopes, but the steeper line has a greater vertical change than horizontal change, resulting in a slope greater than 1. The shallower line has a greater horizontal change than vertical change, resulting in a slope less than 1.

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Common Misconception identifies misconceptions that lead to errors in understanding, which can then be addressed in whole class discussion as students are prompted to explain their reasoning.

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Select and Sequence Student Strategies

Select 2–3 samples that represent the range of student thinking in your classroom. Here is one possible order for class discussion:

- graph used to describe verbally how (*x, y*) values change, such as *up 2, over 5*
- **(misconception)** slope given as $\frac{5}{2}$ or 2.5, if students think slope cannot be less than 1
- reasoning used to identify unit rate
- graph used to find slope between the origin and another point on the line

Facilitate Whole Class Discussion

Call on students to share selected strategies. Prompt students to refer to their models or diagrams as they justify their solutions.

Guide students to **Compare and Connect** the representations. After each strategy, allow student individual think time to process the ideas.

ASK *How are the methods for finding the slope the same? How are they different?*

LISTEN FOR Each method uses unit rate or the vertical change and horizontal change to find slope, by counting grid units, using subtraction, or knowing that slope is the unit rate.

Model It

If students presented these models, have students connect these models to those presented in class.

If no student presented at least one of these models, have students first analyze key features of the models, and then connect them to the models presented in class.

ASK *How are the strategies presented in the two Model Its alike?*

LISTEN FOR Both focus on the relationship between vertical and horizontal change. Both use the same points to determine slope.

For the graph, prompt students to consider the rise over run quotient.

- *Using any two points on the line, how does the rise divided by the run compare to the slope?*
- *How does this way of identifying slope connect the meaning visually and verbally?*

For the formula, prompt students to consider the relationship between the points on the graph and the formula.

- *How does the difference in the y-values in the formula relate to the rise shown in the graph?*
- *How does the difference in the x-values in the formula relate to the run shown in the graph?*

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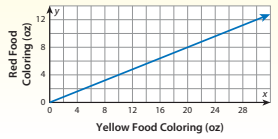
Explore different ways to find the slope of a line.

Ashwini's family is getting ready for the local Holi festival. Ashwini mixes yellow and red food coloring to make orange food coloring. She uses the graph to find how many ounces of yellow and red to mix. What is the slope of the line? What does the slope represent?



Model It

You can use the quotient of the vertical change and the horizontal change between any two points on the line to find the slope of a line.

This quotient representing slope, $\frac{\text{vertical change}}{\text{horizontal change}}$, is also called $\frac{\text{rise}}{\text{run}}$.

Model It

You can choose any two points on the line and use the slope formula to find the slope of a line.

For any two points on a line, (x_1, y_1) and (x_2, y_2), the slope between these points can be found using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. In this formula, the letter m means slope.

(10, 4) and (20, 8) are two points on the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 4}{20 - 10}$$

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DIFFERENTIATION | EXTEND

SMP 7

Deepen Understanding

Using Structure to Connect Numerical and Visual Slope

Prompt students to consider that a positive vertical and horizontal change leads to the same slope as a negative vertical and horizontal change. Have students use the graph from the first Model It. Ask them to consider moving from the right point to the left point. Have them draw the *run* arrow, which will point left, and the *rise* arrow, which will point down.

ASK *How can you label the arrows to show the distance and the direction of the change?*

LISTEN FOR Label the run arrow −10. Label the rise arrow −4.

ASK *What do you get if you calculate the slope using these rise and run values? How does it compare with the slope moving from the left point to the right point?*

LISTEN FOR $\frac{-4}{-10}$ or $\frac{2}{5}$; The slope is the same.

ASK *What conclusion can you make?*

LISTEN FOR It does not matter which direction you move between two points to calculate the slope for this line. Moving from left to right, the rise and run are both positive. Moving from right to left, the rise and run are both negative. In either case, the slope is the same.

Ask/Listen for are mathematical discourse questions followed by expected student responses that support and facilitate whole class discussion.

As students share their thinking, the discourse questions can be used to make connections between student approaches and different models and representations, prompt justifications and critiques of approaches and solutions, and check conceptual understanding.

Standards for Mathematical Practice (SMP) are infused throughout the instructional model.

Deepen Understanding is a consistent opportunity to build conceptual understanding of a key lesson concept by extending mathematical discourse. The content connects a particular aspect of lesson learning to an SMP, showing how it looks in the classroom.

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TEACHER'S GUIDE **Overview** *continued*

Monitor and Confirm Understanding is a way to ensure that students have made sense of mathematical learning goals.

Facilitate Whole Class Discussion provides a series of related discourse questions that illuminate the mathematical ideas of the lesson, prompting students to make connections and use that understanding to solve problems leading to abstract reasoning. These questions help students learn how to articulate a generalization of the mathematical concept.

Hands-On Activities occur consistently at strategic points in the lesson after teachers have acquired understanding of students' learning through observation and their work on questions in the Student Worktext. The activities support students who are unsure of the concept and are an opportunity for small group reteaching while other students work independently. Use of concrete objects lets students access understanding in a different way.

LESSON 8 | SESSION 3 ■■■□

Develop Finding the Slope of a Line

CONNECT IT

SMP 2, 4, 5, 6

Remind students that the relationship between the amounts of red and yellow food coloring is the same in both representations. Explain that they will now use the representations to reason about the formula for the slope of a line.

Before students begin to record and expand on their work in Model It, tell them that problems 1 and 2 will prepare them to provide the explanation asked for in problem 3.

Monitor and Confirm Understanding 1 – 2

- The slope, $\frac{2}{5}$, means that $\frac{2}{5}$ ounce of red is needed for each ounce of yellow.
- The vertical change, or rise, is the same as the difference of the *y*-values.
- The horizontal change, or run, is the same as the difference of the *x*-values.

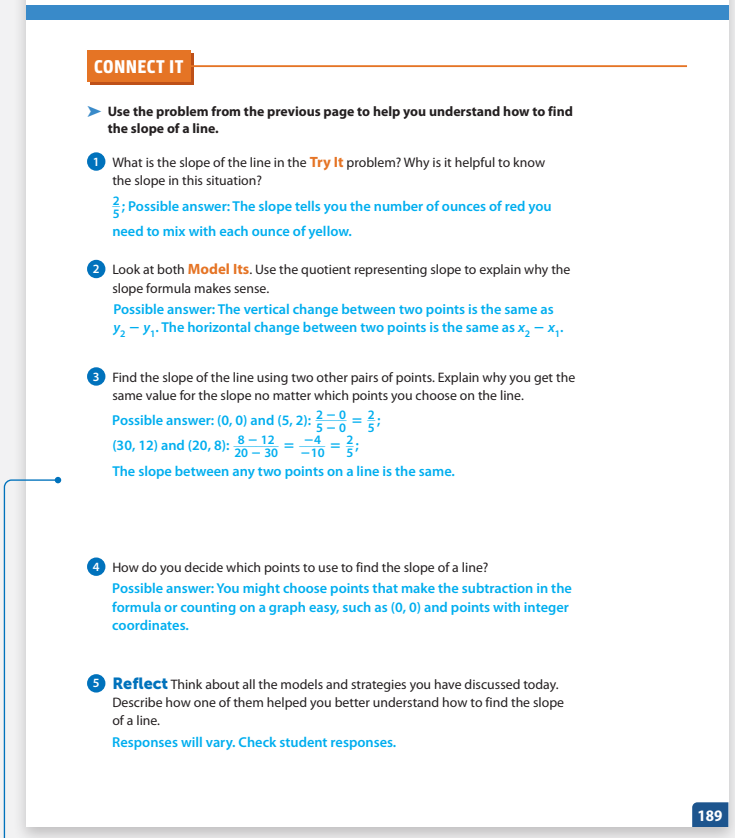
Facilitate Whole Class Discussion

3 Look for the idea that any two points on a line determine the slope of the line.

> **ASK** *Why can you use the coordinates of any two points on the line in the slope formula?*
>
> **LISTEN FOR** The slope for a line is constant, so it is the same between any two points.

4 Look for understanding that thinking critically can help determine the points to use in the slope formula. The calculation may be easier if students use the origin or points with integer coordinates.

5 **Reflect** Have all students focus on the strategies used to solve the Try It. If time allows, have students discuss their ideas with a partner.



CONNECT IT

➤ **Use the problem from the previous page to help you understand how to find the slope of a line.**

1 What is the slope of the line in the **Try It** problem? Why is it helpful to know the slope in this situation?

$\frac{2}{5}$; Possible answer: The slope tells you the number of ounces of red you need to mix with each ounce of yellow.

2 Look at both **Model Its**. Use the quotient representing slope to explain why the slope formula makes sense.

Possible answer: The vertical change between two points is the same as $y_2 - y_1$. The horizontal change between two points is the same as $x_2 - x_1$.

3 Find the slope of the line using two other pairs of points. Explain why you get the same value for the slope no matter which points you choose on the line.

Possible answer: (0, 0) and (5, 2): $\frac{2-0}{5-0} = \frac{2}{5}$;
(30, 12) and (20, 8): $\frac{8-12}{20-30} = \frac{-4}{-10} = \frac{2}{5}$;
The slope between any two points on a line is the same.

4 How do you decide which points to use to find the slope of a line?

Possible answer: You might choose points that make the subtraction in the formula or counting on a graph easy, such as (0, 0) and points with integer coordinates.

5 **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to find the slope of a line.

Responses will vary. Check student responses.

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DIFFERENTIATION | RETEACH or REINFORCE

Hands-On Activity

Use unit cubes to model slope.

If students are unsure about using the concept of slope, then use this activity to make connections between slope and the vertical and horizontal change of points on a line.

Materials For each pair: 20 unit cubes, Activity Sheet *1-Centimeter Grid Paper*

- Have pairs make a first-quadrant coordinate plane on their grid paper, plot and label the points (0, 0) and (5, 4), and then draw a line through the points.
- Have students use the unit cubes to make the horizontal and vertical sides of a right triangle between the two points.
- Ask: *How many cubes are along the vertical distance between the two points?* [4]
- Ask: *How many cubes are along the horizontal distance between the two points?* [5]
- Ask: *What is the slope of the line?* $\left[\frac{4}{5}\right]$
- Have pairs plot and label (10, 8) and extend the line so it passes through this point; repeat bullets 2–5, then compare the two slopes.

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Apply It solutions at point of use give a correct response with explanations that include multiple approaches to solving the problem.

Apply It

For all problems, encourage students to use mathematical reasoning to support their thinking and check their answers.

6 Students may solve this problem by using any two points in the table, although their calculation will be easier if they choose the origin as one point. Encourage students to check their answer by using a different pair of points.

7 **a.** Students may also interpret slope to mean for every 1 cup of yogurt, use 2 cups of berries.

b. Students may also reason that the number of cups of berries is twice the number of cups of yogurt. So, for 9 cups of yogurt, Kaley needs 18 cups of berries.

Apply It

➤ **Use what you learned to solve these problems.**

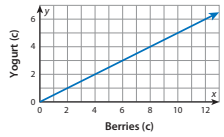
6 Oren competes in a 100-meter wheelchair race. His coach tracks his progress in the table below. The coach plans to make a graph using these points. What is the slope of the line? What does the slope represent? Show your work.

Time (s)	0	5	10	15
Distance (m)	0	31.25	62.5	93.75

Possible work: $\frac{62.5-0}{10-0} = \frac{62.5}{10} = \frac{6.25}{1}$

SOLUTION $\frac{6.25}{1}$, or 6.25; The slope is Oren's speed in meters per second.

7 This graph shows the relationship between cups of yogurt and cups of berries in Kaley's smoothie recipe.



a. What is the slope of the line? What does the slope represent in this situation?

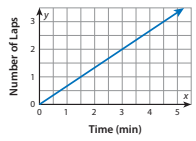
$\frac{1}{2}$; Possible answer: For every 1 cup of berries, use $\frac{1}{2}$ cup of yogurt.

b. Kaley uses 9 cups of yogurt. How many cups of berries should she use? Show your work. Possible work:

$\frac{\frac{1}{2}\text{ cup yogurt}}{1\text{ cup berries}} \cdot \frac{18}{18} = \frac{9\text{ cups yogurt}}{18\text{ cups berries}}$

SOLUTION Kaley should use 18 cups of berries.

8 This graph shows how fast Halima ran on a track. Halima says she was running 1.5 laps per minute because $\frac{3}{2} = 1.5$. What mistake did she make? How fast was Halima running?



Possible answer: Halima used $\frac{\text{run}}{\text{rise}}$ instead of $\frac{\text{rise}}{\text{run}}$.
Halima was running $\frac{2}{3}$ lap per minute.

CLOSE EXIT TICKET

8 Students' solutions should show an understanding that:

- slope is the vertical change, or rise, divided by the horizontal change, or run.
- the slope is $\frac{2}{3}$, which means that Halima runs $\frac{2}{3}$ lap per minute.

Error Alert If students interpret slope as run over rise, then go back to using the description of vertical change divided by horizontal change. Using a graph, have the students connect rise to vertical change and run to horizontal change.

Close: Exit Ticket is a quick formative assessment of each day's learning and serves as an indicator of students' progress toward mastery or partial mastery of the learning goal of the session.

This is the last question on the Student Worktext page.

Error Alert gives insight into misconceptions that can lead to errors in calculation and provides on-the-spot remediation.

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TEACHER'S GUIDE **Overview** *continued*

Additional Practice can be used as in-class small group work, after class work, or at-home learning.

Solutions are labeled as *Basic*, *Medium*, and *Challenge* to show the relative difficulty level in relation to the questions at hand or the standard in question. Use these to support independent practice or differentiation as needed.

Fluency & Skills Practice provides ongoing opportunities for students to accurately, flexibly, and efficiently practice mathematical procedures and operations. This can be used as in-class small group work, after-class work, or at-home learning. Student pages are available in the optional Fluency and Skills Practice Book or on Teacher Toolbox. Download PDFs or editable versions, or assign to any LMS, including Google Classroom.

LESSON 8 | SESSION 3 ■■■□

Practice Finding the Slope of a Line

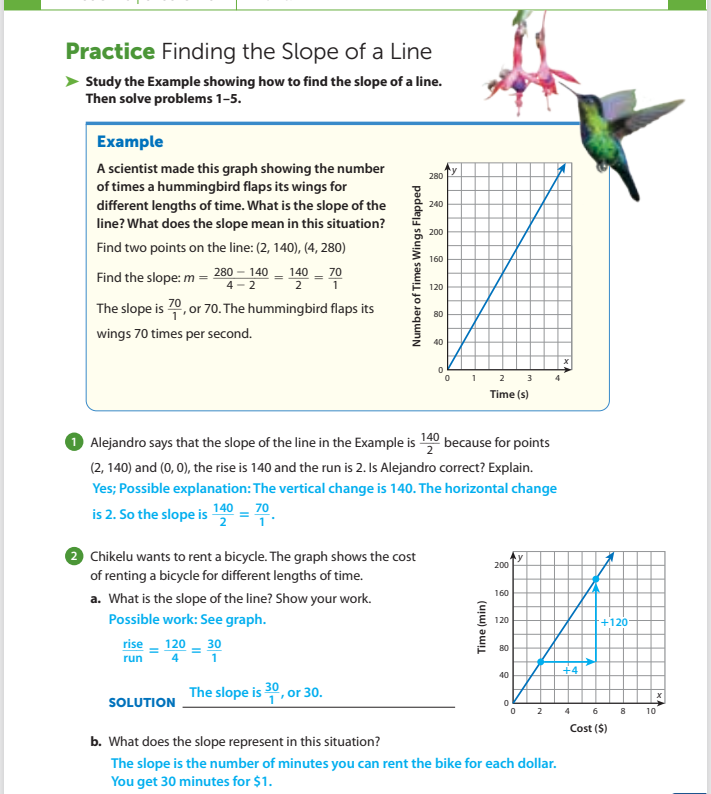
Problem Notes

Assign **Practice Finding the Slope of a Line** as extra practice in class or as homework.

1. Students should understand that any two points on the line may be used to calculate the slope. If the line passes through the origin, using (0, 0) as one point makes the calculations simpler. ***Medium***

2. **a.** Students may also solve the problem using the slope formula. ***Medium***

   b. Students should recognize that the slope represents the change in time for each $1 change in cost. So, you can rent the bike for 30 minutes for each dollar. ***Basic***



LESSON 8 | SESSION 3 Name:

Practice Finding the Slope of a Line

➤ **Study the Example showing how to find the slope of a line. Then solve problems 1–5.**

Example

A scientist made this graph showing the number of times a hummingbird flaps its wings for different lengths of time. What is the slope of the line? What does the slope mean in this situation?

Find two points on the line: (2, 140), (4, 280)

Find the slope: $m = \frac{280 - 140}{4 - 2} = \frac{140}{2} = \frac{70}{1}$

The slope is $\frac{70}{1}$, or 70. The hummingbird flaps its wings 70 times per second.

1. Alejandro says that the slope of the line in the Example is $\frac{140}{2}$ because for points (2, 140) and (0, 0), the rise is 140 and the run is 2. Is Alejandro correct? Explain.
   Yes; Possible explanation: The vertical change is 140. The horizontal change is 2. So the slope is $\frac{140}{2} = \frac{70}{1}$.

2. Chikelu wants to rent a bicycle. The graph shows the cost of renting a bicycle for different lengths of time.
   a. What is the slope of the line? Show your work.
   Possible work: See graph.
   $\frac{\text{rise}}{\text{run}} = \frac{120}{4} = \frac{30}{1}$
   SOLUTION The slope is $\frac{30}{1}$, or 30.

   b. What does the slope represent in this situation?
   The slope is the number of minutes you can rent the bike for each dollar. You get 30 minutes for $1.

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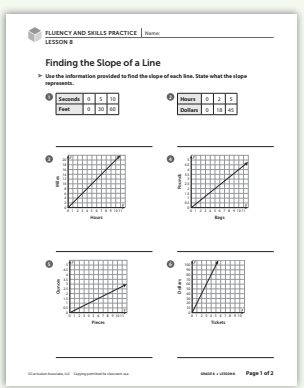
Fluency & Skills Practice

Finding the Slope of a Line

In this activity, students are given tables and graphs of lines, and they are asked to determine the slope and the meaning of the slope in the context of the problem.



Learning Games
Have students play Learning Games to reinforce prerequisite skills.

Interactive Practice
Assign your students additional digital practice, as needed.

Cumulative Practice
Assign Cumulative Practice to review major content from previous units, as needed.

i-Ready Personalized Instruction
A personalized instruction path helps students reinforce prerequisites and build grade-level skills.

Additional Practice Opportunities include digital Learning Games, Interactive Practice, Cumulative Practice, and i-Ready Personalized Instruction.

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Additional Practice

3 **a.** Students may also solve the problem by using the slope formula. ***Medium***

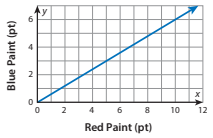
b. Students may also interpret the slope as meaning that 3 pints of blue paint must be mixed with 5 pints of red paint to make the correct shade of purple. ***Basic***

4 **a.** Students should recognize the numbers in the numerator as *x*-values and the numbers in the denominator as *y*-values. The numerator and denominator should be reversed. ***Challenge***

b. Students may solve the problem using the slope formula or by finding rise over run. ***Medium***

5 The most efficient method is to use the origin and a second point to calculate slope. However, students may use any two points in the table for their calculation. Students should recognize that the unit rate represents the number of cars made per hour. ***Medium***

3 Colin wants to make purple paint. He finds a graph online that shows how much red and blue paint he should use to make the shade of purple he wants.



a. What is the slope of the line? Show your work.

Possible work:

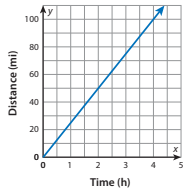
(0, 0) and (5, 3); $\frac{\text{rise}}{\text{run}} = \frac{3}{5}$

SOLUTION The slope is $\frac{3}{5}$.

b. What does the slope represent in this situation?

Possible answer: The slope means that $\frac{3}{5}$ pint of blue paint must be mixed with 1 pint of red paint to make a certain shade of purple.

4 Rafael wants to find the slope of the line.



a. This is Rafael's work. What mistake did he make?

$$m = \frac{4-2}{100-50} = \frac{2}{50} = \frac{1}{25}$$

Possible answer: He used $\frac{x_2 - x_1}{y_2 - y_1}$ instead of $\frac{y_2 - y_1}{x_2 - x_1}$.

b. What is the slope of the line?

$\frac{25}{1}$, or 25

5 A factory makes cars at a constant rate. The table shows the number of cars made for different lengths of time. A manager draws a graph of the number of cars made per hour. What is the slope of the line? What does the slope represent? Show your work.

Time (h)	0	5	8	12	24
Number of Cars	0	130	208	312	624

Possible work: $\frac{208 - 130}{8 - 5} = \frac{78}{3} = \frac{26}{1}$

SOLUTION $\frac{26}{1}$, or 26; The slope represents the number of cars made per hour.

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Use with **Session 4** Apply It

Levels 1–3: Listening/Speaking

Read Apply It problem 2 aloud as students follow along. Help students find the slope and tell what it means.

Prepare students to respond to Pair/Share. Use objects to act out the meaning of *reversing*. Then restate the question: *Reverse the x- and y-values of the points. How does the slope change?* Have students turn to a partner to work on Pair/Share. Allow time for students to find the new slope. Then help them use *reverse* and *reversed* to discuss. Ask: *What did you do to the coordinate of the points? What is the new slope?* Provide sentence frames:

- *I ____ the x- and y-values of the ____.*
- *The ____ values are ____.*
- *The new slope is ____.*

Levels 2–4: Listening/Speaking

Read Apply It problem 2 with students. Have students find the slope and tell what it means.

Prepare students to respond to Pair/Share. Use **Act It Out** to help students illustrate the meaning of *reversing* and *reversed*. Have students turn to a partner to work on Pair/Share. Restate the question as follows: *Reverse the x- and y-values of the points. How does the slope change?* Allow time for students to find the new slope. Then have students use *reversing* and *reversed* to discuss. Ask: *How did you change the coordinates of the points? What is the new slope?* Provide sentence frames:

- *I changed the points by ____.*
- *The new points are ____.*
- *The new slope is ____.*

Levels 3–5: Listening/Speaking

Have students read Apply It problem 2. Have students find the slope and tell what it means.

Prepare students to respond to Pair/Share. Clarify the meaning of *reverse* as needed. Have students turn to a partner to restate the question in Pair/Share. Ask: *What is the new situation you need to consider? What would you need to find for this situation?* Provide sentence starters to guide the conversation:

- *In the new situation, the coordinates ____.*
- *For this new situation, I would need to ____.*

Have partners take turns using *reverse, reversing,* and/or *reversed* to compare the original and new slope. Encourage students to use *inverse* if appropriate.

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