

Using a Session

Teacher's Guide

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.

Objectives
Content Objectives identify the mathematical learning goals for the lesson, while **Language Objectives** identify how students use language to show or develop their understanding of those goals.

Prior Knowledge identifies key skills students will build on during the lesson and presents an opportunity to monitor understanding and identify students' learning needs.

Learning Progression provides 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, setting context for the mathematics of the lesson.

LESSON 10

Overview | Divide Fractions

MATH FOCUS

Focus Standard
6.NS.A.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.
See Unit 2 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 routine.*
This lesson provides additional support for:

- 1 Make sense of problems and persevere in solving them.
- 7 Look for and make use of structure.

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

Objectives

Content Objectives

- Divide fractions by fractions using visual models and equations.
- Use visual models and equations to represent word problems involving fraction division.
- Interpret the quotient of two fractions.
- Solve fraction division problems, including those that have quotients that are fractions.
- Write a word problem to match a given expression involving division of fractions.

Language Objectives

- Discuss connections between visual models and equations in word problems involving fraction division with a partner.
- Read and interpret word problems to determine which quantity is the dividend and which quantity is the divisor.
- Justify the size of the quotient in relationship to the dividend and divisor using reasoning and understanding of fraction division in class discussion.
- Apply understanding of division with fractions to write a word problem to match a given expression using complete sentences.
- Understand and use lesson vocabulary to accurately explain division of fractions.

Prior Knowledge

- Understand that a divisor can represent the size of a group or the number of groups.
- Add, subtract, and multiply fractions.
- Interpret a fraction as division.
- Use visual models to represent division with fractions.
- Write a mixed number as a fraction greater than 1.

Vocabulary

Math Vocabulary
reciprocal for any nonzero number a , the reciprocal is $\frac{1}{a}$. The reciprocal of any fraction $\frac{a}{b}$ is $\frac{b}{a}$. Zero does not have a reciprocal.

Review the following key terms.
common denominator a number that is a common multiple of the denominators of two or more fractions.
fraction a number that names equal parts of a whole. A fraction names a point on the number line and can also represent the division of two numbers.

Academic Vocabulary
nonzero not equal to zero.

Learning Progression

In Grade 5, students multiplied fractions by whole numbers and other fractions. They also divided whole numbers by unit fractions and unit fractions by whole numbers.

In the previous lesson, students used visual models, including bar models and number lines, to find a quotient of two fractions when the fractions were compatible and when the quotient was a whole number.

In this lesson, students use models and strategies to divide fractions, including mixed numbers. They look at situations in which the quotient is not a whole number, including when the divisor is a whole number or a fraction. When there is a remainder, they understand how to write the remainder as a fraction of the divisor. Students explore an algorithm for dividing fractions—multiplying by the reciprocal of the divisor—and they understand why this algorithm works. They solve a variety of word problems involving division of fractions.

In the next lesson, students build on their skills and understandings of multiplying and dividing fractions as they solve volume problems for prisms with fractional edge lengths.

In Grade 7, students will extend their work with fractions to perform operations with positive and negative rational numbers.

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LESSON 10 Overview

Pacing Guide

Items marked with  are available on the Teacher Toolbox.

	MATERIALS	DIFFERENTIATION
SESSION 1 Explore Dividing Fractions (35–50 min) <ul style="list-style-type: none"> • 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 211–212)	 Math Toolkit fraction bars, fraction circles, grid paper, number lines Presentation Slides 	PREPARE Interactive Tutorial  RETEACH or REINFORCE Hands-On Activity Materials For each pair: 1 set of fraction tiles
SESSION 2 Develop Dividing Fractions (45–60 min) <ul style="list-style-type: none"> • 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 217–218)	 Math Toolkit fraction bars, fraction circles, grid paper, number lines Presentation Slides 	RETEACH or REINFORCE Hands-On Activity Materials For each pair: 13 connecting cubes REINFORCE Fluency & Skills Practice  EXTEND Deepen Understanding
SESSION 3 Develop Using Multiplication to Divide by a Fraction (45–60 min) <ul style="list-style-type: none"> • 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 223–224)	 Math Toolkit fraction bars, fraction circles, grid paper, number lines Presentation Slides 	RETEACH or REINFORCE Hands-On Activity Materials For each pair: 2 sets of fraction circles REINFORCE Fluency & Skills Practice  EXTEND Deepen Understanding
SESSION 4 Refine Dividing Fractions (45–60 min) <ul style="list-style-type: none"> • 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 group: 7 sets of fraction circles REINFORCE Problems 4–8 EXTEND Challenge PERSONALIZE  i-Ready
Lesson 10 Quiz  Or Digital Comprehension Check		RETEACH Tools for Instruction  REINFORCE Math Center Activity  EXTEND Enrichment Activity 

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Pacing Guide provides session-by-session pacing to support planning for daily instruction and practice.

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

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

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.

Optional Add-On: PERSONALIZE resources provide students with opportunities to strengthen grade-level skills by working on their personalized path with *i-Ready* Online Instruction or to build fluency skills with interactive Learning Games.

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.

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

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 is frequently an opportunity to have students engage in conversations about mathematics, answering questions such as, *Which would you rather?* and *Which one doesn't belong?*

DEVELOP ACADEMIC LANGUAGE supports all students in understanding and using academic language at the word, sentence, and discourse levels.

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

LESSON 10 | SESSION 3 ■ ■ ■ □

Develop Using Multiplication to Divide by a Fraction

Purpose

- **Develop** strategies for dividing by a fraction.
- **Recognize** that dividing by a fraction gives the same result as multiplying by that fraction's reciprocal.

START CONNECT TO PRIOR KNOWLEDGE

Always, Sometimes, Never

- A When two numbers are divided, the quotient is greater than the dividend.
 B When the divisor is less than the dividend, the quotient is less than 1.
 C When the divisor is the same as the dividend, the quotient is equal to 1.

Solutions

A is sometimes true.

B is never true.

C is always true.

WHY? Support students' understanding of how the size of a quotient is related to the sizes of the dividend and divisor.

DEVELOP ACADEMIC LANGUAGE

WHY? Understand questions by restating them as statements.

HOW? Tell students that one way to start to understand *how* and *why* questions is to restate all or part of them as statements. Demonstrate with Connect It problem 2: *Why does multiplying by 2 tell you how many $\frac{1}{2}$ s are in a number?* → *Multiplying by 2 tells you how many $\frac{1}{2}$ s are in a number. Why?* Encourage students to restate questions they find confusing.

TRY IT

SMP 1, 2, 4, 5, 6

Make Sense of the Problem

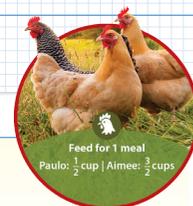
See **Connect to Culture** to support student engagement. Before students work on Try It, use **Notice and Wonder** to help them make sense of the problem. Record student responses as time and interest allow and then lead a discussion about what students noticed and wondered that may be relevant to the problem.

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LESSON 10 Divide Fractions

LESSON 10 | SESSION 3 ■ ■ ■ □

Develop Using Multiplication to Divide by a Fraction



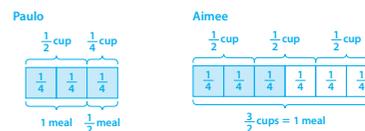
Read and try to solve the problem below.

Paulo and Aimee each have $\frac{3}{4}$ cup of feed left in their bags of chicken feed. Paulo uses $\frac{1}{2}$ cup of feed each time he gives his chickens a meal. Aimee uses $\frac{3}{4}$ cups of feed each time she gives her chickens a meal. How many meals can Paulo give his chickens? How many meals can Aimee give her chickens?

TRY IT

Math Toolkit fraction bars, fraction circles, grid paper, number lines

SAMPLE A



Paulo can give his chickens 1 full meal plus $\frac{1}{2}$ of a second meal.
 Aimee can give her chickens only $\frac{1}{2}$ of a full meal.

SAMPLE B

Paulo: How many $\frac{1}{2}$ s are in $\frac{3}{4}$? Aimee: How many $\frac{3}{4}$ s are in $\frac{3}{4}$?

$?\times\frac{1}{2}=\frac{3}{4}$ $?\times\frac{3}{4}=\frac{3}{4}$

$\frac{3}{4}\div\frac{1}{2}=\frac{3}{4}\div\frac{2}{4}$ $\frac{3}{4}\div\frac{3}{4}=\frac{3}{4}\div\frac{6}{8}$

$=3\div2=1\frac{1}{2}$ $=3\div6=\frac{1}{2}$

Paulo can give his chickens $1\frac{1}{2}$ meals, and Aimee can give hers $\frac{1}{2}$ meal.

DISCUSS IT

Ask: How does your model show the relationship between $\frac{3}{4}$ and $\frac{1}{2}$? Between $\frac{3}{4}$ and $\frac{3}{4}$?

Share: In my model, ... represents ...

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DISCUSS IT

SMP 2, 3, 6

Support Partner Discussion

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

- How would you describe your model?
- How does your model show the amount of feed Paulo and Aimee have?

Common Misconception Listen for students who confuse the dividend and the divisor, giving answers of $\frac{2}{3}$ of a meal and 2 meals. As students share their strategies, ask them to think about whether each person has enough feed to make one full meal. Have them discuss whether this means each quotient should be greater than 1 or less than 1.

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

Common Misconception identifies misconceptions that can be addressed in whole class discussion as students are prompted to explain their reasoning.

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:

- drawings such as bar models to show the fraction of a meal that three fourths represents
- **(misconception)** equations or drawings that confuse the dividend and divisor
- equations, including equations that use a common denominator strategy

Facilitate Whole Class Discussion

Call on students to share selected strategies. After each strategy, allow individual think time for students to process the ideas.

Guide students to **Compare and Connect** the representations. Encourage students to build on each other's ideas by offering reasons or observations about why each model makes sense.

ASK How do these models show whether Aimee can make more than 1 meal or less than 1 meal?

LISTEN FOR Each model shows that the amount of feed Aimee needs for 1 meal is greater than the amount of feed she has, so she can make less than 1 meal.

Model It & Analyze 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 does each model show the dividend and divisor?

LISTEN FOR The diagrams show the dividend as 3 shaded fourths and the divisor as groups of $\frac{1}{2}$ with brackets. The equations show dividing the amount of feed each person has (the dividend) by the amount needed for 1 meal (the divisor).

For the diagrams, prompt students to relate the words and equations to the diagrams.

- How do the diagrams and words help you write the division equations?
- How can the diagrams help you find the quotients?

For the multiplication strategy, prompt students to reason about the two multiplication steps.

- How does multiplying by the denominator of the divisor relate to division?
- Why do you divide by the numerator of the divisor? Why is this the same as multiplying by $\frac{1}{3}$?

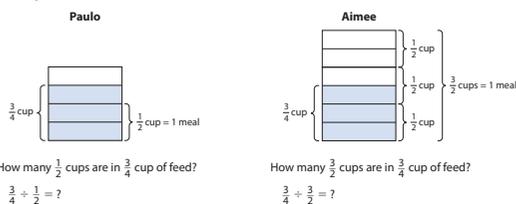
Explore different ways to solve problems that involve dividing by a fraction.

Paulo and Aimee each have $\frac{3}{4}$ cup of feed left in their bags of chicken feed. Paulo uses $\frac{1}{2}$ cup of feed each time he gives his chickens a meal. Aimee uses $\frac{3}{2}$ cups of feed each time she gives her chickens a meal. How many meals can Paulo give his chickens? How many meals can Aimee give her chickens?

Model It

You can use a diagram and words to help you represent a division situation.

Shade $\frac{3}{4}$ of a square to represent the amount of feed Paulo and Aimee have.



Analyze It

You can use multiplication to divide by a fraction.

To find how many $\frac{1}{2}$ s are in a number, you can use two multiplication steps.

$$\frac{3}{4} \div \frac{1}{2}$$

First find how many $\frac{1}{2}$ s are in the number.

$$\frac{3}{4} \times 2 = \frac{6}{4}$$

To do this, multiply by 2.

Then separate the number of $\frac{1}{2}$ s into 3 equal parts.

$$\frac{6}{4} \times \frac{1}{3} = \frac{6}{12}, \text{ or } \frac{1}{2}$$

To divide by 3, multiply by $\frac{1}{3}$.

DIFFERENTIATION | EXTEND



Deepen Understanding

Making Use of Structure to Understand Division of Fractions

SMP 7

Prompt students to relate the steps in Analyze It to the diagrams in Model It. Point out that the first step, multiplying by 2 to find how many halves are in $\frac{3}{4}$, tells how many meals Paulo can feed his chickens. You can write $\frac{6}{4}$ meals as $1\frac{1}{2}$ meals.

ASK How does the diagram for Paulo show that $\frac{1}{2}$ fits into $\frac{3}{4}$ one and a half times?

LISTEN FOR The diagram shows that $\frac{3}{4}$ is made up of 1 half plus $\frac{1}{2}$ of another half.

Then use the diagram for Aimee to explore the step of dividing by 3 (or multiplying by $\frac{1}{3}$).

ASK How does the diagram for Aimee show that she needs 3 times as much feed for 1 meal as Paulo needs? Why can you multiply Paulo's number of meals by $\frac{1}{3}$ to find Aimee's number of meals?

LISTEN FOR You can see 1 meal for Paulo in the diagram for Aimee by looking at one of the groups labeled as $\frac{1}{2}$ cup. You can see that Aimee needs 3 times this amount by looking at the 3 groups that are each labeled as $\frac{1}{2}$ cup. Since Aimee needs 3 times as much as Paulo, she has only $\frac{1}{3}$ of the number of meals Paulo has.

Select and Sequence Student Strategies gives a range of possible strategies—from concrete to representational to abstract—for use in monitoring student work and facilitating discourse. This information can be used to make decisions about which models and strategies, including misconceptions, to share and discuss as a class.

ASK/LISTEN FOR are mathematical discourse questions followed by expected student responses that support whole class discussion.

As students share their thinking, these 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.

SMPs are infused throughout the instructional model.

Deepen Understanding is a consistent opportunity to build 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 might look in the classroom.

Monitor and Confirm

Understanding identifies important student understanding and supports teachers in ensuring that students have made sense of mathematical learning goals.

Facilitate Whole Class Discussion

provides questions and facilitation moves that help teachers guide discussions that illuminate the mathematical ideas of the lesson. Connect It questions prompt students to make connections among representations or solutions and to articulate a generalization of the key mathematical concept in the lesson.

Hands-On Activities and Visual Models

occur consistently at strategic points in the lesson after teachers have gauged students' understanding through observation and their work on questions in the Student Worktext. The activities support students who are unsure of the concept and provide an opportunity for small group reteaching while other students work independently. Use of concrete objects lets students access understanding in a different way. A suggestion for where in the lesson to implement this activity is indicated by a blue line. In this example, the recommended time is after discussing problem 3.

Develop Using Multiplication to Divide by a Fraction

CONNECT IT

SMP 2, 4, 5, 6

Remind students that the quantities and the relationships between them are the same in each representation. Explain that they will now use those relationships to reason about how to use multiplication to divide by a fraction.

Before students begin to record and expand on their work in Analyze It, tell them that problem 3 will prepare them to provide the explanation asked for in problem 4.

Monitor and Confirm Understanding 1 – 2

- Finding the number of $\frac{1}{2}$ cups in $\frac{3}{4}$ cup and the number of $\frac{3}{4}$ cups in $\frac{3}{4}$ cup tells the number of meals each person can give.
- Multiplying by 2 tells how many $\frac{1}{2}$ s are in a number.
- Multiplying by 2 and by $\frac{1}{3}$ tells how many $\frac{3}{2}$ s are in a number.

Facilitate Whole Class Discussion

- Support students in understanding that the reciprocal of any fraction $\frac{a}{b}$ is $\frac{b}{a}$.

ASK What is the reciprocal of 3? Why?

LISTEN FOR The reciprocal of 3 is $\frac{1}{3}$. You can write 3 as $\frac{3}{1}$, so the reciprocal is $\frac{1}{3}$.

- Look for the understanding that dividing by a fraction gives the same result as multiplying by the reciprocal of that fraction.

ASK If the divisor is a fraction, why can you use multiplication to find the quotient?

LISTEN FOR Multiplying by the denominator of the divisor tells how many fractional parts of that size are in the dividend. Then multiplying by the reciprocal of the numerator divides those parts into groups of the size of the numerator.

- Before students complete the generalization of the algorithm stated with letters, suggest that they first record the process symbolically with numbers using the quotient $\frac{3}{4} \div \frac{3}{2}$ from the Try It problem and the quotient $4 \div \frac{2}{5}$ from problem 4.

- 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 use multiplication to divide by a fraction.

- How many meals can Paulo give his chickens? How many meals can Aimee give her chickens? Explain how you know.
 $1\frac{1}{2}$ meals; $\frac{1}{2}$ meal; Possible explanation: For Paulo, $\frac{2}{4}$ is 1 meal and $\frac{1}{4}$ is $\frac{1}{2}$ meal. Aimee has 3 of 6 fourths, which is half of what she needs for 1 meal.

- Look at **Analyze It**. Why does multiplying by 2 tell you how many $\frac{1}{2}$ s are in a number? Why does multiplying the number of $\frac{3}{2}$ s by $\frac{1}{3}$ tell you how many $\frac{3}{2}$ s are in the number?
There are 2 halves in each whole; there are only $\frac{1}{3}$ as many $\frac{3}{2}$ s as $\frac{1}{2}$ s.

- The fraction $\frac{2}{3}$ is called the **reciprocal** of $\frac{3}{2}$. Explain why dividing by $\frac{3}{2}$ gives the same result as multiplying by its reciprocal, $\frac{2}{3}$.

$\frac{2}{3} = 2 \times \frac{1}{3}$, so multiplying by $\frac{2}{3}$ means multiplying by 2 and by $\frac{1}{3}$. Multiplying by 2 and then by $\frac{1}{3}$ is how you divide by $\frac{3}{2}$.

- Explain why dividing by any fraction gives the same result as multiplying by that fraction's reciprocal. Use the example $4 \div \frac{2}{5}$.

You multiply 4 by 5 to find how many $\frac{1}{5}$ s are in 4. Then you find half of that number of fifths to see how many $\frac{2}{5}$ s are in 4. You are multiplying by 5 and by $\frac{1}{2}$, so you are multiplying by $5 \times \frac{1}{2}$, or $\frac{5}{2}$. The fraction $\frac{5}{2}$ is the reciprocal of $\frac{2}{5}$.

- Complete the equations to show how to divide any fraction $\frac{a}{b}$ by any fraction $\frac{c}{d}$.

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} \times \frac{1}{1} \rightarrow \frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

- Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how solve problems that involve dividing by a fraction.

Responses will vary. Check student responses.

DIFFERENTIATION | RETEACH or REINFORCE



Hands-On Activity

Use fraction circles to understand an algorithm for fraction division.

If students are unsure about the connection between dividing by a fraction and multiplying by that fraction's reciprocal, then have them use fraction circles to look at the relationships.

Materials For each pair: 2 sets of fraction circles

- Display $\frac{3}{2} \div \frac{1}{8}$. Have students use fraction circles to model $\frac{3}{2}$ using one-eighth pieces. Ask: How many eighths are in $\frac{3}{2}$? [12] What is $\frac{3}{2} \div \frac{1}{8}$? [12]
- Have students connect dividing by $\frac{1}{8}$ to multiplying by the denominator of $\frac{1}{8}$. Ask: What is the product $\frac{3}{2} \times 8$? [$\frac{24}{2} = 12$] Why is the number of eighths in $\frac{3}{2}$ equivalent to $\frac{3}{2} \times 8$? [To find how many eighths are in a number, you multiply the number by 8.]
- Now have students model $\frac{3}{2} \div \frac{2}{8}$. Ask: How does the number of $\frac{2}{8}$ s in $\frac{3}{2}$ compare to the number of $\frac{1}{8}$ s in $\frac{3}{2}$? [There are $\frac{1}{2}$ as many.] Connect dividing by 2 to multiplying by $\frac{1}{2}$.
- Have students repeat using $\frac{3}{2} \div \frac{3}{8}$ to see that there are $\frac{1}{3}$ as many $\frac{3}{8}$ s as $\frac{1}{8}$ s in $\frac{3}{2}$.

Apply It

For all problems, encourage students to use a model to support their thinking. Allow some leeway in precision; students who draw fraction models may not precisely show fractional parts that are equal in size.

- 7 Students also may use bar models, number lines, or a common denominator to find $\frac{2}{3} \div \frac{2}{5}$.
- 8 Students may recognize the length of the base and the height as factors and the area as the product.

LESSON 10 | SESSION 3

Apply It

► Use what you learned to solve these problems.

- 7 Find the quotient $\frac{2}{3} \div \frac{2}{5}$. Show your work.

Possible work:

$$\frac{2}{3} \div \frac{2}{5} = \frac{2}{3} \times \frac{5}{2}$$

$$= \frac{5}{3}$$

SOLUTION $\frac{5}{3}$

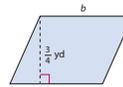
- 8 The parallelogram has an area of $1\frac{1}{8}$ yd². Use the formula $A = bh$ to find the length of the base, b . Show your work.

Possible work: $1\frac{1}{8} = b \cdot \frac{3}{4}$

$$b = 1\frac{1}{8} \div \frac{3}{4}$$

$$= \frac{9}{8} \cdot \frac{4}{3}$$

$$= \frac{36}{24} \text{ or } \frac{3}{2}$$



SOLUTION The length of the base is $\frac{3}{2}$ yd, or $1\frac{1}{2}$ yd.

- 9 It takes Francisco $\frac{5}{6}$ minute to upload a video to his blog. How much of one video can he upload in $\frac{1}{2}$ minute? Show your work.

Possible work:

How many $\frac{5}{6}$ s are in $\frac{1}{2}$?

$$\frac{1}{2} \div \frac{5}{6} = \frac{1}{2} \cdot \frac{6}{5}$$

$$= \frac{6}{10}$$

$$= \frac{3}{5}$$

SOLUTION Francisco can upload $\frac{3}{5}$ of one video in $\frac{1}{2}$ minute.

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CLOSE EXIT TICKET

- 9 Students' solutions should show an understanding of:
- $\frac{5}{6}$ minute as the time to upload 1 video and $\frac{1}{2}$ minute as the time available for an upload.
 - the time available to upload the video is less than the time needed to upload 1 video.

Error Alert If students divide $\frac{5}{6}$ by $\frac{1}{2}$ because of the order given in the problem, then have them check the solution for reasonableness. Prompt students to recognize that $\frac{1}{2}$ minute is less than $\frac{5}{6}$ minute, so in $\frac{1}{2}$ minute an entire video cannot be fully uploaded. Ask: *Should the quotient be greater than 1 or less than 1? [less than 1] Generate open discussion about different ways to think about what makes sense for determining the dividend and divisor in problems involving fraction division.*

Apply It explanations include alternate approaches to solving the problem.

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.

Error Alert draws attention to frequently made errors in procedure or calculation and provides on-the-spot remediation.

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

Problem Notes provide insights into alternate solution strategies and student understandings. Problems are labeled as *Basic*, *Medium*, and *Challenge* to support independent practice that can be differentiated 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 on the Teacher Toolbox.

LESSON 10 | SESSION 3 ■ ■ ■ □

Practice Using Multiplication to Divide by a Fraction

Problem Notes
Assign **Practice Using Multiplication to Divide by a Fraction** as extra practice in class or as homework.

1 a. Students should understand that $\frac{8}{3}$ and $8 \times \frac{1}{3}$ are equivalent expressions. *Basic*

b. Students may recognize that multiplying by 8 tells the number of $\frac{1}{8}$ s in $1\frac{1}{2}$, and then multiplying by $\frac{1}{3}$ tells the number of groups of $\frac{3}{8}$ in $1\frac{1}{2}$. *Medium*

LESSON 10 | SESSION 3 Name: _____

Practice Using Multiplication to Divide by a Fraction

► Study the Example showing how to use multiplication to divide by a fraction. Then solve problems 1–4.

Example

Tyrone has $1\frac{1}{2}$ quarts of honey. He is pouring the honey into jars that each hold $\frac{3}{8}$ quart. How many jars can Tyrone fill?

You can divide the total quarts of honey, $1\frac{1}{2}$, by the number of quarts each jar can hold, $\frac{3}{8}$.

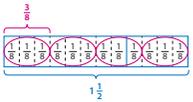
$$1\frac{1}{2} \div \frac{3}{8} = 1\frac{1}{2} \times \frac{8}{3} \quad \leftarrow \text{To divide by } \frac{3}{8}, \text{ multiply by its reciprocal, } \frac{8}{3}.$$

$$= \frac{2}{2} \times \frac{8}{3}$$

$$= \frac{24}{6} = 4$$

Tyrone can fill 4 jars of honey.

1 The Example shows finding the quotient $1\frac{1}{2} \div \frac{3}{8}$ by multiplying $1\frac{1}{2}$ by the reciprocal of $\frac{3}{8}$, or $\frac{8}{3}$. You can relate multiplying by the reciprocal to a bar model that represents the division equation $1\frac{1}{2} \div \frac{3}{8} = 4$.



a. Explain why multiplying by $\frac{8}{3}$ gives the same result as first multiplying by 8 and then multiplying by $\frac{1}{3}$.
You can break apart $\frac{8}{3}$ into the product of two factors: $\frac{8}{3} = 8 \times \frac{1}{3}$.

b. What is the value of the expression $(1\frac{1}{2} \times 8) \times \frac{1}{3}$? Explain how finding the value of the expression is related to the bar model.
4; Possible explanation: You first find $1\frac{1}{2} \times 8 = 12$, which is the same as the number of parts of size $\frac{1}{8}$ in the bar model. Then you multiply 12 by $\frac{1}{3}$, which is $\frac{12}{3}$, or $12 \div 3 = 4$. This is like dividing the 12 eighths in the bar model into 4 groups of $\frac{3}{8}$.

Vocabulary
reciprocal
for any nonzero number a , the reciprocal is $\frac{1}{a}$. The reciprocal of any fraction $\frac{a}{b}$ is $\frac{b}{a}$.

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Fluency & Skills Practice

Using Multiplication to Divide by a Fraction

In this activity, students complete division equations by filling in missing numbers.

FLUENCY AND SKILLS PRACTICE | Name: _____

LESSON 10

Using Multiplication to Divide by a Fraction

► Write the missing digits in the boxes to solve each equation.

$3 \cdot 1 - 1 = \square - \square$	$1 - 1 - 1 = \square - \square$
$1 - 1 - 1 = \square - \square$	$2 - 3 - 1 = \square - \square$
$1 - 1 - 1 = \square - \square$	$1 - 1 - 1 = \square - \square$
$\square - \square - 1 = 1 - \square$	$1 - \square - \square = 1 - \square$
$1 - 1 - 1 = \square - \square$	$1 - \square - \square = 1 - \square$

► Write a word problem that could be solved by the equation in problem 6.

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LESSON 10 Divide Fractions

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LESSON 10 | SESSION 3
Additional Practice

- 2 Students also may use an area model to visually represent the area and length of the park to find the width. **Medium**
- 3 Students also may use a bar model to explore $6 \div 3\frac{3}{4}$. **Challenge**
- 4 Students may also use a bar model to label and represent the situation and visualize the quotient. **Medium**

LESSON 10 | SESSION 3

- 2 A rectangular city park is $\frac{6}{8}$ mi long. The park has an area of $\frac{1}{4}$ mi². What is the width of the park? Show your work.

Possible work:

$$A = \ell w, \text{ so } w = A \div \ell.$$

$$w = \frac{1}{4} \div \frac{6}{8}$$

$$= \frac{1}{4} \cdot \frac{8}{6}$$

$$= \frac{8}{24}, \text{ or } \frac{1}{3}$$

SOLUTION The width of the park is $\frac{1}{3}$ mi.

- 3 Find the value of $6 \div 3\frac{3}{4}$. Show your work.

Possible work:

$$6 \div 3\frac{3}{4} = 6 \div \frac{15}{4}$$

$$= 6 \cdot \frac{4}{15}$$

$$= \frac{24}{15} = \frac{8}{5}$$

SOLUTION $\frac{8}{5}$, or $1\frac{3}{5}$

- 4 During a community service day, 6 teams of students clean a beach by picking up trash. The beach is $1\frac{4}{5}$ mi long. Each team cleans the same length of beach. What is the length of beach that each team cleans? Show your work.

Possible work:

$$1\frac{4}{5} \div 6 = \frac{9}{5} \times \frac{1}{6}$$

$$= \frac{9}{30}, \text{ or } \frac{3}{10}$$



SOLUTION Each team cleans $\frac{3}{10}$ mi of the beach.

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DIFFERENTIATION | ENGLISH LANGUAGE LEARNERS

Use with Session 4 Apply It

Levels 1–3: Listening/Speaking

Support students as they engage in partner discussion about Apply It problem 6. Read the problem aloud. Paraphrase the problem using *if*. Draw a number line to review *less than*, *greater than*, and *equal*. Have students point to a number. Ask them to tell if the number is *less than*, *greater than*, or *equal to* 1. Have students talk to a partner to complete the chart. Encourage students to refer to their models or equations to support their answers. Provide a sentence starter:

- The quotient is ____.

Levels 2–4: Listening/Speaking

Support students as they engage in partner discussion about Apply It problem 6. Call on a volunteer to read the problem aloud. Review *less than*, *greater than*, and *equal to* as needed. Have students work individually to complete the chart. Then have them turn to partners to explain their reasoning. Encourage them to refer to their models or equations to support their explanations.

Have students complete the sentence frame:

- The quotient ____ is ____.

Levels 3–5: Listening/Speaking

Support students as they engage in partner discussion about Apply It problem 6. Call on a volunteer to read the problem aloud. Have students work individually to complete the chart. Organize students into pairs and ask them to take turns explaining their reasoning using their models or equations.

Then have students meet with a different partner and take turns asking each other questions about their charts. Suggest students use the following sentence frames:

- Why is ____ less/greater than 1?
- Why is ____ equal to 1?
- How did you decide that ____ is ____?

DIFFERENTIATION | ENGLISH LANGUAGE LEARNERS suggests ways teachers can scaffold or amplify language in the next session so English Learners can access and engage with grade-level mathematics.