Eureka Acceleration Tool: Grade 6
Module 4, Topic G

To become mathematically proficient, students **must** access on-grade-level content. This document aims to help teachers who use the Eureka curriculum to ensure readiness for students before and during on-grade-level work, creating opportunities for timely support directly connected to the new learning.

About this Topic

Focus Standards:

6.EE.B.5: Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.B.7: Solve real-world and mathematical problems by writing and solving equations and inequalities of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers. Inequalities will include <, >, ≤, and ≥.

Topic Overview per the Eureka Curriculum

In Topic G, students move from identifying true and false number sentences to making true number sentences false and false number sentences true. In Lesson 23, students explain what equality and inequality symbols represent. They determine if a number sentence is true or false based on the equality or inequality symbol.

In Lesson 24, students move to identifying a value or a set of values that makes number sentences true. They identify values that make a true sentence false. For example, students substitute 4 for the variable in $x + 12 = 14$ to determine if the sentence is true or false. They note that when 4 is substituted for x, the sum of $x + 12$ is 16, which makes the sentence false because $16 \neq 14$. They change course in the lesson to find what they can do to make the sentence true. They ask themselves, "What number must we add to 12 to find the sum of 14?" By substituting 2 for x, the sentence becomes true because $x + 12 = 14$, $2 + 12 = 14$, and $14 = 14$. They bridge this discovery to Lesson 25 where students understand that the solution of an equation is the value or values of the variable that make the equation true.

Students begin solving equations in Lesson 26. They use bar models or tape diagrams to depict an equation and apply previously learned properties of equality for addition and subtraction to solve the equation. Students check to determine if their solutions make the equation true. Given the equation 1 + = 6, students represent the equation with the following model: (see page 240 in Teacher Edition)

Students recognize that the solution can also be found using properties of operations. They make connections to the model and determine that 1 + − 1 = 6 − 1 and, ultimately, that = 5. Students represent two-step and multi-step equations involving all operations with bar models or tape diagrams while continuing to apply properties of operations and the order of operations to solve equations in the remaining lessons in this topic.

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Overview

Eureka Acceleration Tools include:

1. a diagnostic assessment to help teachers determine the misunderstandings or gaps in mathematical knowledge related to a specific Topic in the Eureka curriculum
2. guidance for teachers to analyze student work on the diagnostic assessment
3. suggested materials for targeted remedial instruction

Note: The use of this guidance is not intended to delay students' engagement with on-grade-level learning. On-grade-level learning should be the focus of instructional time and be treated as an opportunity for students to "finish" learning previous skills and deepen conceptual understanding.

Diagnostic Assessment

The diagnostic assessment is designed to be administered to targeted students prior to beginning instruction on the given Topic. When appropriate, it is broken into parts (Part A, Part B, and so on); each part addresses a different prerequisite standard and contains three problems. If a student correctly answers at least 2 out of the 3 problems, it can be assumed that he/she is ready to engage with the new content of the Topic with little to no support needed prior to engaging with the Topic. The diagnostic assessment is designed in this way so that teachers can determine the "entry point" to remedial instruction and/or opportunities for unfinished learning within the context of the new learning. The entry points and opportunities for unfinished learning will vary between students.

Guidance for Acceleration

The Acceleration Guidance is designed for teacher use. It is also broken into parts (Part A, Part B, and so on) and correlates to the parts on the diagnostic assessment. Each part contains the following:

1. **The focus standard**: The focus standards are strategically chosen to address prerequisite skills and are purposefully arranged in the order that students typically master the skills and knowledge.
2. **Why this is important for current grade level work**: This section describes how the work of the prerequisite standard relates to the standard(s) addressed in the Topic of instruction.
3. **Using the diagnostic assessment to identify gaps**: This section identifies common errors students make on the diagnostic assessment items.
4. **Acceleration Resources for Targeted Instruction**: The resources pinpoint specific Eureka lessons and parts of lessons for teachers to use to address gaps in mathematical knowledge. Using Eureka materials to address acceleration ensures alignment to the standards, consistency in approach to learning, and similarities in strategies for solving problems.

Part A: 5.NF.A.1

1. $\frac{4}{5} + \frac{7}{10} =$

2. $3\frac{3}{4} - \frac{1}{8} =$

3. $5\frac{1}{3} - 1\frac{1}{2} =$

Part B: 5.NF.B.4a

Use a tape diagram or other visual model to solve the following problems.

4. $\frac{1}{3}$ x 9 =

5. $\frac{2}{5}$ x 10 =

6. $\frac{3}{4}$ x 12 =

Part C: 5.NF.B.4b

Use a tape diagram or other visual model to solve the following problems.

7. $\frac{1}{4} \times \frac{1}{2} =$

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

9. $\frac{3}{5} \times \frac{5}{4} =$

Solutions:

1. $\frac{15}{10}$ or $1\frac{1}{2}$
2. $3\frac{5}{8}$
3. $3\frac{5}{6}$
4. 3
5. 4
6. 9
7. $\frac{1}{8}$
8. $\frac{4}{9}$
9. $\frac{15}{20}$ or $\frac{3}{4}$

Part A Focus: 5.NF.A.1: Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*

Why this is important for current grade level work:
Students will begin their work in Topic G with determining whether specific number sentences and equations are true or false and will progress to solving one-step equations that involve addition and/or subtraction of rational numbers. When teaching this concept, teachers need to be able to focus on the conceptual understanding of solving equations using the properties of equality. In order to teach this concept without the distraction of arithmetic with fractions, students need to be fluent in their ability to add and subtraction fractions with unlike denominators.

Using the Diagnostic Assessment to identify gaps:

Problem 1:
Fluent students may be able to complete this mentally. Look to see if students use the least common denominator or multiply both denominators together to come up with a common denominator of 50. Either is acceptable, but it is more efficient to use the LCD for fluency.

Problem 2:
Look for students who rewrite the mixed number as an improper fraction before subtracting as this might be a sign that the student incorrectly thinks you cannot perform operations with mixed numbers.

Problem 3:
Look for students who subtract the 1/3 from ½, thinking they cannot subtract ½ from 1/3. Such students have a clear misconception about subtraction (and possibly addition) of mixed numbers.

Acceleration Resources for Targeted Instruction:

Adapted from:
5th Grade, Module 3, Topic B, Lesson(s) 3 - 6

Teacher Companion
Student Activity Sheet

Part B Focus: 5.NF.B.4a Interpret the product (m/n) x q as m parts of a partition of q into n equal parts; equivalently, as the result of a sequence of operations, m x $q \div n$. *For example, use a visual fraction model to show understanding, and create a story context for (m/n) x q.*

Why this is important for current grade level work: Beginning in Lesson 27, students will learn to solve one-step equations with multiplication and division using the properties of equality. These equations will involve rational numbers, including fractions. When solving for a variable in an equation involving the multiplication of fractions, students must understand the connection between multiplication of fractions and division. For example, when given the equation, $1/2a = 4$, a 6th grade student should be able to reason that, when 1 group of a is divided by 2, each group has a value of 4; therefore, a must have a value of 8 because $8 \div 2 = 4$.	**Acceleration Resources for Targeted Instruction:** Adapted from: 5th Grade, Module 4, Topic C, Lesson 7
Using the Diagnostic Assessment to identify gaps: **Problems 4-6:** Look for students who incorrectly apply the "invert and multiply" rule/trick as this will show a clear gap in understanding that will likely prove problematic as students try to solve equations involving similar arithmetic problems. Requiring a visual fraction model should help students better understand the problems, leading them to abstract the work from the models, applying the commutative property in to calculate the products in problems 5 and 6.	Teacher Companion Student Activity Sheet

Part C Focus: 5.NF.B.4b Construct a model to develop understanding of the concept of multiplying two fractions and create a story context for the equation. [In general, (m/n) x (c/d) = (mc)/(nd).]

Why this is important for current grade level work: Beginning in Lesson 27, students will learn to solve one-step equations with multiplication and division using the properties of equality. When teaching this concept, teachers need to be able to focus on the conceptual understanding of solving equations using the properties of equality. In order to teach this concept without the distraction of arithmetic with fractions, students need to be fluent in their ability to multiply fractions by fractions.	**Acceleration Resources for Targeted Instruction:** Adapted From 5th Grade, Module 4, Topic E, Lesson(s) 13 - 15
Using the Diagnostic Assessment to identify gaps: **Problems 7-9:** Look for students who incorrectly apply the "invert and multiply" rule/trick as this will show a clear gap in understanding that will likely prove problematic as students try to solve equations involving similar arithmetic problems. Requiring a visual fraction model should help students better understand the problems, leading them to abstract the work from the models.	Teacher Companion Student Activity Sheet

Acceleration Guidance:
Grade 6 Eureka Module 4, Topic G
Appendix

Eureka Acceleration Tools

Prerequisite Support Lesson for Grade 6, Module 4, Topic G

Part A: Adding and Subtracting Fractions with Unlike Denominators

Adapted from Eureka Lesson: Grade 5, Module 3, Topic B, Lessons 3-6
Use Prior to: 6th Grade, Module 4, Topic G, Lesson 23

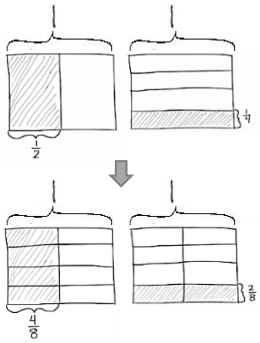
Standard: 5.NF.A.1
Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)
Purpose: Students will begin their work in Topic G with determining whether specific number sentences and equations are true or false and will progress to solving one-step equations that involve addition and/or subtraction of rational numbers. When teaching this concept, teachers need to be able to focus on the conceptual understanding of solving equations using the properties of equality. In order to teach this concept without the distraction of arithmetic with fractions, students need to be fluent in their ability to add and subtraction fractions with unlike denominators.

Note: The goal for this mini lesson is to support students in becoming fluent with fraction addition and subtraction before they begin to develop a conceptual understanding of solving equations. Students will need varying levels of support in this area depending on their prior understanding. Begin with fraction models then encourage students to use a preferred strategy when ready. Work the Example Problems with the students, and then allow the students to complete the **Problem Set** independently as you check for understanding.

Example Problems

1. For the following problems, draw a picture using the rectangular fraction model and write the answer. When possible, write your answer as a mixed number.

   a. $\frac{1}{2} + \frac{1}{4} = \mathbf{\frac{3}{4}}$



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

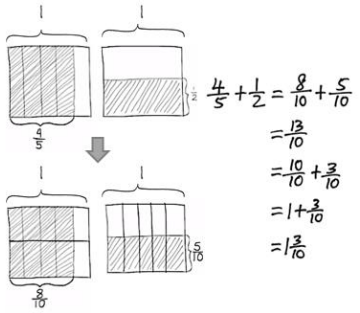
- T: (Write $\frac{1}{2} + \frac{1}{4}$.) Can I add 1 half plus 1 fourth?
- S: I cannot add 1 half plus 1 fourth until the units are the same. We need to find like units.
- T: Now, let's make like units by drawing. (Draw a rectangular fraction model.) How many units will I have if I partition 1 whole into smaller units of one half each?
- S: 2 units.
- T: (Partition the rectangle vertically into 2 equal units.) One half tells me to select how many of the 2 units?
- S: One.
- T: Let's label our unit with $\frac{1}{2}$ and shade in one part. Now, let's draw another whole rectangle. How many equal parts do I divide this whole into to make fourths?
- S: Four.

- T: (Partition the rectangle horizontally into 4 equal units.) One fourth tells me to shade how many units?
- S: One.
- T: Let's label our unit with $\frac{1}{4}$ and shade in one part. Now, let's partition our 2 wholes into the same size units. (Draw horizontal lines on the $\frac{1}{2}$ model and 1 vertical line on the $\frac{1}{4}$ model.) What fractional unit have we made for each whole?
- S: Eighths.
- T: How many shaded units are in $\frac{1}{2}$?
- S: Four.
- T: That's right; we have 4 shaded units out of 8 total units. (Change the label from $\frac{1}{2}$ to $\frac{4}{8}$.) How many units are shaded on the $\frac{1}{4}$ model?
- S: Two.
- T: Yes, 2 shaded parts out of 8 total parts. (Change the label from $\frac{1}{4}$ to $\frac{2}{8}$.) Do our models show like units now?
- S: Yes!
- T: Say the addition sentence now using eighths as our common denominator, or common unit.
- S: 4 eighths + 2 eighths = 6 eighths.
- T: We can make larger units within $\frac{6}{8}$. Tell your partner how you might do that.
- S: 6 and 8 can both be divided by 2. 6 ÷ 2 = 3 and 8 ÷ 2 = 4. The fraction is $\frac{3}{4}$. → We can make larger units of 2 each. 3 twos out of 4 twos. That's 3 out of 4 units or 3 fourths. → $\frac{6}{8}$ is partitioned into 6 out of 8 smaller units. It can be made into 3 out of 4 larger, equal pieces by grouping in 2s.
  1 half + 1 fourth = 4 eighths + 2 eighths = 6 eighths = 3 fourths.

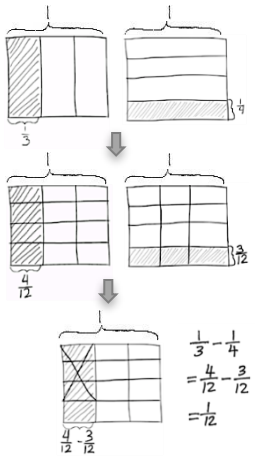
$$\frac{1}{2}+\frac{1}{4}=\frac{4}{8}+\frac{2}{8}=\frac{6}{8}=\frac{3}{4}.$$

b. $\frac{4}{5}+\frac{1}{2}=\mathbf{1\frac{3}{10}}$

Some students may need support to rewrite the improper fraction as a mixed number.



c. $\frac{1}{3}-\frac{1}{4}=\mathbf{\frac{1}{12}}$

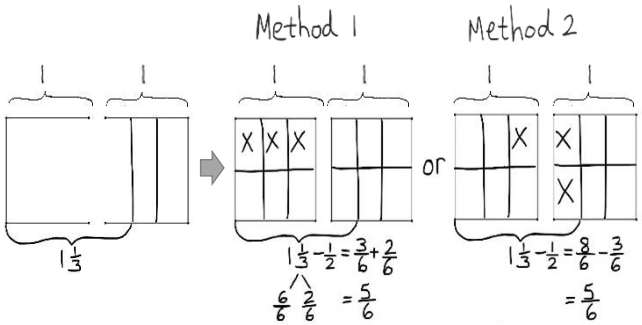


2. Solve each problem. Simplify your answer, if possible.

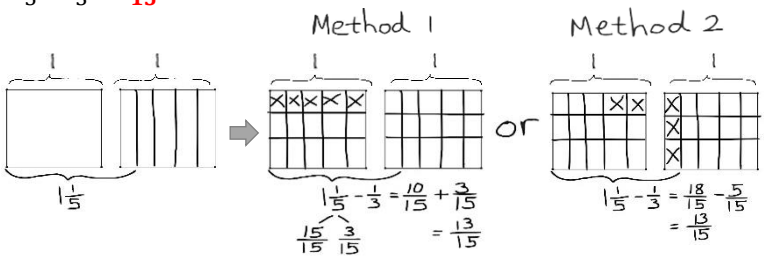
Some students may perform these operations without converting the mixed number into an improper fraction. Support this method if it is resulting in the correct answer.

a. $1\frac{1}{3} - \frac{1}{2} = \mathbf{\frac{5}{6}}$

- T: (Write $1\frac{1}{3} - \frac{1}{2}$.) Read the subtraction expression.
- S: 1 and 1 third minus 1 half.
- T: How many thirds is 1 and 1 third?
- S: 4 thirds.
- T: (Draw 1 whole and 1 third.) What should we do now? Turn and talk to your partner.
- S: Make like units.
- T: How many new smaller units are in each whole?
- S: 6 units.
- T: 4 thirds is how many sixths?
- S: 8 sixths.
- T: 1 half is how many sixths?
- S: 3 sixths.
- T: Looking at my drawing, how would you subtract 3 sixths or a half? Discuss this with your partner.
- S: You can take the half from the whole and then add back the third. → Then, you are adding to subtract? → Yes, you are adding the part you had left after you take away. → It makes it easier because we know really well how to subtract any fraction from one whole. → Yeah, but it's just easier for me to take the 3 sixths from the 8 sixths. → For me, it's easier to take it from the whole and add back the rest.
- T: It's like subtracting 80 from 130. It's easier for me to take 80 from 100 and add 20 and 30.
- S: Can we subtract it either way?
- T: Of course. Choose the way that is easiest for you.
- T: Let's call the different solution strategies Method 1 and Method 2. If you use Method 1, let's record using a number bond. Solve and share your solution with a partner.
- S: (Solve and share.) 8 sixths – 3 sixths = 5 sixths. → 1 and 1 third – 1 half = 5 sixths.



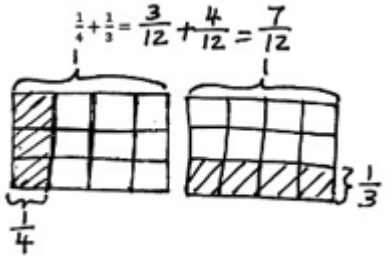
b. $1\frac{1}{5} - \frac{1}{3} = \mathbf{\frac{13}{15}}$



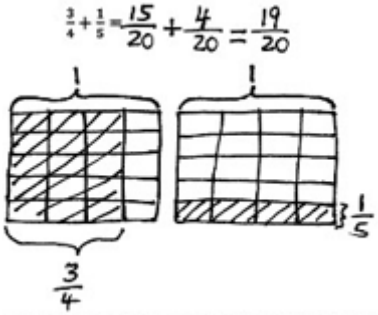
Problem Set

1. Solve each problem. When possible, write your answer as a mixed number.

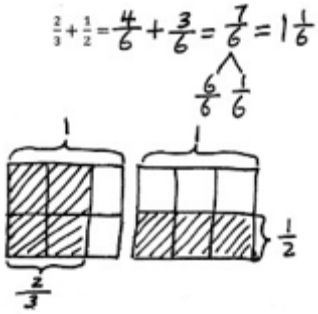
a. $\frac{1}{4}+\frac{1}{3}=$



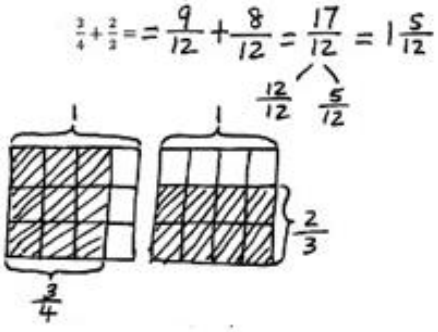
b. $\frac{3}{4}+\frac{1}{5}=$



c. $\frac{2}{3}+\frac{1}{2}=$ $1\frac{1}{6}$

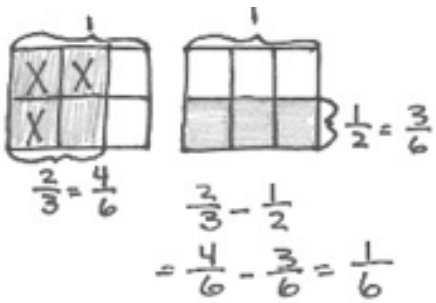


d. $\frac{3}{4}+\frac{2}{3}=$ $1\frac{5}{12}$

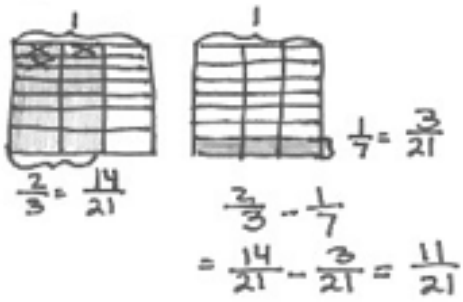


3. Solve each problem. Simplify your answer, if possible.

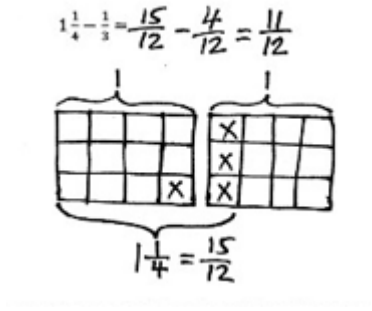
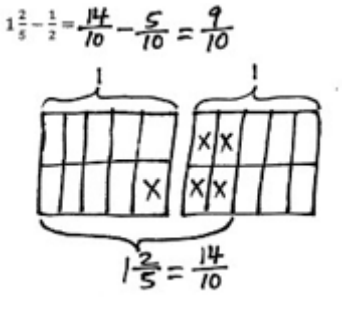
a. $\frac{2}{3}-\frac{1}{2}=$ $\frac{1}{6}$



b. $\frac{2}{3}-\frac{1}{7}=$ $\frac{11}{21}$



4. For the following problems, draw a picture using the rectangular fraction model and write the answer. Simplify your answer, if possible.

a. $1\frac{1}{4} - \frac{1}{3} = \mathbf{\frac{11}{12}}$ 	b. $1\frac{2}{5} - \frac{1}{2} = \mathbf{\frac{9}{10}}$ 

Name: _____

Eureka Acceleration Tools

Prerequisite Support Lesson for Grade 6, Module 4, Topic G

Part A: Adding and Subtracting Fractions with Unlike Denominators

Example Problems

1. For the following problems, draw a picture using the rectangular fraction model and write the answer. When possible, write your answer as a mixed number.

   a. $\frac{1}{2} + \frac{1}{4} =$

   b. $\frac{4}{5} + \frac{1}{2} =$

   c. $\frac{1}{3} - \frac{1}{4} =$

2. Solve each problem. Simplify your answer, if possible.

   a. $1\frac{1}{3} - \frac{1}{2} =$

   b. $4\frac{1}{5} - 1\frac{1}{3} =$

Problem Set

1. Solve each problem. When possible, write your answer as a mixed number.

a. $\frac{1}{4}+\frac{1}{3}=$	b. $\frac{3}{4}+\frac{1}{5}=$
c. $\frac{2}{3}+\frac{1}{2}=$	d. $\frac{3}{4}+\frac{2}{3}=$

3. Solve each problem. Simplify your answer, if possible.

a. $\frac{2}{3}-\frac{1}{2}=$	b. $\frac{2}{3}-\frac{1}{7}=$

4. For the following problems, draw a picture using the rectangular fraction model and write the answer. Simplify your answer, if possible.

a. $1\frac{1}{4}-\frac{1}{3}=$	b. $1\frac{2}{5}-\frac{1}{2}=$

Eureka Acceleration Tools

Prerequisite Support Lesson for Grade 6, Module 4, Topic G
Part B: Multiplication of a Whole Number by a Fraction

Adapted from Eureka Lesson: Grade 5, Module 4, Topic C, Lessons 7
Use Prior to: Grade 6, Module 4, Topic G, Lesson 27

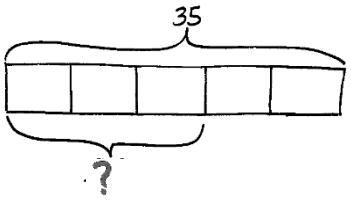
Standard: 5.NF.B.4a
Interpret the product (m/n) x q as m parts of a partition of q into n equal parts; equivalently, as the result of a sequence of operations, m x q ÷ n. For example, use a visual fraction model to show understanding, and create a story context for (m/n) x q.

Purpose: Beginning in Lesson 27, students will learn to solve one-step equations with multiplication and division using the properties of equality. These equations will involve rational numbers, including fractions. When solving for a variable in an equation involving the multiplication of fractions, students must understand the connection between multiplication of fractions and division. For example, when given the equation, 1/2a = 4, a 6th grade student should be able to reason that, when 1 group of a is divided by 2, each group has a value of 4; therefore, a must have a value of 8 because 8 ÷ 2 = 4.

Note: Requiring a visual fraction model should help students better understand the problems, leading them to abstract the work from the models. A tape diagram is used for the examples below but other visual models could be used. Ensure all students are completing the work correctly as they develop an abstract understanding of the concept. Work the Example Problems with the students, and then allow the students to complete the **Problem Set** independently as you check for understanding.

Example Problems

1. What is $\frac{3}{5}$ of 35?. **21**
   - T: (Write 3/5 of 35 = ___ on the board.) As we work through this problem, we will create visual models to help us develop an understanding. I will use fraction models as we complete the example problems.
   - T: We must find 3 fifths of 35. Draw a bar to represent our whole. What's our whole?
   - S: (Draw.) 35.
   - T: (Draw a bar, and label it as 35.) How many units should we cut the whole into?
   - S: 5.
   - T: How do you know?
   - S: The denominator tells us we want fifths. That is the unit being named by the fraction. We are asked about fifths, so we know we need 5 equal parts.
   - T: Divide your bar into fifths.
   - S: (Work.)
   - T: (Cut the bar into 5 equal units.) We know 5 units are equal to 35. How do we find the value of
   - 1 unit? Say the division sentence.
   - S: 35 ÷ 5 = 7.
   - T: (Write 5 units = 35, 1 unit = 35 ÷ 5 = 7.) Have we answered our question?



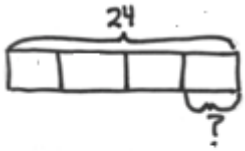
5 units = 35
1 unit = $\frac{35}{5}$
= 7
3 units = 3 x 7
= 21

$\frac{3}{5}$ of 35 is 21.

- S: No. We found 1 unit is equal to 7, but the question is to find 3 units. We need 3 fifths. When we divide by 5, that's just 1 fifth of 35.
- T: How will we find 3 units?
- S: Multiply 3 and 7 to get 21. We could add 7 + 7 + 7. We could put 3 of the 1 fifths together. That would be 21.
- T: What is 3/5 of 35?
- S: 21.

2. $\frac{3}{4} x\ 24 =$ **18**

Walk through this example in the same way as Example Problem 1.



4 units = 24

1 unit = $\frac{24}{4}$

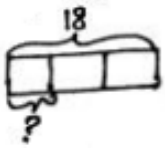
= 6

$\frac{1}{4}$ of 24 = 6

$\frac{3}{4}$ of 24 = 18

3. $\frac{1}{3}\ x\ 18 =$ 6

Allow students an opportunity to attempt the problem on their own..Work through the answer and have student identify in their work if they made any errors.



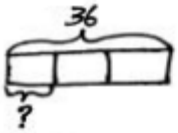
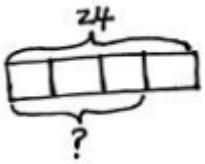
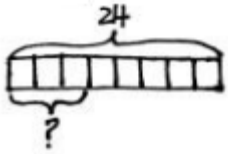
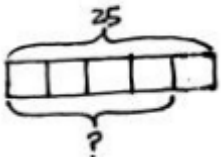
3 units = 18

1 unit = 18 ÷ 3

= $\frac{18}{3}$ = 6

Problem Set

1. Multiply. Draw a rectangular fraction model if it helps you.

a) $\frac{1}{3} x\ 36 =$ **12**  3 units = 36 1 unit = 36 ÷ 3 = $\frac{36}{3}$ = 12	b) $\frac{3}{4} x\ 24 =$ **18**  4 units = 24 1 unit = $\frac{24}{4}$ = 6 3 units = 3 x 6 = 18
c) $\frac{3}{8} x\ 24 =$ **9**  8 units = 24 1 unit = 24 ÷ 8 = $\frac{24}{8}$ = 3 3 units = 3 x 3 = 9	d) $\frac{4}{5} x\ 25 =$ **20**  5 units = 25 1 unit = $\frac{25}{5}$ = 5 4 units = 4 x 5 = 20

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Eureka Acceleration Tools

Prerequisite Support Lesson for Grade 6, Module 4, Topic G

Part B: Multiplication of a Whole Number by a Fraction

Example Problems

1. What is $\frac{3}{5}$ of 35?

2. $\frac{3}{4} x\ 24 =$

3. $\frac{1}{3}\ x\ 18\ =$

Problem Set

1. Multiply. Draw a rectangular fraction model if it helps you.

a) $\frac{1}{3} x\ 36 =$	b) $\frac{3}{4} x\ 24 =$
c) $\frac{3}{8} x\ 24 =$	d) $\frac{4}{5} x\ 25 =$

Eureka Acceleration Tools

Prerequisite Support Lesson for Grade 6, Module 4, Topic G
Part C: Multiplication of a Fraction by a Fraction

Adapted from Eureka Lesson: Grade 5, Module 4, Topic E, Lessons 13-15
Use Prior to: Grade 6, Module 4, Topic G, Lesson 27

Standard: 5.NF.B.4b
Construct a model to develop understanding of the concept of multiplying two fractions and create a story context for the equation. [In general, (m/n) x (c/d) = (mc)/(nd).]

Purpose: Beginning in Lesson 27, students will learn to solve one-step equations with multiplication and division using the properties of equality. When teaching this concept, teachers need to be able to focus on the conceptual understanding of solving equations using the properties of equality. In order to teach this concept without the distraction of arithmetic with fractions, students need to be fluent in their ability to multiply fractions by fractions.

Note: Requiring a visual fraction model should help students better understand the problems, leading them to abstract the work from the models. A tape diagram is used for the examples below but other visual models could be used. Ensure all students are completing the work correctly as they develop an abstract understanding of the concept.Work the Example Problems with the students, and then allow the students to complete the **Problem Set** independently as you check for understanding.

Example Problems

1. Jan has 4 pans of crispy rice treats. She sends $\frac{1}{2}$ of the pans to school with her children. How many pans of crispy rice treats does Jan send to school?

   Note: The purpose of this application problem is to have students progress from finding a fraction of a whole number to a fraction of a fraction. The following sequence is then used: 2 pans, 1 pan, ½ pan.

   - T: (Post Problem 1 on the board, and read it aloud with students.) Work with your partner to write a multiplication sentence that explains your thinking. Be prepared to share. (Allow students time to work.)
   - T: What fraction of the pans does Jan send to school?
   - S: One-half of them.
   - T: How many pans of crispy rice treats did Jan have at first?
   - S: 4 pans.
   - T: What is one-half of 4 pans?
   - S: 2 pans.
   - T: Show the multiplication sentence that you wrote to explain your thinking.
   - S: (Show $\frac{1}{2} \times 4$ pans = 2 pans or $4 \times \frac{1}{2}$ = 2 pans.)
   - T: Say the answer in a complete sentence.
   - S: Jan sent 2 pans of crispy rice treats to school.
   - T: (Erase the 4 in the text of the problem, and replace it with a 2.) Imagine that Jan has 2 pans of treats. If she still sends half of the pans to school, how many pans will she send? Write a multiplication sentence to show how you know.

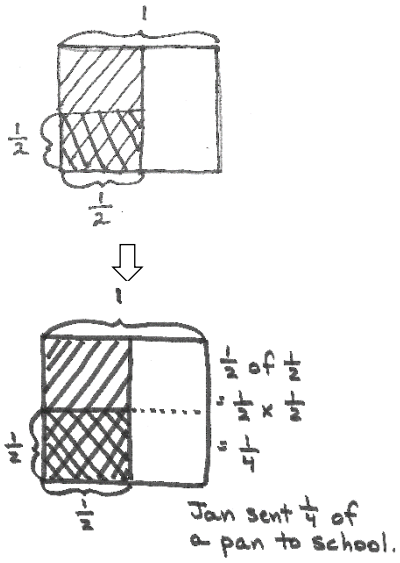
$\frac{1}{2}$ of 4 pans = 2 pans

$\frac{1}{2}$ of 2 pans = 1 pan

$\frac{1}{2}$ of 1 pan = $\frac{1}{2}$ pan

$\frac{1}{2}$ of $\frac{1}{2}$ pan = $\frac{1}{4}$ pan

- S: (Write $\frac{1}{2} \times 2$ pans = 1 pan.)
- T: (Replace the 2 in the problem with a 1.) Now, imagine that she only has 1 pan. If she still sends half to school, how many pans will she send? Write the multiplication sentence.
- S: (Write $\frac{1}{2} \times 1$ pan = $\frac{1}{2}$ pan.)
- T: (Erase the 1 in the problem, and replace it with $\frac{1}{2}$. Read the problem aloud with students.) What if Jan only has half a pan and wants to send half of it to school? What is different about this problem?
- S: There's only $\frac{1}{2}$ of a pan instead of a whole pan. → Jan is still sending half the treats to school, but now we'll find half of a half, not half of 1. → The amount we have is less than a whole.
- T: Let's say that your piece of paper represents the pan of treats. Turn and talk to your partner about how you can use your rectangular paper to find out what fraction of the whole pan of treats Jan sent to school.
- S: (May fold or shade the paper to show the problem.)
- T: Many of you shaded half of your paper and then partitioned that half into 2 equal parts and shaded one of them, like so. (Model as seen to the right.)
- T: We now have two different size units shaded in our model.
- I can see the part that Jan sent to school, but I need to name this unit. To name the part she sent (point to the double-shaded unit), all of the units in the whole must be the same size as this one. Turn and talk to your partner about how we can split the rest of the pan so that all the units are the same as our double-shaded one. Use your paper to show your thinking.
- S: We could cut the other half in half, too. That would make 4 units of the same size. → We could keep cutting across the rest of the whole. That would make the whole pan cut into 4 equal parts.
  → Half of a half is a fourth.
- T: Let me record that. (Partition the unshaded half using a dotted line.) Look at our model. What's the name for the smallest units we have drawn now?

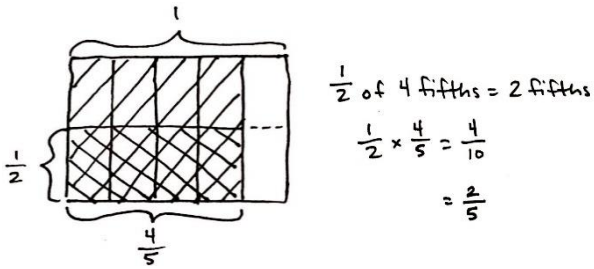


- S: Fourths.
- T: She sent half of the treats she had, but what fraction of the whole pan of treats did Jan send to school?
- S: One-fourth of the whole pan.
- T: Write a multiplication sentence that shows your thinking.
- S: (Write $\frac{1}{2}\ x\ \frac{1}{2} = \frac{1}{4}$.) $\frac{1}{2}$

2. $\frac{1}{2} \times \frac{4}{5} = \frac{2}{5}$

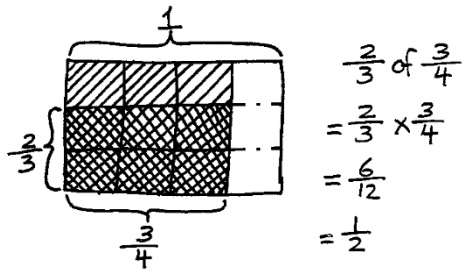
Note: Students may need additional support to simplify fractions.

- T: We need to find 1 half of 4 fifths. If this were 1 half of 4 bananas, how many bananas would we have?
- S: 2 bananas.
- T: How can you use this thinking to help you find 1 half of 4 fifths? Turn and talk.
- S: It's half of 4, so it must be 2. This time, it's 4 fifths, so half would be 2 fifths. → Half of 4 is always 2. It doesn't matter that it is fifths. The answer is 2 fifths.
- T: It sounds like we agree that 1 half of 4 fifths is 2 fifths. Let's draw a rectangular fraction model to confirm our thinking. Work with your partner.
- S: (Draw.)



- T: I notice that our rectangular fraction model shows that the product is 4 tenths, but we said a moment ago that our product was 2 fifths. Did we make a mistake? Why or why not?
- S: No. 4 tenths is just another name for 2 fifths. → I can see 5 groups of 2 tenths, but only 2 of them are double shaded. Two out of 5 groups is another way to say 2 fifths.

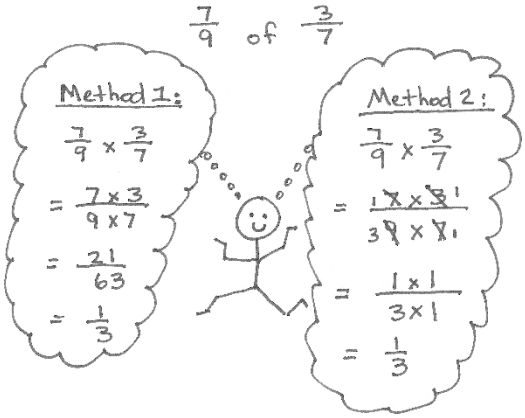
3. $\frac{2}{3} x \frac{3}{4} = \frac{1}{2}$



4. $\frac{7}{9} x \frac{3}{7} = \frac{1}{3}$

Note: Example Problem 4 is essential to supporting students in fluently mulitplying fractions by fractions. If edits need to be made to shorten this mini lesson for timing reasons, prioritize Example Problem 4.

- T: How would this problem look if we drew a rectangular fraction model for it? Discuss with your partner.
- S: We'd have to draw 3 sevenths first and then split each seventh into ninths. → We'd end up with a model showing sixty-thirds. It would be really hard to draw.
- T: You are right. It's not really practical to draw a rectangular fraction model for a problem like this, because the units are so small. Could the pattern that we've noticed in the multiplication expressions help us? Turn and talk.
- S: $\frac{7}{9}$ of $\frac{3}{7}$ is the same as $\frac{7}{9} \times \frac{3}{7}$. → Our pattern lets us just multiply the numerators and the denominators. → We can multiply and get 21 as the numerator and 63 as the denominator. Then, we can simplify and get 1 third.



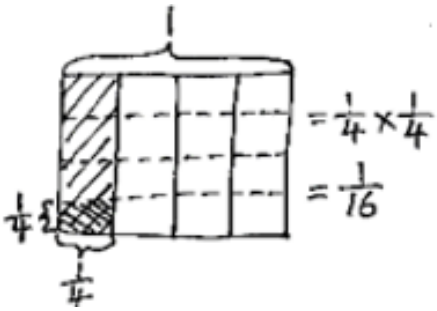
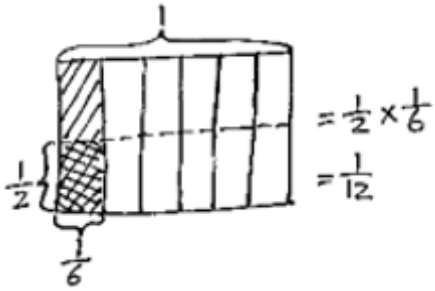
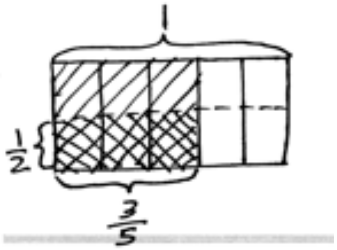
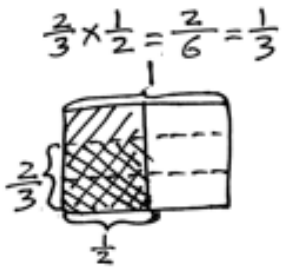
- T: Let me write what I hear you saying. (Write $\frac{7}{9} \times \frac{3}{7} = \frac{7 \times 3}{9 \times 7} = \frac{21}{63}$ on the board.)
- T: What's the simplest form for $\frac{21}{63}$? Solve it on your personal white board.
- S: $\frac{1}{3}$.
- T: Let's use another strategy we learned recently and rename this fraction using larger units before we multiply. (Point to $\frac{7 \times 3}{9 \times 7}$.) Look for factors that are shared by the numerator and denominator. Turn and talk.
- S: There's a 7 in both the numerator and denominator. → The numerator and denominator have a common factor of 7. → I know the 3 in the numerator can be divided by 3 to get 1, and the 9 in the denominator can be divided by 3 to get 3. → 7 divided by 7 is 1, so both sevens change to ones. The factors of 3 and 9 can both be divided by 3 and changed to 1 and 3.
- T: We can rename this fraction by dividing both the numerators and denominators by common factors. 7 divided by 7 is 1 in both the numerator and denominator. (Cross out both sevens, and write ones next to them.) 3 divided by 3 is 1 in the numerator, and 9 divided by 3 is 3 in the denominator. (Cross out the 3 and 9, and write 1 and 3, respectively, next to them.)
- T: What does the numerator show now?

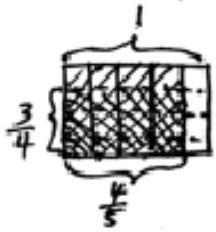
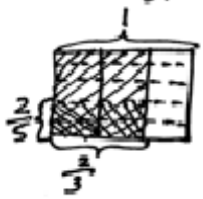
- S: 1 × 1.
- T: What's the denominator?
- S: 3 × 1.
- T: Now, multiply. What is $\frac{7}{9}$ of $\frac{3}{7}$ equal to?
- S: $\frac{1}{3}$.
- T: Look at the two strategies. Which one do you think is easier and more efficient to use? Turn and talk.
- S: The first strategy of simplifying $\frac{21}{63}$ after I multiply is a little bit harder because I have to find the common factors between 21 and 63. → Simplifying first is a little easier. Before I multiply, the numbers are a little smaller, so it's easier to see common factors. Also, when I simplify first, the numbers I have to multiply are smaller, and my product is already expressed using the largest unit.
- T: Let's look back at the other example problems. Would the same methods work for each of those? (Walk through each previous example and review using the two methods when appropriate.)
- S: Yes.

Problem Set

1. Multiply. Draw a rectangular fraction model if it helps you, or use the method in the example below.

Example: $\frac{6}{7} \times \frac{5}{8} = \frac{\cancel{6}^{3} \times 5}{7 \times \cancel{8}_{4}} = \frac{15}{28}$

a) $\frac{1}{4} x \frac{1}{4} = \frac{1x1}{4x4} = \frac{1}{16}$ 	b) $\frac{1}{2} x \frac{1}{6} = \frac{1x1}{2x6} = \frac{1}{12}$ 
c) $\frac{1}{2} x \frac{3}{5} = \frac{1x3}{2x5} = \frac{3}{10}$ 	d) $\frac{2}{3} x \frac{1}{2} = \frac{2x1}{3x2} = \frac{1}{3}$ 

e) $\frac{3}{4} \times \frac{4}{5} = \frac{3}{5}$ $\frac{3}{4} \times \frac{4}{5} = \frac{3 \times \cancel{4}^{1}}{\cancel{4}_{1} \times 5} = \frac{3}{5}$  	f) $\frac{2}{5} \times \frac{2}{3} = \frac{4}{15}$ $\frac{2}{5} \times \frac{2}{3} = \frac{2 \times 2}{5 \times 3} = \frac{4}{15}$ 

Name: _____

Eureka Acceleration Tools

Prerequisite Support Lesson for Grade 6, Module 4, Topic G

Part C: Multiplication of a Fraction by a Fraction

Example Problems

1. Jan has 4 pans of crispy rice treats. She sends 1/2 of the pans to school with her children. How many pans of crispy rice treats does Jan send to school?

2. $\frac{1}{2} \times \frac{4}{5} =$

3. $\frac{2}{3}\ x \frac{3}{4} =$

4. $\frac{7}{9} x \frac{3}{7} =$

Problem Set

1. Multiply. Draw a rectangular fraction model if it helps you, or use the method in the example below.

Example: $\frac{6}{7} \times \frac{5}{8} = \frac{\overset{3}{\cancel{6}} \times 5}{7 \times \underset{4}{\cancel{8}}} = \frac{15}{28}$

a) $\frac{1}{4} x \frac{1}{4} =$	b) $\frac{1}{2} x \frac{1}{6} =$
c) $\frac{1}{2} x \frac{3}{5} =$	d) $\frac{2}{3} x \frac{1}{2} =$
e) $\frac{3}{4} \times \frac{4}{5} =$	f) $\frac{2}{5} \times \frac{2}{3} =$