

Math: Grade 6, Lesson 9, Using Multiplication to Divide a Fraction

Lesson Focus: Recognize that dividing by a fraction gives the same result as multiplying by fraction's reciprocal.

Practice Focus: Students will focus on using visual models and multiplying by the reciprocal for dividing fractions by fractions in order to understand the division of fractions.

Objective: Students will use visual models and multiplying by the reciprocal to divide fractions by fractions to with a focus to begin to connect visual models to the algorithm.

Key Vocabulary: dividend, divisor, quotient, reciprocal

TN Standards: 6.NS.A.1

Teacher Materials:

- White board and markers or smart board
- Visual fraction models (fraction bars, fraction circles, number lines, grid paper)
- Student Practice Packet

Student Materials:

- Paper and a pencil, and a surface to write on

Teacher Do	Student Do
<p><u>Opening:</u> (1 minutes)</p> <p>Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 6th graders out there, though all children are welcome to tune in. This lesson is the ninth in our series.</p> <p>My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!</p> <p>If you didn't see our previous lesson, you can find it on the TN Department of Education's website at www.tn.gov/education. You can still tune in to today's lesson if you haven't see any of our others. But, it might be more fun if you first go back and watch our other lessons since we'll be talking about things we learned previously.</p> <p>Today we will be learning about dividing fraction by fraction using multiplication in mathematics! Before we get started, to participate fully in our lesson today, you will need:</p> <ul style="list-style-type: none"> • Paper and a pencil, and a surface to write on <p>Ok, let's begin!</p>	<p>Students get materials ready for the lesson.</p>
<p><u>Intro</u> (4 minutes)</p> <p>Let's review some vocabulary before we get started.</p> <p>$42 \div 6 = 7$ [Write the problem on the board.]</p> <p>Take a minute to think about what the parts of a division equation are called. [Pause]</p>	<p>Students will review vocabulary for division. Then they will think about whether the statements are true always, sometimes, or never.</p>

<p>Let's look, 42 is the dividend. It is the amount we are separating. The 6 is the divisor or what we are dividing by. Seven is the quotient or the answer.</p> <p>[Write the following title - Always, Sometimes, Never. Then write the following statements while talking.]</p> <p>We're going to look at three statements. Think about whether they are always true, sometimes true, or never true. If it is sometimes or never true, think about an example that makes it sometimes or never true.</p> <p>A. When two numbers are divided, the quotient is greater than the dividend.</p> <p>B. When the divisor is less than the dividend, the quotient is less than 1.</p> <p>C. When the divisor is the same as the dividend, the quotient is equal to 1.</p> <p>[Pause for 2 minutes for the student to answer the statements.]</p> <p>A is sometimes true. 2 divided by $\frac{1}{2} = 4$, so when we divide a whole number by a fraction, the quotient is larger. However, in the previous example, 42 divided 6 = 7. Seven is not greater than 42.</p> <p>B is never true. When what we are dividing by is less than the total amount, the answer will always be greater than one.</p> <p>C is always true. When the divisor is the same as the dividend, it will always equal 1. Let's try 12 divided by 12. That equals 1. What about a fraction? $\frac{1}{2}$ divided by $\frac{1}{2}$ equals 1 also.</p>	
<p><u>Teacher Model</u> (14 minutes)</p> <p><u>Objective 1: Connection to previous learning</u> [Read and write the problem on the board.]</p> <p>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 chicken a meal. How many meals can Paulo give his chickens? How many meals can Aimee give her chickens? Wow, that's a lot of information. Let's try to make sense of the problem.</p> <p>Let's see who gives the chickens more feed.</p> <p>Paulo uses $\frac{1}{2}$ cup of feed each time he gives his chickens a meal.</p> <p>Aimee uses $\frac{3}{2}$ cups of feed each time she gives her chicken a meal.</p>	<p>Objective 1: Students will use a model to connect to division of fractions.</p>

[Pause for student thinking.] **You're right. Aimee uses more feed for her meals, so her number of meals will be smaller than Paulo's.**

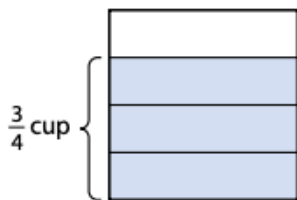
Let's start by solving how many meals Paulo has left. What do we know about Paulo? [Highlight or underline the following information as you read it again.]

Right, Paulo uses $\frac{1}{2}$ cup of feed each time he gives his chickens a meal. He has $\frac{3}{4}$ of a bag left.

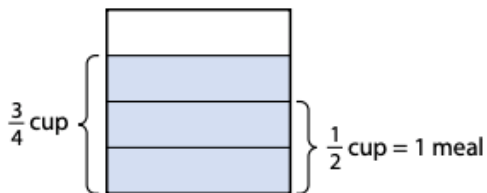
How do we write this as a division problem? [Pause.] **Right! $\frac{3}{4} \div \frac{1}{2}$. Take a minute and model this problem. You can use a number line, area model, or whatever helps you visually model the problem.** [Pause for 1 minute to allow the student to work.]

[As you draw the model, discuss your thinking.]

First, I'm going to draw a rectangle and shade $\frac{3}{4}$ of it.



Next, I think to myself – how many $\frac{1}{2}$ are in the shaded portion?



There is one $\frac{1}{2}$ cup, so 1 whole meal. But wait, there's some left. How much is left? [Pause] **Yes, there is $\frac{1}{4}$ left, but what fraction of a meal is left?** [Point to the fraction of what is left so show that we have $\frac{1}{4}$ left, but that is $\frac{1}{2}$ of a meal.) **We have $\frac{1}{2}$ of a meal left, so we have 1 whole meal and $\frac{1}{2}$ of another meal, so Paulo has $1 \frac{1}{2}$ meals.**

Let's look at Aimee's information.

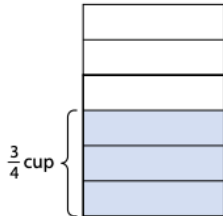
Aimee uses $\frac{3}{2}$ cups of feed each time she gives her chicken a meal. She also use $\frac{3}{4}$ cup of feed per meal. [Highlight or underline the following information as you read it again.]

How do we write this as a division problem? [Pause].

Yes, $3/2 \div 3/4$. Take a minute to solve the problem using a model. Remember, you can use a number line, area model, or whatever helps you visually model the problem.

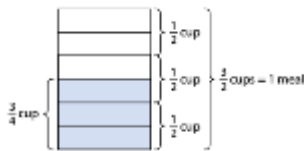
[Pause for 1 minute to allow the student to work.]

First, I'll draw another rectangle.



Notice, the dark line where one whole is. I've divided the rectangle into four parts and I have two more, so the rectangle equals $3/2$. [Point to the three different halves.]

One-half, two-halves, and three halves.



[Write the labels on the model as you talk.]

Aimee needs 3 half cups for one meal. Here's one $1/2$ cup, two $1/2$ cup, and three $1/2$ cup. Does she have enough to have one meal? [Pause]

No, she doesn't. What fraction does she have? Remember the shaded part is what she has. [Pause] Good work, she has $3/6$ or $1/2$ of a meal. Aimee has enough feed for $1/2$ meal.

Objective 2: Connect the model to using multiplication to solve the problem.

I would like to connect Aimee's situation to how we can use multiplication to divide by a fraction. To find how many $3/2$ are in a number, you can use two multiplication steps.

[Write this on the board as you talk it thorough.]

First, find out how many $1/2$ s are in the number. To do this we can multiply by 2.

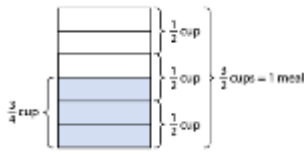
$$3/4 \times 2 = 6/4$$

Then separate the number of $1/2$ into 3 equal parts. To divide by 3, multiply by $1/3$

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

Let's connect this to the model we drew to see where we can see this happening.

Objective 2: Student will connect to using multiplication of the reciprocal to solve the division problem. Student is writing and working the problems with the teacher.



Why does multiplying by 2 tell you how many $\frac{1}{2}$ s are in a number? [Pause] Right, there are 2 halves in each whole.
 Why does multiplying the number of $\frac{1}{2}$ s by $\frac{1}{3}$ tell you how many $\frac{3}{2}$ are in the number? [Pause] Right, there are only $\frac{1}{3}$ as many $\frac{3}{2}$ as $\frac{1}{2}$ s or one out of three.

The fraction $\frac{2}{3}$ is called the reciprocal of $\frac{3}{2}$. A reciprocal is two numbers whose product equals 1. So what we did was multiply by the reciprocal. Let's work put it all together.

$\frac{3}{4} \div \frac{3}{2}$ [Write and work the problem as you talk it through.]

$\frac{3}{4} \times$ the reciprocal of $\frac{3}{2}$ which is $\frac{2}{3}$, so $\frac{3}{4} \times \frac{2}{3} =$
 Let's think back to multiplying fractions. How do we solve this? [Pause] Yes, we multiply the numerator and then multiply the denominator.

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$ which is also equivalent to $\frac{1}{2}$

Let's try another problem.

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?

Let's start by trying to use multiplication to solve this problem. Then we'll draw a model to make connections.

$$1 \frac{1}{2} \div \frac{3}{8} = 1 \frac{1}{2} \times \frac{8}{3}$$

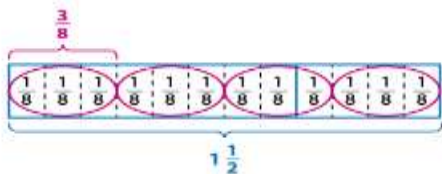
To divide, we are going to multiply by the reciprocal

Let's change $1 \frac{1}{2}$ to an improper fraction, so $\frac{3}{2} \times \frac{8}{3} = \frac{24}{6} = 4$

So Tyrone can fill 4 jars of honey.

Take a minute and make a model of the problem. [Pause, after you pause draw the model below.]

One model you might have drawn is this.



We have 4 jars of honey.

<p><u>Tying the learning together</u> In these problems, we were trying to use what we already know about dividing fractions with models to connect to how we can use multiplication of the reciprocal to solve division of fractions.</p>	<p>Tying the Learning Together: Students will listen to the teacher do a think aloud about how multiplication can be used to divide fractions. They will not write specific problems here, but instead, think through the connection of the visual representations to multiplication used to divide fractions.</p>
<p><u>Guided Practice</u> (9 minutes) Now let's move into you having more ownership of the work. Here's another problem. Let's walk through how to solve it together. Write the problem on your paper.</p> <p>$2/3 \div 2/5$</p> <p>We want to solve the problem by multiplying by the reciprocal. Write $2/3 \times$ ____ What is the reciprocal of $2/5$? [Pause] Right, $5/2$ so we will multiply by $5/2$ $2/3 \times 5/2 =$ Now, multiply the fractions. I'll pause to let you do that. [Pause] Yes, $10/6$ which equals $5/3$ which equals $1 \frac{2}{3}$.</p> <p>Now, you do the next one, and then we'll talk through it.</p> <p>It takes Francisco $5/6$ of a minute to upload a video to his blog. How much of one video can he upload in $\frac{1}{2}$ minutes?</p> <p>We'll set this up together. Write the division problem on your paper. [Pause] That's it. $\frac{1}{2} \div 5/6$ Now, solve this problem and then we'll check it. [Pause]</p> <p>Let's see what you got. $\frac{1}{2} \div 5/6$ The first thing we want to do is multiply by the reciprocal. So the reciprocal of $5/6$ is $6/5$. $\frac{1}{2} \times 6/5$ is $6/10$ or $3/5$. Francisco can upload $3/5$ of a video in $\frac{1}{2}$ minute. <u>Additional Problems (if Needed):</u> 1. $3/2 \div 1/8$ 2. $1 \frac{1}{8} \div 3/4$</p>	<p>Guided Practice: Student is writing and working the problems with the teacher.</p>
<p><u>Independent Practice</u> (1 minutes)</p>	

PBS Lesson Series

<p>Great work! Today, we reviewed dividing fractions by fractions. I hope you're seeing some connections to models and multiplication when we divide! You sure did a great job! After the video, you will have some problems to practice on your own. I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, www.tn.gov/education.</p> <p>[Teacher shows student practice page under document camera or camera zooms in on student practice page.]</p> <p>Good luck and do your best!</p>	
<p><u>Closing</u> (1 minutes)</p> <p>I enjoyed learning how dividing fractions by fractions can be solved with multiplying by the reciprocal with you! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series! Bye!</p>	

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