PBS Lesson Series

Math: Grade 6, Lesson 8, Compute Quotients of Fractions

Lesson Focus: Compute Quotients of Fractions Using Common Denominators
Practice Focus: Students will focus on practicing dividing fractions (including mixed numbers) with common denominators in order to compute quotients fluently.
Objective: Students will use common denominators to divide fractions (including mixed numbers)
Key Vocabulary: numerator, denominator, fraction, divisor, dividend, quotient, unit
TN Standards: 6.NS.A.1
Teacher Materials:

- White board and markers or smart board or chart paper
- Student Practice Packet

Student Materials:

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

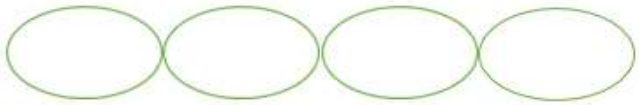
Teacher Do	Student Do
Opening: (1 minute) **Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 6th graders out there, though all children are welcome to tune in. This lesson is the eighth in our series.** **My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!** **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.** **Today we will be learning about dividing fractions (including mixed numbers) using common denominators in mathematics! Before we get started, to participate fully in our lesson today, you will need:** • **Paper and a pencil, and a surface to write on** **Ok, let's begin!**	Students get materials ready for the lesson.
Intro (4 minutes) [Write the following sentences on the board.] **Students, write a division sentence and draw a visual model to solve each problem.** **A.) 8 gallons of batter are poured equally into 4 bowls. How many gallons of batter are in each bowl?** **B.) 1 gallon of batter is poured equally into 4 bowls. How many gallons of batter are in each bowl?**	Students will write division sentences and draw visual models for the 3 given situations. They will notice and wonder about the similarities and differences.

C.) 3 gallons of batter are poured equally into 4 bowls. How many gallons of batter are in each bowl?

[After 1-2 minutes, post the completed division sentences alongside one another to allow for easy comparison. Give students time to make noticings and wonderings.]

What similarities did you notice about the 3 scenarios? [pause for response] **I agree, one of the similarities is they all contain 4 bowls. Let's look at what that might look like as a model.**

A.)



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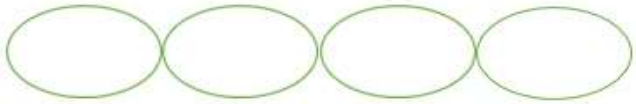

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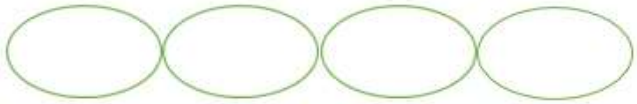
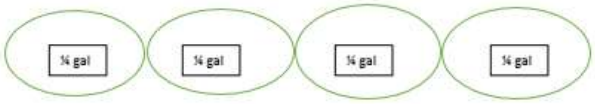


What differences did you notice about the 3 scenarios? [pause for response] **You are correct, the batter is divided into different amounts in each scenario. Let's look at what that might look like as a model.**

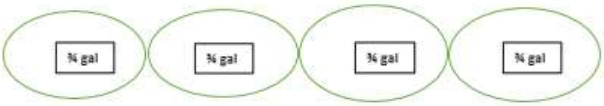
A.) 8 gallons poured equally into 4 bowls

What is our division sentence? [pause for response]
Right, 8 gallons ÷ 4 bowls

B.) 1 gallon poured equally into 4 bowls



What is our division sentence? [pause for response]
Correct, 1 gallon ÷ 4 bowls

C.) 3 gallons poured equally into 4 bowls  **What is our division sentence?** [pause for response] **Super! 3 gallons ÷ 4 bowls** **As we look at the models, we notice that dividing by 4 and multiplying by ¼ are equivalent. We will build on this fact as we divide fractions today.**	
Teacher Model (14 minutes) **Today we are going to compute quotients of fractions. We will dig into mathematical representations of dividing fractions by using common denominators. We will use the terms dividend and divisor throughout the lesson to refer to the division expressions. Remember, the dividend is the number being divided. What is a divisor? Right, it's the official name for a number that is being divided into another number. For example, in 55 ÷11, 55 is the dividend and 11 is the divisor. You're right! The quotient is 5. I'm so glad you remember those terms. Let's apply and extend previous understandings of division to divide fractions.** Objective 1: Dividing When Given Common Denominators [To allow students to understand why we can divide fractions by finding common denominators, do the following set of examples. Write all of the below expressions on the board.] **Students, find the quotient for each example in this sequence:** • **8 ÷ 2** • **8 ones ÷ 2 ones** • **8 tens ÷ 2 tens** • **8 thousands ÷ 2 thousands** • **8 tenths ÷ 2 tenths** • **8 thirds ÷ 2 thirds** [Pause to let students respond to the examples. We will encourage students to discuss why the quotient is 4 in each example] **Let's check your answers and see what we notice.** • **4** • **4 ones** • **4 tens** • **4 thousands** • **4 tenths** • **4 thirds**	Objective 1: Students will be dividing fractions by using common denominators. This allows students to work with dividing fractions when the units are the same.

Wow! We see that the quotient was 4 in each example. Why do you think this is true? [pause for response] **Yes, it is all because we are working with the same units. Remember, units represent a quantity. For us, the unit will be represented by the denominator since it tells us how many groups a whole is divided into.**

Since the units are the same in each example, the basic fact that 8 ÷ 2 = 4 where 8 was the dividend each time and 2 was the divisor each time gives us the same quotients of 4. This will hold true anytime we are dividing with the same units.

Why? [Pause] **Right, because the denominator of each fraction represents the whole unit, while the numerator represents the part of the unit.**

Here it is visually for 4 sixths ÷ 1 sixth.

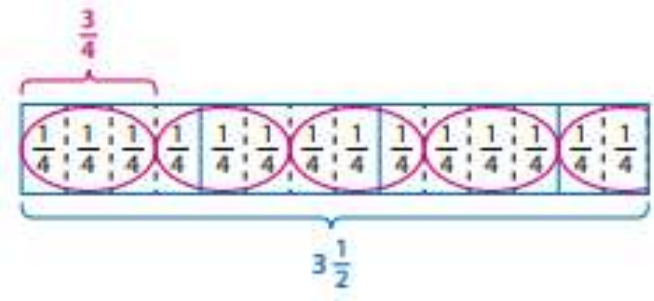
4 ÷1 = 4

Let's see how this looks with fractions!
$\frac{8}{3} \div \frac{4}{3}$ **= 8 thirds ÷ 4 thirds = 2**
[Continue to work the following being intentional about stating the units each time.]

We will work a few and make sure to note the units each time.
$\frac{10}{7} \div \frac{2}{7}$ **= 10 sevenths ÷ 2 sevenths = 5**
$\frac{28}{3} \div \frac{7}{3}$ **= 28 thirds ÷ 7 thirds = 4**
$\frac{4}{5} \div \frac{2}{5}$ **= 4 fifths ÷ 2 fifths = 2**

If we are asked to divide, $\frac{18}{4} \div \frac{5}{4}$**, what do you notice**? [pause for responses] **You are right. 5 does not divide evenly into 18.**
Let's see what happens when the divisor does not divide evenly into the dividend in the numerator. [This will solidify how the denominator is the whole unit while the numerator is the part]

$\frac{18}{4} \div \frac{5}{4}$ = 18 fourths ÷ 5 fourths =$\frac{18}{5}$. We can also write this improper fraction as a mixed number since 5 is not a factor of 18. This would be equivalent $3\frac{3}{5}$. Isn't that cool? **Notice, the denominator in each fraction is the whole unit and the numerator in each fraction is the part of the unit. In all of these examples our dividends and divisors had the same units.** <u>Objective 2: Dividing When Not Given Common Denominator</u> **What do you think we can do if our denominators do not represent the same units? [**pause for student think time] **I think you are right! We can write equivalent fractions to find like denominators. We did this in 5th grade to add and subtract fractions. Let's build on that skill!** **To find equivalent fractions, we must multiply the numerator and denominator by the same number. We will be intentional to find an equivalent fraction with the same units as our divisor.** **Here we go!** **$\frac{11}{4} \div \frac{3}{8}$. Why can't we begin dividing?** [pause for response] **You are correct. Right now, the first fraction has a whole unit of 4, while the second fraction has a whole unit of 8. How can we make sure they have the same whole unit?** [Pause for response]. **I agree, let's see how we can use equivalent fractions to rewrite $\frac{11}{4}$ with eighths.** **$\frac{11}{4} = \frac{22}{8}$ (since we multiplied both numerator and denominator by 2)** **So, we now have** **$\frac{22}{8} \div \frac{3}{8}$ = 22 eighths ÷ 3 eighths = $\frac{22}{3}$ (which is also $7\frac{1}{3}$ as a mixed number)** **Let's look at this one. $3\frac{1}{2} \div \frac{3}{4}$.** **How does this problem differ from the others we have done today?** [pause for student think time] **You guessed it! It has a mixed number and they don't have the same denominator.** **How do you think we can take care of that?** [Pause for response]**. Right, changing the mixed number to an improper fraction will be our best start.** **Let's start there.** **$3\frac{1}{2}$ = ____ as an improper fraction**? [pause for response]	Objective 2: Students will be dividing fractions by finding common denominators. This allows students to work with dividing fractions when the units are not the same in the given problem. This will also review equivalent fractions.

Yes, $3\frac{1}{2}$ does equal $\frac{7}{2}$. We can use that as our dividend. $\frac{7}{2} \div \frac{3}{4}$ = _____ What can we do now to get our common denominators? [Pause for response]. **I agree. Re-writing the dividend as an equivalent fraction with a new denominator will allow us to have the same units. What are the same units that we want**? [pause] **I heard someone say 4. Let's try it!** **$\frac{7}{2} = \frac{14}{4}$. That allows us to divide. We now have:** **$\frac{14}{4} \div \frac{3}{4}$ = 14 fourths divided by 3 fourths = 14 ÷ 3 = $\frac{14}{3}$ as an improper fraction or $4\frac{2}{3}$ as a mixed number.** **Let's remind ourselves of what that means. We started today and in earlier lessons looking at models. Let's look at a bar model of this division problem to make sure we really understand what our answers mean**. [Display bar model on the board. Pause to let students look at the model and determine how it connects to our answer.]  **How does this connect to the work we just did to get $4\frac{2}{3}$?** [pause for response] **Correct, the bar model shows 14 quarter hours or 14 fourths. The dividend in the problem is 14 fourths and the divisor is equal groups of 3 fourths. See that in the model?** [Point to these parts of the model while reading] **So, 14 can be divided by 3 to find the number of 3 fourths in 14 fourths. In this situation, what does the $4\frac{2}{3}$ mean?** [Pause for student think time] **Right, it shows us that when we divide $3\frac{1}{2}$ into sections of $\frac{3}{4}$, we have $4\frac{2}{3}$ of them. We may not always be asked to draw a visual model, but we can always have it as a tool when we want to confirm or clarify a solution.** **We are now going to do one more. We haven't seen what happens if we have a whole number in the division expression. Let's try this one:** **$6 \div 3\frac{3}{5}$**	

Take a minute to start this one so that we can compare our work. [pause for students to work] **Now that you have a response, let's compare. We have several places we can begin. Where did you begin?** [Pause for answers]**. Starting with writing both terms as fractions is a good start.** **We now have $\frac{6}{1} \div \frac{18}{5}$.** [Allow students time to look at the expression you just wrote on board to check their work] **What can we do now to get our common denominators**? [Pause for response]. **I agree. Re-writing the dividend as an equivalent fraction with a new denominator will allow us to have the same units. What are the same units that we want**? [pause] **I heard someone say 5. Let's try it!** **$\frac{6}{1} = \frac{30}{5}$** **So, we now have $\frac{30}{5} \div \frac{18}{5}$. Using common denominators to find the quotient, we see that** **$\frac{30}{5} \div \frac{18}{5}$ = 30 fifths ÷ 18 fifths = 30 ÷18 = $\frac{30}{18}$. Can we re-write this fraction**? [Pause for student response]. **Yes we can**. **It is equivalent to$\frac{5}{3}$, as well as $1\frac{2}{3}$. Way to go!** <u>Tying the learning together:</u> **In these problem, we were using what we already knew about equivalent fractions and the relationship between the part and the whole to solve the problems. We used common denominators to divide fractions. To make sure you've really got it, I'm going to let you try a few with me!**	Tying the learning together: Pull the information about equivalent fractions and division together to connect to dividing using common denominators.
<u>Guided Practice</u> (9 minutes) **Let's do three together to make sure you understand how we can use common denominators to divide fractions. In each of the problems, rewrite fractions, when necessary, to make sure the dividend and divisor have the same units (denominator).** 1.) $\frac{6}{9} \div \frac{1}{3}$ 2.) $1\frac{1}{5} \div \frac{3}{10}$ **3.) $2\frac{1}{2} \div \frac{5}{8}$** [Allow students time to work these three using common denominators. After 3-4 minutes, go through over the following solutions paying close attention to vocabulary.] **We will now walk our way through the solution, so we can see how great you did! Please check your answers as we go.**	Guided Practice: Students will be given time to read the problems and divide using common denominators. They will engage in solution paths after having time to solve on their own.

[Carefully work through each, discussing the notes beside each] **1.)** $\frac{6}{9} \div \frac{3}{9}$ **= 6 ninths $\div$ 3 ninths = 2. When we found an equivalent fraction for the divisor, we got our problem in ninths. As we divided the ninths, we see that we actually were dividing 6 by 3. Did you get it to this point?** [pause for response] **Yes, this gave us a quotient of 2.** **2.)** $\frac{6}{5} \div \frac{3}{10} = \frac{12}{10} \div \frac{3}{10}$ **=12 tenths $\div$ 3 tenths = 4. We first had to re-write the mixed number as an improper fraction. This gave us $\frac{6}{5}$. I am sure you got that as your improper fraction? What did you do next?** [pause for response]. **Yes, we did find an equivalent fraction for the dividend, which is in tenths. We now have the same units, which is the same thing as what?** [pause for response**] You're right! It is the same as a common denominator. As we divided our tenths, we are actually dividing 12 by 3. Did you get it to this point?** [pause for response]. **Good! This gave us a quotient of 4**. **3.)** $\frac{5}{2} \div \frac{5}{8} = \frac{20}{8} \div \frac{5}{8}$ **= 20 eighths $\div$ 5 eighths = 4. We first had to re-write the mixed number as an improper fraction. This gave us $\frac{5}{2}$. I hope you got that as your improper fraction? What did you do next?** [pause for response]. **Right, we did find an equivalent fraction for the dividend, which is in eighths. We now have the same units, which is the same thing as what?** [pause for response**] You're right! It is the same as a common denominator. As we divided our eighths, we are actually dividing 20 by 5. Did you get it to this point?** [pause for response]. **Correct, this gave us a quotient of 4**. <u>Additional Problems (if Needed):</u> **Add in 2 or 3 optional, additional problems for the teacher if they need to fill remaining time.** **1.)** $\frac{7}{9} \div \frac{1}{3}$ **2.)** $3\frac{1}{4} \div 1\frac{3}{8}$	
<u>Independent Practice</u> (1 minute) **Great work! Today, we reviewed dividing fractions (including mixed numbers). I hope you're seeing some connections to visual models and multiplication! 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. [Teacher shows student practice page under document camera or camera zooms in on student practice page.] **Good luck and do your best!**	
Closing (1 minute) **I enjoyed reviewing dividing fractions 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!**	