PBS Lesson Series

Math: Grade 5, Lesson 7, Subtracting Fractions

Lesson Focus: Subtracting fractions with unlike denominators
Practice Focus: Students will focus on using multiples to find a common denominator and using number lines to find equivalent fractions in order to subtract fractions with unlike denominators
Objective: Students will use modeling to subtract fractions with unlike denominators with a focus on using number lines.
Key Vocabulary: multiple, common multiple, numerator, denominator, common denominator, number line
TN Standards: 5.NF.A.1
Teacher Materials:

- Paper and pencil or white board and markers
- Water bottle that is 2/3 full with the water level marked with a black line and a bowl to pour some of the water into (if teacher does not want to drink it)
- Student activity packet

Student Materials:

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

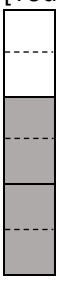
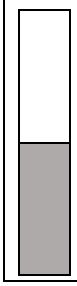
**Note: When writing fractions, remember to write them with a horizontal fraction bar and numerator and denominator lined up one on top of the other. This will help students avoid confusion when working with mixed numbers. Also, each problem should be written on the board or on chart paper for students to read along with the teacher and refer to as they work through the problem.*

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 5th graders out there, though all children are welcome to tune in. This lesson is the seventh in our series.** **My name is ____ and I'm a 5th 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 subtracting fractions with unlike denominators in mathematics! Before we get started, to participate fully in our lesson today, you will need:** • **Paper and pencil, and a surface to write on** **Ok, let's begin!**	Students get materials ready for the lesson.

PBS Lesson Series

Intro (1 minute) **Let's start by looking at this situation:** **Gavin has 2/3 pint of water left in his water bottle.** **He drinks 1/2 pint. How much water is left in the bottle now?** **What is happening in this problem? Gavin has a water bottle that has 2/3 pint of water in it, like this one.** [show a water bottle that is 2/3 full] **He drinks 1/2 pint.** [either drink some to show the water level is dropping or pour some into a bowl] **So how do I find out how much is left?** [pause] **Subtract? Why subtract?** [pause] **Because 1/2 pint is taken out of the bottle, so there is less. Yes, that makes sense to me. Before Gavin drank the water, there was this much in the bottle.** [point to the black line indicating the starting water level] **And after he drank some there was less water in the bottle, like there is less water in this bottle now.** **So to answer the question we need to subtract 2/3 – 1/2.** [write $\frac{2}{3} - \frac{1}{2}$]	
Teacher Model (17 minutes) Objective 1: Review finding a common denominator using multiples and finding equivalent fractions using bar models. **Before we can subtract these fractions, what do we need to do first?** [pause] **Oh yes! We need common denominators! Why do we need common denominators?** [pause] **Of course! So we are subtracting same size pieces.** **Do these fractions have common denominators?** [pause] **No? What are the denominators is these fractions?** [pause] **Yes! The first fraction has a denominator of 3** [point to the denominator of the first fraction] **and the denominator of the second fraction is 2** [point to the denominator of the second fraction]. **How can we find common denominators?** [pause] **Oh that's right! We can find the multiples of each denominator to find one they have in common and use that as our common denominator. Remember, multiples are what you get when you multiply a number by whole numbers. Let's look at the first three multiples of each denominator.** [Create a chart on the board that looks something like this: 3: 3, 6, 9 2: 2, 4, 6	Objective 1: Students will be reviewing using finding a common denominator using multiples and finding equivalent fractions using bar models

And fill it in as you talk through the following] **Let's find the multiples of 3 first** [point to the denominator of the first fraction]: **What do you get when you multiply 3 times 1?** [pause] **3** **What do you get when you multiply 3 times 2?** [pause] **6** **What do you get when you multiply 3 times 3?** [pause] **9** **Great! Now let's find the multiples of 2** [point to the denominator of the second fraction]: **What do you get when you multiply 2 times 1?** [pause] **2** **What do you get when you multiply 2 times 2?** [pause] **4** **What do you get when you multiply 2 times 3?** [pause] **6** **Do you see a multiple that they both have in common?** [pause] **Yes, they both have a multiple of 6! Let's circle the 6's** [circle the two 12s]. **We've found a common denominator!** **Now how can we use that common denominator to find equivalent fractions so we can subtract them?** [pause] **Good idea. Let's draw some models of these fractions so we can see the same size pieces.** **Let's draw a bar model of 2/3.** [teacher draws the model while talking through the following] **Start with a long rectangle.** [draws ▭] **To represent the fraction 2/3, do I divide this rectangle into 2 equal pieces for the numerator** [point to the numerator] **or 3 equal pieces for the denominator** [point to the denominator]**?** [pause] **Yes! 3 equal pieces because the denominator represents how many pieces are in the whole. Good job!** **So to divide this rectangle into 3 equal pieces, we need to draw in 2 lines to separate those 3 pieces like this.** [draw ▭ shading in when you get to it] **Then how many of these pieces do we need to shade in to represent 2/3?** [pause] **2? How do we know to shade in 2 of the pieces?** [pause] **Good! Because the numerator tells us how many pieces** [point to the numerator] **and this numerator is 2.** [shade in 2 pieces] **Let's turn this model vertically so it looks like a water bottle.** [turn the model vertically so it will look like the shaded part is the water in the bottle]**. Imagine the shaded sections represent the water in the bottle.** [pause]	

We found a common denominator of 6, so we need to divide this into 6 equal pieces. **Hm. We have 3 pieces and we need 6 pieces. We know we need to divide each third into equal pieces, but how can figure out how many?** [pause, then looks at camera] **Oh! Great idea! We can use division. After all, we are dividing up the pieces into smaller ones. What is 6 divided by 3?** [pause] **Or if it's easier for you, you can use fact families and ask yourself "3 times what number equals 6?"** [pause] **That's right! 2 We need to divide each third into 2 pieces, so let's draw a line in the middle of each one to cut it in half.** [You should end up with a model that looks similar to:]  **So, how many pieces do we have? Count with me. 1,2,3,4,5,6 Hooray! That's our common denominator! So how many sixths are shaded?** [pause] **1,2,3,4. Great! So 4/6 is equivalent to the 2/3 we originally had. Good job!** [write "= 4/6" next to the 2/3 already written] **Now let's look at the second fraction 1/2.** [write 1/2 underneath the 2/3] **Let's start with our model. Draw another rectangle the same size as this one right next to it.** [Draw the rectangle] **How many pieces does it need to have to represent halves?** [point to the fraction 1/2] **2? Yes! Because that's the denominator. Good job! So let's draw a line in the middle so our model shows 2 halves.** [draw the line] **Now how many of these pieces do we need to shade in to represent 1/2?** [pause] **1? Yes, because the fraction tells us we only want to shade 1 of the 2 pieces.** [point to the numerator 1] [the model should look something like this:] 	

What was our common denominator? [pause] **That's right, 6? Okay, so see if you can figure out how to divide this into 6 total pieces.** [pause]
What did you do first? Did you divide 6 by 2? [pause] **And what did that tell us?** [pause] **That you need to divide each half into 3 equal parts since 6 divided by 2 is 3. Great! If you haven't already done so, go ahead and draw those lines in your picture.** [draw the lines like this]

So how many pieces do we have now? Count with me. 1,2,3,4,5,6 Hooray! That's our common denominator! And how many sixths are shaded? [pause] **1,2,3. Great! So 3/6 is equivalent to the 1/2 we originally had. Good job!** [write "= 3/6" next to the 1/2]

Notice that we divided up each third into two equal pieces and the denominator of the second fraction is a 2. And then we divided up each half in our second model into three equal pieces and the denominator of the first fraction is a 3. Wow! This happened in lesson 6, too. Do you think that will always work? [pause] **We will have to keep watching for that and think about why that seems to work.**

So, now we have these equivalent fractions both written with the common denominator of 6.
[The first two lines should already be written, so just draw the minus sign, the line underneath, and the answer

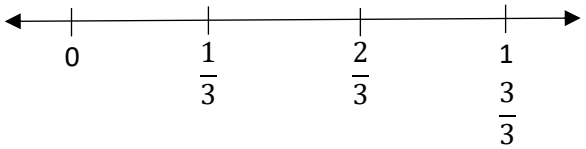
$$\frac{2}{3} = \frac{4}{6}$$

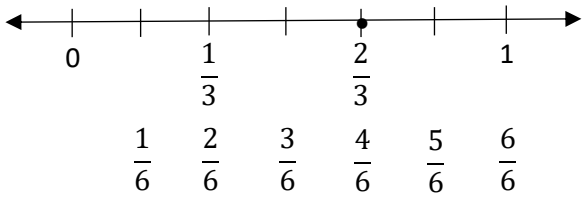
$$-\frac{1}{2} = \frac{3}{6}$$

$$\frac{1}{6}$$

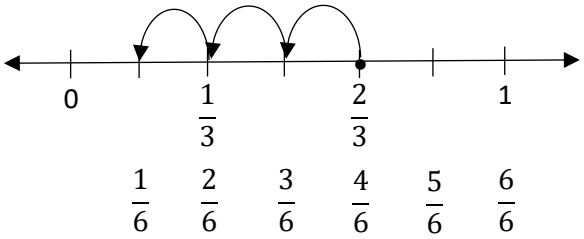
as you are talking through it.]

2/3 - 1/2 is equivalent to 4/6 – 3/6. And 4/6 minus 3/6 equals 1/6.

So that tells us that Gavin had 1/6 pint of water left in his bottle. **Thank you for working through that with me!** <u>Objective 2: Subtracting fractions using a number line.</u> **Let's explore how to model that subtraction problem using a number line.** **Draw a number line on your paper.** [teacher draws an open number line] **To represent our problem 2/3 - 1/2, how should we label this number line?** [pause] **Since we already know that 2/3 is less than 1, let's start by labeling 0 and 1 on our number line.** [number line should look something like this.]  **Where does 2/3 fall on this number line? Let's put thirds on here so we can find it.** [show dividing the number line into thirds and label each tick mark including the 1 as follows.]  **Be sure to make enough tick marks to divide the line into 3 equal parts between 0 and 1. And then label them 1/3 and 2/3. So how many thirds is 1?** [pause] **That's right! 1 is 3/3. Ok, so if we started at 2/3, let's put a dot at 2/3. And we need to subtract 1/2. But how much would that be on this number line?** [pause] **Hm. That's a hard one. How can we make this easier? Any ideas?** [pause] **Oh! Of course! We can use the common denominator and equivalent fractions we found earlier! Good idea!** **So that means since 6 is our common denominator, we need to divide this number line into sixths. We can do that like we did with our bar model. Since these tick marks divide up this line into three equal spaces,** [point to them] **then we can just divide these spaces in half by finding the middle of each of space to get sixths. Because as we saw earlier, 6 divided by 3 is 2.** [draw a tick mark in between each third as indicated below] **And label each sixth. 1/6, 2/6, 3/6, 4/6, 5/6, and one whole is equivalent to** [pause] **6/6.**	Objective 2: Students will explore how they can also use a number line to subtract fractions.



What was the equivalent fraction we found earlier for 1/2 using our common denominator of 6? [pause] **Yes, it was 3/6. So starting at 2/3 or its equivalent fraction 4/6, we need to subtract 1/2 or its equivalent fraction 3/6. Remember, to subtract on the number line, we need to move to the left towards the smaller numbers. Let's do this together.**
Put your pencil on 4/6 and jump back, 1 sixth…2 sixths…3 sixths. [Draw this on the number line.]



So where do we end up? [pause] **Yes! At 1/6! So when we subtract 4/6 – 3/6, the answer is 1/6.**

Tying the learning together:
Now you have two methods you can use to subtract fractions. After you find the common denominator by using the multiples of each denominator, you can find equivalent fractions and subtract either by drawing bar models, or you can use a number line.

Guided Practice (10 minutes)
[I do]
Felicia lives 4/5 mile from school and 3/10 mile from the soccer field. How much closer does she live to the soccer field that to school?

Since I am trying to determine the difference between these distances, I know I will have to subtract 4/5 – 3/10.

Since these two fractions have different denominators, I am going to have to look at the multiples of each denominator to find a common one. I can find the multiples of the first denominator by multiplying 5 by some whole numbers.

Students work alongside the teacher as the teacher thinks aloud.

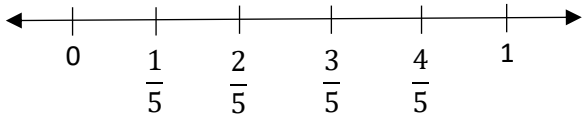
5 times 1 is 5 [write 5]
5 times 2 is 10 [write 10]

Hey! Look at that! 10 is the denominator of the second fraction, and since 10 times 1 is still 10, that is a common multiple. That means, I can use that as a common denominator.

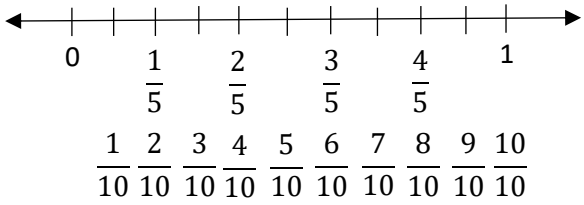
By the way, I also know that 5 times 4 is 20 and 10 times 2 is 20. So since 20 is also a common multiple, could I also use 20 as a common denominator? What do you think? [pause] **Yes! I could. Actually there are many common multiples with these two numbers and I can use any of them. But since I found 10 first, I am going to use that one today.**

Okay, now that I have 10 as my common denominator, I am going to draw a number line and plot the first fraction on it. I will start by labeling 0 and 1 since the first fraction is less than 1.
[Draw an open number line and label 0 and 1]

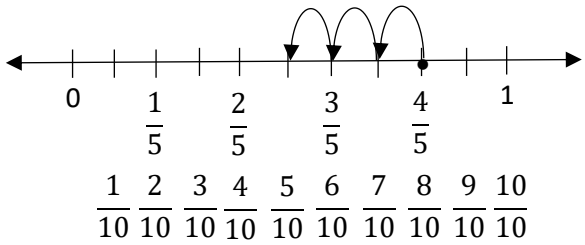
The first fraction is 4/5, so I will put fifths on the number line.



Since my common denominator is 10, that tells me I want to divide this number line into 10 equal spaces instead of the 5 I have currently. Since I know that 10 divided by 5 is two, I can put another tick mark right in the middle of each space to divide these sections in half. Then I will label the tenths.



[Say each fraction as you write them]
So now I can see that 8/10 is equivalent to 4/5 because they have the same location on the number line and are the same distance from 0. So I am going to put a dot at 4/5 or its equivalent fraction 8/10. Since I know I need to subtract 3/10, I will jump back 3/10 on my number line.

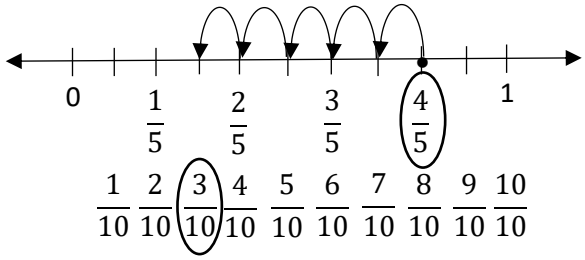


I see that I end up at 5/10. So I know that the difference between 4/5 mile and 3/10 mile is 5/10 mile.

Does anyone see another way to get the answer using the number line? [pause]

Since I can see both 8/10 and 3/10 on the number line, could I just see how far apart they are to get my answer? [Pause}

Let's try it and see. [Pause]
Looking at the number line, I am going to circle the two fractions I am looking at. [circle 4/5 and 3/10] **Then I can count 1/10, 2/10, 3/10, 4/10, 5/10 between these fractions.**



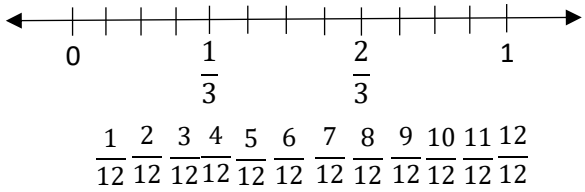
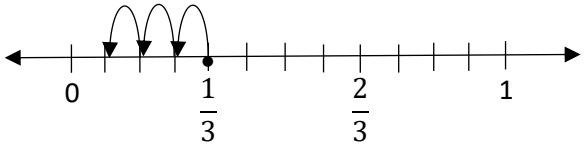
So the distance between 4/5 and 3/10 is 5/10 mile. I got the same answer.

[We do]
Let's try another one together.
What is 1/3 – 1/4? [write 1/3 – 1/4]

What do we need to do first? [pause]
That's right, find a common denominator. List some multiples of each denominator and find one in common. [Pause]
What common multiple do you see? [pause]
Yes! Both 3 and 4 have the multiple 12.

Now try the number line method. Think about how many parts you need to divide the number line into to start. Then use the common denominator we just found to subdivide it further. [Pause, allow students time to think and draw a number line]

Students will respond to teacher questions with less scaffolding than the previous example. Students will have more time to think and respond on their own prior to the teacher providing solutions.

Hold yours up so I can see how you did. [pause] **Very nice! Check your number line to make sure you have 12 spaces in between 0 and 1.** [pause] **Good! Be sure all your twelfths are labeled! Does yours look like mine?** [pause]  $\frac{1}{12}$ $\frac{2}{12}$ $\frac{3}{12}$ $\frac{4}{12}$ $\frac{5}{12}$ $\frac{6}{12}$ $\frac{7}{12}$ $\frac{8}{12}$ $\frac{9}{12}$ $\frac{10}{12}$ $\frac{11}{12}$ $\frac{12}{12}$ **Now use your number line to subtract. Remember, we are subtracting 1/3 – 1/4. You will need to use the common denominator of 12 that we found to create equivalent fractions.** [Pause and allow students time to work] **Great work! Did you see that 1/4 is equivalent to 3/12? To subtract 1/3 by 1/4, we just need to count back 3/12 from 1/3. Where did we end up?** [pause] **Yes! At 1/12. So that means that 1/3 – 1/4 is 1/12.**  $\frac{1}{12}$ $\frac{2}{12}$ $\frac{3}{12}$ $\frac{4}{12}$ $\frac{5}{12}$ $\frac{6}{12}$ $\frac{7}{12}$ $\frac{8}{12}$ $\frac{9}{12}$ $\frac{10}{12}$ $\frac{11}{12}$ $\frac{12}{12}$ [You do] **Now try this one on your own.** **What is 1/2 – 1/4?** **Start by finding your common denominator by looking at the common multiples of each denominator.** [wait for 20-30 seconds] **Did you find that 4 is a common multiple? Or you may have found that 8 is a common multiple. They are both right. I suggest that you choose 4 as your common denominator since it is a smaller number.** **Next draw the number line so that it shows 1/2.** [pause for 20-30 seconds]	Students are working almost exclusively independently with the teacher providing answers at the end.

Now divide your number line into fourths. [pause for 20-30 seconds] **Count the total number of spaces you have between 0 and 1 to make sure there are 4. If not, you will need to fix your number line so that there are a total of 4 spaces between 0 and 1. Be sure to label the fourths.** [pause for 10-15 seconds] **Now put a dot at 1/2 and jump to the left 1/4.** [pause] **Where did you end up?** [pause] **Did you end up at 1/4? If so, then you did it right! Good job!** <u>Additional Problems (if Needed):</u> Try 7/8 - 3/4. Answer: 7/8 – 6/8 = 1/8 Try 1/2 – 3/8. Answer: 4/8 – 3/8 = 1/8	
<u>Independent Practice</u> (<1 minute) **Great work, boys and girls! Today, we reviewed using number lines to subtract fractions with unlike denominators. I hope you're seeing some connections to adding fractions with unlike denominators! 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, <u>www.tn.gov/education</u>.** [Teacher shows student practice page under document camera or camera zooms in on student practice page.] **Remember to always do your best!**	
<u>Closing</u> (<1 minute) **I enjoyed reviewing subtracting fractions with unlike denominators on a number line 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!**	

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