PBS Lesson Series

Math: Grade 5, Lesson 9, Subtracting Mixed Numbers with Unlike Denominators

Lesson Focus: Subtracting Mixed Numbers with Unlike Denominators
Practice Focus: Students will focus on practicing modeling fractions with fraction bars and number lines in order to subtract mixed numbers in real-world problems.
Objective: Students will use fraction bars and number lines to model equivalent fractions with a focus subtracting mixed numbers in real world problems.
Key Vocabulary: Mixed numbers, fraction bars, number lines, multiples, common multiples, whole numbers, numerators, denominators, common denominators
TN Standards: 5.NF.B.6
Teacher Materials:

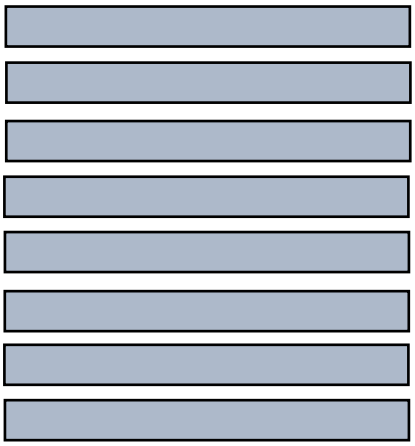
- White board and markers or pencil and paper
- Student Practice Packet

Student Materials:

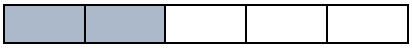
- Paper and a pencil, and a surface to write on

**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 min) **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 ninth 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 mixed numbers with unlike 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!**	
Intro (1 minute)	

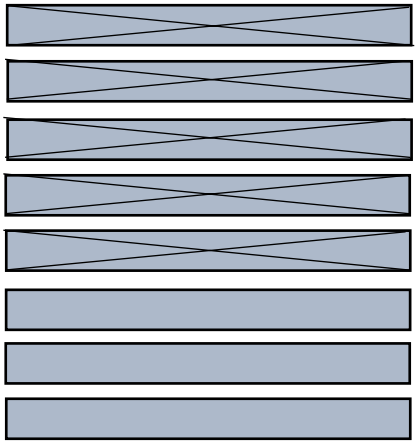
Let's look at this situation. **The first chapter of Henry's book is $5\frac{2}{3}$ pages long. The second chapter is $8\frac{2}{5}$ pages long. How much longer is the second chapter than the first chapter?** **What is this question asking us to find?** [pause] **How much longer the second chapter is than the first chapter. So we are comparing their lengths to find out how much longer the second chapter is than the first chapter. Does that mean we need to add these numbers together or subtract?** [pause] **Subtract! Right! If we add them, then we would find out how long they both are together, but that is not what we are being asked to find. So let's subtract them.** $8\frac{2}{5} - 5\frac{2}{3}$ [write this down]	
Teacher Model (16 minutes) Objective 1: Review the fraction bar method to subtract mixed numbers. **What are some methods you have learned that you can use to subtract these mixed numbers?** [pause] **I am hearing fraction bars, number lines, and equations.** **How can we model this problem with fraction bars?** **Let's start by modeling $8\frac{2}{5}$.** **How many whole bars do we need?** [pause] **Yes, 8! For 8 whole pages. Can you draw these with me?**  **Then we need one more bar to model the fraction 2/5. Remember, this rectangle should be the same size as the**	Objective #1: Students will be reviewing the fraction bar method to subtract mixed numbers.

whole, but we will shade in the parts that represent the fraction.
How many sections do we need to divide this rectangle into? [pause] **Yes, 5! Because 5 is the denominator which represents how many pieces are in our whole. Draw lines in to divide the rectangle into 5 equal pieces.** [Pause and draw in the lines.]

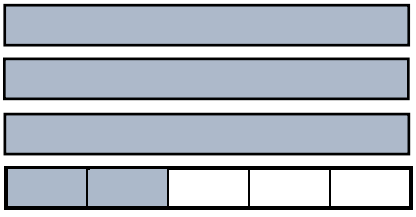


It's always a good idea to check to see if it has the right number of pieces after you've finished. So let's count. 1,2,3,4,5. Great!
Now, how many of those pieces do we need to shade in? [pause] **2? How do you know?** [pause] **Oh! Because that's the numerator which tells us how many of those 5 equal pieces we need. Good job!** [Shade in 2 pieces of the fraction bar – see above example.] **And don't forget to also shade in the 8 wholes, if you haven't already done so.**

Now we need to subtract $5\frac{2}{3}$. What does that 5 represent? [pause] **Yes! The 5 represents whole bars. Can we go ahead and subtract those using our model?** [pause] **We sure can. Just draw an X through 5 of the whole bars.**



So now we are left with this. [indicate the remaining bars]



Now we need to subtract 2 thirds.

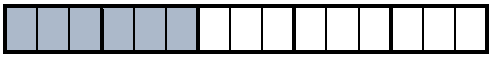
Since the fraction bar that we have is divided into fifths, and this fraction has a denominator of 3, what do we need to do so we are subtracting the same size pieces? [pause]
Exactly, we need to look at the multiples to find a common denominator. Then we will know how to divide up the fraction bars so we will be subtracting the same size pieces.

Remember to find multiples, you simply multiply the number by some whole numbers. [Teacher writes these numbers as they are said and may want to chart them like this:
5: 5,10,15,20,25
3 :3,6,9,12,15]
What are some multiples of 5?
5 times 1 is? [pause] **5**
5 times 2 is? [pause] **10**
5 times 3 is? [pause] **15**
5 times 4 is? [pause] **20**
5 times 5 is? [pause] **25**

And what are some multiples of 3?
3 times 1 is? [pause] **3**
3 times 2 is? [pause] **6**
3 times 3 is? [pause] **9**
3 times 4 is? [pause] **12**
3 times 5 is? [pause] **15**

Do you see any multiples they have in common? [pause]
Yes! They both have 15 as a multiple, so let's use that as our common denominator.

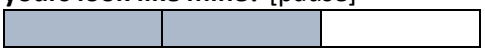
That means we need to divide this fraction bar into fifteenths. [Refer to the 2/5 model.]
We have 5 pieces and we need 15 pieces. We know we need to divide each fifth into equal pieces, but how can figure out how many? [Pause, then looks at camera.] **Oh! Great idea! We can use division. After all, we are dividing up the pieces into smaller ones. What is 15 divided by 5?** [pause] **Or if it's easier for you, you can use fact families and ask yourself "5 times what number equals 15?"** [pause] **That's right! 3 We need to divide each fifth into 3 equal pieces, so let's do that now.**



So how many fifteenths is equivalent to 2 fifths? [pause]
Yes! We can count the number of shaded pieces and see that 6 fifteenths is equivalent to 2 fifths.

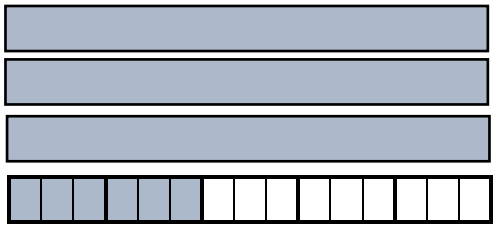
Great! Now we just need to subtract the 2 thirds. How many fifteenths is equivalent to 2/3?

Let's start with a model of 2/3. I'm going to let you try this one. Draw a bar model of 2/3 on your paper. I'll give you some time to do that and then we can compare your model to mine. [Pause for 30 seconds to 45 seconds.]
Hold up your model so I can see it. [pause] **Very nice! Check to see if you have 3 equal spaces in your model. Count them to make sure.** [pause] **Did you shade in 2 of the 3 spaces to represent the fraction 2/3?** [pause] **Here is my model. Does yours look like mine?** [pause]

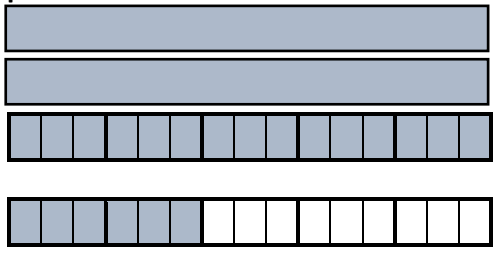


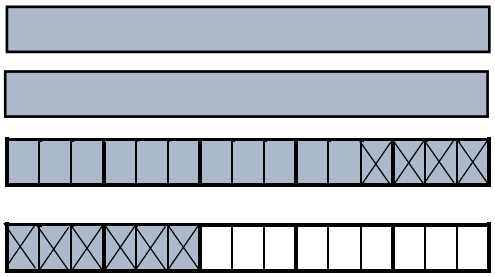
Okay. Now we need to divide it into fifteenths. We have 3 spaces and we want 15. Let's divide like we did before. What is 15 divided by 3? [pause] **Great! 5, so we need to divide each third into 5 equal pieces.** [draw in the lines]

Don't forget to count to make sure you have 15 equal spaces now. [pause] **Good job! So how many fifteenths is equivalent to 2/3?** [pause] **Right! 10 fifteenths. So that tells us how many fifteenths we need to subtract from our first model. Let's look at that one again.**

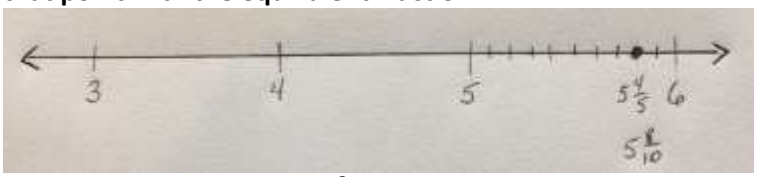


Now we just need to subtract 2/3 or 10/15. Uh oh! I only have 6/15 shaded in this fraction bar. What should I do? [pause] **Good idea! Let's divide up one of these whole bars into fifteenths. Then I will have enough to subtract.**
Go ahead and divide yours up. You can use the lines from the one already divided up to help you put them in the right places.

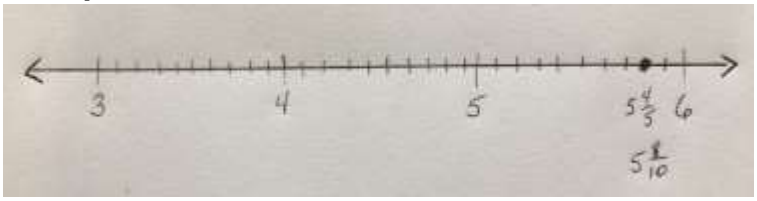


Now we can put an X on ten of the fifteenths to show we are subtracting. Let's start at the end and mark them out as we go. Count with me. [Count the boxes as you mark them out saying 1 fifteenth, 2 fifteenths, etc.]  **Great! Thank you for counting those with me.** **So what mixed number is my model telling me the answer is?** [pause] **Good! I see 2 wholes and 12 fifteenths. Very good!** <u>Objective 2: Review the number line method to subtract mixed fractions.</u> **Do you remember when we used a number line to find equivalent fractions and subtract them? Let's explore how that looks when we are subtracting mixed numbers.** **Let's look at the problem $5\frac{4}{5} - 1\frac{9}{10}$.** **Let's start by drawing a number line.** [Draw and open number line.] **Look at the first fraction. Between what two whole numbers would $5\frac{4}{5}$ be on the number line?** [pause] **Right! Between 5 and 6, so let's be sure we include those numbers on our number line and leave some space in between. We also need to include some numbers less than 5 since we will be subtracting.** [Label the number line from 3 to 6 leaving room in between for tenths] **How do we know where to put $5\frac{4}{5}$ between the 5 and the 6?** [pause] **Yes! We need to break this section down into fifths by putting tick marks to separate each fifth.** [Draw the tick marks.] **Now we can put a dot at 5 and 4/5. Count over with me starting at the 5. $5\frac{1}{5}$, $5\frac{2}{5}$, $5\frac{3}{5}$, $5\frac{4}{5}$. Put a dot and label the point $5\frac{4}{5}$.** [pause] **Now we need to subtract $1\frac{9}{10}$. We can subtract one whole easily enough, but our graph is marked in fifths, not tenths. How are we going to subtract 9/10? What should we do?** [pause] **Of course! We can divide this up into tenths!**	Objective #2: Students will review the number line method for subtracting fractions and apply it to subtracting mixed numbers.

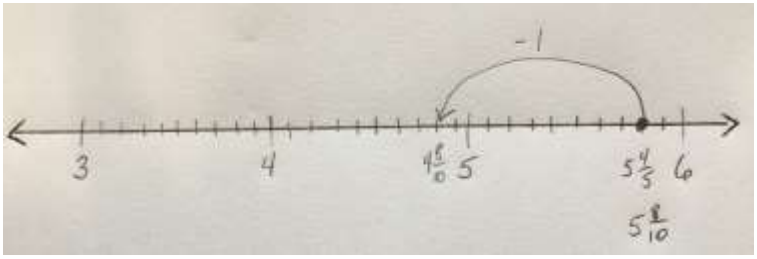
So how do we do that? [pause] **Good job! We can divide! We have 5 spaces but we want 10 spaces. 10 divided by 5 is 2, so we just need to divide each fifth in 2. So let's put another tick mark in between each of these to divide each fifth into 2 equal spaces.** [Draw the tick marks.] **So what fraction is equivalent to $\frac{4}{5}$?** [pause] **Count these tenths with me. $5\frac{1}{10}$, $5\frac{2}{10}$, $5\frac{3}{10}$, $5\frac{4}{10}$ $5\frac{5}{10}$, $5\frac{6}{10}$, $5\frac{7}{10}$, $5\frac{8}{10}$. Good job! Now let's label that point with the equivalent fraction.**



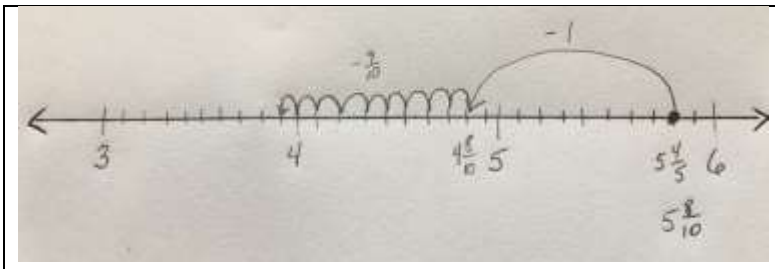
Since we are subtracting $1\frac{9}{10}$, we are going to need more tick marks on our number line. Let's go ahead and put tenths in between the 4 and the 5 and between the 3 and the 4. It's okay if they aren't perfect, just be sure there are 10 spaces in between each whole number. [Draw the remaining tick marks.]



Now we need to jump back 1 whole and 9 tenths. Let's start with the whole. Since we are starting at $\frac{8}{10}$, and we are subtracting 1 whole, we would jump back to $4\frac{8}{10}$. [Draw the jump and label it with -1.] **Be sure you land at $4\frac{8}{10}$. Remember that 8 is only 2 less than 10, so you should be 2 tenths to the left of 5.**

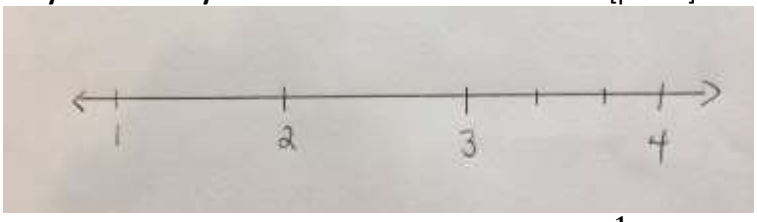


Now we need to jump back 9 tenths. Count with me. $\frac{1}{10}$, $\frac{2}{10}$, $\frac{3}{10}$, $\frac{4}{10}$, $\frac{5}{10}$, $\frac{6}{10}$, $\frac{7}{10}$, $\frac{8}{10}$, $\frac{9}{10}$. Good job! Where did we end up? [pause] **Yes! We landed on $3\frac{9}{10}$.**

 Tying the learning together: **We just went through an example of subtracting using fraction bars and another example of subtracting using number lines. So we can use either method to find equivalent fractions with a common denominator and subtract - even with mixed numbers.** **Did you notice that we still needed to use our common denominator when we are using the number line to subtract? Otherwise, we would have been jumping back the wrong size pieces!**	
Guided Practice (12 minutes) **Let's try another problem. Read this situation with me.** **Cara's bathroom floor has an area of $3\frac{2}{3}$ square yards. She lays down a rug that has an area of $1\frac{1}{4}$ square yards. What area of her floor is NOT covered by the rug?** **What information is the problem giving us?** [pause] **Yes! It's telling us two pieces of information. The area of Cara's floor, which is $3\frac{2}{3}$ square yards, and the area of her rug, which is $1\frac{1}{4}$ square yards.** **And what is it asking us to find?** [pause] **Good catch.** **If you read the question carefully, it is asking for what area of the floor is NOT covered by the rug.** **So do we need to add these numbers together or subtract them?** [pause] **Right! Subtract, because we want to know the difference between the area of the whole floor and the area of the floor covered by the rug. Good!** **So we need to subtract $3\frac{2}{3} - 1\frac{1}{4}$.** [write this problem down] **Let's solve this using the number line.** **Draw a number line on your paper.** [draw an open number line] **In order to plot $3\frac{2}{3}$ on this number line, what whole**	Follow the same directions as in the Intro section. Describe how the students will move through the gradual release process. Be explicit as to what the gradual release looks like from the student perspective.

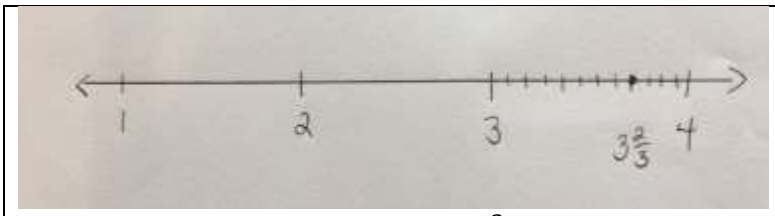
numbers do we want to include? [pause] **Good! Yes, we need to at least include 3 and 4 since this fraction will fall between those whole numbers.**
Do we need to be sure to include other numbers? [pause] **Which ones?** [pause] **Okay. Since we will be subtracting $\frac{1}{4}$, it will be important to include at least a couple more numbers less than 3.** [Number the line between 1 and 4 leaving room for twelfths in between.]

Alright, so where does $3\frac{2}{3}$ go? [pause] **To find where it goes, we need to put some more tick marks in between these whole numbers. How many spaces do we need in between each pair of whole numbers?** [pause] **3? Why 3?** [pause]
Yes, because 3 is the denominator.
Okay, let's mark thirds between the 3 and the 4 so we can plot $3\frac{2}{3}$. Go ahead and mark your number line and put a dot at $3\frac{2}{3}$ and label it, then hold it up when you are finished so I can see it. [Pause for 20 seconds.]
Very nice! Does your number line look like mine? [pause]



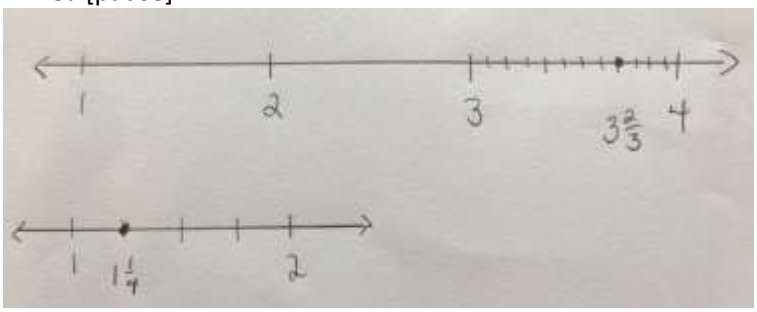
Good! Now remember that we need to subtract $1\frac{1}{4}$. So are we ready to do that? [pause] **No? Why not?** [pause]
Of course, we don't have fourths, we have thirds. So what do we need to do? [pause] **Right! We need to find our common denominator so we can divide this number line into pieces we can subtract.**
We practiced finding a common denominator earlier. So I am going to let you try this one. I'll give you a few minutes to look at the multiples to find one they share. [Pause for 30-45 seconds.]

Did you find a multiple that both 3 and 4 have? [pause]
Great! It's 12! So go ahead and divide up your number line between 3 and 4 into twelfths. [draw in the tick marks and wait for 20-30 seconds]
Did you figure out how many spaces to divide each third into? [pause] **Great! How did you figure that out?** [pause] **I heard someone say 12 divided by 3 is 4, so check your work and see if you have 4 spaces within each third and a total of 12 spaces between 3 and 4. Remember you are counting spaces and not tick marks.** [pause]

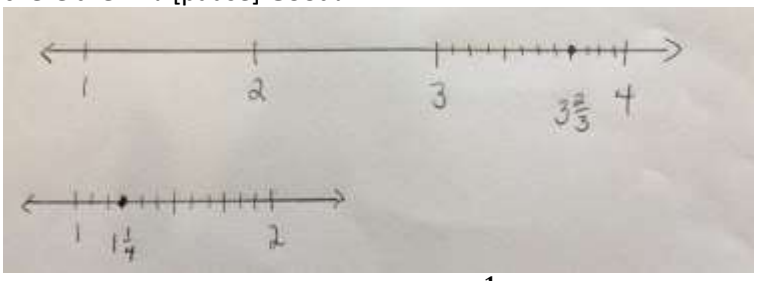


So how many twelfths is equivalent to $\frac{2}{3}$? Go ahead and count over to see. I'll wait. [pause] **Did you get $\frac{8}{12}$? Great! Now we need to figure out an equivalent fraction for $1\frac{1}{4}$ using our common denominator of 12. To do this, let's draw another number line under this one.** [Draw an open number line and number it the same way.]

To model $1\frac{1}{4}$, we need to divide this number line into fourths, because that's the denominator. Go ahead and do that on your paper and then put a dot at $1\frac{1}{4}$ and label it. Hold up your thumb when you are finished, so I know you are done. [pause] **Good job! Does your number line look like mine?** [pause]



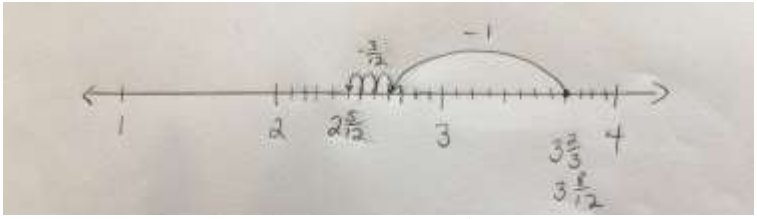
Now we need to divide it into twelfths because that is our common denominator. How many spaces do we need in each fourth? [pause] **Yes! Since 12 divided by 4 is 3, we need to divide each fourth into 3 spaces. Go ahead and do that, too.** [pause] **Did you remember to count the spaces to make sure there are 12?** [pause] **Good!**



So what is the equivalent fraction for $1\frac{1}{4}$ in twelfths? [pause] **Yes! It's $1\frac{3}{12}$. Excellent work! Label that on your graph.** [pause]

So looking at our first number line, we need to subtract $1\frac{3}{12}$ from $3\frac{8}{12}$. What should we do first? [pause] **Can we go ahead and subtract the 1 whole?** [pause] **Yes we can. What is $3\frac{8}{12} - 1$ whole? Can you show that on your number line?** [pause] **Uh oh. What are we missing?** [pause] **Oh, of course. We need to see the twelfths in between 2 and 3. Let's put those in, too.** [Draw the twelfths.] **Great! Now we can subtract 1 whole from $3\frac{8}{12}$.** [Draw the arc in to show the jump of -1 – see below for an example.]

Where did we end up? [pause] **At $2\frac{8}{12}$. Right! Good. We still need to subtract the $\frac{3}{12}$. So go ahead and count over 3 more twelfths and tell me where you land.** [pause] **Did you land at $2\frac{5}{12}$? Me, too!**



Now we know that since $\frac{2}{3} - 1\frac{1}{4} = 2\frac{5}{12}$, so the area of Cara's floor not covered by her rug is $2\frac{5}{12}$ square yards. Great work everyone!

Cara's friend Jordan said she had $2\frac{3}{7}$ square yards left in her room. How do you think he got that answer? [pause] **If you recall, we started with this subtraction problem: $3\frac{2}{3} - 1\frac{1}{4}$. How did he get the 2 whole?** [pause] **Yes! The same way we did, by subtracting the whole numbers 3 - 1. So how do you think he got $\frac{3}{7}$?** [pause] **Look closely at the fractions.** [Point at the fractions in the problem.] **How do you get 3 from the numerators 2 and 1?** [Point at the numerators in each fraction.] **Maybe so. Maybe he just added them together. Doesn't 2 + 1 = 3?** [pause] **And how do you think he got a 7 in the denominator?** [pause] **Maybe he added those too? Perhaps. Maybe he was just playing around with the numbers and not really thinking about what subtraction means in this problem. What does subtraction mean?** [pause] **That's right! It means taking away. In this problem we were trying to find out how much of Cara's floor was not covered by her rug. So in a way, we were taking**

away the area that was covered by the rug to find what was left. **Thank you for thinking through that with me!** **<u>Additional Problems (if Needed):</u>** **What number do you add to $1\frac{3}{4}$ to get $\frac{5}{6}$?** **Solve using either the number line method or review the fraction bar method again.**	
<u>Independent Practice</u> (<1 minute) **Great work, boys and girls! Today, we reviewed subtracting mixed fractions with unlike denominators. I hope you're seeing some connections to adding mixed numbers 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, 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!**	
<u>Closing</u> (<1 minute) **I enjoyed reviewing subtracting mixed 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!**	