PBS Lesson Series

Math: Grade 3, Lesson 14, Area

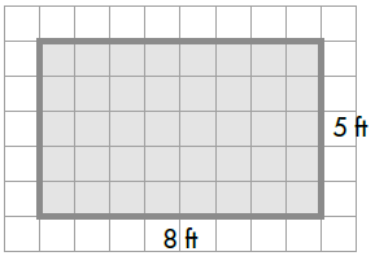
Lesson Focus: Area and the Distributive Property
Practice Focus: Student practice will focus on using areas of rectangles to model the distributive property of multiplication.
Objective: Students will use the area of rectangles to model the distributive property.
Key Vocabulary: area, multiplication, distributive property, model, equation
TN Standards: 3.MD.C.7
Teacher Materials:

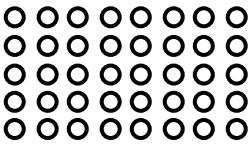
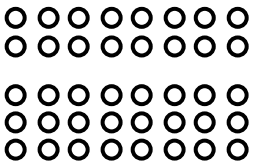
- Paper, pencil, and dry erase board/marker
- Student practice packet

Student Materials:

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

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 3rd graders out there, though all children are welcome to tune in. This lesson is the fourteenth 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 using the area of a rectangle to model the distributive property. Before we get started, to participate fully in our lesson today, you will need:** • **Paper and a pencil, and a surface to write on** • **Student packet for Math, Grade 3, Lesson 14 which can be found at www.tn.gov/education.** **Ok, let's begin!**	Students get materials ready for the lesson.

Intro (5 min) **First, let's review how to find the area of rectangles by multiplying. Look at this rectangle.** [Teacher displays image below.]  **I want to find its area or the amount of space inside a figure. What are different ways we have learned to find area this week?** [Pause.] **That's one way! Because this rectangle is on a grid, we've learned to find its area by counting the total number of unit squares in the shaded space. I heard another way! We've learned to find the area of the rectangle we can multiply the two side lengths.**	Students actively listen to teacher as they review finding the area of a rectangle.
On your paper, write the multiplication expression that you think describes the area in this rectangle. [Pause.] **Did you write the expression 5 x 8?** [Pause.] **We can see in the picture that the two side lengths of the rectangle are 5 and 8. That makes sense because the rectangle has 5 groups or rows of 8 unit squares.**	Students record on their paper a multiplication expression that describes the area of the rectangle.
So to find the area we can multiply 5 x 8. Record the product of 5 x 8 on your paper. [Pause.] **Give me a thumbs up if you found the product 40.** [Pause.] **Great! You may just know that 5 x 8 = 40. This means the space inside this rectangle is covered with 40 unit squares. Since the side lengths are measured in feet, the area is measured in square feet. So the area of this rectangle is 40 square feet.**	Students record the product of 5 x 8. Students give a thumbs up for writing 40 for the product.
Now let's review the distributive property because we will also be using it in our lesson today. Do you remember using the distributive property when you were learning multiplication facts? Take a moment to write down what you remember about the distributive property. [Pause.] **We used the distributive property to break apart unknown multiplication facts into the sum of known multiplication facts. I'll show you an example.** **A minute ago, we multiplied 5 x 8. If I didn't know that multiplication fact, I could have used the distributive**	Students record what they remember about the distributive property.

property to break it apart into the sum of multiplication facts that I did know. Listen to my think aloud as I do this.	
I don't know the product of 5 x 8 yet. Are there some multiplication facts that I do know that can help me find that product? I know that 5 x 8 means I have 5 groups of 8. I'll represent this with an array. You draw the array on your paper using dots. The array for 5 x 8 has 5 rows of 8 objects in each row. [Pause.]	Students listen to teacher think-aloud of using the distributive property with 5 x 8. Students use dots to draw an array for 5 x 8.
[Teacher displays array below or uses counters to build an array.] 	
How can I break apart this array? I know that 2 groups of 8 or 2 x 8 is 16. So I'll break apart my array so that the first two rows are separated from the other rows. You can draw a horizontal line on your array to show the separation. [Teacher displays the separated array below.]  2 x 8 = 16 3 x 8 = 24	Students draw a horizontal line on their array to separate it into two parts so that there are two rows of 8 and three rows of 8.
The other part of the array has 3 rows of 8. I know that 3 groups of 8 or 3 x 8 is 24. Write the multiplication equations on your paper next to the arrays. If we add those two sums together, 16 + 24, we get 40. So the product of 5 x 8 = 40. Write the equation 5 x 8 = 40 at the bottom of your array. [Pause.]	Students record 2 x 8 = 16 and 3 x 8 = 16 next to their array parts. Students record 5 x 8 = 40 below their array.
I can represent my thinking with equations. Write the equations on your paper as I write them. [Teacher records equations below.] **5 x 8 = (2 x 8) + (3 x 8)** **5 x 8 = 16 + 24** **5 x 8 = 40**	Students record the equations on their paper.
I'm excited to see how we'll use the distributive property and multiplication to help us find the area of rectangles!	

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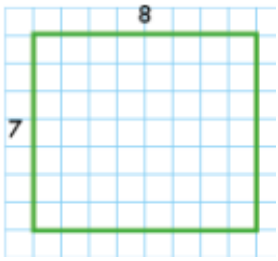
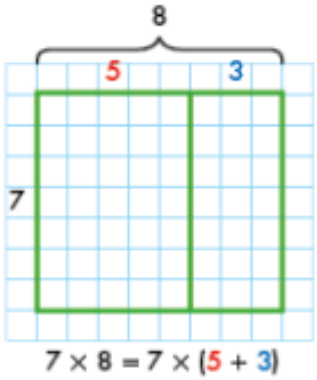
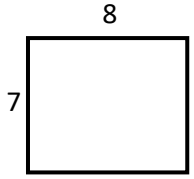
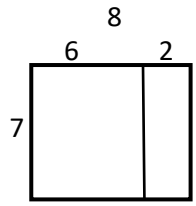
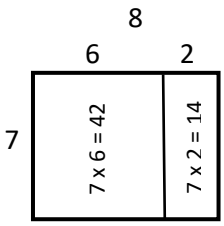
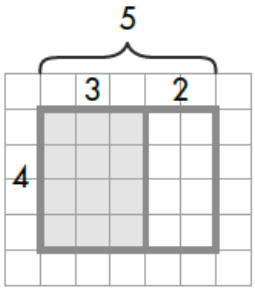
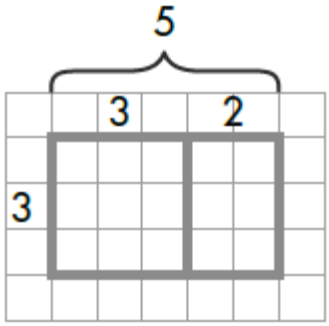
Teacher Model (10 min) Objective 1: Teacher modeling using areas of rectangles to model the distributive property. **We just reviewed using the distributive property to break apart multiplication facts into known facts in order to find the product. Now we'll see how we can use the distributive property to break apart the area of a rectangle into smaller areas. Do you think the sum of the areas of the two smaller rectangles will equal the sum of the area of the whole rectangle? Record yes or no on your paper.** [Pause.] **Let's find out!** **Look at this rectangle.** [Teacher shows image below.] Area = 7 × 8  **What does the product of 7 x 8 describe about the rectangle?** [Pause.] **Give me a thumbs up if you said 7 x 8 describes the area. We learned that we can find the area of a rectangle by multiplying the two side lengths. So the area of the whole 7 by 8 rectangle is 56 square units. Draw the outline of this rectangle on your paper. Label the sides 7 and 8.** [Pause.] **Now I'm going to break apart the 7 by 8 rectangle into two smaller rectangles. This will help us figure out if the sum of the areas of the two smaller rectangles equals the area of the whole rectangle. In this case, will the sum of the areas of the two smaller rectangles equal an area of 56 square units? Let's find out!** [Pause.] **I am going to draw a vertical line to break apart the side with a length of 8 into two lengths of 5 and 3. I chose 5 and 3 because I know that 5 + 3 = 8. I could have also made lengths of 4 and 4, 1 and 7, or 2 and 6 because each of those pairings give us a sum of 8. You draw a vertical line on your rectangle where you think it breaks apart the side into a length of 5 and a length of 3.** [Pause.]	Objective #1: Students will be using their prior knowledge of multiplying side lengths to find area and using the distributive property to break apart multiplication facts to solve area problems. Students record yes or no on their paper to indicate if they think the sum of the areas of two smaller rectangles will equal the sum of the area of the whole rectangle. Students give a thumbs up for saying that 7 x 8 describes the area of the rectangle. Students draw the outline of the rectangle and label the length of the two sides 7 and 8. Students draw a vertical line through their rectangle to break the side length of 8 apart into 5 and 3.

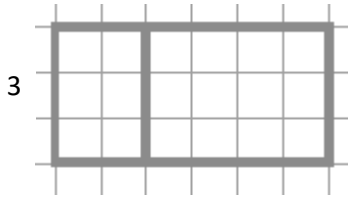
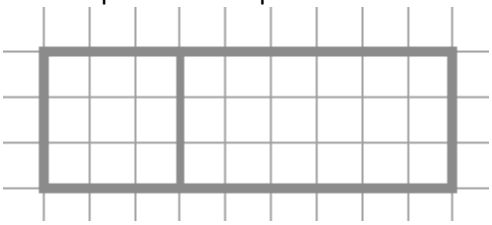
Look at my rectangle now that it is broken into two smaller rectangles. [Teacher shows rectangle below.]  	
Do you see the vertical line that separates it into two smaller rectangles? Did you draw your vertical line so that one of your smaller rectangles is larger than your other rectangle? [Pause.] **Is any area gained or lost now that I separated the 7 by 8 rectangle into two rectangles?** [Pause.] **No, the space inside has not changed.**	Students check that they drew their vertical line so that one of the smaller rectangles is larger than the other rectangle.
It's important to understand that when we break apart a rectangle into two smaller rectangles that the total area does not change. Let's prove this by doing the math. I can describe the area of the two smaller rectangles with the expressions 7 x 5 and 7 x 3. [Teacher records the expressions inside the appropriate rectangle.] **Give me a thumbs up if you see how I came up with those expressions.** [Pause.] **Record the expressions in your drawing.** [Pause.]	Students record the expressions 7 x 5 and 7 x 3 in their drawing.
If we multiply, we get that the areas of the two smaller rectangles are 35 square units and 21 square units. Now let's add the areas together to see if their sum equals the area of the original rectangle. Find the sum on your paper. [Pause.]	Students find the sum of 35 plus 21.
35 plus 21 equals 56. The sum of the areas of the two smaller rectangles is 56 square units. Wow! 56 square units is the area of the whole 7 x 8 rectangle too! So the total area does not change when we break apart a rectangle into parts.	
Objective 2: Teacher modeling/guided practice on writing equations to represent using the distributive property with area problems.	Objective 2: Students will write equations to describe that the area of a whole rectangle is equal to the sum of the areas of the decomposed rectangles.
We can describe this with an equation. First, let's try to make sense of the equation that is written below the rectangle. Since it is an equation, I know that both sides of the equation have equivalent expressions. The equation says seven times	

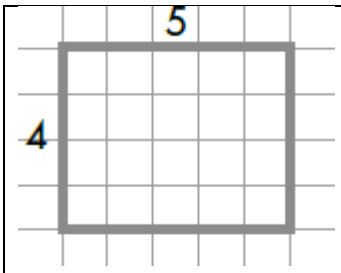
eight equals seven times the sum of five plus three. Write this equation on your paper. [Pause.] **The left side of the equation has the expression 7 x 8. We already stated that 7 x 8 describes the area of the large rectangle. What do you think is described by the expression on the right side of this equation?** [Pause.] **The seven is still describing the side length of 7 in all the rectangles. The 5 + 3 describes how we decomposed the side length of 8 into a length of 5 and a length of 3. So seven times the sum of five plus three is describing the area of the two parts.**	Students write the equation 7 x 8 = 7 x (5 + 3). Students think about what is described by the expression 7 x (5 + 3).
We can also describe that the area of the whole rectangle is equal to the sum of the areas of the two smaller rectangles with the equation 7 x 8 = (7 x 5) + (7 x 3). Record this equation on your paper. [Teacher records this equation under the other equation.] **What does the expression on the right side of the equation describe?** [Pause.] **It describes the sum of the area of the two smaller rectangles because 7 x 5 is one area and 7 x 3 is the other area.** [Teacher points to the two areas in the rectangle image.]	Students record the equation 7 x 8 = (7 x 5) + (7 x 3).
Lastly, we can record the products of the two smaller areas and their sum with this equation. Write this equation on your paper. [Teacher records this equation under the other two.] **7 x 8 = 35 + 21 = 56.**	Students record the equation 7 x 8 = 35 + 21 = 56.
Tying the learning together: **We just showed how to use the area of a rectangle to represent the distributive property! We did this by showing that the area of a whole rectangle is equal to the sum of the areas of its smaller rectangles. First we showed it in our drawing of the rectangle. Then we wrote equations to show the math.** **Are you convinced that if you break apart a rectangle, the area of the whole is the sum of the areas of its parts?** [Pause.] **To convince ourselves, let's draw another rectangle with the side lengths of 7 and 8. You draw it on your paper too.** [Teacher draws the rectangle like image below and displays it.]	Students draw another 7 by 8 rectangle.
 **Now we'll draw a vertical line to separate our rectangles into two smaller rectangles that's different than what we did**	

earlier. This time let's separate the side length of 8 into side lengths of 6 and 2. Go ahead and do this on your paper as I do it on mine. [Pause.]  [Teacher shows the divided rectangle with 6 and 2 labeled.] **Give me a thumbs up if your rectangle looks similar to mine.** [Pause.] **Make sure that your rectangle with a side length of 6 covers more space than your rectangle with a side length of 2.**	Students draw a vertical line to break their rectangles apart into side lengths of 6 and 2.
Now inside each of the smaller rectangles, we'll write the multiplication equations that describe their areas. Write the equations as I write them. I can express the area of the rectangle on the left as 7 x 6 so the equation is 7 x 6 = 42. I can express the area of the rectangle on the right as 7 x 2 so the equation is 7 x 2 = 14. 	Students write multiplication equations to describe the areas of the smaller rectangles.
If the sum of the two areas is equal to the area of the whole rectangle, then we've just modeled the distributive property. On your paper, find the sum of the areas of the two smaller rectangles. [Pause.] **Give me a thumbs up if the sum you found is 56. Yes, 42 plus 14 is 56. The area of the whole rectangle is 7 x 8 which is also 56. We just showed that when a rectangle is divided into two parts, the area of the whole rectangle is equal to the sum of the areas of the parts!**	Students add the two areas of 42 and 14 to find the sum of 56.
Now I'll write some equations to represent the same thing. Write the equations on your paper too. [Teacher writes and reads the equation.] **7 x 8 = 7 x (6 + 2) Both sides of this equation have the same value. 7 x 8 is the area of the whole rectangle and 7 x (6 + 2) is also the area of the whole rectangle. We're just showing how we broke apart the side length of 8 into 6 and 2.**	Students write the equation 7 x 8 = 7 x (6 + 2).

Now let's write another equation underneath this one. Write this equation on your paper too. **7 x 8 = (7 x 6) + (7 x 2). Again, both sides of the equation have the same value. 7 x 8 is the area of the whole rectangle and (7 x 6) + (7 x 2) is also the area of the whole rectangle because it's the sum of the two parts. This is an example of the distributive property!**	Students write the equation 7 x 8 = (7 x 6) + (7 x 2).
<u>Guided Practice (10 min)</u> [I do.] **Now let's practice some problems using what we've learned. I'll do the first practice problem.** [Teacher shows the problem below and reads the directions to students.] **Complete the equations that represent the picture.**  **4 x ___ = ___ x (3 + ___)** **4 x ___ = (4 x ___) + (___ x 2)** [Teacher does a think aloud as she completes the equations.] **Before I complete the equations, I'm going to make sense of this picture. I see a rectangle that is divided into two smaller rectangles. The whole rectangle has side lengths of 4 and 5. The vertical line shows that the side length of 5 is being cut into the side lengths of 3 and 2. The first equation can describe this so I'll complete it to say 4 x 5 = 4 x (3 + 2).** [Teacher writes the numbers to complete the equation as she reads it aloud.] **Write this equation on your paper too.** [Pause.] **The next equation describes that the area of the whole rectangle is equal to the sum of the areas of the smaller rectangles. I know to find the area of the smaller rectangles that I can multiply their side lengths of 4 and 3 and 4 and 2. I'll complete this equation to say 4 x 5 = (4 x 3) + (4 x 2).** [Teacher writes the numbers to complete the equation as she reads it aloud.] **Write this equation on your paper too.** [Pause.]	Students listen as the teacher completes a practice problem. Students record the completed equation on their paper. Students record the completed equation on their paper.

[We do.] **Now let's do this next problem together.** [Teacher displays the problem and reads the directions.] **Complete the equations that represent the picture.**  **3 x ___ = ___ x (3 + ___)** **3 x ___ = (3 x ___) + (___ x 2)**	
Draw this rectangle and its parts on your paper. [Pause.]	Students draw the rectangle and its parts on their paper.
Let's make sense of this rectangle. One side length is 3. Show me with your fingers what the other side length is. [Pause.] **Yes, the other side length for the whole rectangle is 5. There is a vertical line dividing the rectangle into two smaller rectangles. The side length that measures 5 is being cut into what two lengths? Say them out loud.** [Pause.] **Yes, 5 is being cut into 3 and 2. We have enough information to complete the first equation now. I'll give you a moment to complete it on your paper first.** [Pause.] **Our first equation should read as 3 x 5 = 3 x (3 + 2). The left side 3 x 5 represents the area of the whole rectangle. The right side represents how we cut the 5 into 3 and 2.**	Students show 5 fingers to indicate the other side length for the whole rectangle is 5. Students say out loud the parts 3 and 2. Students complete the first equation on their paper.
To complete the second equation, we need to know what multiplication expressions we can write to describe the area of the whole rectangle and the areas of the two small rectangles. You try to complete it on your paper before we talk about it. [Pause.]	Students complete the second equation on their paper.
We already noticed that the multiplication expression for the area of the whole rectangle is 3 x 5. The areas of the smaller rectangles can be expressed as 3 x 3 and 3 x 2. So our equation reads 3 x 5 = (3 x 3) + (3 x 2). Great job!	Students check their equation.

[You do.] **Now you try one by yourself!** **Complete the equations that represent the picture.** 6 2 4 3  **3 x ___ = ___ x (2 + ___)** **3 x ___ = (3 x ___) + (___ x 4)**	Students try to complete equations for a picture on their own.
Draw the figure and record the two equations on your paper. Then try to complete the equations using what you've learned today. [Pause.] [Teacher completes the equations for students to view and reads them aloud.] **The completed first equation is 3 x 6 = 3 x (2 + 4).** **The completed second equation is 3 x 6 = (3 x 2) + (3 x 4).** [Additional problems if needed.]	Students draw the figure and record the two equations on their paper. Students then complete the equations. Students check their completed equations.
Write equations to represent the total area of the shapes.  List all the ways you can separate the rectangle into two smaller rectangles.	

	
Independent Practice (10 min) **Great work, students! Today, we reviewed using the area of rectangles to represent the distributive property. We did this by cutting a rectangle into two smaller rectangles and then completing equations to show that the area of the large rectangle equals the sum of the areas of the small rectangles. You sure did a great job! 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!**	Students listen to teacher summarize today's learning and view the independent practice problems.
Closing (1 min) • **Students, I enjoyed reviewing using the area of rectangles to model the distributive property! 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!**	