PBS Lesson Series

Math: Grade 3, Lesson 13, Area

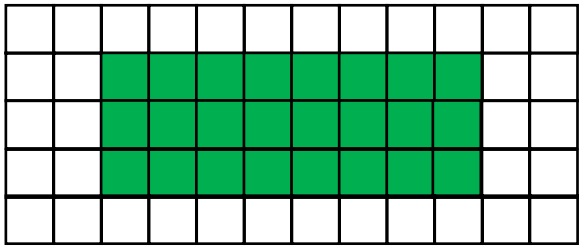
Lesson Focus: Use unit squares and multiplication to find areas of squares and rectangles.
Practice Focus: Students will focus on practicing using standard units and multiplication to find areas of squares and rectangles with a focus on the relationship between counting units and using multiplication.
Objective: Students will use unit squares and multiplication to find areas of squares and rectangles.
Key Vocabulary: unit square, multiplication, area, length, width
TN Standards: 3.MD.C.7, 3.MD.D.8
Teacher Materials:

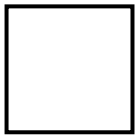
- Paper, pencil, and dry erase board/marker
- Student practice packet

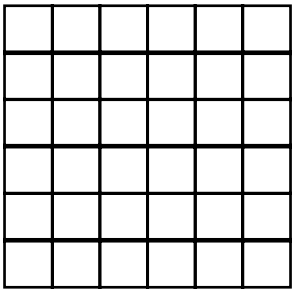
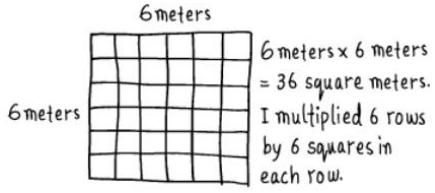
Student Materials:

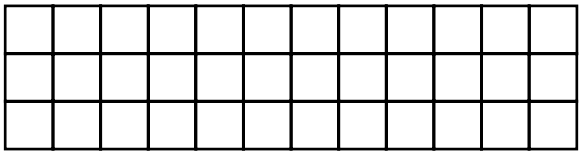
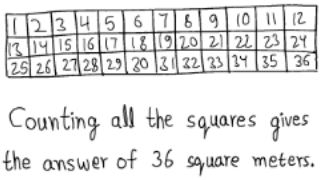
- Paper and a pencil, and a surface to write on

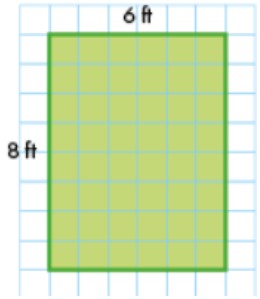
Teacher Do	Student Do
Opening (1 min) **Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 3rd graders out there, though all children are welcome to tune in. This lesson is the thirteenth in our series.** **My name is ____ and I'm a ____ grade teacher in Tennessee 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 unit squares and multiplication to find areas of squares and rectangles. 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 13 which can be found at www.tn.gov/education.** **Ok, let's begin!**	Students get materials ready for the lesson.

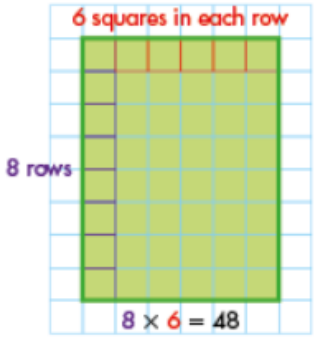
Intro (5 min) **Let's solve a problem to review finding area using standard units.** [Teacher displays rectangle below.] **On your paper, write a definition for area.** [Pause.] **Area is the space inside of a shape. We've learned to find area by counting the number of unit squares that cover the space inside of the shape. Let's find the area of this rectangle. Notice that the unit squares in this rectangle have an area of 1 square centimeter. What is the area of the shaded rectangle? Record your answer on your paper.** [Pause.]	Students write definition of area on their paper. Students count unit squares to find area of rectangle and record their answer.
	
Give me a thumbs up if you wrote that the area of the rectangle is 24 square centimeters. Great job! Remember that the area will have both the number of unit squares and the standard units of measure being used. Some of you may have counted the unit squares one at a time. It would have sounded like 1, 2, 3, 4, 5, …, all the way to 24. Some of you may have skip counted. For instance, I notice that there are 8 unit squares in each row of the rectangle. Since there are 3 rows, I need to skip count by 8 three times. Skip count with me! 8, 16, 24. Either way, we find an area of 24 square centimeters.	Students give a thumbs up to indicate they wrote an area of 24 square centimeters. Students skip count by 8s with teacher.
Let's solve one more review problem related to finding area of a shape using standard units. Listen as I read the problem. Is the area of a rectangular desk more likely to be 8 square feet or 8 square inches? Take a moment to think. [Pause.] **Let's try to visualize these area measurements. Can you picture a piece of notebook paper or printer paper? The paper is usually shaped like a rectangle. For most of the paper we use, the shorter side has a length of about 8 inches. We can probably draw a rectangle with 8 square inches on that paper. So do you think a desk is likely to be 8 square feet or 8 square inches?** [Pause.] **Yes, a desk is more likely to be 8 square feet.** **Now that we've reviewed counting unit squares to find area of shapes, we're ready to think about finding area using other operations.**	Students think about appropriate square units for the area of a desk.

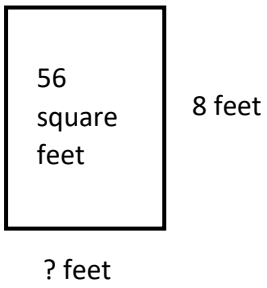
Teacher Model (10 min) Objective 1: Teacher modeling of using different ways to find area including using the operation of multiplication. **Today we're going to continue finding the area of squares and rectangles, but we're going to consider if there's another operation besides addition that can help us.** **Listen to me read a problem that we'll solve together.** [Teacher displays the story problem and images for students to see and reference.] **Jorge is carpeting two rooms. One room is a square with a side that measures 6 meters. The other room is a rectangle with sides that measure 3 meters and 12 meters. How many square meters of carpet does Jorge need?**  6 meters  3 meters 12 meters	Objective #1: Students will be using their prior knowledge of counting unit squares to find area, and they'll also begin noticing that multiplication can be used to find area. This will allow students to understand that area is related to addition and multiplication.
Before we start finding the area, let's make sense of the problem. What are we being asked to find? [Pause.] **We are being asked to find how many square meters of carpet that Jorge needs. The problem says he needs the carpet for two rooms. How are the shapes of the two rooms different?** [Pause.] **One room is a square with side lengths of 6 meters. The other room is a rectangle with a shorter side length of 3 meters and a longer side length of 12 meters. How are the shapes of the two rooms the same?** [Pause.] **They both have 4 side lengths measured in meters and they both have areas measured in square meters. How can a unit square help us find the area of each shape?** [Pause.] **We can figure out how many unit squares it takes to cover each floor of the two rooms. In this case, our unit squares are square meters.**	Students make sense of the problem.
Copy the square on your paper. Think about what you already know about using unit squares to find area. Now take a minute to find the area. [Pause.]	Students draw the square with 6 meter sides and think about how to find the area.
[Teacher shows drawing or image of square such as the one below.] **Did you draw unit squares inside your square so that there were 6 unit squares for each row inside your square? It takes 6 of these rows of 6 unit squares to cover the space inside the square. How many total unit squares is that? There are 36 unit squares. So our room that is a square has an area**	Students check their area measurement with teacher's work.

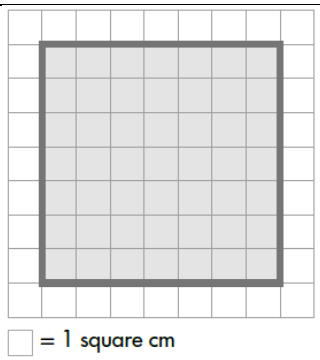
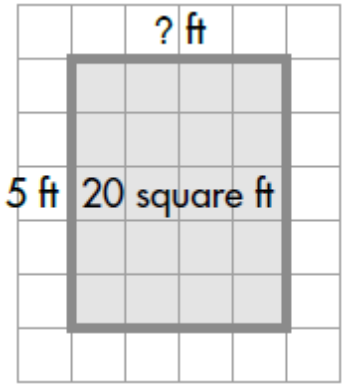
of 36 square meters. [Teacher records Area = 36 square meters under the square.]  Area = 36 square meters	
There are different ways we could have come up with 36 unit squares. Some of you may have counted every square one at a time. Some of you may have skip counted by sixes until you counted all the rows. When we count by ones or skip count by sixes, we are using the operation of addition. Is there another operation we can use to help us find the area? [Pause.]	Students begin thinking about operations besides addition that may be helpful in finding area.
Let me show you how my student Shelly found the area. [Teachers displays image of Shelly's work.]  	Students view a piece of student work for finding area using multiplication.
Shelly drew her square and labeled two sides with a length of 6 meters. We were given that side length in the problem. Next, Shelly made a connection to multiplication where she learned to draw area models with rows and columns to solve multiplication problems. She saw each row as a group of 6 unit squares. She knew she had a total of the 6 groups. This reminded her that she could use multiplication to find the area. So by using multiplication, Shelly also determined the area of the square to be 36 square meters.	
Now we need to find the area of the rectangular room. Draw the rectangle so that its shorter side is 3 meters and its longer side is 12 meters. Draw unit squares to cover the	Students draw a 3 m by 12 m rectangle and find the area. Students record the area using square meters.

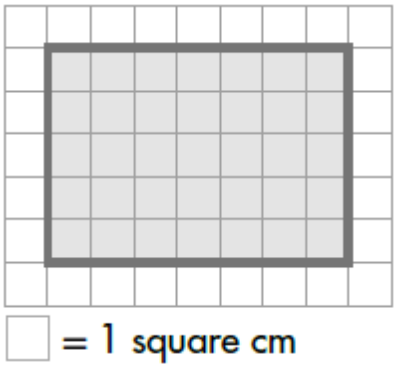
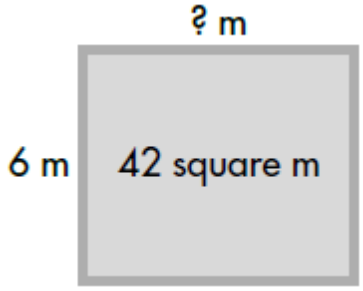
rectangle and then find the area. Be sure to include square meters with your area measurement. [Pause.]  Area = 36 square meters [Teacher shows rectangle image above or own drawing for the 3 by 12 room with the area measurement.]	
Give me a thumbs up if you drew a rectangle similar to this and you wrote that the area is 36 square meters. [Pause.]	Students give a thumbs up for drawing a similar rectangle and finding its area to be 36 square meters.
Great job! Now let's talk about the different ways we could have determined that the area was 36 square meters. We could've counted by ones like my student Kyle. [Teacher shows image below.]	Students look at Kyle's work.
	
Kyle counted by ones and wrote the number of the count in each unit square to keep track of his counting which is a great strategy. Kyle also recorded that he got 36 square meters. It's very important to record both the number and the standard units!	
You could also find 36 square meters by skip counting by twelves. Skip count with me! You would say 12, 24, 36.	Students skip count by 12s with teacher.
A third way to find the area is to multiply the number of rows by the number inside each row. Say out loud what our multiplication equation will be. [Pause.] **Three times twelve is also 36.**	Students say out loud 3 x 12 = 36.
So whether we used addition or multiplication, we all arrived at 36 square meters for the area of the rectangular room.	
Both of the rooms that Jorge wants to carpet have an area of 36 square meters. Isn't that interesting? To find the total square meters of carpet that Jorge needs, we can add the two areas together. 36 square meters plus 36 square meters equals 72 square meters. Jorge needs 72 square meters of carpet to cover the shapes of both rooms.	
Great thinking! Pat yourself on the back for making sense of the problem and for persevering!	Students pat themselves on the back for persevering.

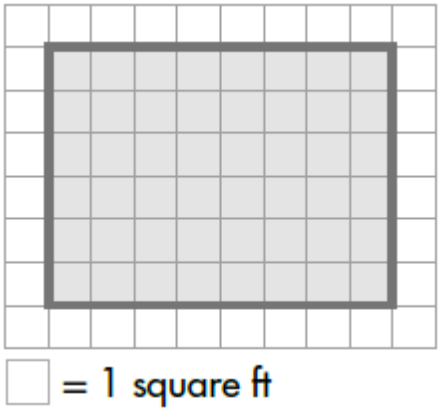
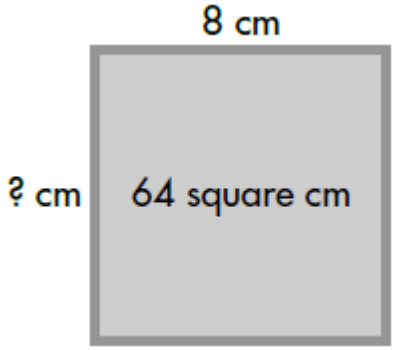
Objective 2: Teacher modeling/guided practice on using multiplication to find area. **Let's work through another area problem and think about how we can count unit squares or use multiplication to find the area.** **Mike paints a rectangular wall in his room green. The picture shows the length and width of Mike's wall.** [Teacher shows the image below.] **A small can of paint covers 40 square feet. Does Mike need more than one small can to paint the wall of his room?**  **What am I trying to solve in this problem? I need to find out if Mike needs more than one small can of paint in order to cover the area of his wall. One small can of paint covers 40 square feet. I need to figure out the area of his wall. If the area of the wall is 40 square feet or less, then one can of paint is all he needs. If the area of his wall is greater than 40 square feet, then he'll need more than one can of paint.** **I notice in the picture of his wall that the length of the shorter side is 6 feet and the length of the longer side is 8 feet. I learned in the previous problem that we can find the area in different ways. I'll find the area now. You also find the area and we'll talk about our thinking. You may need to draw the picture on your paper. Record the area measurement on your paper.** [Pause.] **One way to find the area of the wall is to use addition to either count each unit square by ones or to skip count by the number inside each row. Let's skip count by sixes together. We'll need to do it 8 times for the 8 rows. 6, 12, 18, 24, 30, 36, 42, 48. The rectangle side lengths are measured in feet so the area of our rectangle is 48 square feet. Check your paper to see if you recorded 48 square feet.**	Objective 2: Students will develop conceptual understanding for the relationship among area, addition, and multiplication. Students will count unit squares and use multiplication to find area. Students listen to teacher read the problem. Students make sense of the problem by listening to teacher's think-aloud. Students find the area of the wall. Students record the area they found on their paper. Students skip count by sixes with the teacher. Students check their paper to see if they recorded 48 square feet.

Another way to find the area is to use multiplication. [Teacher shows image below.]  	
Here's the same rectangular wall. I outline the top row and notice that there are six unit squares in each row. I outline the unit squares in the first column and notice that there are a total of 8 rows. That means I have 8 groups of 6. I can use multiplication to find the product for 8 groups of 6. 8 x 6 = 48. Each unit square is one square foot so my area is 48 square feet.	Students study the figure while listening to the teacher's think-aloud.
Have we solved the problem? [Pause.] **Not yet. We did find that the area of the wall is 48 square feet, but we haven't determined if Mike needs more than one small can of paint. Give me a thumbs up if you think Mike can paint his wall with one can of paint.** [Pause.] **Give me a thumbs down if you think Mike needs more than one can of paint.** [Pause.] **The can of paint will cover a space with an area of 40 square feet. The area of the wall is 48 square feet which is greater than 40 square feet so Mike does need more than one can of paint.**	Students give a thumbs up if they think Mike only needs one can of paint and a thumbs down if they think Mike needs more than one can of paint.
Tying the learning together: Explicit Instruction, Example(s), Guided Practice **We've used our prior knowledge about unit squares, area, rectangles, squares, and standard units to solve problems involving area of rectangular and square shapes. We've used addition to find the area of shapes by counting and skip counting. Today we learned that multiplication can also help us find the area of a rectangle and square.** **Let's apply this learning to an area problem where we don't know the length of a shape's side. Listen as I read the problem.**	

The area of another wall in Mike's room is 56 square feet. The wall is 8 feet high. How wide is the wall? **Let's draw a picture to represent the wall.** [Teacher displays or draws a rectangle like the one below.]  **I know the number of unit squares inside the rectangle is 56 because we were given the area is 56 square feet. The vertical length of the shape is 8 feet because we were told that the height of the wall is 8 feet. How can we use what we know about finding area to help us find the width of the wall?** [Pause.] **We learned today that another way to find area to use what we know about multiplication. The 8 foot length in the rectangle tells me how many groups or rows of unit squares that cover the shape. I don't know the number of unit squares in each row, but I do know the area. I can describe what I know with the multiplication problem 8 ft x ___ ft = 56 square feet.** [Write the problem beside the rectangle.] **Show me with your fingers what you think the missing side length is.** [Pause.] **Yes, the missing width is 7 feet. Mike's wall is 8 feet wide. Record the multiplication equation 8 x 7 = 56 below your rectangle.** [Fill in the blank.] **Great job tying it all together! Now we're ready for guided practice.**	Students draw a rectangle to represent Mike's wall. Students actively listen to teacher's think-aloud. Students show 7 fingers for the missing factor. Students record 8 x 7 = 56 under their rectangle drawing.
<u>Guided Practice (10 min)</u> [I do.] **I'll do the first practice problem.** [Teacher reads the problem out loud and does a think aloud as she solves it.] **Find the area of the square.** [Teacher shows square image.]	Students actively listen to teacher reading the problem.

 **I can find the area of the square by counting unit squares and by multiplying two side lengths. First I'll using counting. I counted 7 unit squares in the top row. There are also 7 total rows. I will skip count by 7 seven times. 7, 14, 21, 28, 35, 42, 49. The area of the square is 49 square centimeters.** **I should get the same area measurement if I multiply. 7 times 7 is 49. Multiplying also gives me 49 square centimeters.** **Now I'll work a problem that has a missing side measure.** [Teacher shows figure below.]  **I notice this shape is a rectangle with an area of 20 square feet. One side length is 5 feet. I'm going to write this as a multiplication equation.** [Teacher writes multiplication equation.] **5 feet x ___ feet = 20 square feet. I know that 5 times 4 is 20. The missing side length is 4 feet.** [We do.] **Now let's do the next problems together.** [Teacher displays shape image.] **Find the area of the shape.** [Pause.]	Students actively listen to teacher think aloud. Students actively listen to teacher's think-aloud for finding a missing side length. Students look at teacher's display to find the area of the shape.

	
When you find the area, be sure to include the standard unit with your measurement. Record your answer on your paper. I'll give you a few more seconds. [Pause.]	Students record their answer on their paper.
Let's discuss our solutions. If you found the area by counting unit squares, you probably either counted by ones or skip counted by groups of seven. Do the skip count with me. We'll need to skip count by 7 five times because there are 5 groups or rows of 7. 7, 14, 21, 28, 35. The area of this shape is 35 square centimeters. If you didn't record 35 square centimeters on your paper, please do it now. [Pause.]	Students skip count by sevens with teacher to 35. Students record 35 square centimeters on their paper.
If you found the area by multiplying, you would multiply the number of groups or rows by the number inside each row. The number of rows is 5 and the number inside each row is 7. 5 x 7 = 35. Again, we get 35 square centimeters.	
Let's try an area problem with a missing side length. [Teacher displays the figure below.] 	Students find a missing side length of a shape along with the teacher.
Take a moment to write a related multiplication equation for this rectangle. [Pause.] **Did you use the side lengths as your factors and the area measure as your product? Take another moment.** [Pause.] **Give me a thumbs up if you wrote the equation 6 meters x ___ meters = 42 square meters.** [Teacher writes the equation. It's okay to use m for meter.] **It's also okay to write this as the related division equation 42 square m ÷ 6 m = _____ m. Both equations mean the same thing.**	Students write a multiplication equation 6 x ___ = 42.

Give yourself some applause for finding 7 meters as the missing side length. [You do.] **Now you try two problems by yourself!** **Find the area of the shape.** [Teacher displays the shape below and pauses to give students time to solve problem.]  **Give yourself a pat on the back if you wrote that the area of this shape is 48 square feet. Great job!** **Now solve one more problem.** [Teacher shows image below.] **Use multiplication to find the missing side length.** [Pause.]  **The missing side length is 8 centimeters because 8 x 8 = 64.** Additional problems if needed. **Sue's garden is 4 feet long and 4 feet wide. What is the area of Sue's garden?**	Students give themselves applause for finding 7 meters for the length of the missing side. Students solve the problems alone.

The area of Michi's garden is 32 square feet. The garden is 8 feet long. How wide is Michi's garden?	
Independent Practice (10 min) **Great work, students! Today, we reviewed counting unit squares to find the area of a figure. We also learned that we can use multiplication to find area. We applied this knowledge to finding areas of squares and rectangles and to find missing side lengths when we know the area. I hope you're seeing the connections between area and addition and multiplication. 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 counting unit squares to find the area of squares and rectangles and learning that we can also use multiplication to find area! 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!**	