PBS Lesson Series

Math: Grade 7, Lesson 18, Area of Composite Figures

Lesson Focus: This lesson will focus on various strategies in order to calculate the area of composite figures.
Practice Focus: Students will use various strategies to find the area of composite figures.
Objective: The objective of the lesson is to explore a variety of different strategies in order to calculate the area of composite figures
Key Vocabulary: Area, Composite Figures, and Irregular
TN Standards: 7.G.A.1, 7.G.B.3, and 7.G.B.5
Teacher Materials

- Paper or white board
- Pen/pencil/marker
- Prepared copies of the examples (to save time)
- 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 7th graders out there, though all children are welcome to tune in. This lesson is the eighteenth 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. If you don't already have the student packet for this lesson, you can find it online at www.tn.gov/education. You can still tune in to today's lesson if you haven't seen 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 finding the area of composite figures. Before we get started, to participate fully in our lesson today, you will need:** • **Paper, a pencil and a surface to write on and the optional student packet** **Ok, let's begin!**	Students get materials ready for the lesson.
Intro (5 minutes)	

In your previous classes you may have learned what area of an object is. Can you describe area to me in your own words? [Pause] **That is a very good description! Sometimes students have misconceptions about perimeter and area. Perimeter is like a fence around your yard and is the total distance it would take to walk the length of the fence. Area is the amount of space that is inside of the fence. A more formal definition of area could be; a measure of how much space there is on a flat surface.** [Teacher writes definition on the board.]

Student describes area in their own words.

In your previous classes you have likely learned the formulas for area of a triangle, square, rectangle, parallelogram, and trapezoid. If you haven't or you don't remember the formula exactly it is ok! We are going to review them before we continue on with the lesson! Let's go ahead and do that now!

Create a two column chart like mine on your paper please! [Pause. Display chart below and give time for students to copy chart.]

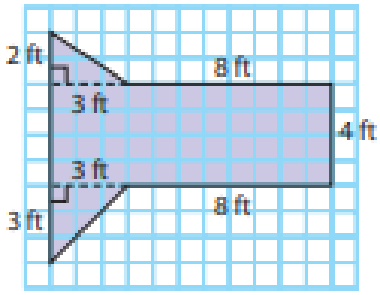
Shape	Area Formula
Triangle	
Square	
Rectangle	
Parallelogram	
Circle	

Students copy chart in preparation to review formulas.

Do you remember any of the area formulas for these shapes? [Pause] **If you do, go ahead and write them in the chart. I will give you a few moments to do that!** [Pause] **Did you get some of them? Did you get all of them?** [Pause] **Compare your formulas to mine as I write them in the chart. These will be very important as we move forward today.** [Teacher writes in formulas on the board while saying them aloud. "b" stands for base, "h" stands for height, "s" stands for side, "l" stands for length, "w" stands for width, and "b" stands for base.]

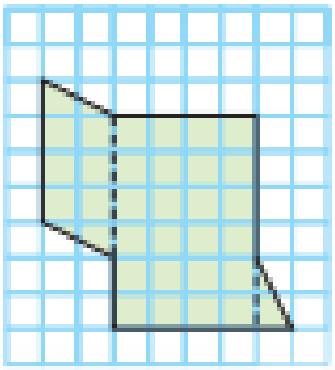
Shape	Area Formula
Triangle	A = $\frac{1}{2}\ b\ h$
Square	A = s^2
Rectangle	A = l w
Parallelogram	A = b H
Circle	A = πr^2

Students write in area formulas.

This chart is going to be very helpful as we solve for areas of composite figures today. Before we start looking at some examples let's explore what composite figures are. **A composite figure is made up of simple geometric shapes such as squares, rectangles, triangle, parallelogram, circles, and trapezoids. To find the area of a composite figure or other irregular-shaped figure, divide it into simple, non-overlapping figures. Find the area of each simpler figure, and then add the areas together to find the total area of the composite figure.** **Are you ready to look at some composite figures?** [Pause] **Great! Let's do it!**	
<u>Teacher Model</u> (10 minutes) Objective 1: Find the area of a composite figure. [Teacher reads problem aloud and displays it on board.] **Find the area of each figure. Use 3.14 for π.**  **Let's figure out how many shapes are in our composite figure. How many simple shapes do you see?** [Pause] **I see three different simple shapes.** [Teacher will point to each of the shapes as they reads the script.] **There are three different simple shapes. There is the top triangle, the middle rectangle, and another bottom triangle.** **We will focus on the top triangle area first. What is the area formula for a triangle?** [Pause] **Right! The area of a triangle is** $\frac{1}{2}$ $(\boldsymbol{base})$ $(\boldsymbol{height})$**. What is the base of the top triangle?** [Pause] **Right it is 3 because the triangle is sitting on the 3. What is the height of the same triangle?** [Pause] **2 feet great! Go ahead and solve for the area of the top triangle.** [Teacher shows solving process on the board that is shown below.]	Objective 1: Students will calculate the area of composite figures. Student answers prompts throughout question. Student solves.

$$\frac{1}{2}\ (\boldsymbol{Base})(\boldsymbol{Height})$$ $$\frac{1}{2}\ (\boldsymbol{3})(\boldsymbol{2})$$ $$= \boldsymbol{3\ square\ feet}$$ **Let's move to finding the area for the middle rectangle.** [Teacher points to middle rectangle.] **What is the area formula for a rectangle?** [Pause] **Exactly! It is** $\boldsymbol{A = (Length)(Width)}$**.** [Teacher writes formula on the board] **What is the length of the rectangle?** [Pause] **It is 11 feet because we have to add 8 feet and 3 feet together. What is the width of the rectangle?** [Pause] **Good job! It is 4 feet. Can you solve for the area now?** [Pause] **Go ahead!** [Teacher does the work on the board as shown below as student does it on their paper.] $$\boldsymbol{A = (Length)(Width)}$$ $$\boldsymbol{A = (11\ feet)(4\ feet)}$$ $$\boldsymbol{A = 44\ square\ feet}$$ **The last simple figure that we have to calculate the bottom triangle.** [Teacher points to bottom triangle.] **What is the area formula of a triangle again?** [Pause] **Nice! It is** $\boldsymbol{A = \frac{1}{2}\ (base)(height)}$**. What is the base of this triangle?** [Pause] **Yes it is 3 feet. What is the height of the triangle?** [Pause] **Right again! It is 3 feet! Go ahead and substitute these numbers into the formula and solve!** [Teacher does the work on the board as shown below as student does it on their paper.] $$\boldsymbol{A = \frac{1}{2}\ (base)(height)}$$ $$\boldsymbol{A = \frac{1}{2}\ (3\ feet)(3\ feet)}$$ $$\boldsymbol{A = 4.5\ square\ feet}$$ **Our last step of this problem is to add the areas of the three simple shapes together. Recall the areas were 3 square feet, 44 square feet, and 4.5 square feet. What is the sum of our three simple shape?** [Pause] **Exactly! It is 51.5 square feet! You did it!** Objective 2: Find the area of a composite figure in a contextual problem. **You did a great job with that last problem! This next one is a little bit different.**	Student solves. Student solves. Student answers question. Objective 2: Students will use a chart in order calculate the area of a composite figure.

[Teacher reads problem aloud and displays on board.]
A banquet room is being carpeted. A floor plan of the room is shown at the right. Each unit represents 1 yard. The carpet costs $23.50 per square yard. How much will it cost to carpet the room?



Student reads and listens to question.

Let's start the problem by figuring out how many simple shapes make up this composite figure. How many do you see? [Pause] **I see three as well. I see a parallelogram on the left, a rectangle in the middle, and a small triangle to the bottom right.** [Teacher points to each of the shapes as they say them aloud.] **This time let's create a chart to help organize our work. Here is a chart that I believe will help us.** [Teacher displays chart and students copy it down.]

Student copies chart down.

Parallelogram	Rectangle	Triangle

In the next row put the area formulas for each of the shapes in the chart. [Teacher puts area formulas in the second row while students do the same.]

Student fills out table with teacher.

Parallelogram	Rectangle	Triangle
A = base x height	**A = length x width**	**Area = $\frac{1}{2}$ x Base x Height**

Next we need to find the various side lengths and heights of our various shapes. Since they are not given to us we will have to use the grid in order to count them. Can you count the number or grids there are to represent the base of the parallelogram? [Pause. After Pause teacher counts and points

Student calculates dimensions by counting.

to calculate the base of the parallelogram.] **1, 2, 3, 4! 4 yards is the length of the base. Next we will have to calculate the height of the parallelogram. Can you count to determine the height?** [Pause. After Pause teacher counts and points to calculate the height of the parallelogram.] **1, 2! The height is 2 yards! Now use your table to continue solving for the area of the parallelogram.** [Teacher fills out the first column as shown below as student does it on their paper.]

Parallelogram	Rectangle	Triangle
A = base x height	**A = length x width**	**Area = $\frac{1}{2}$ x Base x Height**
A = 4 yards x 2 yards		
A = 8 square yards		

Student continues to fill out table.

Great job! Now let's calculate the length and the width of the rectangle. Can you count those out using the chart paper? [Pause. After Pause teacher counts and points to calculate the length and height of the rectangle.] **1, 2, 3, 4, 5, 6! 6 yards is the length of the rectangle. 1, 2, 3, 4! 4 yards is the width of the rectangle. Use your chart to continue to solve the rectangle column!** [Teacher fills out the second column as shown below as student does it on their paper.]

Parallelogram	Rectangle	Triangle
A = base x height	**A = length x width**	**Area = $\frac{1}{2}$ x base x height**
A = 4 yards x 2 yards	**A = 6 yards x 4 yards**	
A = 8 square yards	**A = 24 square yards**	

The last simple shape that we must calculate is the triangle. Can you count to determine what the base length is and what the height is? [Pause. After Pause teacher counts and points to calculate the base and height of the triangle.] **1, 2. The height of the triangle is 2 yards. The base of the triangle is 1 yard. Finish your chart now that we know those two measurements!** [Teacher fills out the second column as shown below as student does it on their paper.]

Parallelogram	Rectangle	Triangle
A = base x height	**A = length x width**	**Area = $\frac{1}{2}$ x base x height**

Student finishes table.

A = 4 yards x 2 yards	**A = 6 yards x 4 yards**	**A = $\frac{1}{2}$ x 2 Yards x 1 yard**
A = 8 square yards	**A = 24 square yards**	**A = 1 square yard**

Great! You have solved for all for all of the simple shapes in the figure! What is the total area of the figure? [Pause] **33 square yards! Good job adding the 8, 24, and 1 correctly.**

If the carpet costs $23.50 per square yard and you have calculated that the area is 33 square yards, how much will it cost in order to carpet the room? [Pause] **Exactly!** [Teacher writes this equation as they say it on the board.] **Multiplying 33 by 23.50 will equal the total cost in order to carpet the banquet room. 33 times 23.50 equals $775.50! Awesome job with that problem! Let's keep going!**

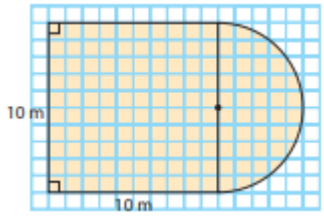
Student calculates final answer.

Guided Practice (10 minutes)

You have been doing such a great job helping me through these problems! Thank you very much for your help and answering the questions. Will you please help me with this one? [Pause] **Great let's do it!**

[I do]
[Teacher posts and reads problem aloud.]

Find the area of each figure. Use 3.14 for π.

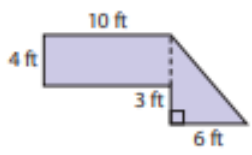


Student reads and listens to problem while thinking of possible strategies to use to solve.

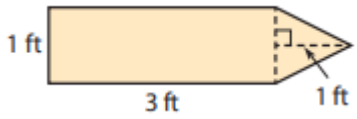
Let's figure out how many simple shapes are in our composite figure. How many simple shapes do you see? [Pause] **I see two different simple shapes.** [Teacher will point to each of the shapes as they reads the script.] **The two simple shapes that I see are a square and a half circle. Is that what you see?** [Pause] **Perfect! Now we have to calculate the areas of the two shapes.**

What is the area formula for a square? [Pause] **You got it! It's** $= (\boldsymbol{Side})^2$ **. What is one of the side lengths of the square?** [Pause] **10 meters great! Go ahead and calculate the area of**

Student answers prompts throughout problem.

the square! [Teacher will do this on the board as shown below as student does it on their paper.] $$Area = (side)^2$$ $$Area = (10m)^2$$ $$Area = 100\ square\ meters$$ **Excellent job! The area of the square portion is 100 square meters. Now you just have to find the area of the half circle.** **What is the area formula for a circle?** [Pause] **Yes! It is** $A = \pi r^2$**. You are getting these formulas down! What is the radius of the circular portion in our drawing?** [Pause] **Got it! Its 5 meters. Go ahead and solve like the entire circle is there and then you can make adjustments later.** [Teacher will do this on the board as shown below as student does it on their paper.] $$A = \pi r^2$$ $$A = \pi 5^2$$ $$A = 3.14\ (25)$$ $$A = 78.5\ square\ meters$$ **You are not quite done yet!** [Pause] **What does the 78.5 square meters actually represent?** [Pause] **The area of an entire circle! How much of the circle is represented in the drawing?** [Pause] **A half circle! What do we need to do in order to calculate the actual area according to the drawing?** [Pause] **Just divide it by 2 or multiply by a half! 78.5 square meters divided by 2 is equal to 39.25 square meters.** [Teacher writes 39.25 square meters on the board.]	Student calculates final answer.
What is the total area of the composite figure? [Pause] **You got it! Its 139.25 square meters. Good job!** **Here is another one for you to try!** [We do] [Teacher posts and reads aloud the problem.] **Erin wants to carpet the floor of her closet. The floor plan of the closet is shown. What is the area of her closet?**  	Student reads and listens to questions and thinks of possible strategies to use.

What is the first thing you need to do in order to help Erin calculate the area of her closet? [**Pause**] **You need to figure out how many simple shapes are in the composite figure! How many do you see?** [Pause] **Two! What are they?** [Pause] **A rectangle and a triangle. Excellent job! Now what are the two formulas you need in order to calculate the area of the rectangle and triangle?** [Pause] **The area formula for the rectangle is A = (Length) x (Width) and the triangle is $A = \frac{1}{2}(Base)(Height)$. Now all you have to do is figure out the dimensions of the two figures and substitute them into your formulas.** [Pause]	Student answers prompts throughout the question.
	Student writes down equations needed.
What is the length and width of the rectangle? [Pause] **You got it! The length is 10 feet and the width is 4 feet. What about the base and height of the triangle?** [Pause] **You got those too! The base is 6 feet and the height is 7 feet. How did you calculate the 7 feet for the height?** [Pause] **Right. You need to add the 3 feet to the 4 feet! Ok now let's calculate the areas. You do it on your paper and then we will compare answers in a minute.** [Teacher does work on the board as shown below while student does work on their paper.]	
$$Rectangle$$ $$\boldsymbol{Area = Lengh\ x\ width}$$ $$\boldsymbol{Area = 10\ feet\ x\ 4\ feet}$$ $$\boldsymbol{Area = 40\ square\ feet}$$	Student solves for area.
$$Triangle$$ $$\boldsymbol{Area = \frac{1}{2}(base)(height)}$$ $$\boldsymbol{Area = \frac{1}{2}(6\ feet)(7\ feet)}$$ $$\boldsymbol{Area = 21\ square\ feet}$$	
The last step in order to calculate the full area of the composite figure is to do what? [Pause] **Yes! Add the 21 square feet of the triangle to the 40 square feet of the square. This gives you what as a total amount of area?** [Pause] **Perfect! 61 square feet in total.**	Student calculates final answer.
You are doing great! Way to help Erin out! Try this next one!	
[You do] [Teacher reads problem and puts it up on the board.]	
Alex is making 12 pennants for the school fair. The pattern he is using to make the pennants is shown in the figure. The	Student reads and listens to questions and thinks of possible strategies to use.

fabric of the pennants cost $1.25 per square foot. How much will it cost Alex to make 12 pennants?  **How many simple shapes make up this composite figure?** [Pause] **Two is exactly correct! What two figures are they?** [Pause] **A rectangle and a triangle! Can you tell me the two formulas that you need to calculate their individual areas? Go ahead and write them down on your paper.** [Pause. Teacher writes formulas that are needed on the board.] **We need $Area = lengh\ x\ width$ and $Area = \frac{1}{2}\ (base)(height)$. What are the dimensions of the rectangle shown?** [Pause] **You got it! The width is 1 foot and the length is 3 feet.** [Teacher writes dimensions on board.] **What about the triangle?** [Pause] **That's correct! The base of the triangle is 1 foot and the height is 1 foot.** [Teacher writes dimensions on board.] **Can you calculate the areas on your paper? Great! Go ahead! If you get stuck use your previous examples to help you!** [Teacher does work on the board as shown below while student does work on their paper.]	Student answers prompts throughout the problem.
$$Rectangle$$ $$Area = Lengh\ x\ width$$ $$Area = 3\ feet\ x\ 1\ feet$$ $$Area = 3\ square\ feet$$ $$Triangle$$ $$Area = \frac{1}{2}\ (base)(height)$$ $$Area = \frac{1}{2}(1\ feet)(1\ feet)$$ $$Area = \frac{1}{2}\ square\ feet$$	Student solves for areas of simple shapes.
Did you get 3 square feet for the rectangle and $\frac{1}{2}$ square feet for the triangle? [Pause] **Excellent! What is the total area of the composite figure?** [Pause] **3.5 square feet is right!**	
The problem continues and tells us that Alex is making a total of 12 pennants therefore if one pennant is 3.5 square feet and Alex is making 12 of them how many total square feet of fabric will Alex need? [Pause. Teacher writes 12 times 3.5 on the board.] **We are going to multiply 12 times 3.5 in order to find out! 12 times 3.5 is 42 square feet so Alex's 12 pennants**	Student solves and makes sense of problem.

will need a total of 42 square feet of fabric. [Teacher writes 42 square feet on the board.] **The problem is asking how much it will cost Alex to make these pennants if they cost of fabric is $1.25 per square foot? From your calculations you know that he will need 42 square feet worth of fabric and if the fabric costs $1.25 per square foot then how much will Alex have to pay?** [Pause] **Can you solve it on your paper?** [Pause] **Great Go ahead and do so!** [Teacher does work on the board as shown below while student does work on their paper.] $$\boldsymbol{Total\ cost = 42\ square\ feet\ x\ \$1.25\ per\ foot}$$ $$\boldsymbol{Total\ cost = \$52.50}$$ **Did you get that it will cost Alex $52.50 to make the pennants?** [Pause] **Great! So did I! You did an awesome job with that problem and I believe you are starting to get the hang of these composite figures!** Additional problem if needed: A bookmark is shaped like a rectangle with a semicircle attached at both ends. The rectangle is 12 cm long and 4 cm wide. The diameter of each semicircle is the width of the rectangle. What is the area of the bookmark? Use 3.14 for π.	
Independent Practice (1 min) **Great work, 7th grade! Today we worked on using different strategies in order to solve for composite figures. You sure did a great job! After the video, you will have some problems to practice on your own. I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, www.tn.gov/education.** [Teacher shows student practice page under document camera or camera zooms in on student practice page.]**Good luck and do your best!**	
Closing (1 min) **I enjoyed reviewing finding unit rates with ratios of fractions, and use them to solve multi-step problems 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!**	