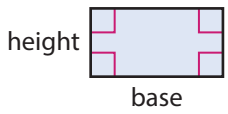
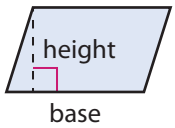
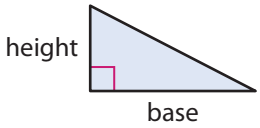
LESSON 2

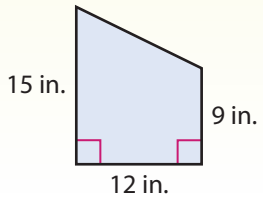
Dear Family,

This week your student is learning to find the area of triangles and other polygons. You can use formulas to find the area of some polygons.

Rectangle	Parallelogram	Triangle
		
$A = bh$	$A = bh$	$A = \frac{1}{2}bh$

The area of other polygons can be found by breaking apart, or decomposing, the shape into triangles, rectangles, and parallelograms. Your student will be learning to solve problems like the one below.

What is the area of the polygon?



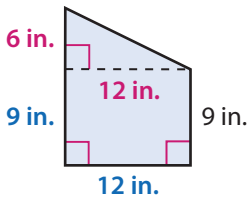
➤ **ONE WAY** to find the area of a polygon is to decompose the shape and add areas.

Area of polygon = Area of rectangle + Area of triangle

$= 12 \cdot 9 + \frac{1}{2}(12 \cdot 6)$

$= 108 + 36$

$= 144$



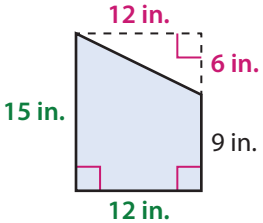
➤ **ANOTHER WAY** is to subtract areas.

Area of polygon = Area of rectangle − Area of triangle

$= 12 \cdot 15 - \frac{1}{2}(12 \cdot 6)$

$= 180 - 36$

$= 144$



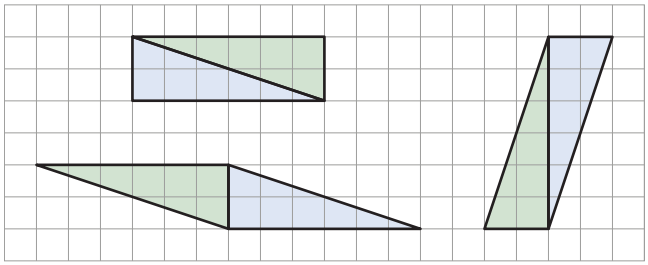
Using either method, the area of the polygon is 144 in.^{2}.

Use the next page to start a conversation about triangles.

Activity Exploring Triangles and Parallelograms

➤ **Do this activity together to investigate the relationship between triangles and parallelograms.**

Have you noticed that a parallelogram can be decomposed into two identical triangles? You can also arrange two identical triangles into a parallelogram. Look at each shape below. What similarities and differences do you notice?



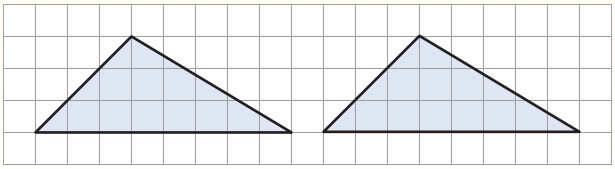
? What are other ways you can arrange two triangles?

Explore The Area of a Triangle

Previously, you learned about finding the area of a parallelogram. In this lesson, you will learn about finding the area of a triangle.

➤ **Use what you know to try to solve the problem below.**

Caitlyn has two decals shaped like the triangles shown. She arranges them on the back of her skateboard to form a parallelogram. Each grid square represents 1 square inch. What area do the two decals cover?



TRY IT

Math Toolkit grid paper, tracing paper, unit tiles

DISCUSS IT

Ask: What did you do first to find the area that the decals cover? Why?

Share: I started by . . . because . . .

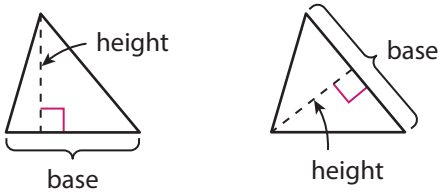
Learning Target SMP 1, SMP 2, SMP 3, SMP 4, SMP 5, SMP 6, SMP 7

Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

CONNECT IT

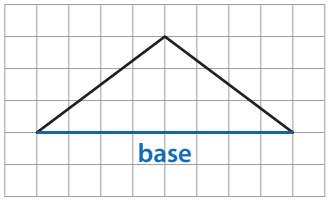
1 Look Back What area do Caitlyn's two decals cover? Explain how you know.

2 Look Ahead As in a parallelogram, the **base** and **height of a triangle** are perpendicular. Any side of a triangle can be called the base. The corresponding height is drawn from the vertex that is opposite the base.

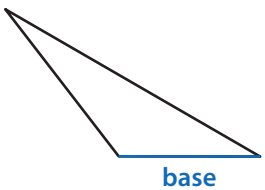


a. Use the triangle at the right. Draw the height that corresponds to the side labeled as the base. Then write the lengths of the base and height.

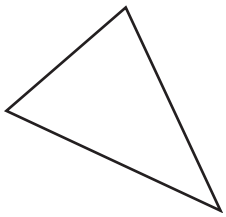
base = _____ units height = _____ units



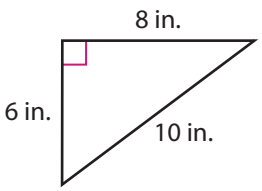
b. Use the triangle at the right. Draw the height that corresponds to the side labeled as the base.



c. Choose one side of the triangle at the right to be the base of the triangle. Then draw the height that corresponds to that base. Label the base *b* and the height *h*.



3 Reflect Look at the right triangle. Which pair of sides can be called a base and height for the triangle? Explain.



 Name:

Prepare for Finding the Area of Triangles and Other Polygons

1 Think about what you know about parallelograms. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

In My Own Words

My Illustrations

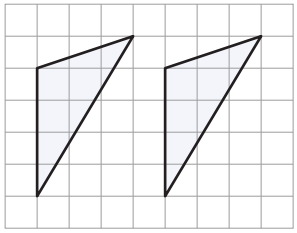
parallelogram

Examples

Non-Examples

2 Is this polygon a parallelogram? Explain.

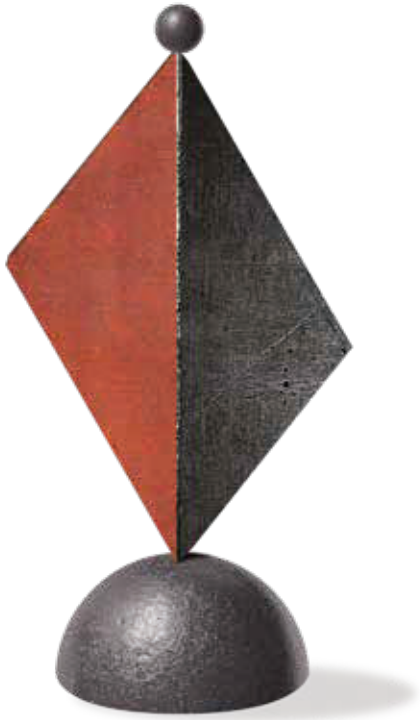
3 An artist makes a sculpture by joining together two triangular pieces of metal to form a parallelogram. The shape of the triangles is shown below. Each grid square represents 1 square foot.



a. What is the area of the parallelogram that the artist makes? Show your work.

SOLUTION _____

b. Check your answer to problem 3a. Show your work.

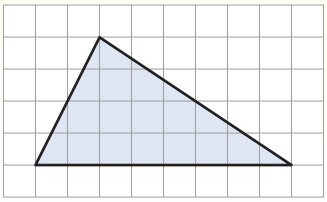


Develop Finding the Area of a Triangle

➤ **Read and try to solve the problem below.**

Maria's class is painting a mural on a school wall. Staff at an Acoma cultural center help Maria copy an Acoma Pueblo pottery design to use in the mural.

Maria draws her design on 1-centimeter grid paper. She begins with one of the triangles. What is the area of Maria's triangle?



TRY IT

Math Toolkit grid paper, tracing paper, unit tiles

DISCUSS IT

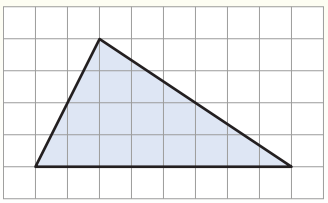
Ask: How is your strategy for finding the area similar to mine?

Share: My strategy is similar to yours because . . .

➤ **Explore different ways to find the area of a triangle.**

Maria's class is painting a mural on a school wall. Staff at an Acoma cultural center help Maria copy an Acoma Pueblo pottery design to use in the mural.

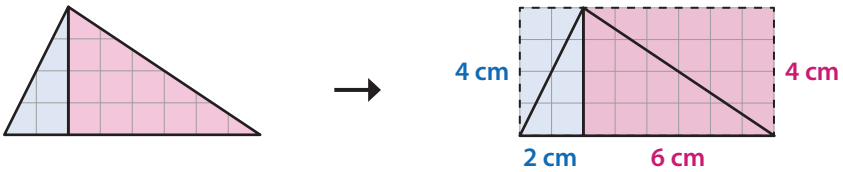
Maria draws her design on 1-centimeter grid paper. She begins with one of the triangles. What is the area of Maria's triangle?



Model It

You can find the area of a triangle by decomposing it into two right triangles.

Think of each right triangle as one half of a rectangle.

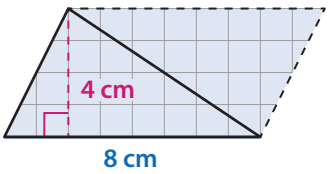


Write an expression for the area of Maria's triangle.

$\frac{1}{2}(2 \cdot 4) + \frac{1}{2}(6 \cdot 4)$

Model It

You can find the area of a triangle by composing the triangle with a copy of itself to form a parallelogram.



The area of the triangle is half the area of the parallelogram.

$A = \frac{1}{2}(8 \cdot 4)$

CONNECT IT

Use the problem from the previous page to help you understand how to find the area of a triangle.

1. How can thinking of a right triangle as half of a rectangle help you find the area of the right triangle?

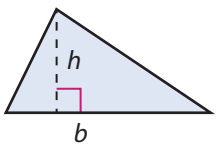
2. Look at the expression in the first **Model It**.

   a. What does the product $\frac{1}{2}(2 \cdot 4)$ represent? How do you know?

   b. Use the expression to find the area of Maria's triangle.

3. Look at the second **Model It**. How are the base and height of Maria's triangle related to the base and height of the parallelogram? Explain.

4. The formula for the area of a parallelogram is $A = bh$. Explain why the formula for the area of a triangle is $A = \frac{1}{2}bh$.

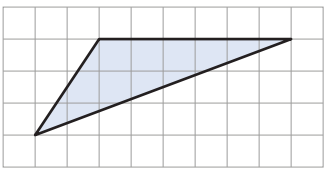


5. **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to find the area of a triangle.

Apply It

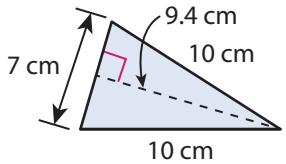
Use what you learned to solve these problems.

6 Forest managers plant trees in a triangular section of a state park. The managers model the area on grid paper. Each grid square represents 1 km^2. What is the area of the section that the forest managers plant with trees? Show your work.



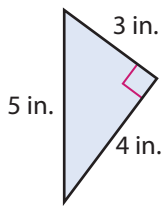
SOLUTION

7 What is the area of the triangle? Show your work.



SOLUTION

8 Elena claims that the expression $\frac{1}{2}(4)(5)$ represents the area of the triangle, in square inches. Explain why Elena is not correct. Then explain how to correct her error and find the area of the triangle.

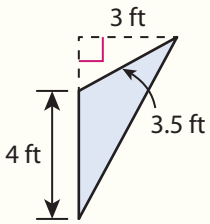


Practice Finding the Area of a Triangle

➤ **Study the Example showing how to find the area of a triangle. Then solve problems 1–5.**

Example

Students in an art club are painting a design on a wall of their school. Rodrigo paints the triangle shown. What is the area of the triangle?



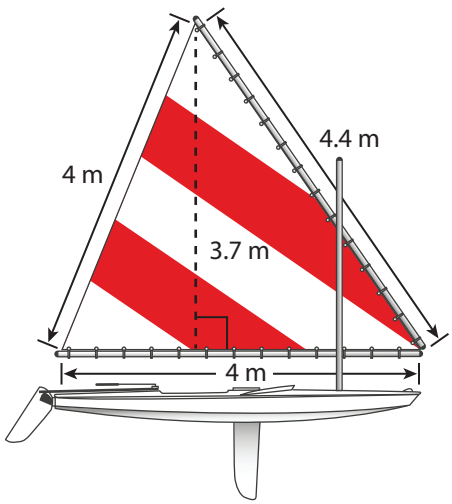
You can use a formula to find the area. Use the side labeled **4 ft** as the base. Then the height is **3 ft**.

$$A = \frac{1}{2}bh$$
$$= \frac{1}{2}(4)(3)$$
$$= \frac{1}{2}(12)$$
$$= 6$$

The area of the triangle is 6 ft^2.

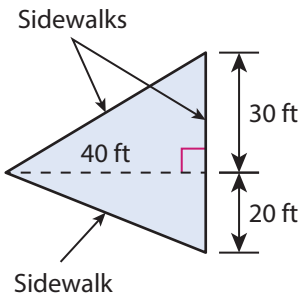
1 Suppose the height of Rodrigo's triangle in the Example is doubled. Will the area of the triangle also double? Explain how you know.

2 A sail on a boat is shaped like a triangle as shown. What is the area of the sail? Show your work.



SOLUTION _____

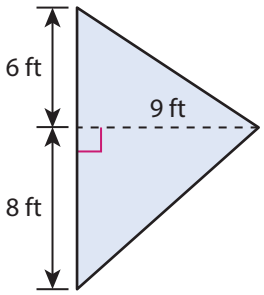
3 **a.** Three sidewalks in a schoolyard form a triangle. Explain how the expression $\frac{1}{2}(40)(30) + \frac{1}{2}(40)(20)$ represents the area inside the three sidewalks.



b. What is the area inside the sidewalks? Show your work.

SOLUTION

4 Which expressions represent the area of the triangle in square feet? Select all that apply.



A $\frac{1}{2} \cdot 48 \cdot 9$

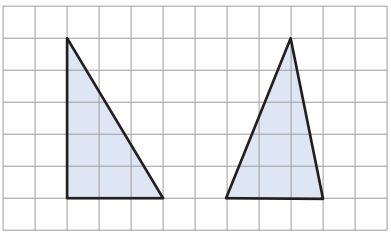
B $\frac{1}{2}(6 + 8)(9)$

C $(14 \cdot 9) \div 2$

D $\frac{1}{2}(6)(9) + \frac{1}{2}(8)(9)$

E $(6)(9) + (8)(9) \div 2$

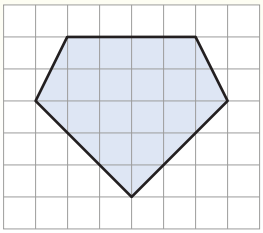
5 Explain how you know that the two triangles have the same area.



Develop Finding the Area of a Polygon

Read and try to solve the problem below.

A costume designer is making a superhero costume for a movie. The costume will have a logo on the front. The designer draws a plan for the logo on 1-inch grid paper. What is the area of the logo in the drawing?



TRY IT

Math Toolkit grid paper, tracing paper, unit tiles

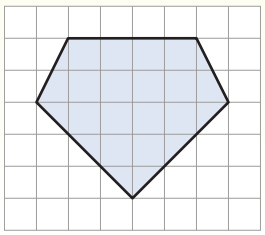
DISCUSS IT

Ask: Why did you choose that strategy to find the area of the logo?

Share: I chose that strategy because . . .

➤ **Explore different ways to find the area of a polygon.**

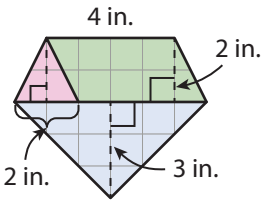
A costume designer is making a superhero costume for a movie. The costume will have a logo on the front. The designer draws a plan for the logo on 1-inch grid paper. What is the area of the logo in the drawing?



Model It

You can find the area of a polygon by using addition.

Decompose the logo into two triangles and a parallelogram.



Shape	Formula	Area
Large triangle	$A = \frac{1}{2}bh$	$\frac{1}{2}(6)(3) = 9$
Small triangle	$A = \frac{1}{2}bh$	$\frac{1}{2}(2)(2) = 2$
Parallelogram	$A = bh$	$(4)(2) = 8$

Write an addition expression for the area of the logo.

Area of the logo $= 9 + 2 + 8$

Model It

You can find the area of a polygon by using subtraction.

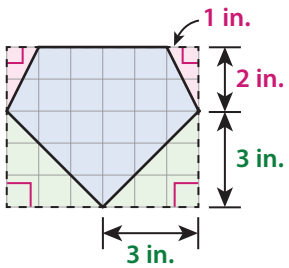
Draw a rectangle around the logo.

The rectangle is composed of the shape of the logo and four right triangles.

Write a subtraction expression for the area of the logo.

$(6 \cdot 5) - 2 \cdot \left(\frac{1}{2} \cdot 3 \cdot 3\right) - 2 \cdot \left(\frac{1}{2} \cdot 1 \cdot 2\right)$

Area of the logo $= 30 - 9 - 2$



CONNECT IT

➤ **Use the problem from the previous page to help you understand how to find the area of a polygon.**

1. Look at the first **Model It**. Why might you choose to divide the logo into triangles and a parallelogram?

2. Look at the expression in the second **Model It**. The product $6 \cdot 5$ represents the area of the rectangle. What does the product $2 \cdot \left(\frac{1}{2} \cdot 3 \cdot 3\right)$ represent? Why is this product subtracted from the area of the rectangle?

3. What is the area of the logo? How is the strategy of adding to find the area similar to the strategy of subtracting to find the area? How are these strategies different?

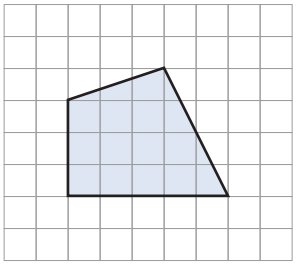
4. How can you find the area of a polygon when you do not know a formula for the area of that polygon?

5. **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to find the area of a polygon.

Apply It

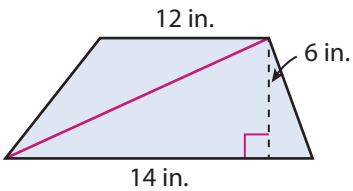
Use what you learned to solve these problems.

6 What is the area of the polygon in square units? Show your work.

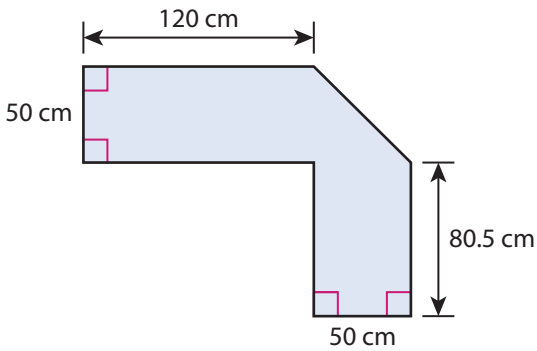


SOLUTION

7 To find the area of a trapezoid, Badru decomposes it into two triangles as shown. He says the area of the trapezoid is two times the area of the top triangle. Is Badru correct? Why or why not?



8 The polygon represents the top of a desk. What is the area of the top of the desk? Show your work.



SOLUTION

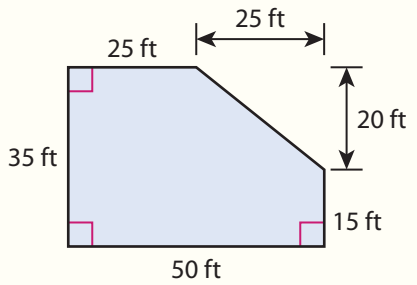
Practice Finding the Area of a Polygon

➤ **Study the Example showing how to find the area of a polygon. Then solve problems 1–5.**

Example

The polygon represents the floor space of a clothing store in a mall. How many square feet of floor space does the store have?

Decompose the polygon into two rectangles and a triangle.



Area of top rectangle

$bh = (25)(20) = 500$

Area of bottom rectangle

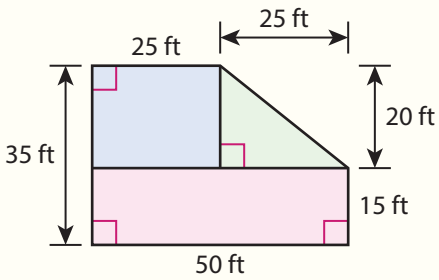
$bh = (50)(15) = 750$

Area of triangle

$\frac{1}{2}bh = \frac{1}{2}(25)(20) = 250$

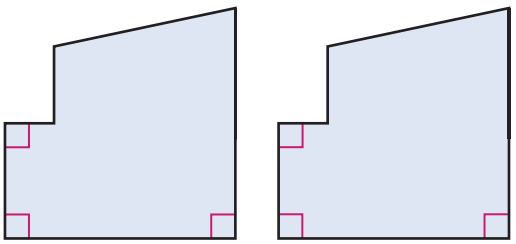
Total area: $500 + 750 + 250 = 1{,}500$

The store has 1,500 ft^2 of floor space.

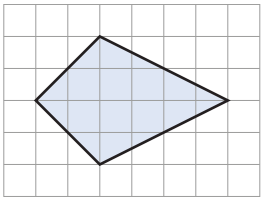


1. Show another way to find the number of square feet of floor space for the store in the Example.

2. Teresa wants to find the area of a wall in her attic. The wall is shaped like the polygons at the right. Show two different ways Teresa could decompose the wall into triangles, rectangles, or both.

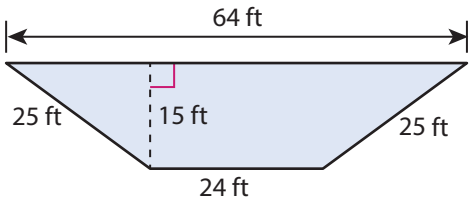


3 What is the area of the polygon? Show your work.



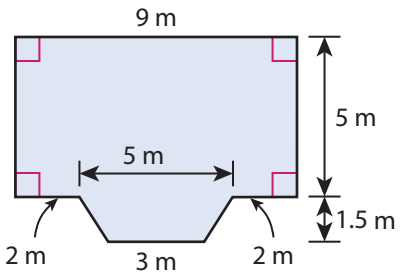
SOLUTION _____

4 A tarp covers the grass on part of a baseball field during batting practice. The tarp is shaped like the trapezoid at the right. What is the area of the tarp? Show your work.



SOLUTION _____

5 A stage for a concert is shaped like the polygon shown. What is the area of the stage? Show your work.



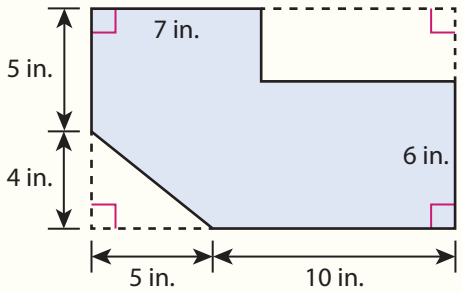
SOLUTION _____

Refine Finding the Area of Triangles and Other Polygons

➤ **Complete the Example below. Then solve problems 1–9.**

Example

Rachel has a poster board. She cuts away a triangle and a rectangle from two corners. What is the area of the poster board that remains?



Look at how you could use a table to organize your work.

	Base	Height	Area
Poster board	5 + 10 = 15	4 + 5 = 9	15 • 9 = 135
Triangle	5	4	$\frac{1}{2}$ • 5 • 4 = 10
Rectangle	15 – 7 = 8	9 – 6 = 3	8 • 3 = 24
Remaining area			135 – 10 – 24

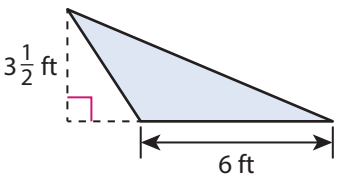
SOLUTION _____

CONSIDER THIS . . .
You can use lengths you know to find lengths that are not labeled.

PAIR/SHARE
How could you solve the problem another way?

Apply It

1 Find the area of the triangle. Show your work.

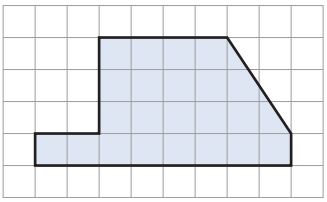


SOLUTION _____

CONSIDER THIS . . .
How can you multiply a mixed number by a whole number?

PAIR/SHARE
How would your answer change if the base of the triangle were 3 ft instead of 6 ft?

2 Each grid square represents 1 cm^2. What is the area of the polygon? Show your work.

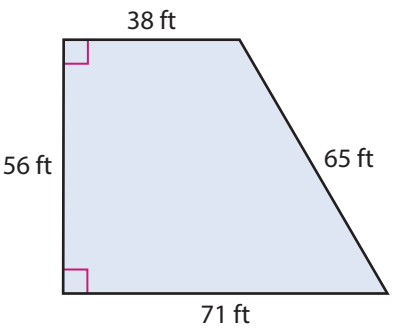


CONSIDER THIS . . .
How could you use subtraction to help you find the area?

PAIR/SHARE
What other strategy could you use to find the area of the polygon?

SOLUTION

3 The carpet in a school library needs to be replaced. The dimensions of the library floor are shown. Each square foot of new carpet costs $1.25. What is the total cost of the new carpet for the library?



A $3,052

B $3,815

C $4,970

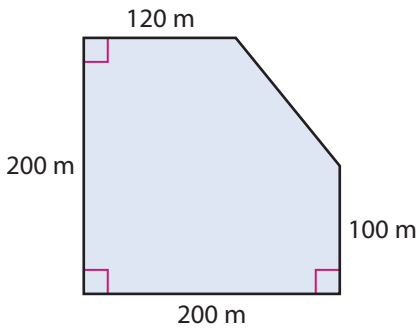
D $5,145

Daniel chose A as the correct answer. How might he have gotten that answer?

CONSIDER THIS . . .
How can you use the cost for each square foot to find the total cost?

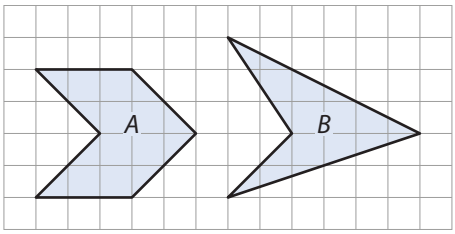
PAIR/SHARE
How can you check your answer?

4 A rancher has a field in the shape of the polygon shown. The rancher plans to keep one sheep in the field for every 2,000 m^2. Based on this plan, how many sheep can the rancher keep in the field? Show your work.



SOLUTION

5 What is the difference between the area of Figure *A* and the area of Figure *B*? Each grid square represents 1 square foot.



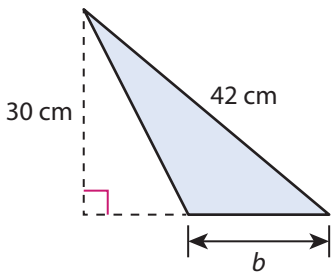
A 2 ft^2

B 4 ft^2

C 8 ft^2

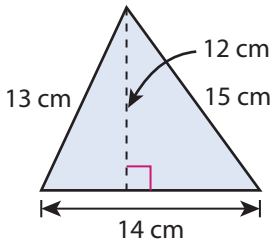
D 10 ft^2

6 The height of the triangle is 12 cm greater than the base of the triangle, *b*. What is the area of the triangle? Show your work.



SOLUTION

7 Seth is making panes for a stained-glass window. He makes a triangular pane shaped like the triangle shown. Which of these rectangular panes has the same area as the triangular pane? Select all that apply.



A a 12-cm by 7-cm rectangle

B a 15-cm by 7-cm rectangle

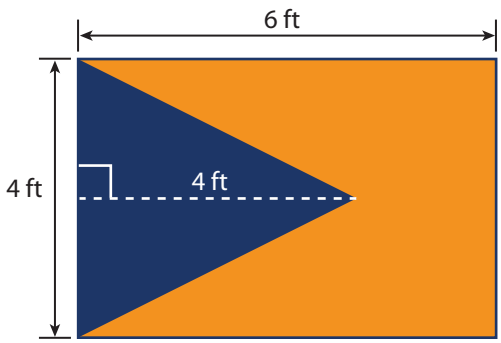
C a 21-cm by 4-cm rectangle

D a 21-cm by 8-cm rectangle

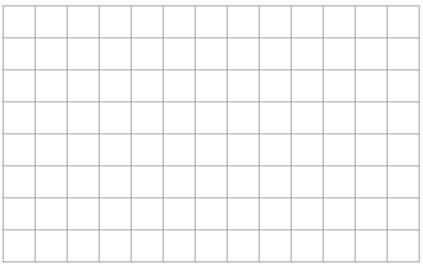
E a 28-cm by 6-cm rectangle

8 Jaime makes a rectangular flag in his school colors.

One section of the flag is a triangle. He says the area of the triangle is $\frac{16}{24}$ of the area of the flag. Do you agree? Explain.



9 **Math Journal** Draw a polygon with at least 5 sides on the grid. Show one way to find the area of your polygon.



End of Lesson Checklist

- ☐ **INTERACTIVE GLOSSARY** Write a new entry for *represent*. Tell what you do when you use an expression to *represent* the area of a triangle.
- ☐ **SELF CHECK** Go back to the Unit 1 Opener and see what you can check off.