LESSON

13.4 Area of Polygons

COMMON CORE 6.G.1

Find the area of ... polygons by composing into rectangles or decomposing into triangles and other shapes ....

ESSENTIAL QUESTION

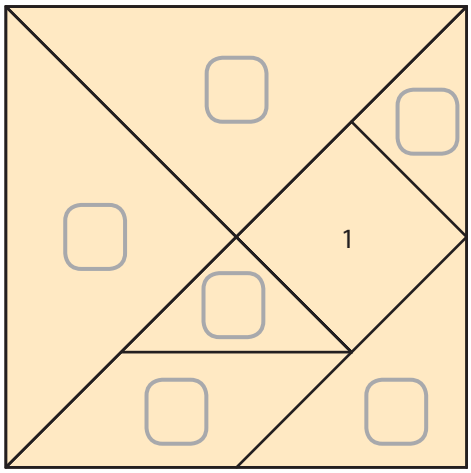
How can you find the area of a polygon by breaking it into simpler shapes?

EXPLORE ACTIVITY Real World

COMMON CORE 6.G.1

Finding Areas Using Tangrams

A tangram is a square that is divided into smaller shapes. The area of the small square is 1 square unit. Use a tangram to find the area of each of the other tangram pieces.



A Place one large triangle on top of the other large triangle. What is true about these two triangles? What does this mean about the areas of these two triangles?

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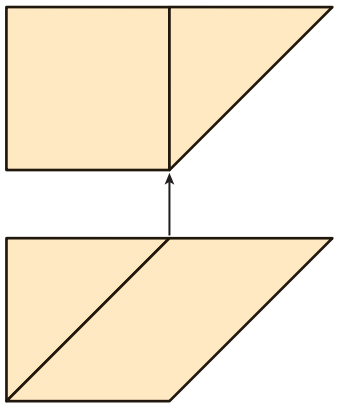
B Place the two small triangles on top of the square. What is the area of each small triangle? Write this area on the diagram. _____

C Arrange the square and one of the small triangles as shown.

What is the combined area? _____



Place the parallelogram and the other small triangle on top of the combined square and triangle. What is the area of the parallelogram? Explain.

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_____

Reflect

1. **Critical Thinking** Complete the rest of the diagram by filling in the remaining areas. Explain how you found your answers.

_____

_____

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Finding Areas of Polygons

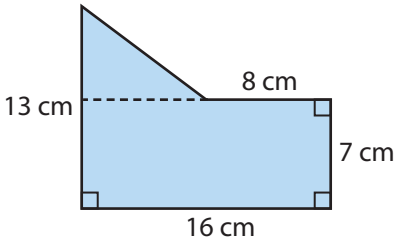
You can find the areas of polygons by breaking the polygons into smaller shapes. Then you can apply area formulas you already know.

EXAMPLE 1

COMMON CORE 6.G.1

Find the area of each polygon.

A **STEP 1** Draw a horizontal line segment on the diagram that divides the polygon into a rectangle and a triangle.



STEP 2 Find the area of the rectangle.

$A = bh = 16 \cdot 7 = \mathbf{112}$ square centimeters

STEP 3 Find the area of the triangle.

$b = 16 - 8 = 8$ $\quad h = 13 - 7 = 6$

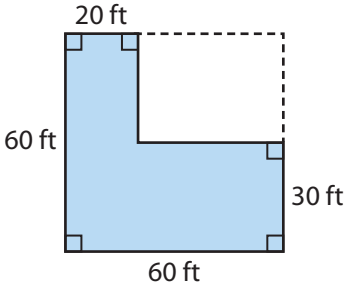
$A = \frac{1}{2}bh = \frac{1}{2} \cdot 8 \cdot 6 = \mathbf{24}$ square centimeters

STEP 4 Add the areas from Steps 2 and 3 to find the total area.

$A = \mathbf{112} + \mathbf{24} = 136$ square centimeters

Math Talk
Mathematical Practices
What other shapes could you divide the polygon in **A** into? What formulas would you use?

B **STEP 1** Extend the top edge and the right edge of the polygon to form a square with side length 60 feet. Find the area of this square.



$60 \cdot 60 = \mathbf{3600}$ square feet

STEP 2 Notice that the square you drew has a rectangular "missing piece." Find the area of this missing piece.

$b = 60 - 20 = 40$ $\quad h = 60 - 30 = 30$

$A = bh = 40 \cdot 30 = \mathbf{1200}$ square feet

STEP 3 Subtract the area in Step 2 from the area in Step 1.

$A = \mathbf{3600} - \mathbf{1200} = 2400$ square feet

Reflect

2. Describe another way to find the area of the polygon in **B**.

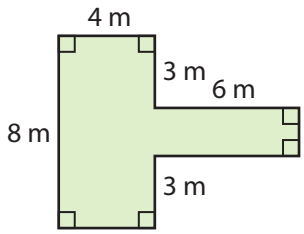
_____

_____

YOUR TURN

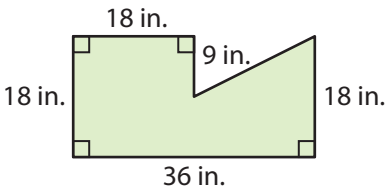
Find the area of each polygon.

3.



$A =$ _____ square meters

4.



$A =$ _____ square inches

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Solving Real-World Problems

You can apply the technique of dividing a shape into smaller shapes in problems that involve finding area.

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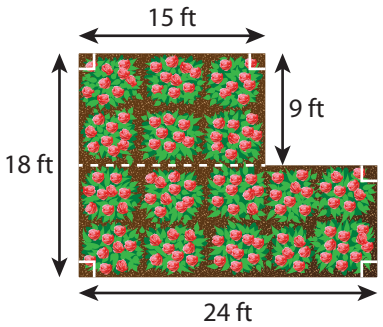
EXAMPLE 2

Real World

COMMON CORE 6.G.1

The diagram shows the shape and dimensions of Teresa's rose garden.



A Find the area of the garden.

STEP 1 Draw a horizontal line segment on the diagram that divides the polygon into two rectangles, one on top of the other.

STEP 2 Find the area of the smaller (top) rectangle.

$A = bh = 15 \cdot 9 = \mathbf{135}$ square feet

STEP 3 Find the area of the larger (bottom) rectangle.

The base of the larger rectangle is 24 feet.

The height is $18 - 9 = 9$ feet.

$A = bh = 24 \cdot 9 = \mathbf{216}$ square feet

STEP 4 Add the areas from Steps 2 and 3 to find the total area.

$A = \mathbf{135} + \mathbf{216} = 351$ square feet

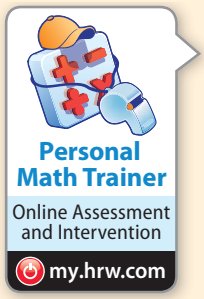
The area of the garden is 351 square feet.

B Teresa wants to buy mulch for her garden. One bag of mulch covers 12 square feet. How many bags will she need?

$\frac{351 \text{ square feet}}{12 \text{ square feet}} = 29.25$ *Divide to find the number of bags needed.*

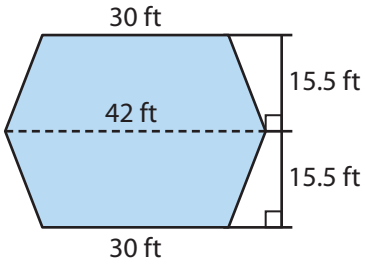
Teresa will need to buy 30 bags of mulch.

My Notes



YOUR TURN

5. The diagram shows the floor plan of a hotel lobby. Carpet costs $3 per square foot. How much will it cost to carpet the lobby?



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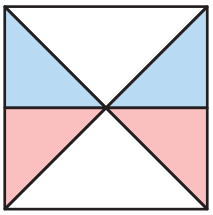
Guided Practice

1. In the diagram, the area of the large square is 1 square unit. Two diagonal segments divide the square into four equal-sized triangles. Two of these triangles are divided into smaller red and blue triangles that all have the same height and base length. Find the area of a red triangle. (Explore Activity)



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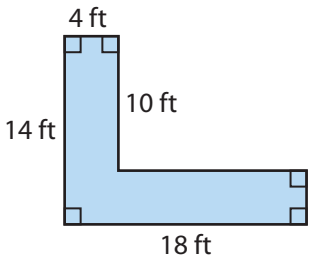
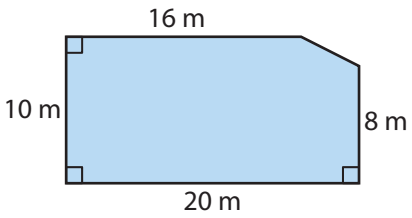
Find the area of each polygon. (Example 1)

2.



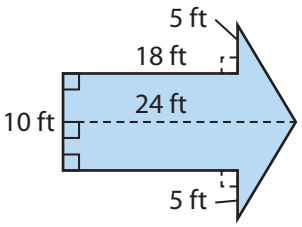
$A =$ _____ square feet

3.



$A =$ _____ square meters

4. Jess is painting a giant arrow on a playground. Find the area of the giant arrow. If one can of paint covers 100 square feet, how many cans should Jess buy? (Example 2)



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ESSENTIAL QUESTION CHECK-IN

5. How can you find the area of a polygon that is not one for which you know an area formula?

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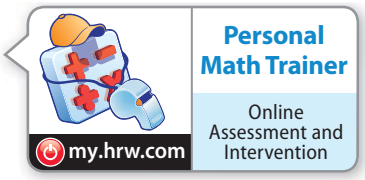
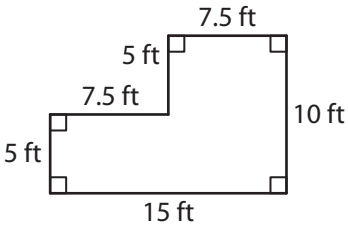
Name _____ Class _____ Date _____

13.4 Independent Practice

COMMON CORE 6.G.1



6. Alice wants to put wall-to-wall carpeting in a small room with the floor plan shown.



a. Alice says she can find the area of the room by dividing the floor plan into two trapezoids. Show how she can divide the floor plan. Then find the area using her method.

_____

b. Describe another way to find the area.

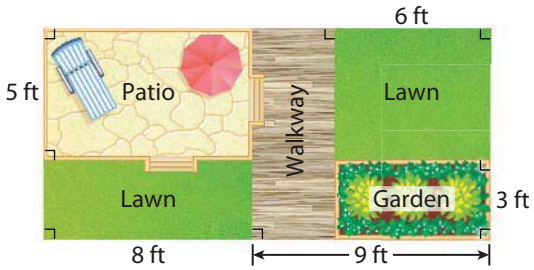
_____

_____

c. How much will Alice pay for carpet that costs $4.50 per square foot?

_____

7. Hal's backyard has a patio, a walkway, and a garden.



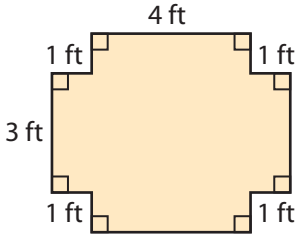
a. About what percent of the total area of Hal's backyard is the area taken up by the patio, walkway, and garden? Round to the nearest whole percent.

_____

b. One longer side of Hal's backyard lies next to the back of his house. Hal wants to build a fence that costs $9.75 per foot around the other three sides. How much will Hal spend on his new fence?

_____

8. The students in a furniture-making class make a tabletop shaped like the figure shown.



a. What is the area of the tabletop?

_____

b. One of the students wants to make a tabletop shaped like a right triangle. This tabletop will have the same area as the tabletop shown. What are a set of possible lengths for the sides of the tabletop that meet in a right angle? Explain.

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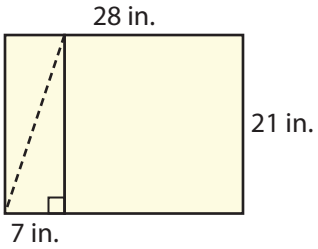
9. **Multistep** Cho is making banners shaped like triangles out of a rectangular piece of fabric. She cuts out two triangular banners as shown.



a. What is the area of a triangular banner?

_____

b. What are the dimensions of the fabric left over after Cho cuts out the two banners?

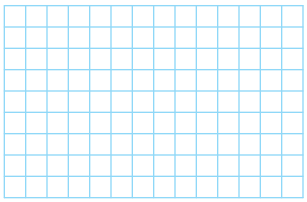
_____

c. What is the maximum number of banners that Cho can cut out from the fabric? Will she use all the fabric?

_____

H.O.T. FOCUS ON HIGHER ORDER THINKING

10. **Persevere in Problem Solving** The base of a parallelogram is 8 units, and the height is 5 units. A segment divides the parallelogram into two identical trapezoids. The height of each trapezoid is 5 units. Draw the parallelogram and the two trapezoids on the grid shown. Then find the area of one of the trapezoids.



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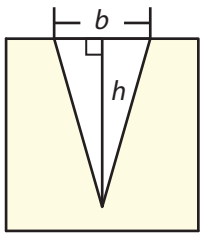
11. **Persevere in Problem Solving** The figure shown is a square with a triangular hole cut into one side. The ratio of the height h of the triangle to a side length of the square is 7 to 8. The ratio of the base b of the triangle to the side length of the square is 1 to 2. If the area of the square is 64 square inches, what is the area of the shaded part of the square? Show your work.



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Work Area