

Lesson 7-4

Find Areas of Polygons

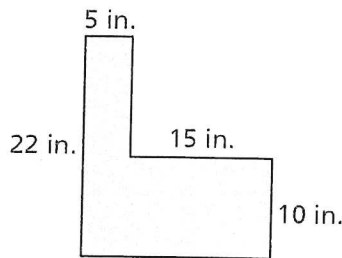
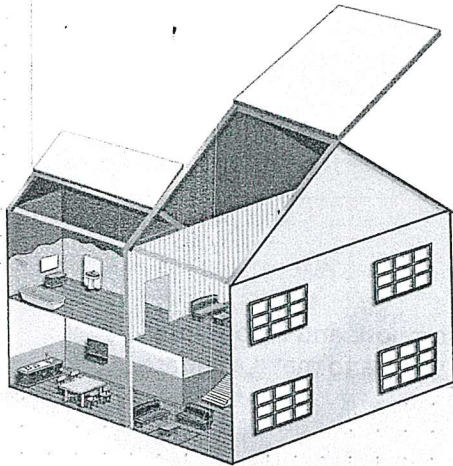


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Solve & Discuss It!



Gabrielle wants to cover the floors of a room and a hallway in her dollhouse. She measured the room and hallway and sketched the floor plan below. How much felt does Gabrielle need?



Make Sense and Persevere

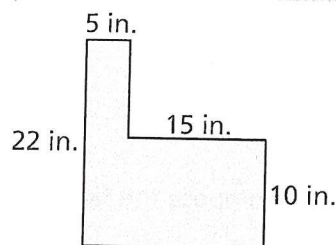
How can you decompose the sketch into regular shapes?

I can...
find the areas of polygons.

MAFS.6.G.1.1 Find the area of... 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. Also 6.EE.1.2c, 6.G.1.3, 6.NS.3.6c, 6.NS.3.8
MAFS.K12.MP.1.1, MP.4.1, MP.6.1, MP.7.1

Focus on math practices

Make Sense and Persevere Show another way to find the area of the sketch.



Essential Question How can you find the areas of polygons?



VISUAL LEARNING



ASSESS

EXAMPLE 1

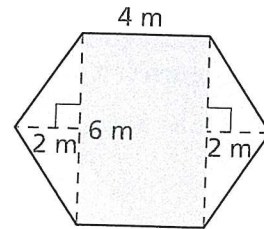


Decompose to Find the Total Area

Scan for Multimedia



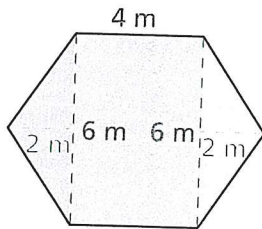
Denise is building a patio in her backyard as shown in the diagram. She needs to know the area before she orders patio tiles. What is the area of the patio?



Use Structure How can you use shapes you know to help you find the area?

ONE WAY

Decompose the polygon into a rectangle and two identical triangles.



Find the area of each shape.

Each Triangle

$$\begin{aligned} A &= \frac{1}{2}bh \\ &= \frac{1}{2}(6 \cdot 2) \\ &= 6 \end{aligned}$$

Rectangle

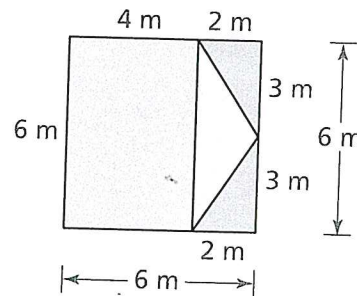
$$\begin{aligned} A &= \ell w \\ &= 6 \cdot 4 \\ &= 24 \end{aligned}$$

Add the areas: $6 + 6 + 24 = 36$.

The area of the patio is 36 m^2 .

ANOTHER WAY

Decompose and recompose the shapes to make a square.



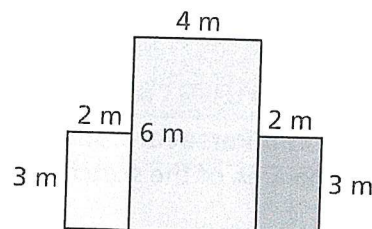
Find the area of the square.

$$\begin{aligned} A &= \ell w \\ &= 6 \cdot 6 \\ &= 36 \end{aligned}$$

The area of the patio is 36 m^2 .

Try It!

Shari found the area of the patio by composing the shapes as shown at the right. How is Shari's strategy different?



Convince Me! How could you decompose the figure in the Try It! into two rectangles?



EXAMPLE 2



Subtract to Find the Total Area



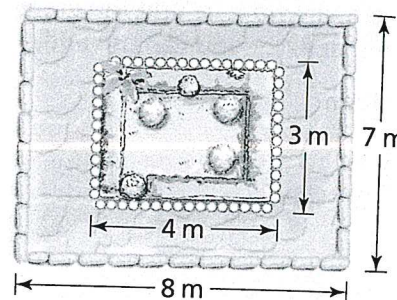
ACTIVITY



ASSESS

The Robinsons are planning to resurface the path that surrounds their garden, as shown. What is the area of the path?

Make Sense and Persevere The area of the path can be found by subtracting the area of the garden from the total area of the garden and the path.



STEP 1 Find the total area of the garden and the path.

$$\begin{aligned} A &= \ell w \\ &= 8 \times 7 \\ &= 56 \text{ m}^2 \end{aligned}$$

STEP 2 Find the area of the garden.

$$\begin{aligned} A &= \ell w \\ &= 4 \times 3 \\ &= 12 \text{ m}^2 \end{aligned}$$

STEP 3 Subtract the area of the garden from the total area of the garden and the path.

$$\begin{aligned} 56 - 12 &= 44 \\ \text{The area of the path is } &44 \text{ m}^2. \end{aligned}$$

EXAMPLE 3



Find the Area of a Polygon on the Coordinate Plane

The floor plan for a new stage at a school is sketched on a coordinate plane. A flooring expert recommends bamboo flooring for the stage floor. How much bamboo flooring, in square meters, does the school need?

STEP 1 Decompose the polygon. Find the needed dimensions.

STEP 2 Find the area of each part.

Right Triangle

$$\begin{aligned} A &= \frac{1}{2}bh \\ &= \frac{1}{2} \cdot 5 \cdot 4 \\ &= 10 \end{aligned}$$

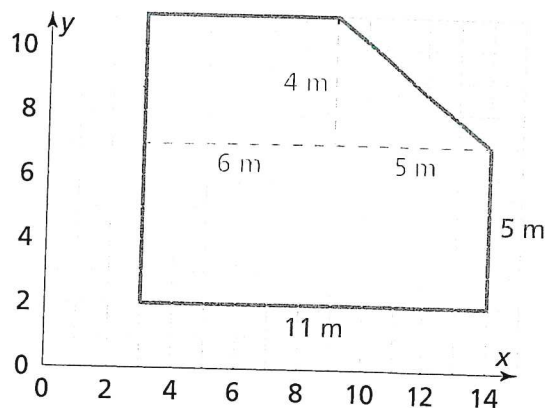
Rectangles

$$\begin{aligned} A &= \ell w & A &= \ell w \\ &= 6 \cdot 4 & &= 11 \cdot 5 \\ &= 24 & &= 55 \end{aligned}$$

Add the areas: $10 + 24 + 55 = 89$

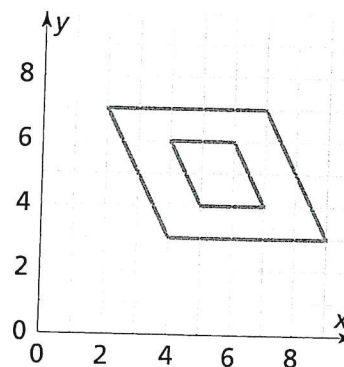
The school needs 89 m^2 of bamboo flooring.

Each square represents 1 square meter.



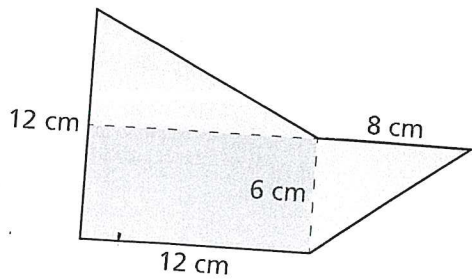
Try It!

Find the area of the shaded region in square units.



There are many ways to find the area of a polygon. You can decompose or compose shapes, or you can use addition or subtraction, to calculate the area.

Use Addition



Blue triangle: $A = \frac{1}{2}(12)(6) = 36$

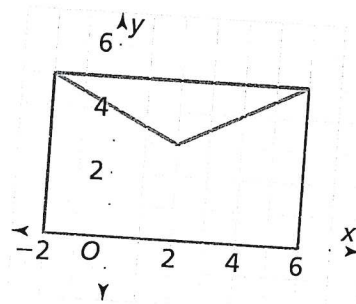
Green triangle: $A = \frac{1}{2}(8)(6) = 24$

Rectangle: $A = (12)(6) = 72$

$36 + 24 + 72 = 132$

The area of the polygon is 132 cm^2 .

Use Subtraction



Draw a rectangle around the polygon.

Rectangle: $A = 8 \times 4 = 32$

Triangle: $A = \frac{1}{2} \times 4 \times 4 = 8$

$32 - 8 = 24$

The area of the polygon is 24 square units.

Do You Understand?

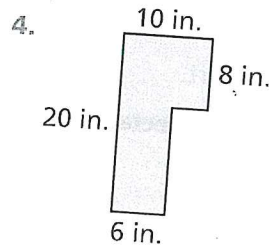
1. **Essential Question** How can you find the areas of polygons?

2. Describe a way in which you can use subtraction to find the area of the shape in Exercise 4.

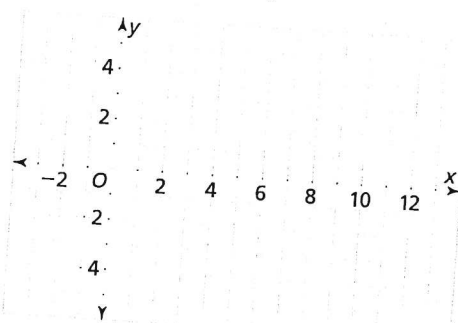
3. **Model with Math** Describe how to break the floor plan in Example 3 into a trapezoid and a rectangle. Use coordinates to describe the line you can draw.

Do You Know How?

In 4 and 5, find the area of each polygon.



5. A polygon with vertices at $(6, 2)$, $(9, 5)$, $(12, 2)$, $(12, -4)$, and $(6, -4)$



Name: _____



PRACTICE



TUTORIAL

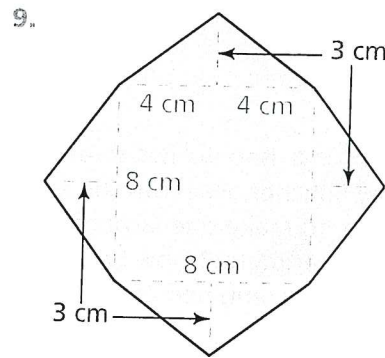
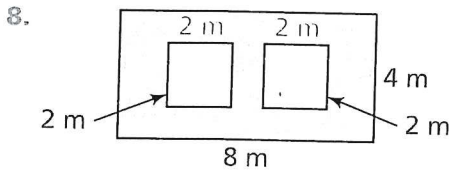
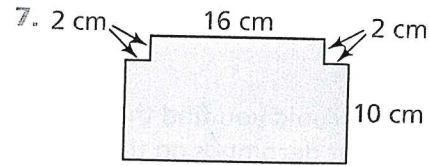
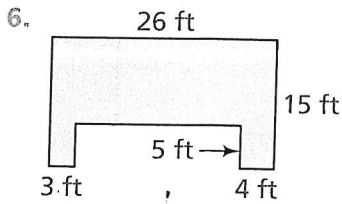
Practice & Problem Solving



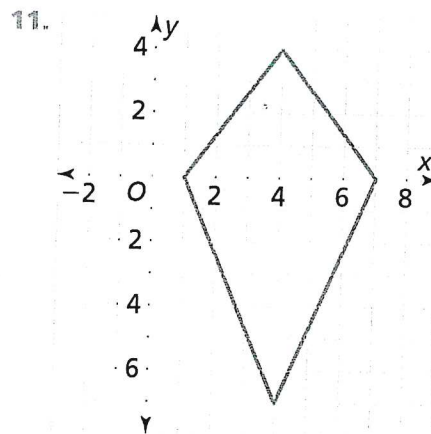
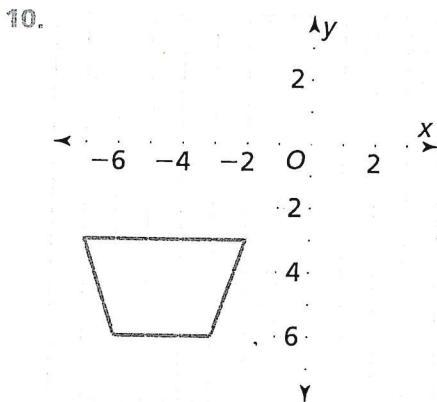
Scan for
Multimedia



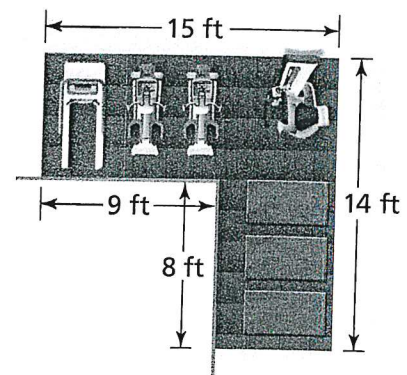
In 6–9, find the area of each polygon or shaded region.



In 10 and 11, find the area in square units of each polygon.



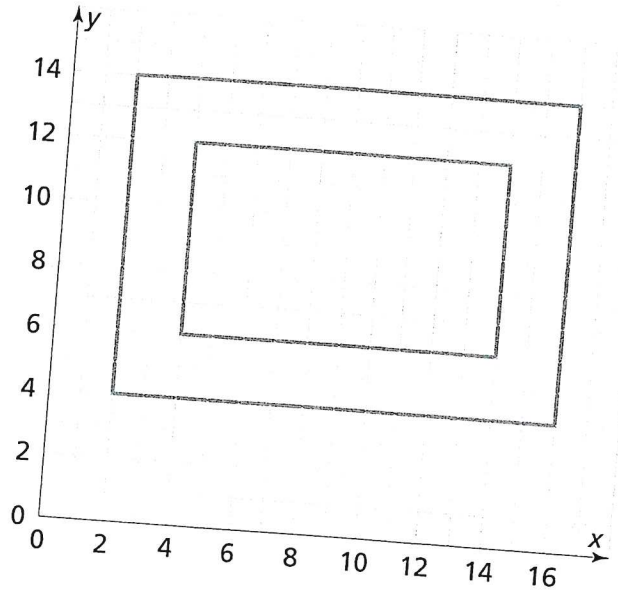
12. **Be Precise** Diego is designing an exercise room. How many square feet of rubber flooring will he need to cover the floor? The product is sold in whole square yards. How many square yards should Diego buy? Explain.



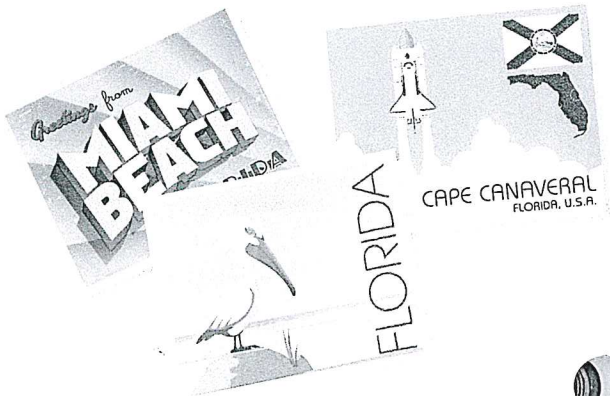
In 13 and 14, use the diagram at the right.

13. David drew this diagram of a picture frame that he is going to make. Each square represents 1 square inch. What is the area of the picture frame?

14. **Use Structure** How could you find the area of the picture frame without decomposing the frame into smaller shapes?



15. **Higher Order Thinking** Isabella has three rectangular cards that are 4 inches by 5 inches. How can she arrange the cards, without overlapping, to make one larger polygon with the smallest possible perimeter? How will the area of the polygon compare to the combined area of the three cards?



Assessment Practice

16. Select all expressions that can be used to find the area of the given polygon.

6.G.1.1

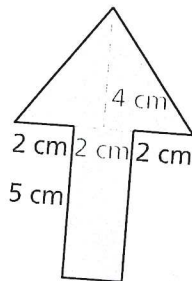
$(2 \times 5) + (6 \times 4)$

$(5 \times 2) + 2 \cdot \frac{1}{2}(3 \times 4)$

$(6 \times 5) - (3 \times 4)$

$(6 \times 9) - (3 \times 4)$

$(5 \times 2) + \frac{1}{2}[(2 + 2 + 2) \times 4]$



17. What is the area of the polygon at the right?

6.G.1.1

(A) 86 square units

(B) 78 square units

(C) 70 square units

(D) 68 square units

