

# 8.2

## Lesson

Trapezoid  $A = \frac{1}{2}h(b_1 + b_2)$

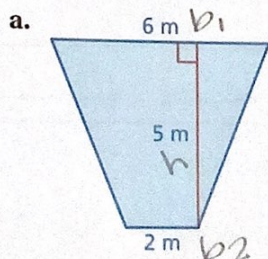
Trapezoids have 4 sides \* The 2 bases are parallel to each other

You can use decomposition to find areas of trapezoids and other polygons.

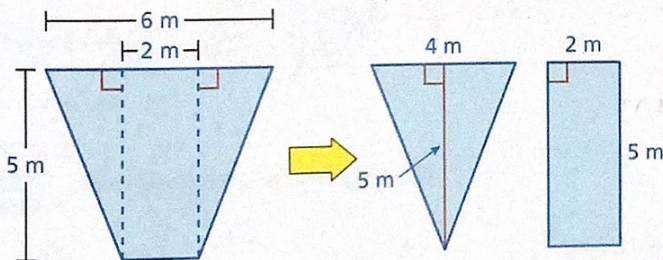
### Example 1 Finding Areas of Trapezoids and Other Polygons

Find the area of each figure.

$\frac{1}{2} \cdot 5 \cdot 8$   
 $20m^2$



Decompose the trapezoid into a triangle and a rectangle. Find the sum of the areas of the figures.



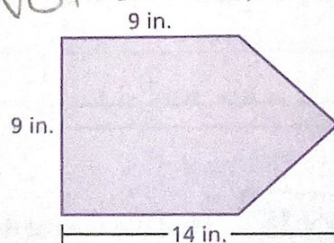
$$A = \frac{1}{2}(4)(5) + 5(2)$$

$$= 10 + 10$$

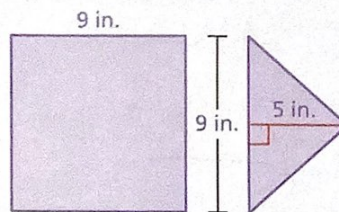
$$= 20$$

▶ The area of the trapezoid is 20 square meters.

Not a trapezoid



Decompose the pentagon into a square and a triangle. Find the sum of the areas of the figures.



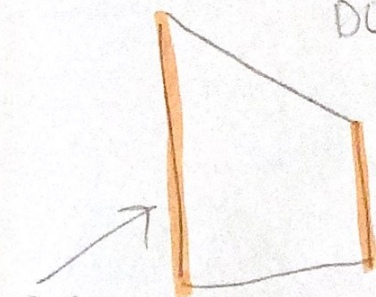
$$A = 9(9) + \frac{1}{2}(9)(5)$$

$$= 81 + 22\frac{1}{2}$$

$$= 103\frac{1}{2}$$

▶ The area of the pentagon is  $103\frac{1}{2}$  square inches.

Doesn't look like a trapezoid at first glance but



This is a base

this is a base

parallel lines are 2 lines across from each other that will never meet

Because these lines are parallel





**1**  
MTR **HELP A CLASSMATE**

Help a classmate find the area in Example 1(a) using a decomposition into two triangles.

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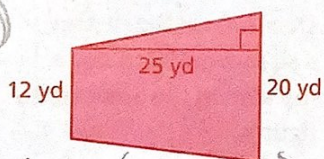
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**Try It**

Find the area of the figure.

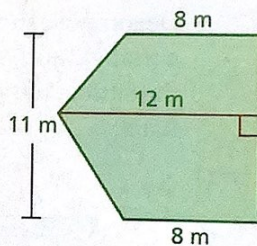
1.



$$A = \frac{1}{2}h(b_1 + b_2)$$
$$= \frac{1}{2} \cdot 25 \cdot 32$$

$$A = 400 \text{ yd}^2$$

2.



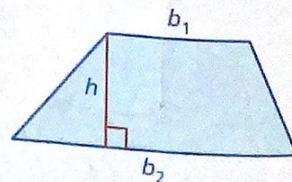
In Example 1(a), you could have used a copy of the trapezoid to form a parallelogram. As you may have discovered in the exploration, this leads to the following formula for the area of a trapezoid.

**Key Idea**

**Area of a Trapezoid**

**Words** The area  $A$  of a trapezoid is one-half the product of its height  $h$  and the sum of its bases  $b_1$  and  $b_2$ .

**Algebra**  $A = \frac{1}{2}h(b_1 + b_2)$





## Example 2 Finding Areas of Trapezoids

### 2 MTR USE ANOTHER METHOD

Use decomposition to find the area in Example 2(a).

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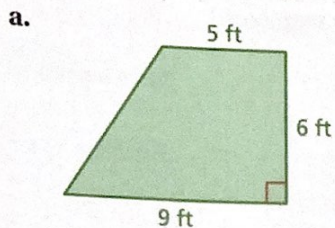
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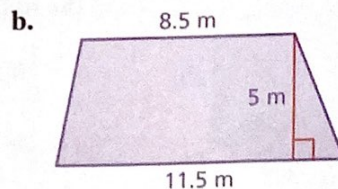
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Find the area of each trapezoid.



$$\begin{aligned} A &= \frac{1}{2}h(b_1 + b_2) \\ &= \frac{1}{2}(6)(5 + 9) \\ &= \frac{1}{2}(6)(14) \\ &= 42 \end{aligned}$$

▶ The area of the trapezoid is 42 square feet.



$A = \frac{1}{2}h(b_1 + b_2)$	Write formula.	$A = \frac{1}{2}h(b_1 + b_2)$
$= \frac{1}{2}(5)(8.5 + 11.5)$	Substitute.	$= \frac{1}{2}(5)(20)$
$= \frac{1}{2}(5)(20)$	Add.	$= 50$
$= 50$	Multiply.	

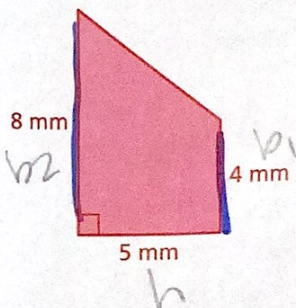
▶ The area of the trapezoid is 50 square meters.

### Try It

Find the area of the trapezoid.

*you try*

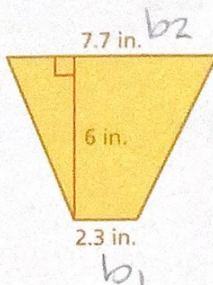
3.



$$\begin{aligned} A &= \frac{1}{2}h(b_1 + b_2) \\ &= \frac{1}{2}h(4 + 8) \\ &= \frac{1}{2}(5)(12) \end{aligned}$$

$$A = 30 \text{ mm}^2$$

4.



$$A = \frac{1}{2}h(b_1 + b_2)$$

$$\frac{1}{2} \cdot 6 \cdot 10$$

$$A = 30 \text{ in}^2$$

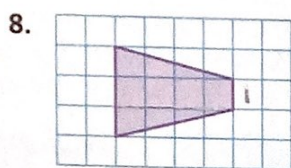
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## Concepts, Skills, & Problem Solving

**USING TOOLS** Find the area of the trapezoid by forming a parallelogram. (See Exploration 1.)



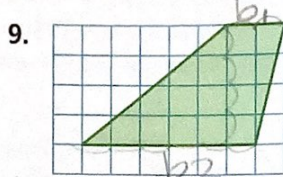
$$b_1 = 1$$

$$b_2 = 3$$

$$h = 4$$

$$\frac{1}{2} \cdot 4 \cdot 4$$

8 units<sup>2</sup>



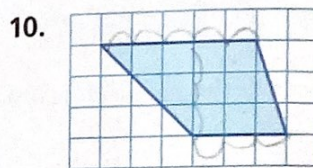
$$b_1 = 2$$

$$b_2 = 6$$

$$h = 4$$

$$\frac{1}{2} \cdot 4 \cdot 8$$

16 units<sup>2</sup>



$$b_1 = 5$$

$$b_2 = 3$$

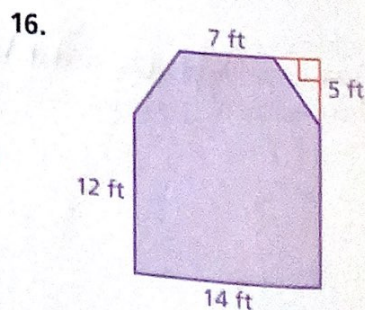
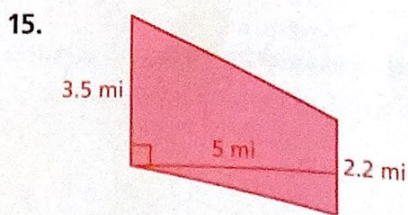
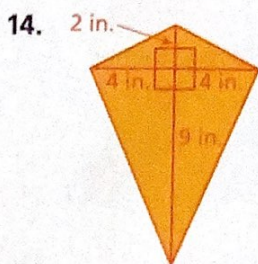
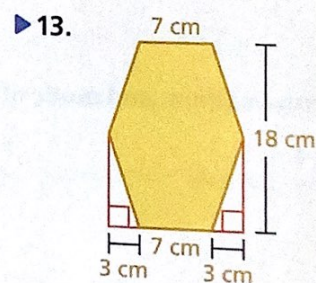
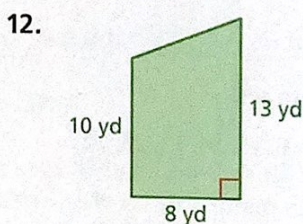
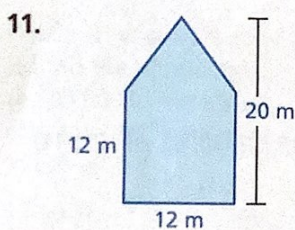
$$h = 3$$

$$\frac{1}{2} \cdot 3 \cdot 8$$

12 units<sup>2</sup>

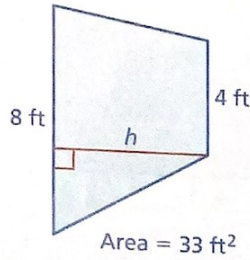
**FINDING AREA** Find the area of the figure. (See Example 1.)

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### Example 3 Finding a Missing Dimension of a Trapezoid



Find the height of the trapezoid.

$$A = \frac{1}{2}h(b_1 + b_2)$$

Write formula for area of a trapezoid.

$$33 = \frac{1}{2}h(4 + 8)$$

Substitute 33 for  $A$ , 4 for  $b_1$ , and 8 for  $b_2$ .

$$33 = \frac{1}{2}h(12)$$

Add.

$$33 = 6h$$

Simplify.

$$\frac{33}{6} = \frac{6h}{6}$$

Division Property of Equality

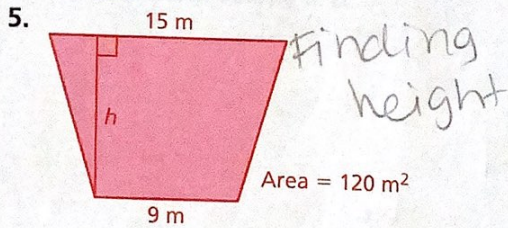
$$5\frac{1}{2} = h$$

Simplify.

► The height of the trapezoid is  $5\frac{1}{2}$  feet.

#### Try It

Find the missing dimension of the trapezoid.



$$A = \frac{1}{2}h(b_1 + b_2)$$

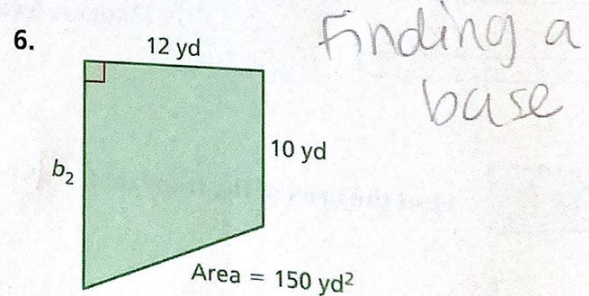
$$120 = \frac{1}{2}h(15 + 9)$$

$$120 = \frac{1}{2}h \cdot 24$$

$$120 = 12 \cdot h$$

$$\div 12$$

$$10\text{ m} = h$$



$$A = \frac{1}{2}h(b_1 + b_2)$$

$$150 = \frac{1}{2}(12)(10 + b_2)$$

$$150 = 6(10 + b_2)$$

$$150 = 60 + 6b_2$$

$$-60$$

$$90 = 6b_2$$

$$\div 6$$

$$15 = b_2$$

yd

Try this when do #6