

## Lesson 8-5

### Summarize Data Using Measures of Variability



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## Solve & Discuss It!



ACTIVITY

Suppose you collected data from 11 people about the number of pieces of fruit they have eaten in the past week. The median number is 6 pieces of fruit.

Make two possible dot plots that could be used to display the data—one in which the data vary a little and one in which the data vary a lot. Explain how you created your dot plots.

Names

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**Reasoning** How can you find values that have the same median? © MP.2

### I can...

use measures of variability to describe a data set.



Common Core Content Standards  
6.SP.B.5c, 6.SP.B.4

Mathematical Practices  
MP.2, MP.3, MP.4

### Focus on math practices

**Critique Reasoning** Jackline says that only 3 people surveyed ate more than six pieces of fruit in the past week. Do you agree? Explain why or why not. © MP.3

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**EXAMPLE 1** Find the Mean Absolute Deviation to Describe Variability

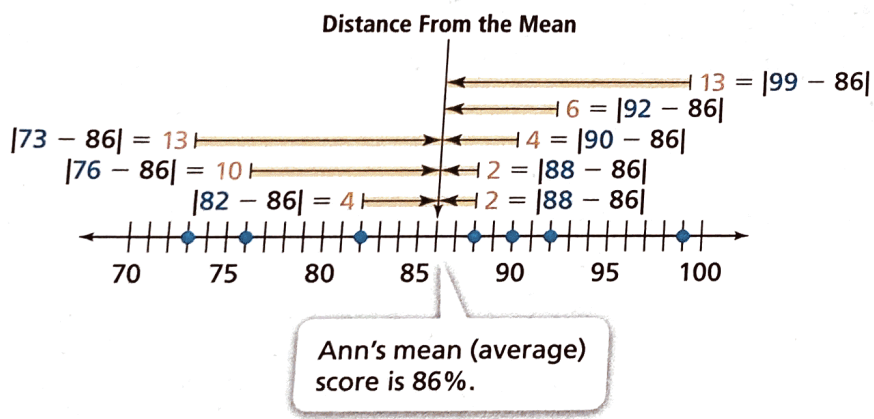
Ann is looking at her math quiz scores for one grading period. She wants to know how much her scores varied. She knows that her average (mean) score is 86%. How can Ann determine how much her scores varied during this grading period?

Ann's Math Quiz Scores (%)	
82	99
76	73
92	90
88	88

**Model with Math**  
You can use a number line to show the spread and clustering of data in relation to the mean. © MP.4

**STEP 1** Find the differences between each of Ann's quiz scores and her mean (average) score. Show all differences as positive integers.

The **absolute deviation** is the absolute value of the difference between a value and the mean.



**STEP 2** Find the mean of all of the differences, or absolute deviations. This value is called the **mean absolute deviation (MAD)**.

Add all of the absolute deviations.

$$\frac{13 + 10 + 4 + 2 + 2 + 4 + 6 + 13}{8} = \frac{54}{8} \text{ or } 6.75$$

Divide by the number of scores.

Ann can find the mean absolute deviation (MAD) to determine how much her math quiz scores varied during this grading period. Her scores varied by an average of 6.75 points.

**Try It!**

Ann's vocabulary quiz scores are 75, 81, and 90. The mean score is 82. What is the mean absolute deviation?

Score	Absolute Deviation
75	$ 82 - 75  = \square$
81	$ \square - \square  = \square$
90	$ \square - \square  = \square$

**Convince Me!** Can the mean absolute deviation ever have a negative value? Explain.

## EXAMPLE 2



### Find the Interquartile Range (IQR) to Describe Variability



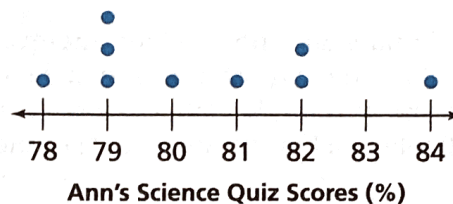
ACTIVITY



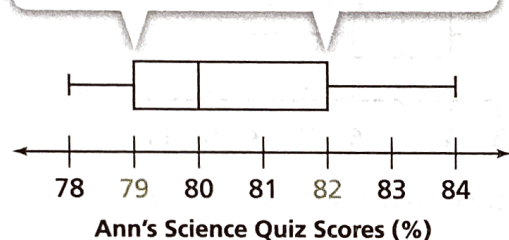
ASSESS

The dot plot shows Ann's science quiz scores. How can Ann determine the variability in her science quiz scores?

Draw a box plot to determine the interquartile range.



The **interquartile range (IQR)** is a measure of variability. It represents the difference between the third quartile and the first quartile.

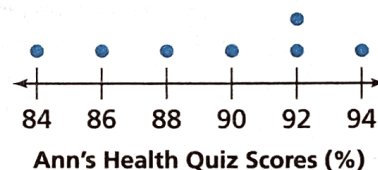


The interquartile range is  $82 - 79 = 3$ .  
So, at least half of Ann's science quiz scores were within 3 points.



### Try It!

The dot plot shows the distribution of Ann's health quiz scores. How can the IQR describe her scores?



## EXAMPLE 3



### Use the Mean Absolute Deviation (MAD) to Find the Variability of a Data Set

Jonah recorded the points his team scored during its last nine basketball games. The mean number of points scored was 42 and the MAD was  $4.\bar{4}$ . How can Jonah use these measures to describe the variability of the points his team scored during the last nine games?

The MAD shows that the scores generally varied greatly from the mean. The scores were mostly less than 38 ( $42 - 4.4 = 37.6$ ) or greater than 46 ( $42 + 4.4 = 46.4$ ).



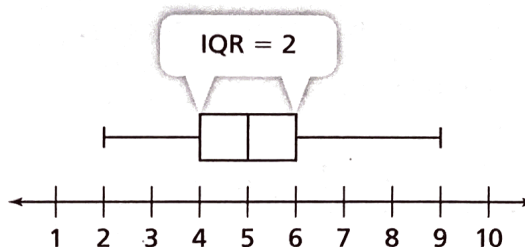
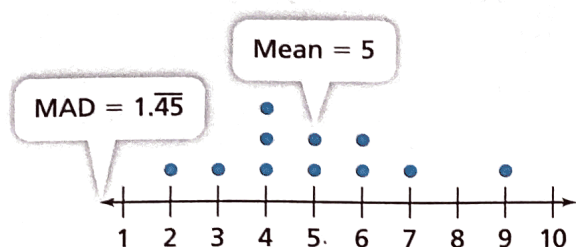
### Try It!

Jonah's team scored 36, 37, 38, 38, 41, 46, 47, 47, and 48 points in the last nine games. Find the IQR and range of the points Jonah's team scored in its last nine games. Are these good measures for describing the points scored?





The mean absolute deviation and the interquartile range each use a single number to describe the variability, or spread, of a data set. The **mean absolute deviation (MAD)** tells you how far the data are spread out from the mean. The **interquartile range (IQR)** tells you how far the middle of the data is spread out from the median.



## Do You Understand?

1. **Essential Question** How can the variability of data be described using a single number?

2. What does the IQR show that the range does not show?

3. **Reasoning** Two data sets have the same mean, 8. However, the MAD of Data Set A is 2 and the MAD of Data Set B is 4. What does this indicate about the variability of the data sets? © MP.2

## Do You Know How?

In 4–7, use these data.

Davita works at a shoe store. She measured the feet of nine customers and found that their shoe sizes were 4, 5, 5, 6, 7, 8, 8, 10, and 10.

4. Find the mean.
5. Find the sum of the absolute deviations from the mean.
6. Find the mean absolute deviation. Explain how you found the MAD.
7. Find the range and IQR. How is each calculated?



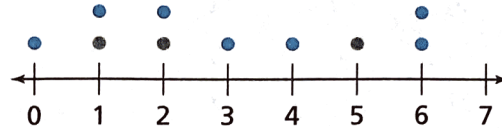
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# Practice & Problem Solving



**8. Leveled Practice** The mean of the data set is 3. Find the absolute deviation of each of the green values.

- a. The absolute deviation of 1 is .
- b. The absolute deviation of 2 is .
- c. The absolute deviation of 5 is .



In 9 and 10, use the data table showing the number of miles that Jill biked on 9 days.

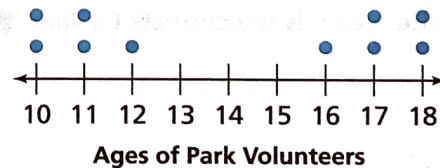
9. Find the mean.

Miles Biked		
5	9	11
10	8	6
7	12	4

10. Find the MAD of this data set. What does this tell you about the number of miles that Jill biked?

In 11 and 12, use the data shown in the dot plot.

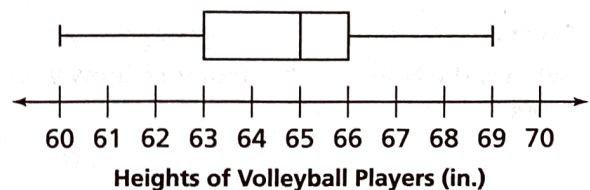
11. What are the mean and the MAD?



12. Describe the variability of the data.

In 13 and 14, use the data shown in the box plot.

13. What are the range and the IQR?



14. Describe the variability of the data.

15. The data set shows prices for concert tickets in 10 major cities.

City	Price (\$)	City	Price (\$)
Q	45	V	36
R	50	W	24
S	35	X	25
T	37	Y	27
U	29	Z	43

- a. Find the IQR of the data set.
- b. How do prices vary within the middle 50%?

16. **Reasoning** The MAD of the data set in the table is about 6.7. Does the value 4 deviate more or less than most of the values in the table? Explain. © MP.2

4	28	25
19	7	13
16	22	10

In 17–19, use the data set shown in the table.

17. **Vocabulary** What is the term used to describe the range of the middle half of the data set? Find that value for this data.

Temperatures (°F)			
11	17	20	16
19	16	15	22

18. **Critique Reasoning** Dina said that the greatest absolute deviation will be found from the highest temperature because it has to be the farthest from the mean. Is she correct? Explain. © MP.3

19. **Higher Order Thinking** What is the MAD for the data and what does it tell you about the temperatures?

## © Assessment Practice

20. Harlo recorded the tide, in feet, every hour during an 8-hour period as shown in the table.

Tide (ft)
3, 7, 11, 15, 20, 31, 39, 42

### PART A

What is the MAD for the data set? Show your work.

### PART B

Is the IQR greater or less than the MAD? What does this tell you about the variability of the data?



# Lesson 7-3

## Find Areas of Trapezoids and Kites

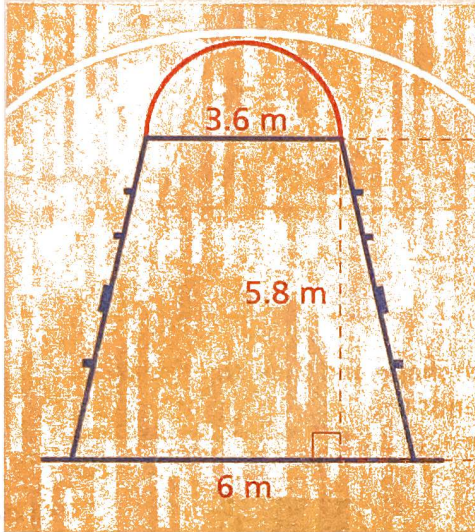


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### Explain It!

The European basketball key was changed from a trapezoid shape to a rectangle in 2010. The diagram shows the shape of the key before 2010 outlined in blue.



foul line

The key on a basketball court is the area between the foul line and the baseline.

baseline

### I can...

find areas of trapezoids and kites.

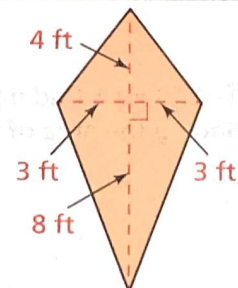
© Common Core Content Standards  
6.G.A.1, 6.EE.A.2c  
Mathematical Practices  
MP.1, MP.3, MP.6, MP.7

**A. Construct Arguments** Tim finds the area of the key by multiplying the base by the height. Does his strategy make sense? © MP.3

**B. Use Structure** How could Tim find the area of the trapezoid by decomposing it into shapes he knows? What is the area of the key? © MP.7

### Focus on math practices

**Use Structure** How can you find the area of this kite? Explain. © MP.7



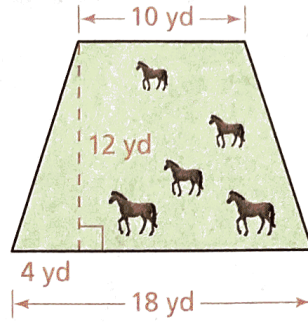


**EXAMPLE 1** Find the Area of a Trapezoid

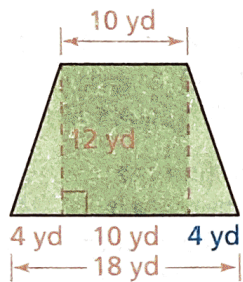


The pasture is in the shape of a trapezoid. What is the area of the pasture?

**Be Precise** What are the properties of a trapezoid and how can they help you to find the area of a trapezoid? © MP.6



Decompose the trapezoid into a rectangle and two right triangles.

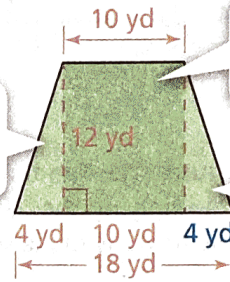


Find the length of any unknown base or height.

$$18 - (4 + 10) = 4$$

Find the area of each shape and then add the areas. The triangles are identical.

$$A = \frac{1}{2}bh = \frac{1}{2} \times 4 \times 12 = 24 \text{ yd}^2$$



$$A = \ell w = 12 \times 10 = 120 \text{ yd}^2$$

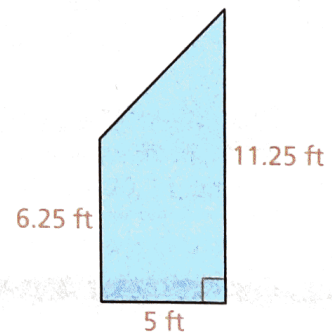
$$A = \frac{1}{2}bh = \frac{1}{2} \times 4 \times 12 = 24 \text{ yd}^2$$

Add the areas:  $24 + 120 + 24 = 168$

The area of the pasture is  $168 \text{ yd}^2$ .

**Try It!**

How would you decompose this trapezoid to find its area? Find the area of the trapezoid.



**Convince Me!** How is finding the area of the trapezoid in Example 1 different from finding the area of the trapezoid in the Try It!?





## EXAMPLE 2



## Find the Area of a Different Trapezoid



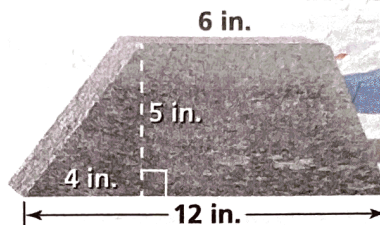
ACTIVITY



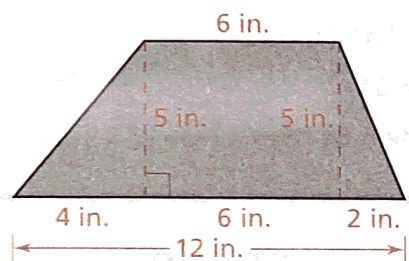
ASSESS

A builder needs to cut one stone in the shape of a trapezoid to fit in the space. What is the area of the front side of that stone?

**Look for Relationships** When you decompose a trapezoid into a rectangle and two triangles, the triangles are not always identical. © MP.7



Draw lines to show the rectangle and the two triangles. Label needed measurements.



The triangles have different bases.

Find the areas:

$$\text{Triangle: } A = \frac{1}{2}bh = \frac{1}{2}(4 \times 5) = 10$$

$$\text{Rectangle: } A = \ell w = 6 \times 5 = 30$$

$$\text{Triangle: } A = \frac{1}{2}bh = \frac{1}{2}(2 \times 5) = 5$$

Add the areas:

$$10 \text{ in.}^2 + 30 \text{ in.}^2 + 5 \text{ in.}^2 = 45 \text{ in.}^2$$

The area of the side of the stone is  $45 \text{ in.}^2$ .

## EXAMPLE 3



## Find the Area of a Kite

Jackson has a rectangular piece of cloth that has an area of  $298 \text{ cm}^2$ . Does Jackson have enough cloth to make the kite shown?

**STEP 1** Decompose the kite into two identical triangles. Find the area of the triangles.

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2} \cdot 30 \cdot 10$$

$$A = 150 \text{ cm}^2$$

Each triangle has an area of  $150 \text{ cm}^2$ .  
The area of the kite is  $300 \text{ cm}^2$ .

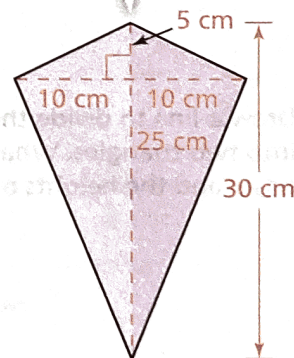
**STEP 2** Find the area of the kite. Compare the area of the kite to the area of the cloth.

$$2 \times 150 \text{ cm}^2 = 300 \text{ cm}^2$$

$$300 \text{ cm}^2 > 298 \text{ cm}^2$$

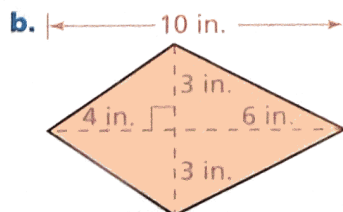
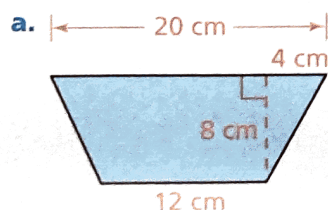
Jackson does not have enough cloth to make the kite.

A kite is a quadrilateral with two pairs of adjacent sides that are equal in length.



## Try It!

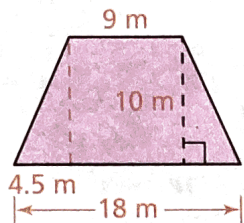
Find the area of the trapezoid and the area of the kite.





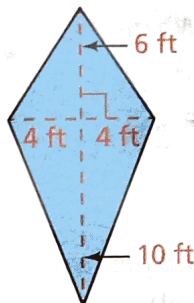
You can find the area of a trapezoid or a kite by decomposing the shapes into rectangles and triangles.

Trapezoid



Decompose the trapezoid into two triangles and a rectangle. Find the length of the unknown triangle base.

Kite



Decompose the kite into two identical triangles.

Each triangle:  $A = \frac{1}{2}(4.5)(10) = 22.5$

Rectangle:  $A = 9(10) = 90$

Trapezoid:  $A = 22.5 + 22.5 + 90 = 135$

The area of the trapezoid is  $135 \text{ m}^2$ .

Each triangle:  $A = \frac{1}{2}(16)(4) = 32$

Kite:  $A = 32 + 32 = 64$

The area of the kite is  $64 \text{ ft}^2$ .

## Do You Understand?

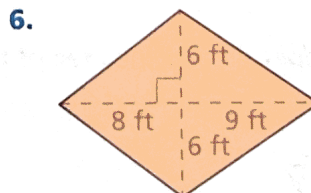
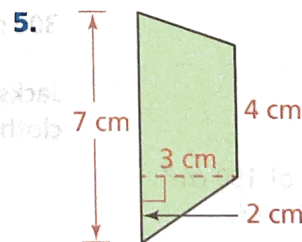
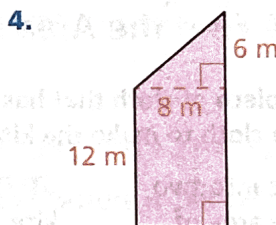
- Essential Question** How can you find the areas of trapezoids and kites?

- Draw a line to divide the pasture in Example 1 into two triangles. What are the measures of the bases and the heights of the two triangles?

- Construct Arguments** In Example 3, how could you use 4 triangles to find the kite's area? © MP.3

## Do You Know How?

In 4–6, find the area of each trapezoid or kite.

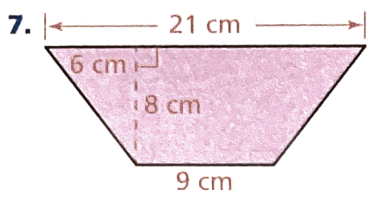


Name: \_\_\_\_\_

# Practice & Problem Solving

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**Leveled Practice** In 7–12, find the area of each trapezoid or kite.



Each triangle:

$$A = \frac{1}{2}bh$$

$$= \frac{1}{2} \times \boxed{\phantom{00}} \times 8$$

$$= \boxed{\phantom{00}} \text{ cm}^2$$

Rectangle:

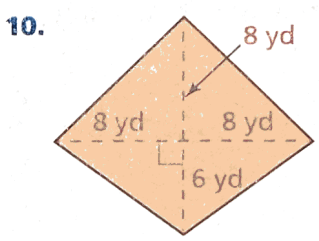
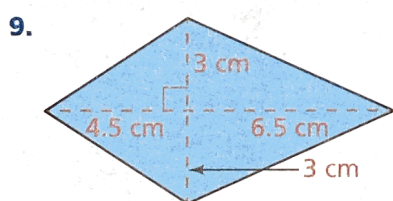
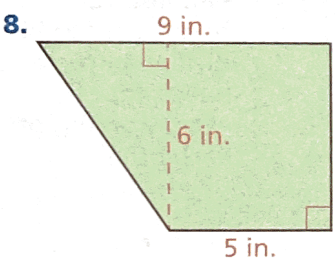
$$A = \ell w$$

$$= \boxed{\phantom{00}} \times 8$$

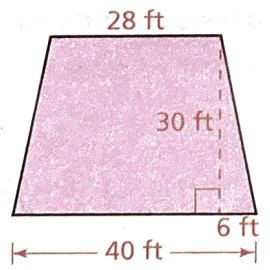
$$= \boxed{\phantom{00}} \text{ cm}^2$$

Trapezoid:

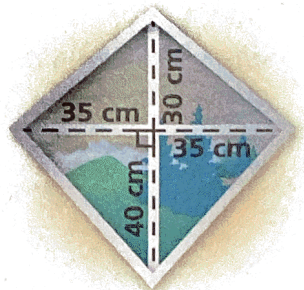
$$A = \boxed{\phantom{00}} + \boxed{\phantom{00}} + \boxed{\phantom{00}} = \boxed{\phantom{00}} \text{ cm}^2$$



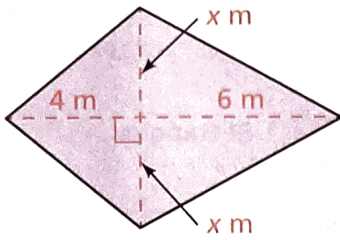
11. A sidewall of a building is shown below. What is the area of the wall?



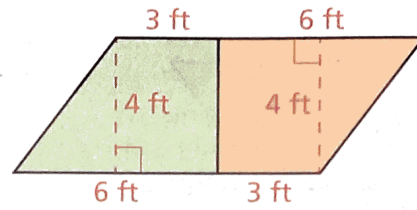
12. **Be Precise** The window has the shape of a kite. How many square meters of glass were used to make the window? © MP.6



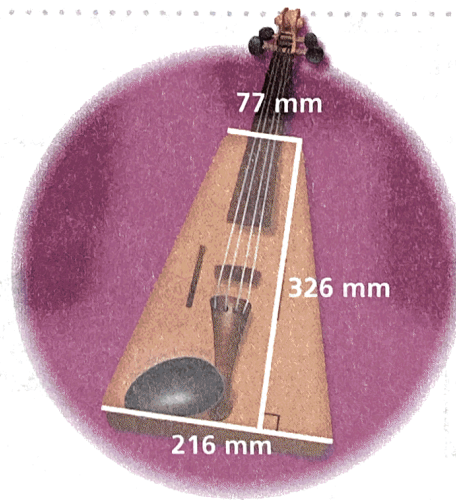
13. The area of the kite is  $30 \text{ m}^2$ . What is the value of  $x$ ? Explain.



14. **Make Sense and Persevere** Hunter drew two identical trapezoids and composed them to form a parallelogram. Use the area of the parallelogram to find the area of one trapezoid. Explain. © MP.1



15. **Higher Order Thinking** A craftsman wants to build this symmetrical fiddle. He needs to know the area of the face of the fiddle. How could he use the measurements shown to find the area? Use your strategy to find the area of the face of the fiddle.



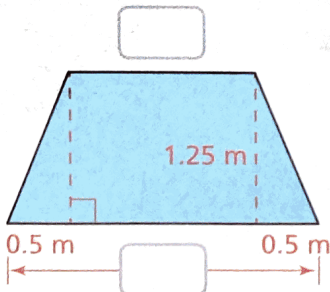
The figure is symmetrical because it can be divided into two halves that fit exactly on top of each other.

## © Assessment Practice

16. Marique is making a large table in the shape of a trapezoid. She needs to calculate the area of the table. The longest side of the table is twice as long as the table's width.

### PART A

Write numbers in the boxes to show the missing dimensions.



### PART B

What is the area of the table?

