

## 7-4

## Similar Figures

© CONTENT STANDARDS

8.G.4

**What You'll Learn**

To identify similar figures and to use proportions to find missing measurements in similar figures

**New Vocabulary** similar figures, similar polygons

You will need  
your Evernote today.


**Check Skills  
You'll Need**
**1. Vocabulary Review**

How can you tell whether a relationship is *proportional*?

2. Does the table show a proportional relationship? Explain.

$x$	$y$
4	16
6	24
8	32

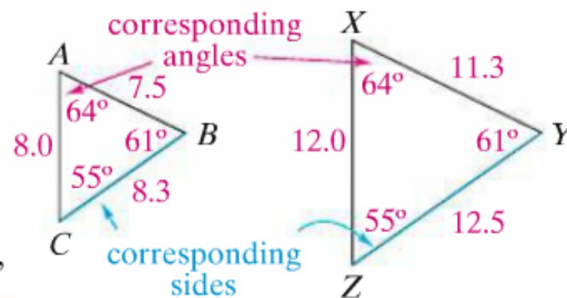
**Why Learn This?** Consider taking a picture for Evernote

Sometimes you want an image to be larger or smaller than the original.

**Similar figures** have the same shape but not necessarily the same size. The ratios of the lengths of corresponding sides in similar figures are proportional.

The symbol  $\sim$  means “is similar to.”

If two polygons are **similar polygons**, then corresponding angles are congruent and the lengths of corresponding sides are in proportion. Recall that in a proportion, the *cross products* are equal. In the diagram above,  $\triangle ABC \sim \triangle XYZ$ .



**EXAMPLE****Identifying Similar Polygons**

1 Is rectangle  $LMNO$  similar to rectangle  $HIJK$ ? Explain.

$$\angle L \cong \angle H \quad \angle M \cong \angle I \quad \angle N \cong \angle J \quad \angle O \cong \angle K$$

$$\frac{MN}{IJ} \stackrel{?}{=} \frac{LM}{HI} \quad \leftarrow \text{Write a proportion.}$$

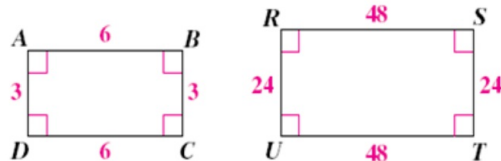
$$\frac{4}{3} \stackrel{?}{=} \frac{10}{8} \quad \leftarrow \text{Substitute.}$$

$$4 \cdot 8 \stackrel{?}{=} 3 \cdot 10 \quad \leftarrow \text{Write the cross products.}$$

$$32 \neq 30 \quad \leftarrow \text{Simplify.}$$

The corresponding angles are congruent, but the corresponding sides are not in proportion. So the rectangles are *not* similar.

1 **EXAMPLE** Is rectangle  $ABCD$  similar to rectangle  $RSTU$ ? Explain why or why not.



First, check to see if corresponding angles are congruent.

$$\angle A \cong \angle R \quad \angle B \cong \angle S \quad \leftarrow \text{All right angles are } 90^\circ.$$

$$\angle C \cong \angle T \quad \angle D \cong \angle U$$

Next, check to see if corresponding sides are in proportion.

$$\frac{AB}{RS} \stackrel{?}{=} \frac{DA}{UR} \quad \leftarrow AB \text{ corresponds to } RS. DA \text{ corresponds to } UR.$$

$$\frac{6}{48} \stackrel{?}{=} \frac{3}{24} \quad \leftarrow \text{Substitute.}$$

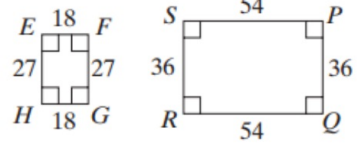
$$6 \cdot 24 \stackrel{?}{=} 48 \cdot 3 \quad \leftarrow \text{Write the cross products.}$$

$$144 = 144 \quad \leftarrow \text{Simplify.}$$

The corresponding sides are in proportion, so rectangle  $ABCD$  is similar to rectangle  $RSTU$ .

**Quick Check**

1. Is rectangle  $EFGH$  similar to rectangle  $PQRS$ ? Explain.



You can use proportions to find unknown lengths in similar figures.

### EXAMPLE Application: Design

- 2 You are designing a poster. A sketch for the letter H is shown. The letter will be 9 in. tall on the poster. If the two letters are similar, what is the width on the poster?

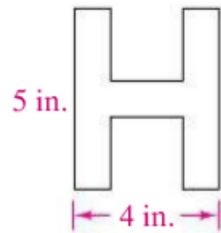
$$\frac{5 \text{ in.}}{9 \text{ in.}} = \frac{4 \text{ in.}}{w} \quad \leftarrow \text{Write a proportion.}$$

$$5 \cdot w = 9 \cdot 4 \quad \leftarrow \text{Write the cross products.}$$

$$5w = 36 \quad \leftarrow \text{Simplify.}$$


$$\frac{5w}{5} = \frac{36}{5} \quad \leftarrow \text{Divide each side by 5.}$$

$$w = 7.2 \quad \leftarrow \text{Simplify.}$$



The width of the letter is 7.2 inches.

- 2 EXAMPLE** A stonemason's sketch of a carving to be made on a building includes the letter "E" shown below. If the width of the actual letter in the arrangement is 22 in., what is the height?



$$\frac{2.75 \text{ in.}}{5 \text{ in.}} = \frac{22 \text{ in.}}{x} \quad \leftarrow \text{Set up a proportion.}$$

$$2.75 \cdot x = 5 \cdot 22 \quad \leftarrow \text{Write the cross products.}$$

$$2.75x = 110 \quad \leftarrow \text{Simplify.}$$

$$\frac{2.75x}{2.75} = \frac{110}{2.75} \quad \leftarrow \text{Divide each side by 2.75.}$$

$$x = 40 \quad \leftarrow \text{Simplify.}$$

The height of the letter is 40 inches.

When similar figures overlap, you can separate them.

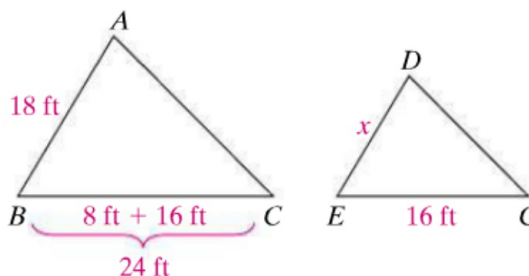
### EXAMPLE Overlapping Similar Triangles

- 3 Multiple Choice** In the figure at the left,  $\triangle ABC \sim \triangle DEC$ . Find the value of  $x$ .

- (A) 8 ft      (B) 9 ft      (C) 12 ft      (D) 18 ft

**Step 1** Separate the triangles as shown at the right.

**Step 2** Write a proportion using corresponding sides of the triangles.



$$\frac{18}{x} = \frac{24}{16} \quad \leftarrow \text{Write a proportion.}$$

$$18 \cdot 16 = 24 \cdot x \quad \leftarrow \text{Write the cross products.}$$

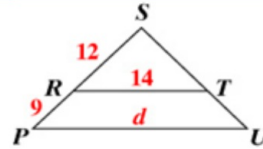
$$288 = 24x \quad \leftarrow \text{Simplify.}$$

$$\frac{288}{24} = \frac{24x}{24} \quad \leftarrow \text{Divide each side by 24.}$$

$$12 = x \quad \leftarrow \text{Simplify.}$$

The value of  $x$  is 12 ft. The correct answer is choice C.

**3 EXAMPLE**  $\triangle RST \sim \triangle PSU$ . Find the value of  $d$ .



$$\frac{14}{d} = \frac{12}{21}$$

← Write a proportion.

$$12 \cdot d = 21 \cdot 14$$

← Write the cross products.

$$12d = 294$$

← Simplify.

$$\frac{12d}{12} = \frac{294}{12}$$

← Divide each side by 12.

$$d = 24.5$$

← Simplify.

The value of  $d$  is 24.5.

### Check Your Understanding

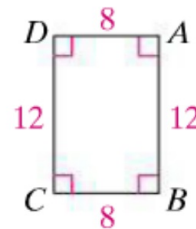
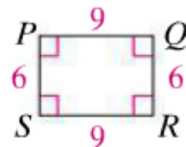
1. **Vocabulary** Can a triangle and square be similar figures? Explain.

Complete each statement for the similar figures at the right.

2.  $\angle P \cong \angle A$ ,  $\angle R \cong \angle \blacksquare$

3.  $\angle Q \cong \angle B$ ,  $\angle S \cong \angle \blacksquare$

4.  $\frac{PQ}{AB} = \frac{\blacksquare}{BC}$



## Vocabulary and Key Concepts

**Similar Polygons** If two polygons are similar polygons, then

- corresponding angles are [redacted] and
- lengths of corresponding sides are [redacted].

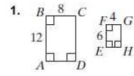
Similar figures have the same [redacted] but not necessarily the same [redacted].

Go to [m.socrative.com](https://m.socrative.com)  
room number 262013

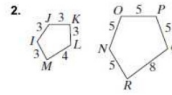
**Practice 7-4**

**Similar Figures**

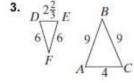
Tell whether each pair of polygons is similar. Yes or No



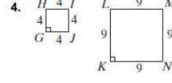
\_\_\_\_\_



\_\_\_\_\_

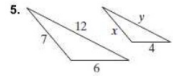


\_\_\_\_\_

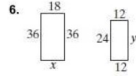


\_\_\_\_\_

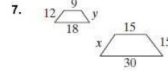
Exercises 5-7 show pairs of similar polygons. Find the unknown lengths.



x= \_\_\_\_\_ y= \_\_\_\_\_



x= \_\_\_\_\_ y= \_\_\_\_\_



x= \_\_\_\_\_ y= \_\_\_\_\_

**Solve.**

8. A rock show is being televised. The lead singer, who is 75 inches tall, is 15 inches tall on a TV monitor. The image of the bass player is 13 inches tall on the monitor. How tall is the bass player?

\_\_\_\_\_

All rights reserved.

© Pearson Education, Inc., publishing as Pearson Prentice Hall.