

7-4

Similar Figures

 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

GO for Help
Lesson 3-3

© CONTENT STANDARD

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

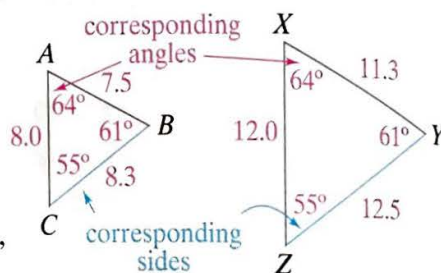
Why Learn This?

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.

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

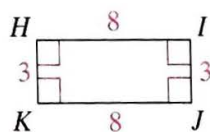
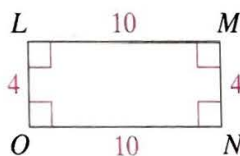
$$\frac{MN}{IJ} \stackrel{?}{=} \frac{LM}{HI} \quad \leftarrow \text{Write a proportion.}$$

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

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

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

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


 Quick Check

1. Rectangle $EFGH$ has side lengths of 18 and 27. Rectangle $LMNO$ has side lengths of 36 and 54. Are the rectangles similar? 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?

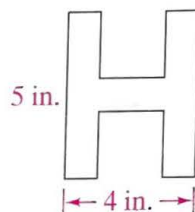
$$\frac{5 \text{ in.}}{9 \text{ in.}} = \frac{4 \text{ in.}}{w} \quad \leftarrow \text{Write a proportion.}$$

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

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

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

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



The width of the letter is 7.2 inches.

Quick Check

2. If the letter H on the poster has a height of 14 in., what is its width?

When similar figures overlap, you can separate them.

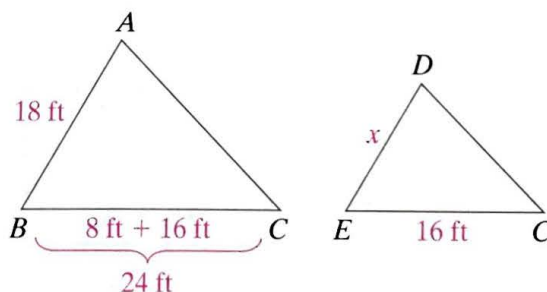
EXAMPLE Overlapping Similar Triangles

- 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.



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

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

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

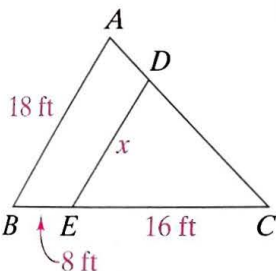
$$\frac{288}{24} = \frac{24x}{24} \quad \leftarrow \text{Divide each side by 24.}$$

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

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

Quick Check

3. If DC is 14 ft, what is the length of \overline{AC} ?



Test Prep Tip

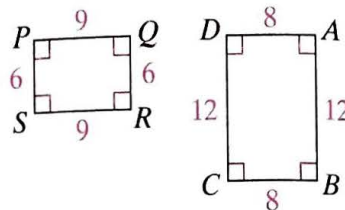
You can reduce $\frac{24}{16}$ in the first step. This uses more steps but makes calculations easier.



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

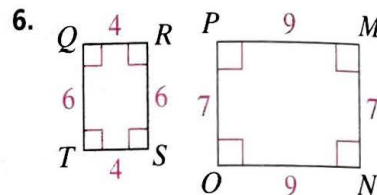
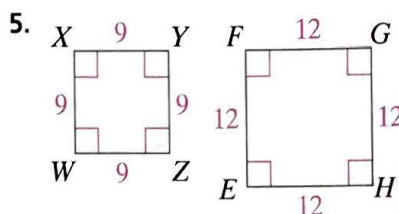
Homework Exercises

For more exercises, see **Extra Skills and Word Problems**.

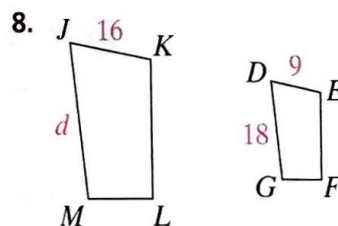
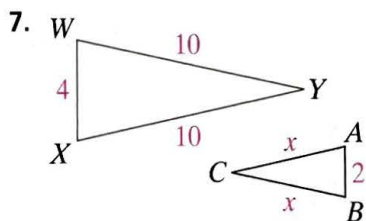
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For Exercises	See Examples
5–6	1
7–9	2
10–11	3

Are the figures in each pair similar? Explain.

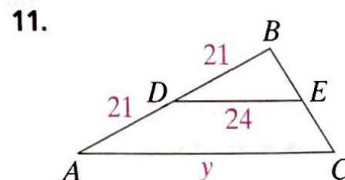
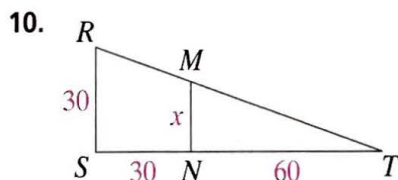


Exercises 7–8 show pairs of similar figures. Find the unknown lengths.



9. **Movies** A frame of movie film is 35 mm wide and 26.25 mm high. The film projects an image 8 m wide. How high is the image?

Exercises 10–11 show similar figures. Find the unknown lengths.



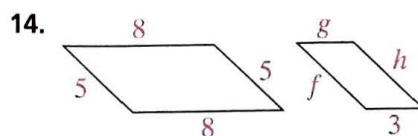
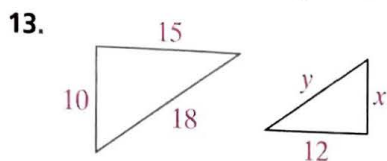
GPS

12. **Guided Problem Solving** You have a class photo that is 10 in. long and 8 in. wide. If you want to enlarge your photo to be 15 in. long, how wide will the photo be?

- **Understand the Problem** You know the dimensions of the original photo and the length of the enlarged photo. Find the width of the enlarged photo.
- **Make a Plan** Draw the figures and label their sides.



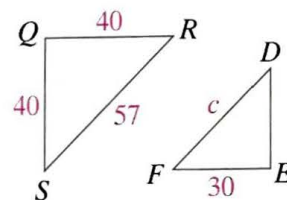
Exercises 13–14 show pairs of similar figures. Find the unknown lengths.



15. **Clothing** A T-shirt comes in different sizes. A large T-shirt is 21.5 in. wide and 26.5 in. long. If a small youth T-shirt is 15.5 in. wide, what is its length to the nearest inch?
16. **Writing in Math** Are squares always similar? Explain.
17. **Multiple Choice** Which statement is *true*?
- (A) Corresponding sides of similar polygons are equal.
 - (B) Not all circles are similar.
 - (C) Corresponding sides of similar polygons are congruent.
 - (D) Not all rectangles are similar.

For Exercises 18–19 use the similar triangles shown below.

18. Find the length of side c .
19. **Challenge** Find the ratio of corresponding sides and the ratio of the perimeters. What do you notice?

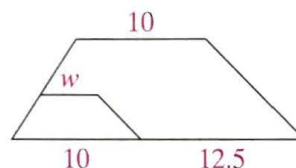


Test Prep and Mixed Review

Practice

Multiple Choice

20. The figures shown at the right are similar. What is the value of w ?
- (A) 4.0
 - (B) 4.4
 - (C) 6.3
 - (D) 8.0



21. Each day, the International Space Station orbits the Earth about 15.6 times and travels about 6.62×10^5 kilometers. Approximately how many kilometers does the International Space Station travel in 1 orbit around the Earth?
- (F) 4.24×10^4 km
 - (G) 1.03×10^5 km
 - (H) 4.24×10^5 km
 - (J) 1.03×10^7 km
22. Judy spends 3 more than twice as many hours studying for history as she does for math. She studies 4 hours for history. Which equation can be used to find x , the number of hours she studies for math?
- (A) $3x + 3 = 4$
 - (B) $3x + 2 = 4$
 - (C) $2x + 2 = 4$
 - (D) $2x + 3 = 4$

Algebra Solve each equation. Check the solution.

23. $-3(n + 5) = 27$
24. $0.9(s - 4) = 3.6$
25. $-16 = -8(g + 4)$
26. $3 = \frac{1}{2}(12 + t)$

GO for Help

For Exercises	See Lesson
23–26	2-3