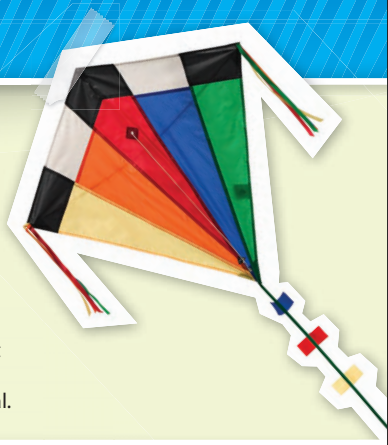
Lesson 5-9

Similar Figures



Interactive Study Guide

See pages 115–116 for:
- Getting Started
- Real-World Link
- Notes

Essential Question

How can you identify and represent proportional relationships?

Common Core State Standards

Content Standards
7.RP.2, 7.RP.2c

Mathematical Practices
1, 3, 4

Vocabulary

similar
congruent
corresponding parts

Math Symbols
≅ is read *is congruent to*
~ is read *is similar to*

What You'll Learn

- Find missing measures of similar figures.
- Use scale factors to solve problems.

Real-World Link

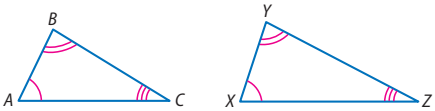
Kites It is believed that kites were first flown in China more than 2500 years ago. Since then, kites have been used to transport materials, to pull carriages, and as tools for scientific research. However, a typical kite that you might fly in your backyard is much smaller and usually comes in the shape of a triangle or quadrilateral.

Key Concept Similar Figures

Words **Similar figures** are figures that have the same shape but not necessarily the same size. If two figures are similar, then

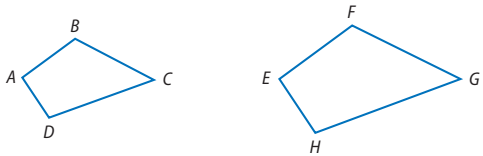
- the corresponding angles are **congruent**, or have the same measure, and
- the corresponding sides are proportional and opposite corresponding angles.

Model



Symbols $\triangle ABC \sim \triangle XYZ$
$\angle A \cong \angle X, \angle B \cong \angle Y, \angle C \cong \angle Z$ and $\frac{AB}{XY} = \frac{BC}{YZ} = \frac{AC}{XZ}$

Figure *ABCD* is similar to figure *EFGH*. In symbols, *ABCD* ~ *EFGH*.



Similar figures have **corresponding parts**. These are angles and sides in the same position.

Corresponding Angles		Corresponding Sides	
$\angle A \leftrightarrow \angle E$	$\angle C \leftrightarrow \angle G$	$\overline{AB} \leftrightarrow \overline{EF}$	$\overline{CD} \leftrightarrow \overline{GH}$
$\angle B \leftrightarrow \angle F$	$\angle D \leftrightarrow \angle H$	$\overline{BC} \leftrightarrow \overline{FG}$	$\overline{DA} \leftrightarrow \overline{HE}$

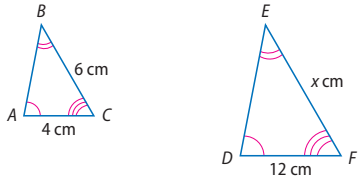
Since corresponding sides are proportional, you can use a proportion or the scale factor to determine the measures of the sides of similar figures when some measures are known.

Example 1

Tutor

The figures are similar. Find each missing measure.

a.



Since $\triangle ABC \sim \triangle DEF$, the corresponding angles are congruent and the corresponding sides are proportional.

$\frac{BC}{EF} = \frac{AC}{DF}$ Write a proportion.

$\frac{6}{x} = \frac{4}{12}$ Replace BC with 6, EF with x, AC with 4, and DF with 12.

$6 \cdot 12 = x \cdot 4$ Find the cross products.

$72 = 4x$ Simplify.

$18 = x$ Division Property of Equality

The length of $\overline{EF}$ is 18 centimeters.

Alternative Method

You can also use ratios that compare sides within the figures. In Example 1a, you can use $\frac{6}{4} = \frac{x}{12}$.

b.

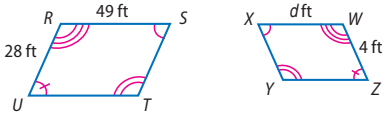


Figure $RSTU \sim$ figure $WXYZ$. The corresponding sides are proportional.

$\frac{RS}{WX} = \frac{RU}{WZ}$ Write a proportion.

$\frac{49}{d} = \frac{28}{4}$ Replace RS with 49, WX with d, RU with 28, and WZ with 4.

$49 \cdot 4 = d \cdot 28$ Find the cross products.

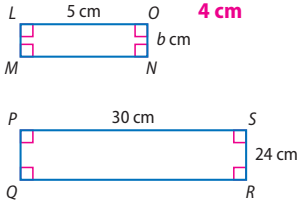
$196 = 28d$ Simplify.

$7 = d$ Division Property of Equality

The length of $\overline{WX}$ is 7 feet.

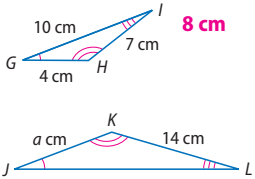
Got It? **Do these problems to find out.**

1a.



4 cm

1b.



8 cm

Scale Factor

The scale factor is the constant of proportionality. In Lesson 5–5, you learned that proportional relationships can be described using equations of the form $y = kx$, where k is the constant of proportionality.

Scale Factor

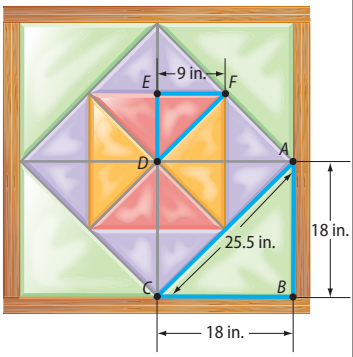
Recall that the scale factor is the ratio of a length on a scale drawing to the corresponding length on the real object. It is also the ratio of corresponding sides in similar figures.

Real World

Example 2

Tutor

An architect is using similar triangles to design a decorative window for the entrance of a new office building. If $\triangle ABC \sim \triangle DEF$, find the length of segment DF.



Find the scale factor from $\triangle DEF$ to $\triangle ABC$ by finding the ratio of corresponding sides with known lengths.

scale factor: $\frac{BC}{EF} = \frac{18}{9}$ or 2

Words	Tw times a length on triangle DEF is a corresponding length on triangle ABC.
Variable	Let m represent the measure of $\overline{DF}$.
Equation	$2m = 25.5$

$2m = 25.5$ Write the equation.

$m = 12.75$ Divide each side by 2.

So, the length of $\overline{DF}$ is 12.75 inches.

Got It? **Do this problem to find out.**

2. A rectangular blue tile has a length of 4.25 inches and a width of 6.75 inches. A similar red tile has a length of 12.75 inches. What is the width of the red tile? **20.25 in.**