English Spanish

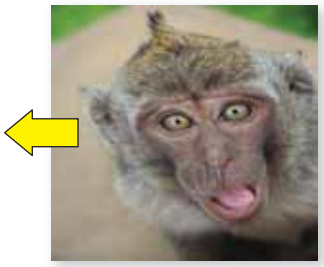
5.1 Identifying Similar Figures

Essential Question How can you use proportions to help make decisions in art, design, and magazine layouts?

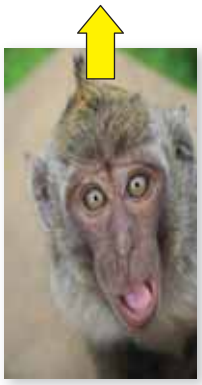
Original Photograph

In a computer art program, when you click and drag on a side of a photograph, you distort it.

But when you click and drag on a corner of the photograph, it remains proportional to the original.



Distorted



Distorted

Proportional

1 ACTIVITY: Reducing Photographs

Work with a partner. You are trying to reduce the photograph to the indicated size for a nature magazine. Can you reduce the photograph to the indicated size without distorting or cropping? Explain your reasoning.

a.

b.

c.

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2 ACTIVITY: Proportional Designs

Work with a partner.

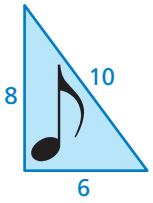
a. Tell whether the new designs are proportional to the original design. Explain your reasoning.

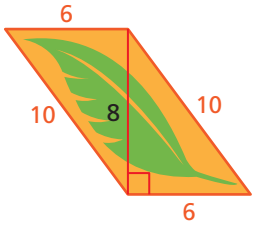
Original

Design 1

Design 2

b. Draw two designs that are proportional to the given design. Make one bigger and one smaller. Label the sides of the designs with their lengths.

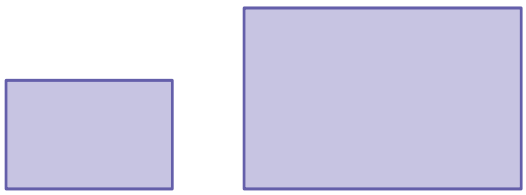




What Is Your Answer?

3. IN YOUR OWN WORDS How can you use proportions to help make decisions in art, design, and magazine layouts? Give two examples.

4. a. Use a computer art program to draw two rectangles that are proportional to each other.



"I love this statue. It seems similar to a big statue I saw in New York."

b. Print the two rectangles on the same piece of paper.

c. Use a centimeter ruler to measure the length and width of each rectangle.

d. Find the following ratios. What can you conclude?

$$\frac{\text{Length of Larger}}{\text{Length of Smaller}} \qquad \frac{\text{Width of Larger}}{\text{Width of Smaller}}$$

Practice Use what you learned about similar figures to complete Exercises 9 and 10 on page 198.

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5.1 Lesson

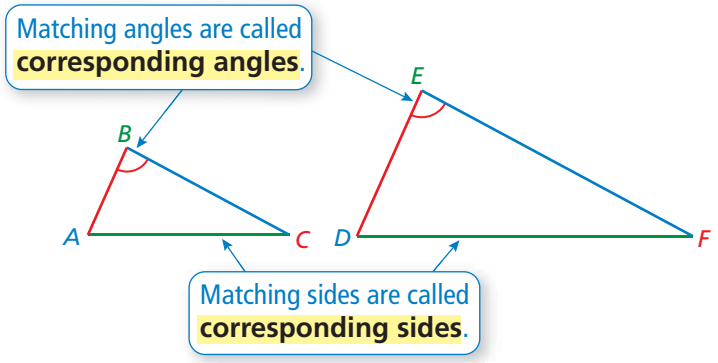
Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Idea

Key Vocabulary
similar figures, *p. 196*
corresponding angles, *p. 196*
corresponding sides, *p. 196*

Similar Figures

Figures that have the same shape but not necessarily the same size are called **similar figures**. The triangles below are similar.



EXAMPLE 1 Naming Corresponding Parts

The trapezoids are similar. (a) Name the corresponding angles. (b) Name the corresponding sides.

Reading
$\angle A$ is read as "angle A."

a. Corresponding angles:

$\angle A$ and $\angle P$

$\angle B$ and $\angle Q$

$\angle C$ and $\angle R$

$\angle D$ and $\angle S$

b. Corresponding sides:

Side AB and Side PQ

Side BC and Side QR

Side CD and Side RS

Side AD and Side PS

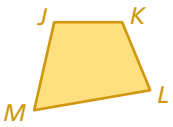
On Your Own

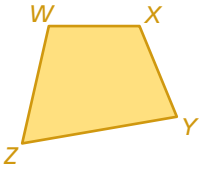
Now You're Ready
Exercises 5 and 6

1. The figures are similar.

a. Name the corresponding angles.

b. Name the corresponding sides.





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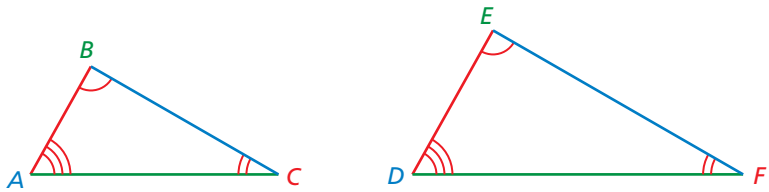
Key Idea

Identifying Similar Figures



Triangle ABC is similar to triangle DEF: $\triangle ABC \sim \triangle DEF$

Words Two figures are similar if

- corresponding side lengths are proportional, and
- corresponding angles have the same measure.

Symbols

Side Lengths

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

Angles

$\angle A$ has the same measure as $\angle D$.
$\angle B$ has the same measure as $\angle E$.
$\angle C$ has the same measure as $\angle F$.

Reading

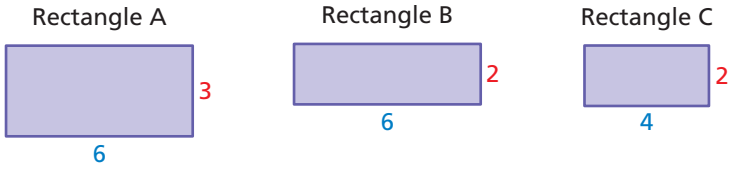
Red arcs are used to indicate angles that have the same measure. The symbol $\sim$ means "is similar to."

Common Error

When writing a similarity statement, make sure to list the vertices of the figures in the same order.

EXAMPLE 2 Identifying Similar Figures

Which rectangle is similar to Rectangle A?



Each figure is a rectangle. So, corresponding angles have the same measure. Check to see if corresponding side lengths are proportional.

Rectangle A and Rectangle B

$$\frac{\text{Length of A}}{\text{Length of B}} = \frac{6}{6} = 1 \qquad \frac{\text{Width of A}}{\text{Width of B}} = \frac{3}{2}$$

Not proportional

Rectangle A and Rectangle C

$$\frac{\text{Length of A}}{\text{Length of C}} = \frac{6}{4} = \frac{3}{2} \qquad \frac{\text{Width of A}}{\text{Width of C}} = \frac{3}{2}$$

Proportional

∴ So, Rectangle C is similar to Rectangle A.

On Your Own

Now You're Ready
Exercises 7–12

2. Rectangle D is 3 units long and 1 unit wide. Which rectangle in Example 2 is similar to Rectangle D?

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5.1 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

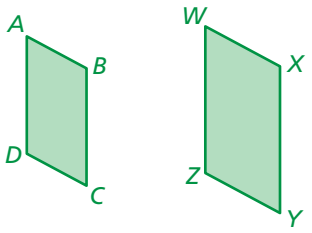
1. **VOCABULARY** How are corresponding angles of two similar figures related?
2. **VOCABULARY** How are corresponding side lengths of two similar figures related?
3. **OPEN-ENDED** Give examples of two real-world objects whose shapes are similar.
4. **CRITICAL THINKING** Are two figures that have the same size and shape similar? Explain.

Practice and Problem Solving

Name the corresponding angles and the corresponding sides of the similar figures.

1

5.



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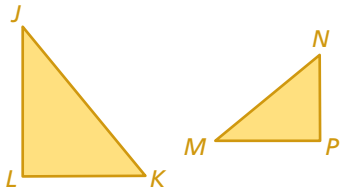


In a coordinate plane, draw the figures with the given vertices. Which figures are similar? Explain your reasoning.

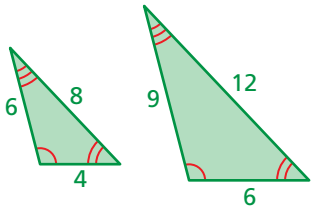
2

7. Triangle A: (0, 0), (3, 0), (0, 3)
   Triangle B: (0, 0), (5, 0), (0, 5)
   Triangle C: (0, 0), (3, 0), (0, 6)

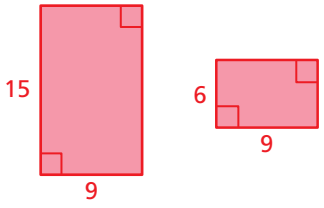
8. Rectangle A: (0, 0), (4, 0), (4, 2), (0, 2)
   Rectangle B: (0, 0), (−6, 0), (−6, 3), (0, 3)
   Rectangle C: (0, 0), (4, 0), (4, 2), (0, 2)

Tell whether the two figures are similar. Explain your reasoning.

9.



10.



11. **MEXICO** A Mexican flag is 63 inches long and 36 inches high. Is the drawing at the right similar to the Mexican flag?

12. **DESKS** A student's rectangular desk is 30 inches long and 18 inches wide. The teacher's rectangular desk is 60 inches long and 36 inches wide. Are the desks similar?

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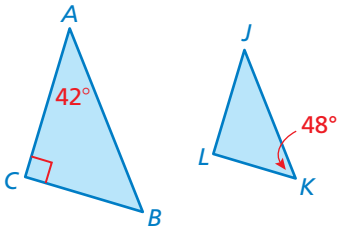
The two triangles are similar. Find the measure of the angle.



13. $\angle B$ **14.** $\angle L$ **15.** $\angle J$

16. REASONING Given $\triangle FGH \sim \triangle QRT$, name the corresponding angles and the corresponding sides.

17. PHOTOS You want to buy only photos that are similar rectangles. Which of the photo sizes should you buy?

Photo Size
4 in. × 5 in.
5 in. × 7 in.
8 in. × 12 in.
11 in. × 14 in.
18 in. × 27 in.

18. CRITICAL THINKING Are the following figures *always*, *sometimes*, or *never* similar? Explain.

a. Two triangles **b.** Two squares

c. Two rectangles **d.** A square and a triangle

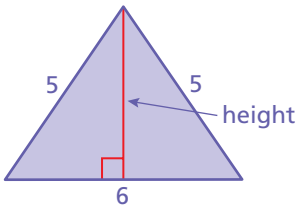
19. CRITICAL THINKING Can you draw two quadrilaterals each having two 130° angles and two 50° angles that are *not* similar? Justify your answer.

20. SIGN All of the angle measures in the sign are 90°.

a. Each side length is increased by 20%. Is the new sign similar to the original?

b. Each side length is increased by 6 inches. Is the new sign similar to the original?

21. GEOMETRY Use a ruler to draw two different isosceles triangles similar to the one shown. Measure the heights of each triangle to the nearest centimeter.



a. Is the ratio of the corresponding heights proportional to the ratio of the corresponding side lengths?

b. Do you think this is true for all similar triangles? Explain.

22. Critical Thinking Given $\triangle ABC \sim \triangle DEF$ and $\triangle DEF \sim \triangle JKL$, is $\triangle ABC \sim \triangle JKL$? Give an example or non-example.

Fair Game Review What you learned in previous grades & lessons

Simplify. SKILLS REVIEW HANDBOOK

23. $\left(\frac{4}{9}\right)^2$ **24.** $\left(\frac{3}{8}\right)^2$ **25.** $\left(\frac{7}{4}\right)^2$ **26.** $\left(\frac{6.5}{2}\right)^2$

27. MULTIPLE CHOICE Which equation shows inverse variation? SECTION 3.8

Ⓐ $3y = 8x$ Ⓑ $y = \frac{8}{3x}$ Ⓒ $\frac{y}{3} = \frac{x}{8}$ Ⓓ $y = 8x - 3$