English Spanish

5.2 Perimeters and Areas of Similar Figures

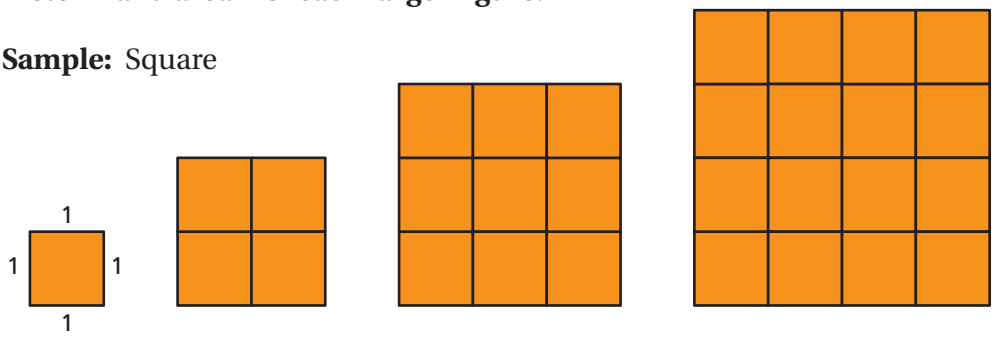
STATE STANDARDS
MA.7.G.4.1

Essential Question How do changes in dimensions of similar geometric figures affect the perimeters and areas of the figures?

1 ACTIVITY: Comparing Perimeters and Areas

Work with a partner. Use pattern blocks to make a figure whose dimensions are 2, 3, and 4 times larger than those of the original figure. Find the perimeter P and area A of each larger figure.

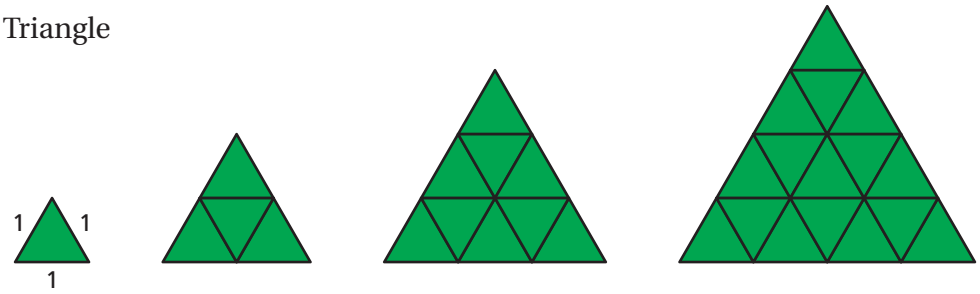
a. Sample: Square



$P = 4$ $P = 8$ $P = 12$ $P = 16$

$A = 1$ $A = 4$ $A = 9$ $A = 16$

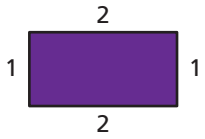
b. Triangle



$P = 3$ $P = 6$ $P =$ ☐ $P =$ ☐

$A = B$ $A = 4B$ $A =$ ☐ $A =$ ☐

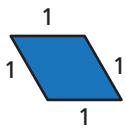
c. Rectangle



$P = 6$

$A = 2$

d. Parallelogram



$P = 4$

$A = C$

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2 ACTIVITY: Finding Patterns for Perimeters

Work with a partner. Copy and complete the table for the perimeters of the figures in Activity 1. Describe the pattern.

	Figure	Original Side Lengths	Double Side Lengths	Triple Side Lengths	Quadruple Side Lengths
Perimeters		$P = 4$	$P = 8$	$P = 12$	$P = 16$
		$P = 3$	$P = 6$		
		$P = 6$			
		$P = 4$			

3 ACTIVITY: Finding Patterns for Areas

Work with a partner. Copy and complete the table for the areas of the figures in Activity 1. Describe the pattern.

	Figure	Original Side Lengths	Double Side Lengths	Triple Side Lengths	Quadruple Side Lengths
Areas		$A = 1$	$A = 4$	$A = 9$	$A = 16$
		$A = B$	$A = 4B$		
		$A = 2$			
		$A = C$			

What Is Your Answer?

4. **IN YOUR OWN WORDS** How do changes in dimensions of similar geometric figures affect the perimeters and areas of the figures?

Practice Use what you learned about perimeters and areas of similar figures to complete Exercises 8–11 on page 204.

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5.2 Lesson

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Lesson Tutorials
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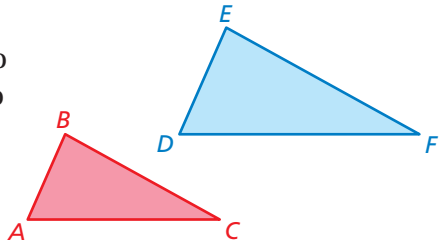
Key Idea

Perimeters of Similar Figures

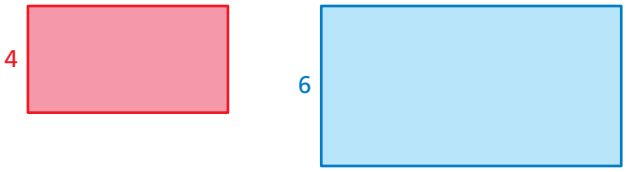
If two figures are similar, then the ratio of their perimeters is equal to the ratio of their corresponding side lengths.



$$\frac{\text{Perimeter of } \triangle ABC}{\text{Perimeter of } \triangle DEF} = \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

EXAMPLE 1 Finding Ratios of Perimeters

Find the ratio (red to blue) of the perimeters of the similar rectangles.



$$\frac{\text{Perimeter of red rectangle}}{\text{Perimeter of blue rectangle}} = \frac{4}{6} = \frac{2}{3}$$

∴ The ratio of the perimeters is $\frac{2}{3}$.

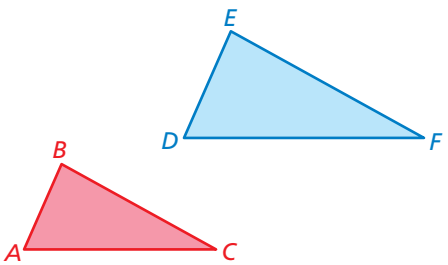
On Your Own

1. The height of Figure A is 9 feet. The height of a similar Figure B is 15 feet. What is the ratio of the perimeter of A to the perimeter of B?

Key Idea

Areas of Similar Figures

If two figures are similar, then the ratio of their areas is equal to the *square* of the ratio of their corresponding side lengths.



$$\frac{\text{Area of } \triangle ABC}{\text{Area of } \triangle DEF} = \left(\frac{AB}{DE}\right)^2 = \left(\frac{BC}{EF}\right)^2 = \left(\frac{AC}{DF}\right)^2$$

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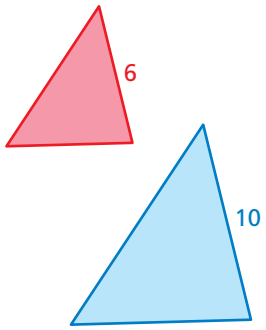
EXAMPLE 2 Finding Ratios of Areas

Find the ratio (red to blue) of the areas of the similar triangles.



$$\frac{\text{Area of red triangle}}{\text{Area of blue triangle}} = \left(\frac{6}{10}\right)^2$$

$$= \left(\frac{3}{5}\right)^2 = \frac{9}{25}$$

∴ The ratio of the areas is $\frac{9}{25}$.

EXAMPLE 3 Real-Life Application

You place a picture on a page of a photo album. The page and the picture are similar rectangles.

a. How many times greater is the area of the page than the area of the picture?

b. The area of the picture is 45 square inches. What is the area of the page?

a. Find the ratio of the area of the page to the area of the picture.

$$\frac{\text{Area of page}}{\text{Area of picture}} = \left(\frac{\text{length of page}}{\text{length of picture}}\right)^2$$

$$= \left(\frac{8}{6}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

∴ The area of the page is $\frac{16}{9}$ times greater than the area of the picture.

b. Multiply the area of the picture by $\frac{16}{9}$.

$$45 \cdot \frac{16}{9} = 80$$

∴ The area of the page is 80 square inches.

On Your Own

Now You're Ready
Exercises 4–13

2. The base of Triangle P is 8 meters. The base of a similar Triangle Q is 7 meters. What is the ratio of the area of P to the area of Q?

3. In Example 3, the perimeter of the picture is 27 inches. What is the perimeter of the page?

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5.2 Exercises

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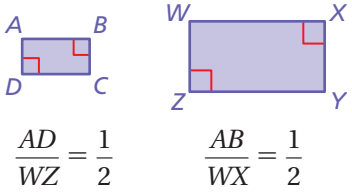
Vocabulary and Concept Check

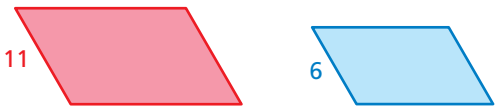
1. **WRITING** How are the perimeters of two similar figures related?
2. **WRITING** How are the areas of two similar figures related?
3. **VOCABULARY** Rectangle *ABCD* is similar to Rectangle *WXYZ*. The area of *ABCD* is 30 square inches. What is the area of *WXYZ*? Explain.

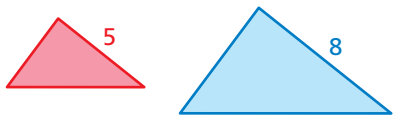


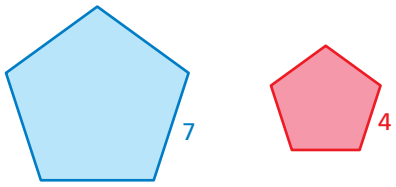
$\frac{AD}{WZ} = \frac{1}{2}$ $\frac{AB}{WX} = \frac{1}{2}$

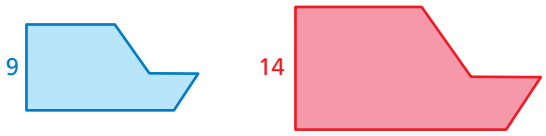
Practice and Problem Solving

The two figures are similar. Find the ratios (red to blue) of the perimeters and of the areas.

4. 

5. 

6. 

7. 

8. How does doubling the side lengths of a triangle affect its perimeter?
9. How does tripling the side lengths of a triangle affect its perimeter?
10. How does doubling the side lengths of a rectangle affect its area?
11. How does quadrupling the side lengths of a rectangle affect its area?
12. **BASKETBALL** The Orlando Magic's court is similar to a playground court. The ratio of the corresponding side lengths is 10 : 7. What is the ratio of the areas?
13. **LAPTOP** The ratio of the corresponding side lengths of two similar computer screens is 13 : 15. The perimeter of the smaller screen is 39 inches. What is the perimeter of the larger screen?

Triangle *ABC* is similar to Triangle *DEF*. Tell whether the statement is *true* or *false*. Explain your reasoning.

14. $\frac{\text{Perimeter of } \triangle ABC}{\text{Perimeter of } \triangle DEF} = \frac{AB}{DE}$

15. $\frac{\text{Area of } \triangle ABC}{\text{Area of } \triangle DEF} = \frac{AB}{DE}$

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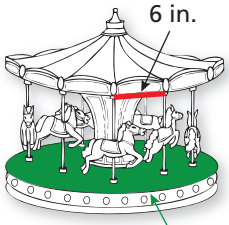
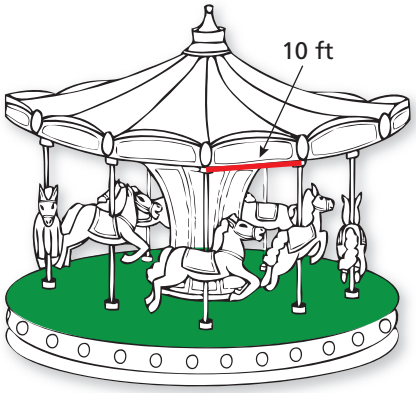
16. **FABRIC** The cost of the fabric is $1.31. What would you expect to pay for a similar piece of fabric that is 18 inches by 42 inches?



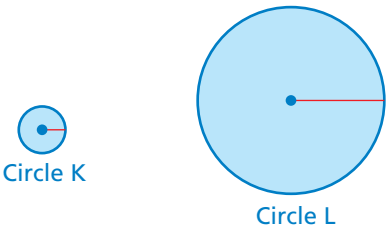


17. **AMUSEMENT PARK** A model of a merry-go-round has a base area of about 450 square inches. What is the percent of increase of the base area from the model to the actual merry-go-round? Explain.

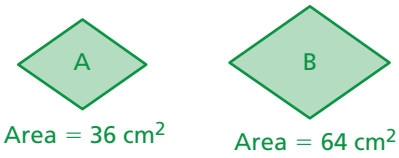
18. **CRITICAL THINKING** The circumference of Circle K is π. The circumference of Circle L is 4π.

a. What is the ratio of their circumferences? of their radii? of their areas?

b. What do you notice?



19. **GEOMETRY** Rhombus A is similar to Rhombus B. What is the ratio (A to B) of the corresponding side lengths?



20. Geometry A triangle with an area of 10 square meters has a base of 4 meters. A similar triangle has an area of 90 square meters. What is the *height* of the larger triangle?

Fair Game Review What you learned in previous grades & lessons

Find the percent of change. Round to the nearest tenth of a percent, if necessary. SECTION 4.2

21. 24 feet to 30 feet

22. 90 miles to 63 miles

23. 150 liters to 86 liters

24. **MULTIPLE CHOICE** A runner completes an 800-meter race in 2 minutes 40 seconds. What is the runner's speed? SECTION 3.1

Ⓐ $\frac{3 \text{ sec}}{10 \text{ m}}$ Ⓑ $\frac{160 \text{ sec}}{1 \text{ m}}$ Ⓒ $\frac{5 \text{ m}}{1 \text{ sec}}$ Ⓓ $\frac{10 \text{ m}}{3 \text{ sec}}$