

Check Skills You'll Need

1. **Vocabulary Review**
The first coordinate in an *ordered pair* is the ? - coordinate.

Graph each point on a coordinate plane.

2. $A(3, 6)$ 3. $B(-2, 7)$
4. $C(5, -1)$ 5. $D(-3, 0)$



CONTENT STANDARDS

8.G.3, 8.G.4

Vocabulary Tip

You can think of the *scale factor* of a dilation as a multiplier.

What You'll Learn

To graph dilations and to determine the scale factor of a dilation

New Vocabulary dilation, scale factor, enlargement, reduction

Why Learn This?

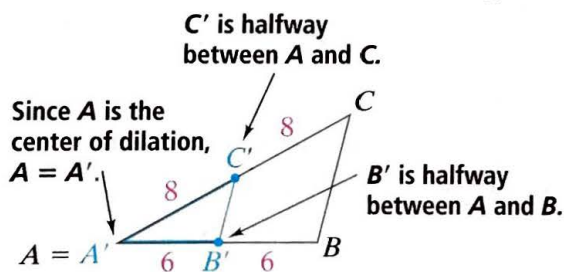
Photos can be enlarged or reduced using scale factors.

A **dilation** is a transformation in which a figure and its image are similar. The ratio of a length in the image to the corresponding length in the original figure is the **scale factor**.



EXAMPLE Finding a Dilation

- 1 Find the image of $\triangle ABC$ after a dilation with center A and a scale factor of $\frac{1}{2}$.



$\triangle A'B'C'$ is the image of $\triangle ABC$ after a dilation with a scale factor of $\frac{1}{2}$.
 $\triangle ABC \sim \triangle A'B'C'$.

Quick Check

1. Find the image of $\triangle DEF$ with vertices $D(-2, 2)$, $E(1, -1)$, and $F(-2, -1)$ after a dilation with center D and scale factor 2.

You can use the coordinate plane to graph dilations. In this book, all dilations are centered at $(0, 0)$. To find the image of a figure in the coordinate plane after a dilation, you multiply the x - and y -coordinates of its vertices by the scale factor.

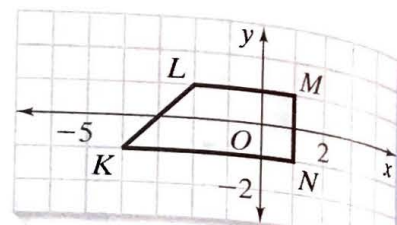


For: Similar Figures Activity

Use: Interactive Textbook, 8-5

EXAMPLE Graphing Dilation Images

- 2 Find the coordinates of the vertices of the image of quadrilateral $KLMN$ after a dilation with scale factor of $\frac{3}{2}$. Then graph the image.



Step 1 Multiply the coordinates of each vertex by $\frac{3}{2}$.

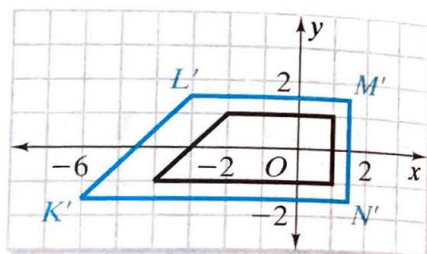
$$K(-4, -1) \rightarrow K'\left(-6, -\frac{3}{2}\right)$$

$$L(-2, 1) \rightarrow L'\left(-3, \frac{3}{2}\right)$$

$$M(1, 1) \rightarrow M'\left(\frac{3}{2}, \frac{3}{2}\right)$$

$$N(1, -1) \rightarrow N'\left(\frac{3}{2}, -\frac{3}{2}\right)$$

Step 2 Graph the vertices of the image. Draw $K'L'M'N'$.



Quick Check

2. $ABCD$ has vertices $A(0,0)$, $B(0,3)$, $C(3,3)$, and $D(3,0)$. Find the coordinates of the vertices of the image of $ABCD$ after a dilation with a scale factor of $\frac{4}{3}$. Then graph the image.

A dilation with a scale factor greater than 1 is called an **enlargement**. The image is bigger than the original. A dilation with a scale factor less than 1 is called a **reduction**. The image is smaller than the original.

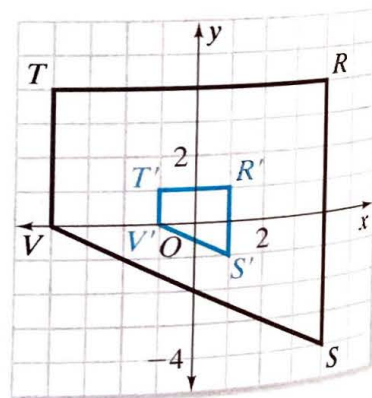
EXAMPLE Application: City Planning

- 3 $TRSV$ shows the outline of a park. A city planner dilates the figure to show the area of the park that can be used for concerts. What is the scale factor of the dilation?

The image is smaller than the original figure, so the dilation is a reduction. The scale factor must be less than 1.

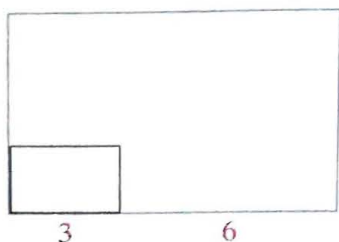
$$\frac{\text{image}}{\text{original}} \rightarrow \frac{T'R'}{TR} = \frac{2}{8} = \frac{1}{4}$$

The correct answer is choice B.



Quick Check

3. The blue figure at the left shows the outline of a yard. The black figure is a doghouse. The blue figure is a dilation image of the black figure. Find the scale factor. Is the dilation an enlargement or a reduction?

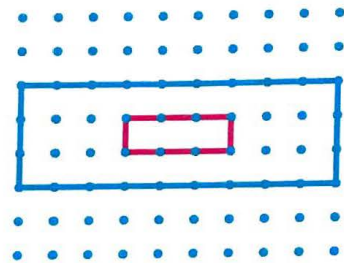


Check Your Understanding

1. **Vocabulary** A rectangle is dilated with a scale factor of 0.6. Is the image a reduction or an enlargement? Explain.

The blue figure is a dilation image of the red figure.

2. Is the blue figure an enlargement or a reduction of the red figure?
3. What is the scale factor?



Homework Exercises

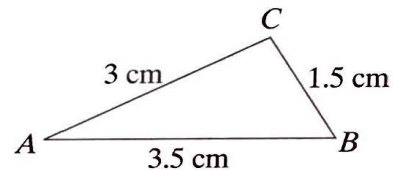
For more exercises, see Extra Skills and Word Problems.

GO for Help

For Exercises	See Examples
4-5	1
6-7	2
8-10	3

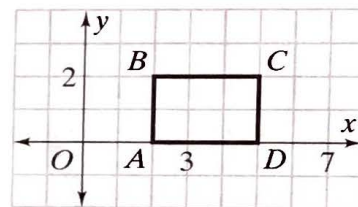
Copy $\triangle ABC$. Find the image of $\triangle ABC$ after a dilation with the given center and scale factor.

4. center C , scale factor $\frac{1}{2}$
5. center B , scale factor 2

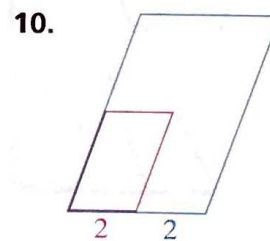
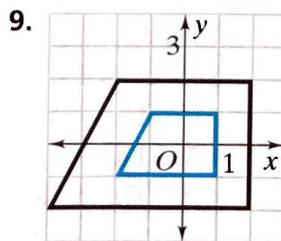
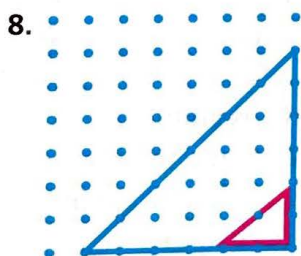


Find the coordinates of the vertices of the image of $ABCD$ after a dilation with the given scale factor. Graph the image.

6. scale factor 2 7. scale factor $\frac{1}{2}$



The blue figure is a dilation image of the original figure. Find the scale factor. Classify each dilation as an *enlargement* or a *reduction*.



GPS

11. **Guided Problem Solving** You are reducing a digital photo that is 2 in. high and 3 in. wide. If the reduced photo is $1\frac{1}{4}$ in. high, what is its width? Write your answer as a mixed number in simplest form.

- **Understand the Problem** You know the height and width of the original photo and the height of the reduced photo. You want to find the width of the reduced photo.
- **Make a Plan** Draw and label the original photo and the reduced photo. Label the missing width w .

Graph quadrilateral $EFGH$ with the given vertices. Find the coordinates of the vertices of its image after a dilation with the given scale factor. Graph the image.

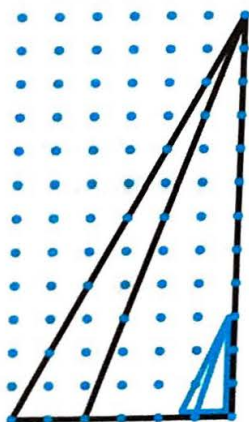
12. $E(-2, -1), F(2, 0), G(2, 2), H(-1, 2)$; scale factor of 2
13. $E(-3, 0), F(1, -4), G(5, 0), H(1, 4)$; scale factor of $\frac{1}{2}$
14. **Computers** A window on a computer screen is $1\frac{1}{2}$ in. high and 2 in. wide. After you click the “size reduction” button, the window is reduced to $1\frac{1}{8}$ in. high and $1\frac{1}{2}$ in. wide. What is the scale factor?
15. $\triangle A'B'C'$ is the image of $\triangle ABC$ after a dilation. $AB = 7$ cm, $AC = 10$ cm, $A'B' = 28$ cm, and $B'C' = 24$ cm. What is the ratio of the perimeter of $\triangle ABC$ to the perimeter of $\triangle A'B'C'$?
16. **Writing in Math** Explain how to dilate a figure in the coordinate plane.
17. **Challenge** $\triangle ABC$ has three angles that measure 60° each and three sides that measure 60 cm each. With what scale factor should you dilate $\triangle ABC$ so that its image $\triangle A'B'C'$ has sides that measure 21 cm each?



Test Prep and Mixed Review

Practice

Multiple Choice



18. The blue figure is a dilation image of the black figure. What is the scale factor?
 A $\frac{1}{4}$ B $\frac{1}{2}$ C 2 D 4
19. The number of people a restaurant can hold is proportional to the area of its floor space. One restaurant has a length of 45 feet, a width of 40 feet, and a ceiling height of 25 feet. It can hold 115 people. Which piece of information do you NOT need in order to find the amount of space needed for 200 people?
 F The length of the restaurant
 G The number of people the restaurant can hold
 H The ceiling height of the restaurant
 J The width of the restaurant
20. Cory is putting strips of tape along the diagonals of windows to prepare for a storm. Each window is 54 inches high and 40 inches wide. Which estimate is closest to the total length of the strips of tape Cory needs to cover 12 windows?
 A 11 ft B 67 ft C 134 ft D 185 ft

GO for Help

For Exercises	See Lesson
21–22	1–4

The lengths of the legs of a right triangle are given. Find the length of the hypotenuse.

21. 16 cm, 12 cm
22. 57 in., 76 in.