

## 8-5

# Dilations

### © CONTENT STANDARDS

8.G.3, 8.G.4

### 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.

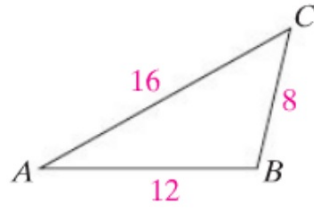
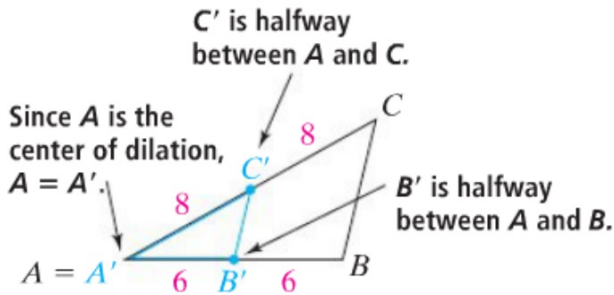


*Please put these definitions in your notes.*

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  $\frac{1}{2}$ .

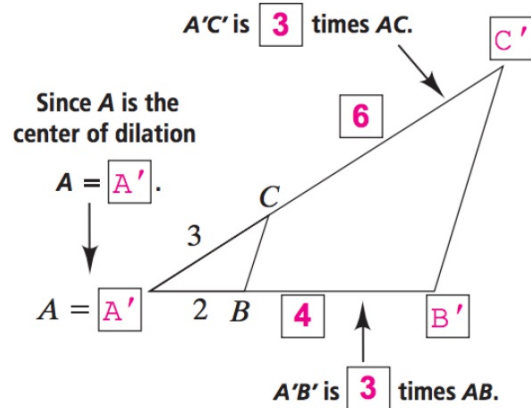


$\triangle A'B'C'$  is the image of  $\triangle ABC$  after a dilation with a scale factor of  $\frac{1}{2}$ .  
 $\triangle ABC \sim \triangle A'B'C'$ .

## Example

- 1 **Finding a Dilation** Find the image of  $\triangle ABC$  after a dilation with center  $A$  and a scale factor of 3.

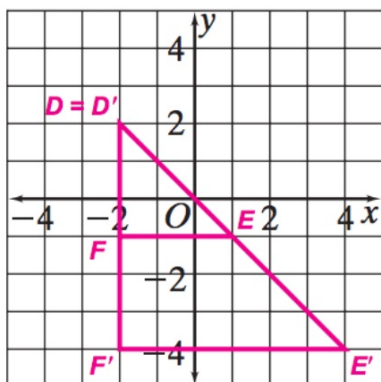
$\triangle A'B'C'$  is the image of  $\triangle ABC$  after a dilation with center  $A$  and a scale factor of 3.  $\triangle ABC \sim \triangle A'B'C'$ .



## 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 a scale factor of 2.

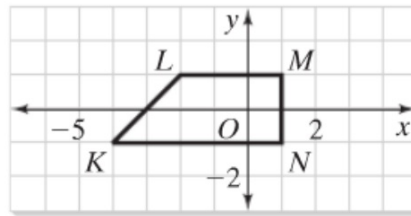
$D'(-2, 2)$   
 $E'(4, -4)$   
 $F'(-2, -4)$



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.

## 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  $\frac{3}{2}$ .

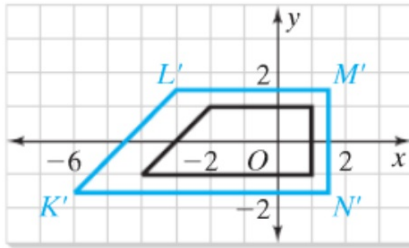
$$K(-4, -1) \rightarrow K'\left(-6, -\frac{3}{2}\right)$$

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

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

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

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



- 2 **Graphing Dilation Images** Find the coordinates of the vertices of the image of quadrilateral  $WXYZ$  after a dilation with center  $(0, 0)$  and a scale factor of  $\frac{1}{2}$ . Then graph the image. Quadrilateral  $WXYZ$  has vertices  $W(-2, -1)$ ,  $X(0, 2)$ ,  $Y(4, 2)$ , and  $Z(4, -1)$ .

**Step 1** Multiply the  $x$ - and  $y$ -coordinates of each point by  $\frac{1}{2}$ .

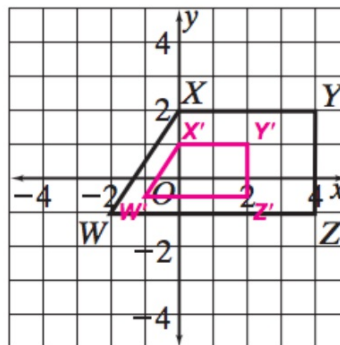
$$W(-2, -1) \rightarrow W'\left(\boxed{-1}, -\frac{\boxed{1}}{\boxed{2}}\right)$$

$$X(0, 2) \rightarrow X'\left(\boxed{0}, \frac{\boxed{1}}{\boxed{2}}\right)$$

$$Y(4, 2) \rightarrow Y'\left(\frac{\boxed{2}}{\boxed{2}}, \frac{\boxed{1}}{\boxed{2}}\right)$$

$$Z(4, -1) \rightarrow Z'\left(\frac{\boxed{2}}{\boxed{2}}, -\frac{\boxed{1}}{\boxed{2}}\right)$$

**Step 2** 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.

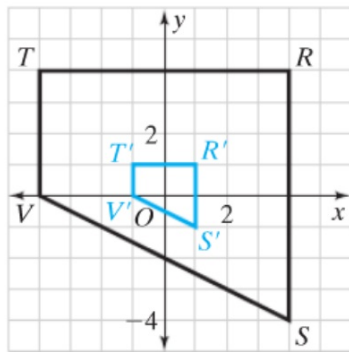
**EXAMPLE** Application: City Planning

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.

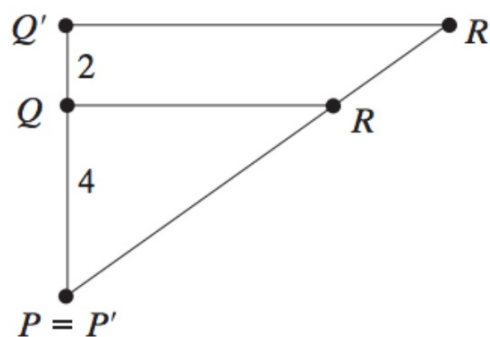
$$\frac{\text{image}}{\text{original}} \rightarrow \frac{T'R'}{TR} = \frac{2}{8} = \frac{1}{4}$$

The correct answer is choice B.



Ⓔ **Finding a Scale Factor**  $\triangle Q'P'R'$  is a dilation of  $\triangle QPR$ . What is the scale factor of the dilation?

$$\frac{\text{image}}{\text{original}} \rightarrow \frac{QP'}{QP} = \frac{4 + 2}{4} = 1.5$$



The scale factor is **1.5**. It is **greater** than 1, so the dilation is a(n) **enlargement**.

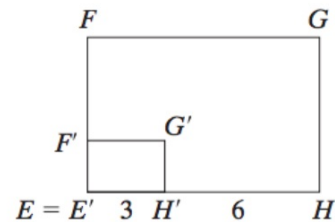
**Quick Check**

*Table Talk about this problem*

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.

*Table talk about this problem*

3. Figure  $EFGH$  shows the outline of a yard. Figure  $E'F'G'H'$  is a doghouse. Figure  $E'F'G'H'$  is a dilation image of figure  $EFGH$ . Find the scale factor. Is the dilation an enlargement or a reduction?



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