

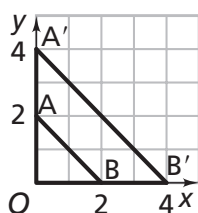
# Topic 10: Dilations

for use before *Kaleidoscopes, Hubcaps, and Mirrors* Investigation 1

A **dilation** is a transformation of a figure that changes its size but not its shape. The **scale factor** of a dilation determines the extent of the change in size. A dilation is an enlargement when the scale factor is greater than 1. It is a reduction if the scale factor is less than 1. When you dilate a figure, you are either shrinking or enlarging an original figure toward or farther from another point called the **center of dilation**.

## Problem 10.1

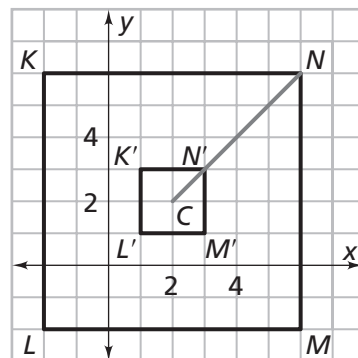
The graph shows the dilation of  $\triangle AOB$  to  $\triangle A'O'B'$  with the center of dilation at the origin. The naming of a point like  $A'$  (ay-prime) signals that  $A'$  is the new position of  $A$  after the transformation.



- A.** Is  $\triangle A'O'B'$  an enlargement or a reduction of  $\triangle AOB$ ?
- B.**
1. How many times greater is  $OA'$  than  $OA$ ?
  2. How many times greater is  $OB'$  than  $OB$ ?
  3. How many times greater is  $A'B'$  than  $AB$ ?
  4. The scale factor in a dilation measures the comparative size of linear measures in a figure before and after dilation. What is the scale factor of this dilation?
  5. When you are examining a dilation, what is the least information you need in order to determine the scale factor?
- C.** How did the center of dilation change position in the dilation of  $\triangle AOB$ ?
- D.** Draw  $\triangle LOM$  with vertices  $L(0, 4)$ ,  $O(0, 0)$ , and  $M(2, 0)$ . Then draw  $\triangle L'OM'$  as a dilation of  $\triangle LOM$  with the center of dilation at  $(0, 0)$  and a scale factor of 1.5.

## Problem 10.2

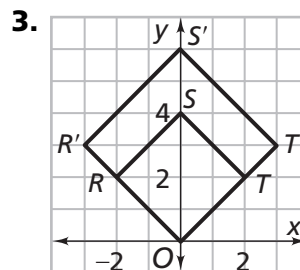
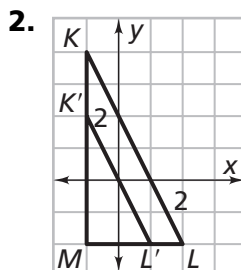
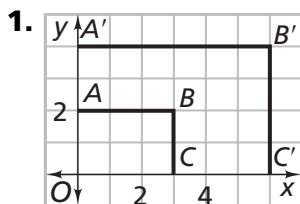
The graph shows the dilation of figure  $KLMN$  to  $K'L'M'N'$  with the center of dilation at  $C(2, 2)$  and a scale factor of  $\frac{1}{4}$ .



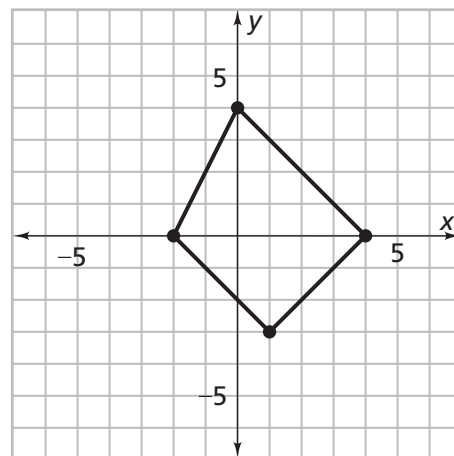
- A. Is  $K'L'M'N'$  an enlargement or a reduction of  $KLMN$ ?
- B.
  1. What is the ratio of side  $K'L'$  to side  $KL$ ?
  2. What is the ratio of the length of  $\overline{CN'}$  to the length of  $\overline{CN}$ ?
  3. What does the fact that  $\overline{CN}$  and  $\overline{CN'}$  lie on the same line suggest about a strategy for drawing the dilation of a polygon when you know the scale factor?
- C. Make a copy of  $KLMN$  and draw a reduction with the center of dilation at  $(2, 2)$  and a scale factor of  $\frac{3}{4}$ .

## Exercises

Identify each as an enlargement or reduction. Name the location of the center of dilation and give the scale factor.



4. For a dilation centered at the origin you can find the location of points on the dilated image by multiplying the coordinates on the original image by the scale factor. Use this technique to draw the dilation of the quadrilateral. Use a scale factor of  $\frac{3}{2}$  and a center of dilation at  $(0, 0)$ .
5.
  - a. Draw  $\triangle ABC$  with vertices at  $(-5, -1)$ ,  $(1, 3)$ , and  $(1, -1)$ .
  - b. Dilate  $\triangle ABC$  with a scale factor of  $\frac{1}{2}$  and a center of dilation at  $(1, 3)$ .



## Topic 10: Dilations

PACING 1 day

### Mathematical Goals

- Identify and describe the dilation of a figure on the coordinate plane.
- Apply a dilation to a rectangle, square, or right triangle.

### Guided Instruction

A dilation is the enlargement or reduction of a figure. The size of the figure changes but the shape does not, so the original figure and the dilation are similar.

In a dilation, there are two conditions that determine the location of the vertices of the dilation. The first is the scale factor. The scale factor determines if the dilation is larger or smaller than the original. It also determines how much larger or smaller the dilation will be. The second condition is the center of rotation. The center of dilation can be any point on the coordinate plane that is inside, on, or outside the original figure. The center of dilation determines the location of the dilation in reference to the original figure.

After Problem 10.1

- *The scale factor in the dilation is 2. What is the scale factor if you start with the larger triangle and reduce it to the smaller one? ( $\frac{1}{2}$ )*

After Problem 10.2

- *How does the center of dilation in this problem differ from the one in the first problem? (The first one is located at (0, 0) and this one is at (2, 2).)*

You will find additional work on dilations in the grade 7 unit *Stretching and Shrinking*.

### Vocabulary

- dilation
- scale factor
- center of dilation

### Materials

- Labsheet 10ACE  
Exercise 4

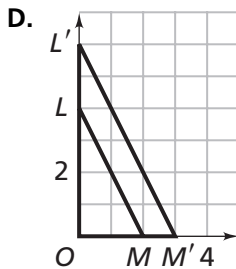
## Assignment Guide for Topic 10

Core 1–5

## Answers to Topic 10

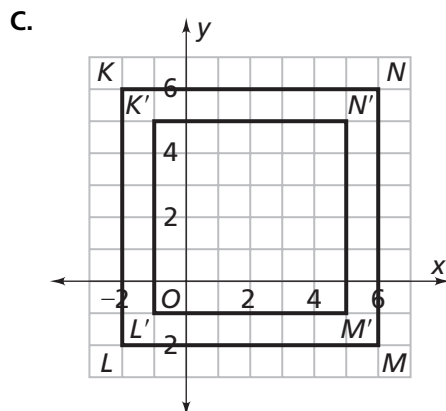
### Problem 10.1

- A. 1. enlargement  
 B. 1. 2 times  
 2. 2 times  
 3. 2 times  
 4. 2  
 5. The ratio of any linear measurement in the original figure to the corresponding measurement in the dilated image.  
 C. It did not change position.



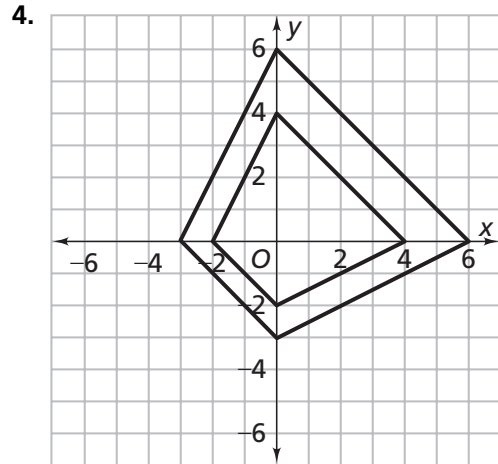
### Problem 10.2

- A. 1. reduction  
 B. 1. 1:4  
 2. 1:4  
 3. Draw a line from the center of dilation through a vertex on the polygon. Draw a line segment in that line with one endpoint at the center of dilation and with a length that corresponds to the scale factor. Repeat for the remaining vertices in the original polygon. Connect the dilated vertices to form the dilation of the original polygon.

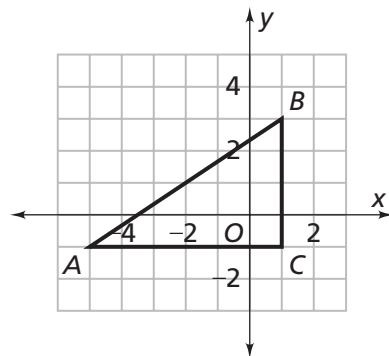


### Exercises

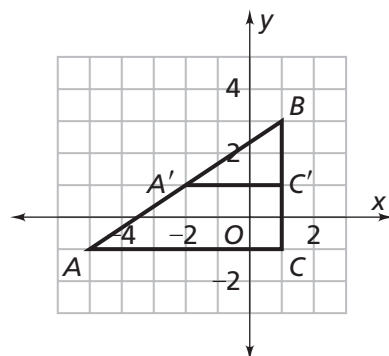
1. Enlargement,  $(0, 0)$ , scale factor of 2
2. Reduction,  $(-1, -2)$ , scale factor of  $\frac{1}{3}$
3. Enlargement,  $(0, 0)$ , scale factor of 1.5



5. a.



b.



## Labsheet 10ACE Exercise 4

Topic **10**

4.

