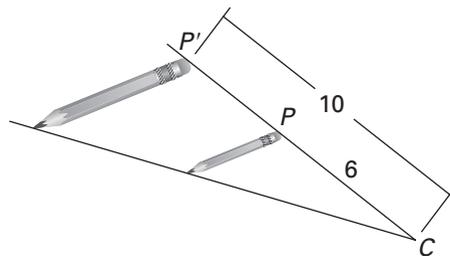


LESSON
9.7**Study Guide**

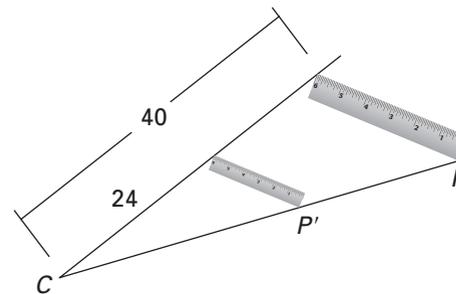
For use with pages 625–633

GOAL Use drawing tools and matrices to draw dilations.**Vocabulary****Scalar multiplication** is the process of multiplying each element of a matrix by a real number or scalar.A **dilation** is a transformation in which the original figure and its image are similar.A **reduction** is a dilation that has a scale factor that lies between 0 and 1.An **enlargement** is a dilation that has a scale factor greater than 1.**EXAMPLE 1** Identify dilations**Find the scale factor of the dilation. Then, tell whether the dilation is a reduction or an enlargement.**

a.



b.

**Solution**a. Because $\frac{CP'}{CP} = \frac{10}{6}$, the scale factor is $k = \frac{5}{3}$.The image P' is an enlargement.b. Because $\frac{CP'}{CP} = \frac{24}{40}$, the scale factor is $k = \frac{3}{5}$.The image P' is a reduction.**EXAMPLE 2** Scalar multiplication**Simplify the product** $3 \begin{bmatrix} 4 & 1 & 2 \\ 1 & -2 & -3 \end{bmatrix}$.**Solution**

$$3 \begin{bmatrix} 4 & 1 & 2 \\ 1 & -2 & -3 \end{bmatrix} = \begin{bmatrix} 3(4) & 3(1) & 3(2) \\ 3(1) & 3(-2) & 3(-3) \end{bmatrix} \quad \text{Multiply each element in the matrix by 3.}$$

$$= \begin{bmatrix} 12 & 3 & 6 \\ 3 & -6 & -9 \end{bmatrix} \quad \text{Simplify.}$$

LESSON
9.7**Study Guide** *continued*
For use with pages 625–633**Exercises for Examples 1 and 2**

1. In a dilation, $CP' = 32$ and $CP = 8$. Tell whether the dilation is a *reduction* or an *enlargement* and find its scale factor.

Simplify the product.

2. $6 \begin{bmatrix} 7 & 4 & 3 \\ -3 & 0 & -5 \end{bmatrix}$

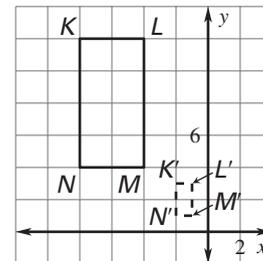
3. $-5 \begin{bmatrix} -3 & 2 & 6 \\ 8 & -9 & 1 \end{bmatrix}$

EXAMPLE 3 Use scalar multiplication in a dilation

The vertices of a quadrilateral $KLMN$ are $K(-8, 12)$, $L(-4, 12)$, $M(-4, 4)$, and $N(-8, 4)$. Use scalar multiplication to find the image of $KLMN$ after a dilation with its center at the origin and a scale factor of $\frac{1}{4}$. Graph $KLMN$ and its image.

Solution

$$\frac{1}{4} \begin{bmatrix} K & L & M & N \\ -8 & -4 & -4 & -8 \\ 12 & 12 & 4 & 4 \end{bmatrix} = \begin{bmatrix} K' & L' & M' & N' \\ -2 & -1 & -1 & -2 \\ 3 & 3 & 1 & 1 \end{bmatrix}$$

**EXAMPLE 4** Find the image of a composition

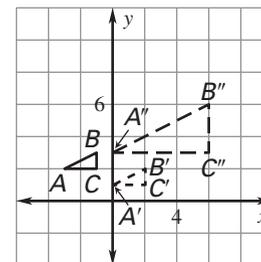
The vertices of $\triangle ABC$ are $A(-3, 2)$, $B(-1, 3)$, and $C(-1, 2)$. Find the image of $\triangle ABC$ after the given composition.

Translation: $(x, y) \rightarrow (x + 3, y - 1)$

Dilation: centered at the origin with a scale factor of 3

Solution

Graph the preimage $\triangle ABC$. Translate $\triangle ABC$ 3 units to the right and 1 unit down. Label it $\triangle A'B'C'$. Dilate using the origin as the center and a scale factor of 3 to find $\triangle A''B''C''$.

**Exercises for Examples 3 and 4**

4. The vertices of $\triangle RST$ are $R(-2, 0)$, $S(0, -1)$, and $T(0, 0)$. Use scalar multiplication to find the vertices of $\triangle R'S'T'$ after a dilation with its center at the origin and a scale factor of 4.
5. A segment has the endpoints $C(-2, 2)$ and $D(2, 2)$. Find the image of \overline{CD} after a 180° rotation about the origin followed by a dilation with its center at the origin and a scale factor of $\frac{1}{2}$.