

Notes 10.2

Objective: Dilations

Transformation: A change in the position, shape, or size of a geometric figure.

Examples of Transformations:

- *reflections* (flips)
- *translations* (slides)
- *rotations* (twists)
- *dilations* (enlargements or reductions)

Preimage: The original figure in a transformation.

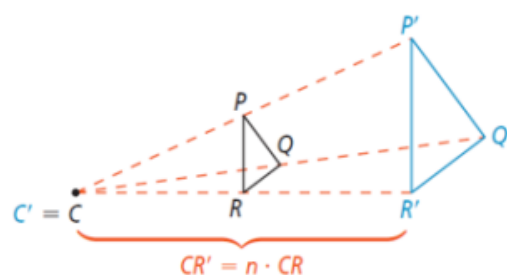
Image: The resulting figure after the transformation.

Dilation: A transformation in which a larger or smaller copy of a figure is made that is similar to the original figure.

A **dilation** with center C and **scale factor** n , $n > 0$, is a transformation with these two properties:

- The image of C is itself (that is, $C' = C$).
- For any other point R , R' is on \overrightarrow{CR} and $CR' = n \cdot CR$, or $n = \frac{CR'}{CR}$.

The image of a dilation is similar to its preimage.



Enlargement: A dilation with a scale factor greater than 1. The image is larger than the preimage.

Reduction: A dilation with a scale factor between 0 and 1. The image is smaller than the preimage.

Properties of Dilations:

- If the scale factor is n , the segments in the image are n times as long as the corresponding segments in the preimage.
- The angles in the image are congruent to the corresponding angles in the preimage.
- The points on the image are n times as far away from the **center of dilation** as the points on the preimage.

Dilations with the Center at the Origin

If the center of dilation is the origin and the scale factor is n , the image of the point $A(x, y)$ will have coordinates $A'(nx, ny)$. In other words, multiply both the x and y coordinates by the scale factor to find the coordinates of the new point.

Examples: A dilation has center $(0, 0)$. Find the image of each point for the given scale factor.

a) $L(3, 0)$; scale factor = 5

$$L'(15, 0)$$

b) $N(-4, 7)$; scale factor = 0.2

$$N'(-.8, 1.4)$$

c) $A(6, 2)$; scale factor = 1.5

$$A'(9, 3)$$

d) $F(3, -2)$; scale factor = $\frac{1}{3}$

$$F'(1, -\frac{2}{3})$$

Examples: Graph and label the figure with the given vertices. Then dilate the figure by the given scale factor with center $(0,0)$. Give the coordinates of the new vertices and graph the image.

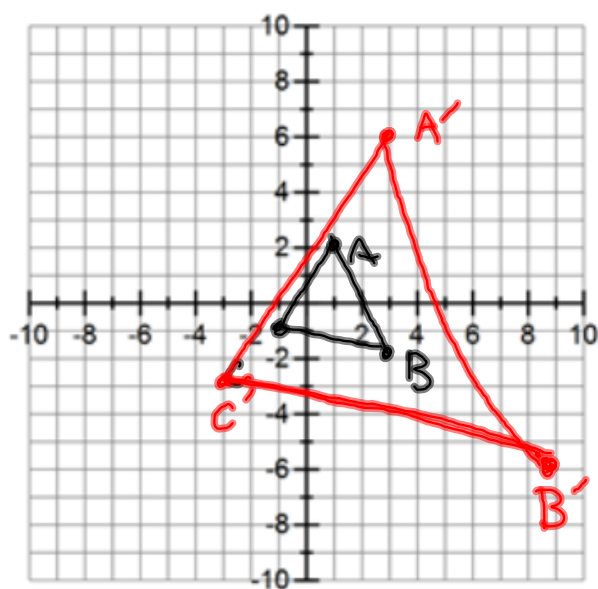
a) $A(1, 2)$, $B(3, -2)$, $C(-1, -1)$

scale factor = 3

$A'(3, 6)$

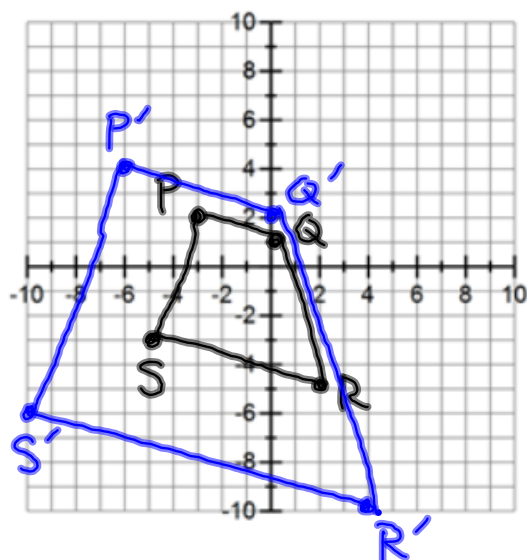
$B'(9, -6)$

$C'(-3, -3)$



b) $P(-3, 2)$, $Q(0, 1)$, $R(2, -5)$, $S(-5, -3)$

scale factor = 2 **MULTIPLY BY 2**



$$P'(-6, 4)$$

$$Q'(0, 2)$$

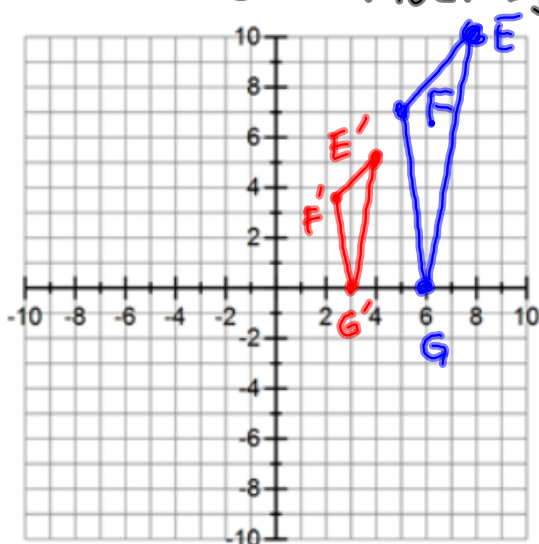
$$R'(4, -10)$$

$$S'(-10, -6)$$

c) $E(8,10)$, $F(5,7)$, $G(6,0)$

scale factor = $\frac{1}{2}$

MULT by $\frac{1}{2}$



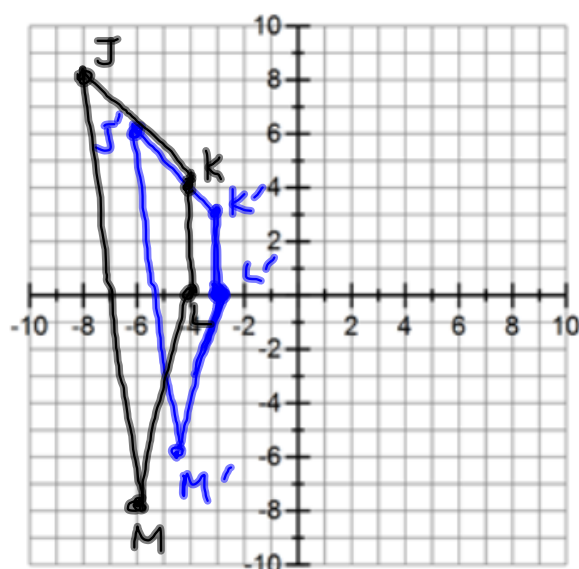
$$E' (4, 5)$$

$$F' \left(\frac{5}{2}, \frac{7}{2} \right)$$

$$G' (3, 0)$$

d) $J(-8, 8)$, $K(-4, 4)$, $L(-4, 0)$, $M(-6, -8)$

scale factor = 0.75 *MULT by .75*



$$J'(-6, 6)$$

$$K'(-3, 3)$$

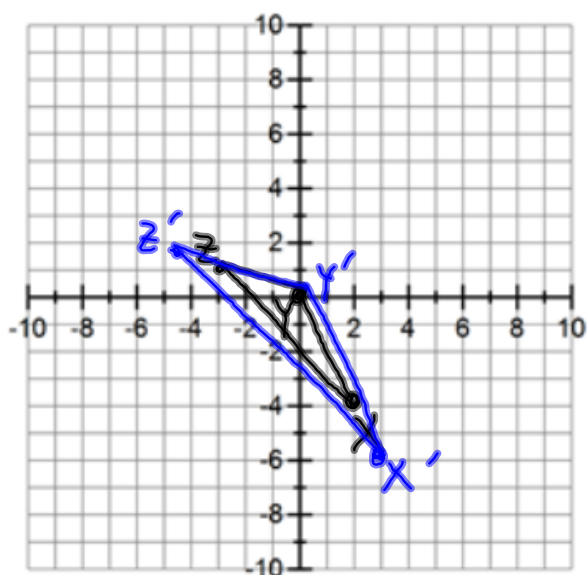
$$L'(-3, 0)$$

$$M'(-4.5, -6)$$

e) $X(2, -4)$, $Y(0, 0)$, $Z(-3, 1)$

scale factor = 1.5

MULT by 1.5



$$X'(3, -6)$$

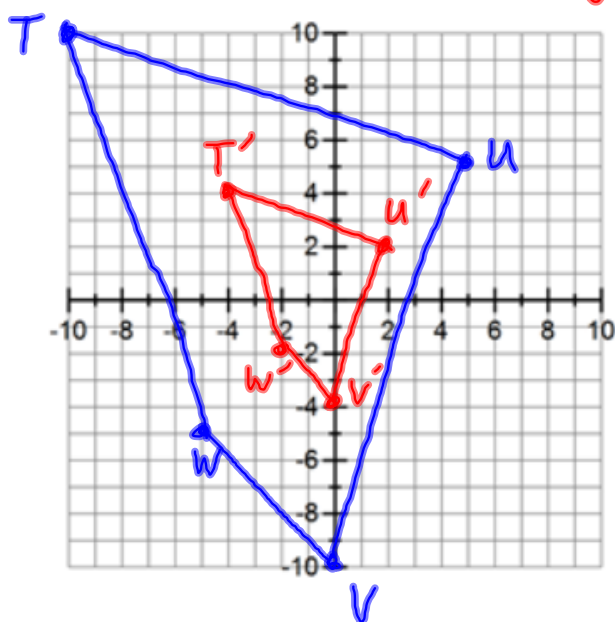
$$Y'(0, 0)$$

$$Z'(-4.5, 1.5)$$

f) $T(-10, 10)$, $U(5, 5)$, $V(0, -10)$, $W(-5, -5)$

scale factor = $\frac{2}{5}$

MULT by $\frac{2}{5}$



$T'(-4, 4)$

$U'(2, 2)$

$V'(0, -4)$

$W'(-2, -2)$