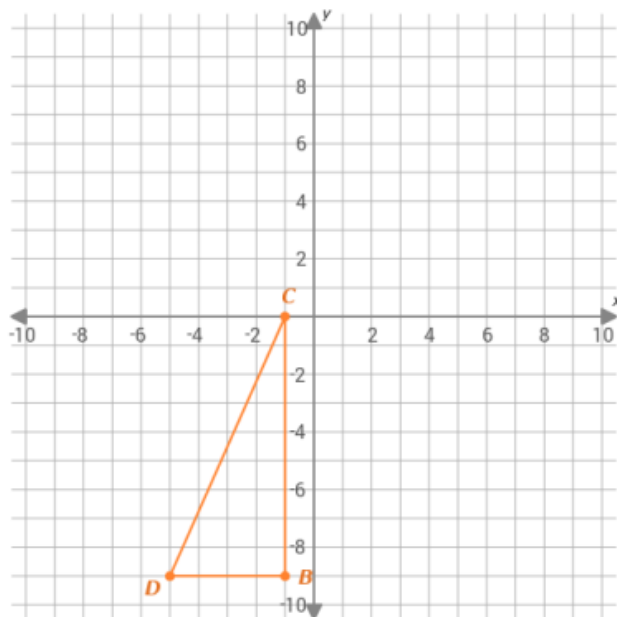


# Warm Up

Write the coordinates of the vertices after a rotation  $90^\circ$  counterclockwise around the origin.



$$B' = (\square, \square)$$

$$C' = (\square, \square)$$

$$D' = (\square, \square)$$

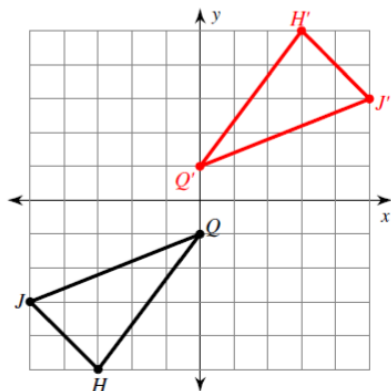
Turn in when you're done!

Questions about rotations?

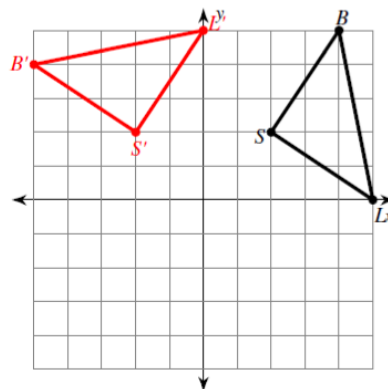


Graph the image of the figure using the transformation given.

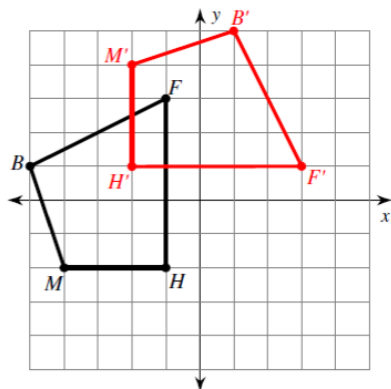
1) rotation  $180^\circ$  about the origin



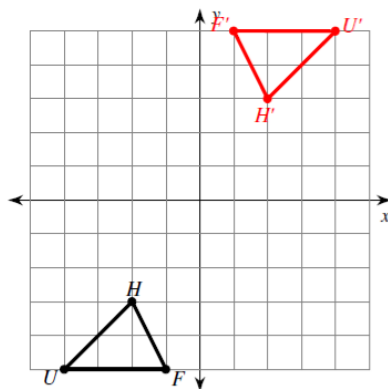
2) rotation  $90^\circ$  counterclockwise about the origin



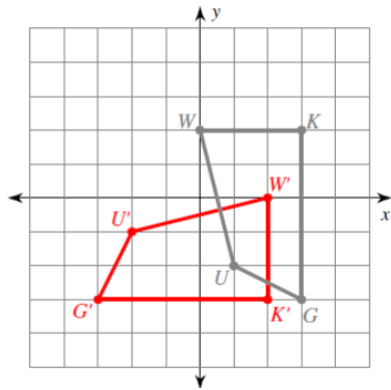
3) rotation  $90^\circ$  clockwise about the origin



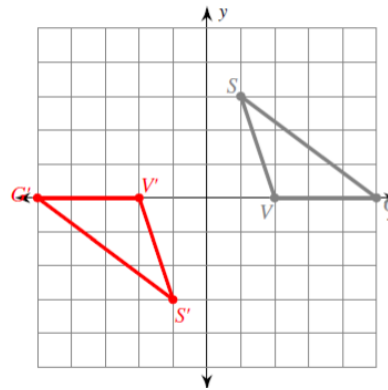
4) rotation  $180^\circ$  about the origin



5) rotation  $90^\circ$  clockwise about the origin  
 $U(1, -2)$ ,  $W(0, 2)$ ,  $K(3, 2)$ ,  $G(3, -3)$



6) rotation  $180^\circ$  about the origin  
 $V(2, 0)$ ,  $S(1, 3)$ ,  $G(5, 0)$



**Find the coordinates of the vertices of each figure after the given transformation.**

7) rotation  $180^\circ$  about the origin

$Z(-1, -5), K(-1, 0), C(1, 1), N(3, -2)$

$Z'(1, 5), K'(1, 0), C'(-1, -1), N'(-3, 2)$

8) rotation  $180^\circ$  about the origin

$L(1, 3), Z(5, 5), F(4, 2)$

$L'(-1, -3), Z'(-5, -5), F'(-4, -2)$

9) rotation  $90^\circ$  clockwise about the origin

$S(1, -4), W(1, 0), J(3, -4)$

$S'(-4, -1), W'(0, -1), J'(-4, -3)$

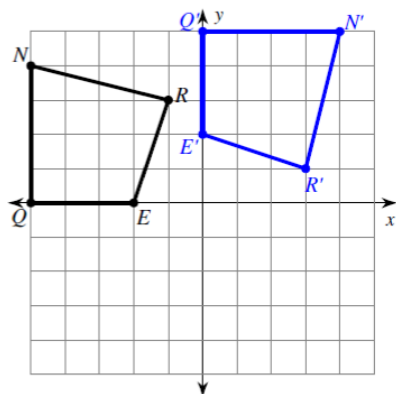
10) rotation  $180^\circ$  about the origin

$V(-5, -3), A(-3, 1), G(0, -3)$

$V'(5, 3), A'(3, -1), G'(0, 3)$

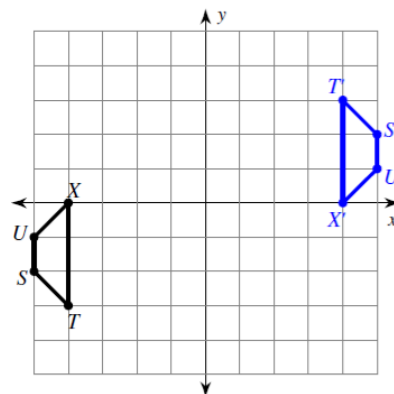
**Write a rule to describe each transformation.**

11)



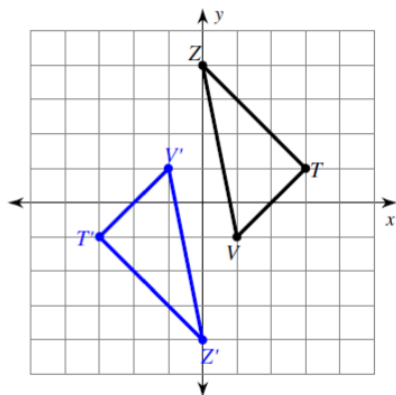
rotation  $90^\circ$  clockwise about the origin

12)



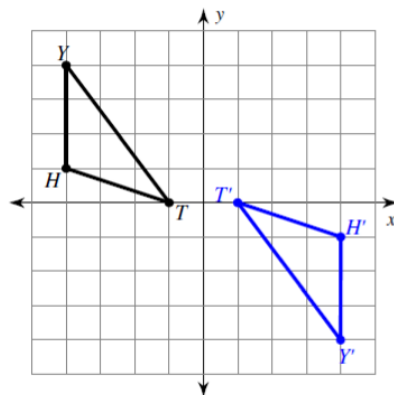
rotation  $180^\circ$  about the origin

13)



rotation  $180^\circ$  about the origin

14)



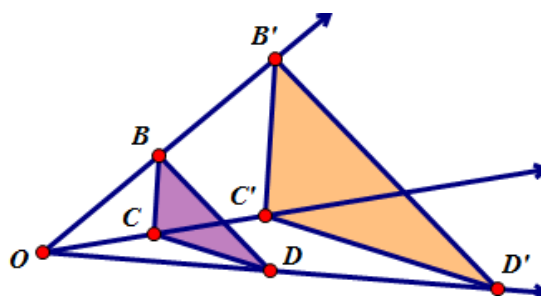
rotation  $180^\circ$  about the origin

# DILATION

*Stretching and Shrinking*

.

A **DILATION** is a transformation that produces an image that is the **same shape** as the original, but a **different size**.



## Rules for Dilations:

- Dilations are centered around the origin  $(0, 0)$  unless otherwise stated.
- The image and the preimage are similar.
- Dilations involve a scale factor.

**Scale Factors:**

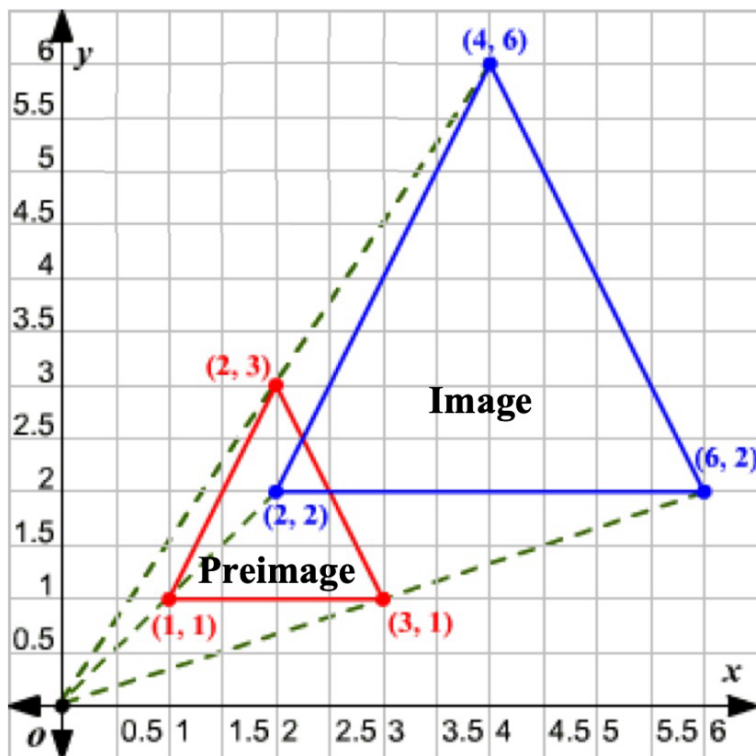
- Scale factor is:  $\frac{\text{image length}}{\text{pre-image length}}$  which is a ratio.
- If the scale factor is greater than 1, the figure becomes larger.
- If the scale factor is between 0 and 1, the figure becomes smaller.

A dilation is

**SIMILAR / CONGRUENT**

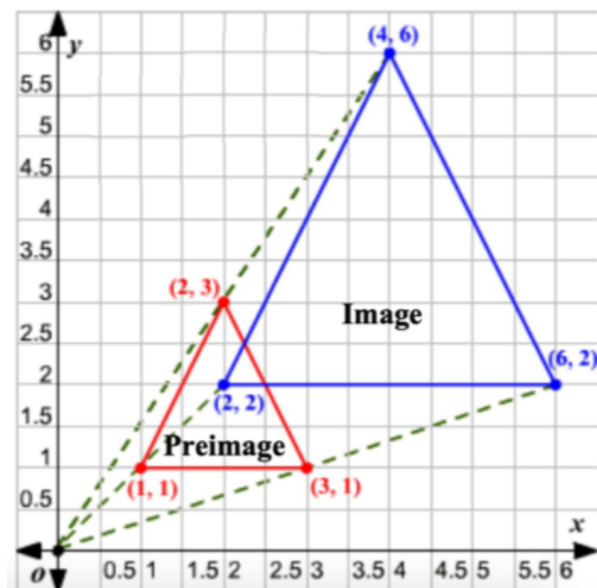
to the original figure.

**Example 1:** How can we calculate the scale factor?



Let's compare the lengths of the base of each triangle:

$$\frac{\text{image length}}{\text{pre-image length}} = \frac{4}{2} = 2$$



Let's look at what is happening to each point that is dilated:

A  $(1, 1) \rightarrow A'(2, 2)$

B  $(2, 3) \rightarrow B'(4, 6)$

C  $(3, 1) \rightarrow C'(6, 2)$

multiply by 2

$$(x, y) \rightarrow (2x, 2y)$$

The rule for dilations is:

- $(x, y) \rightarrow (fx, fy)$  where  $f$  represents the scale factor.

If the scale factor is 3, how would you write the rule?

$$(x, y) \rightarrow (3x, 3y)$$

**Example 2:**

Triangle ABC has vertices A (0, 2), B (4, 4), and C (-1, 4). What are the vertices of its image with a scale factor of 4?

$$(x, y) \rightarrow (4x, 4y)$$

$$A(0, 2) \rightarrow A'(0, 8)$$

$$B(4, 4) \rightarrow B'(16, 16)$$

$$C(-1, 4) \rightarrow C'(-4, 16)$$

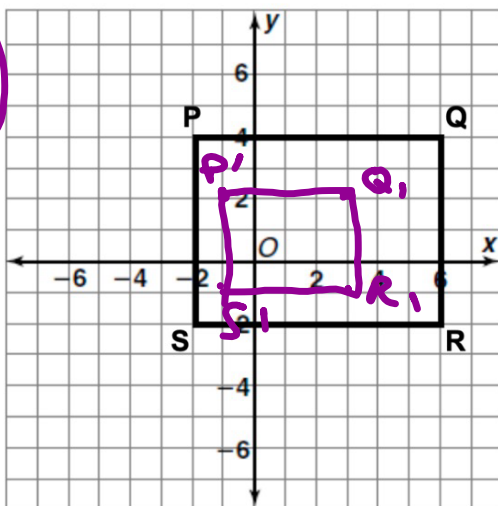
**Example 3:**

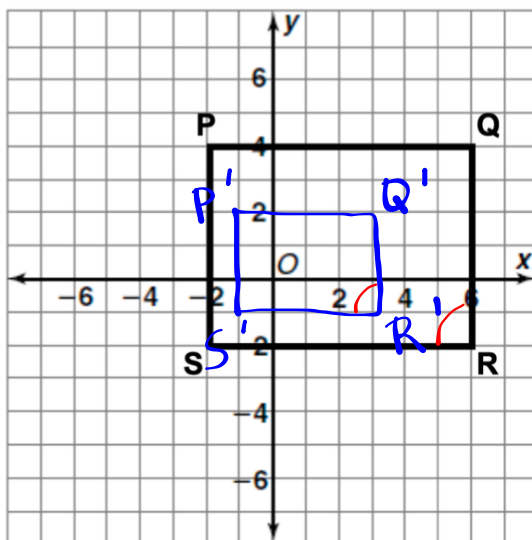
Quadrilateral PQRS has vertices P (-2, 4), ~~Q (6, 4)~~ <sup>(6, 4)</sup>, R (6, -2), and S (-2, -2). It is dilated by a scale factor of  $\frac{1}{2}$ .

a. What are the coordinates of the image (after dilation)? Graph them.

$P'(-1, 2)$      $Q'(3, 2)$      $R'(3, -1)$      $S'(-1, -1)$

$(x, y) \rightarrow (\frac{1}{2}x, \frac{1}{2}y)$





- b. Demonstrate these quadrilaterals are similar by comparing the ratios of the lengths.

$$\frac{P'Q'}{PQ} = \frac{4}{8} = \frac{1}{2} \quad \frac{Q'R'}{QR} = \frac{3}{6} = \frac{1}{2} \quad \frac{R'S'}{RS} = \frac{4}{8} = \frac{1}{2} \quad \frac{S'P'}{SP} = \frac{3}{6} = \frac{1}{2}$$

- c. What do you notice about the angle measurements of the two figures?

same

**Example 4:**

If the scale factor is  $\frac{5}{2}$ , how would you write the general rule? Is this an enlargement or a reduction?

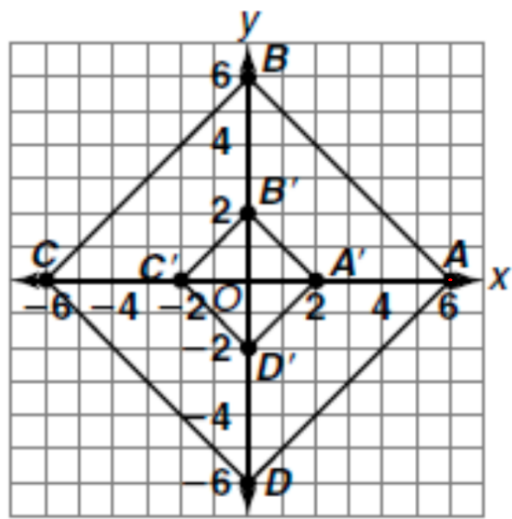
$$(x, y) \rightarrow \left( \frac{5}{2}x, \frac{5}{2}y \right)$$

Enlargement

$$\frac{5}{2} > 1$$

**Example 5:**

Quadrilateral  $A'B'C'D'$  is a dilation of quadrilateral  $ABCD$ . Find the scale factor. Classify the dilation as an enlargement or a reduction.



$$B(0,6) \rightarrow B'(0,2)$$

$$\frac{2}{6} = \frac{1}{3}$$

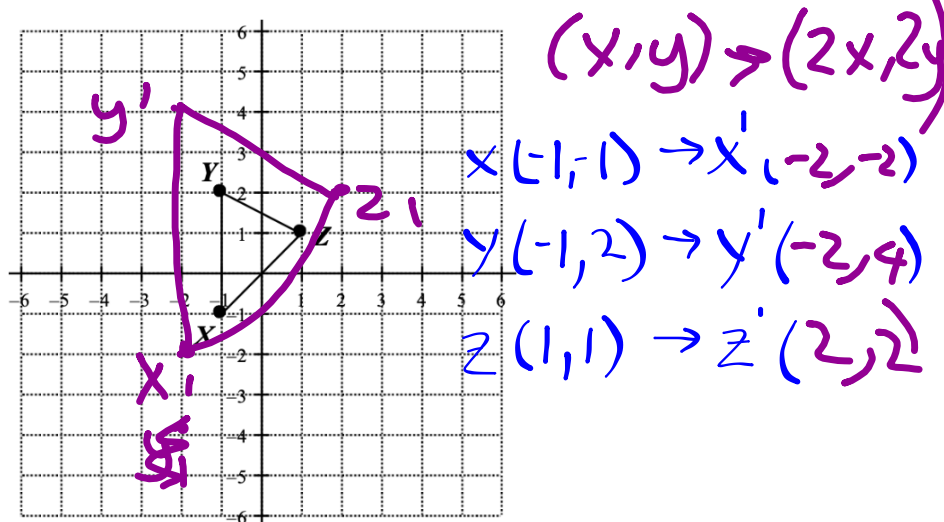
$$A(6,0) \rightarrow A'(2,0)$$

$$\frac{2}{6} = \frac{1}{3} \quad \frac{2}{6} = \frac{1}{3}$$

**This is a reduction!**

**Example 6:**

$\Delta XYZ$  is graphed below. Draw and label  $\Delta X'Y'Z'$  after a dilation with scale factor of two.

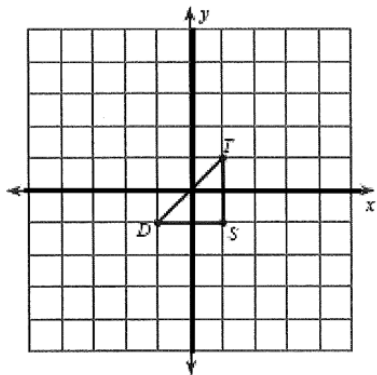


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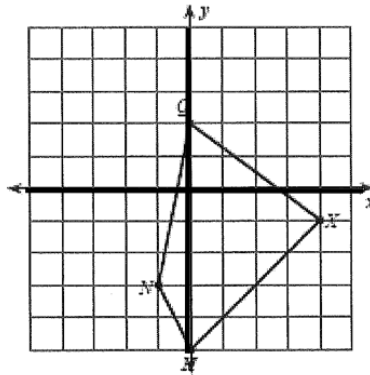
### Dilations Practice

Graph the image of the figure using the transformation given. Assume all dilations are from the origin unless otherwise noted.

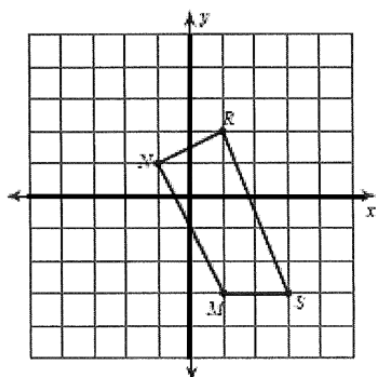
1. Dilation of 2.5



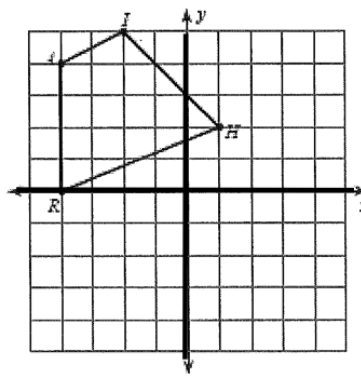
2. Dilation of 0.5



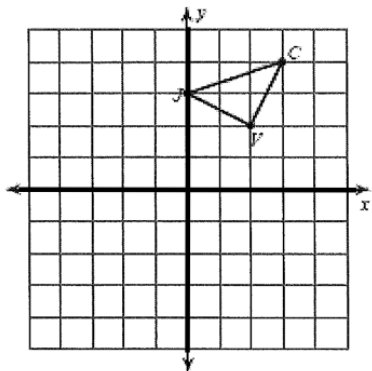
3. Dilation of 1.5



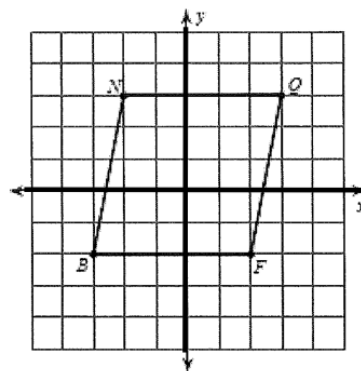
4. Dilation of 0.5



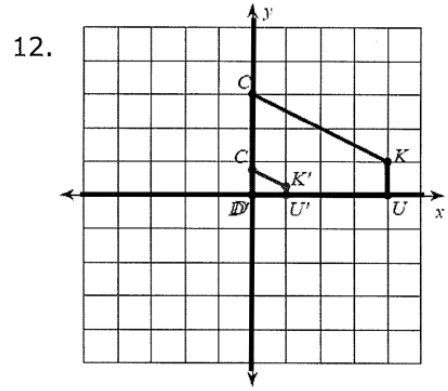
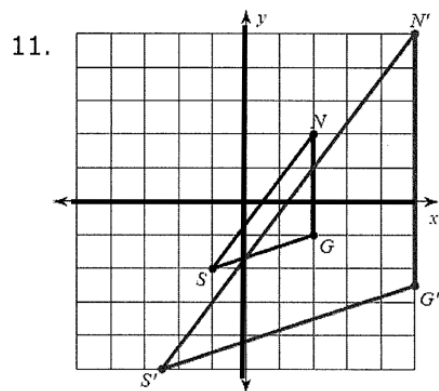
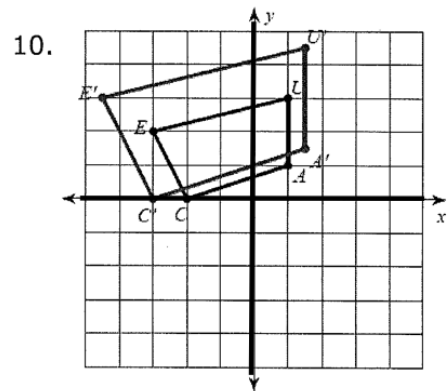
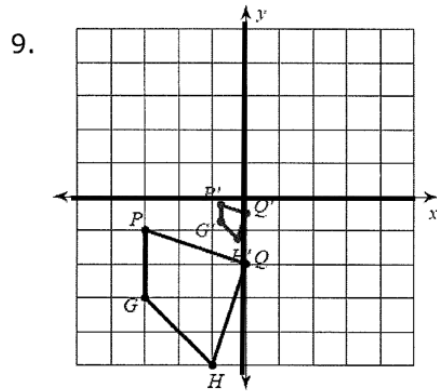
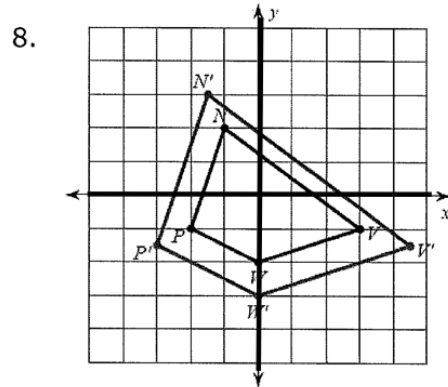
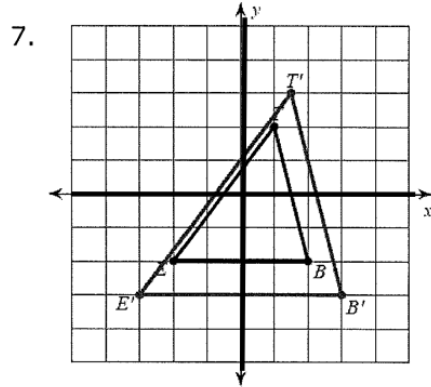
5. Dilation of  $\frac{1}{4}$



6. Dilation of 1.5



Write a rule to describe each transformation.



Write a rule to describe each transformation.

13.  $U(-2, -1), K(0, 2), F(2, -2)$  to  $U'(-3, -1.5), K'(0, 3), F'(3, -3)$
14.  $V(-1, -2), K(-1, 3), Y(1, 0)$  to  $V'(-1.5, -3), K'(-1.5, 4.5), Y'(1.5, 0)$
15.  $K(-1, -2), U(-2, 2), V(2, 2), Q(2, -1)$  to  $K'(-2, -4), U'(-4, 4), V'(4, 4), Q'(4, -2)$
16.  $N(-4, 1), T(-5, 3), J(-4, 3), C(-1, 0)$  to  $N'(-1, 0.25), T'(-1.25, 0.75), J'(-1, 0.75), C'(-0.25, 0)$
17.  $K(-1, 0), N(-2, 2), H(3, 3), T(3, -2)$  to  $K'(-1.5, 0), N'(-3, 3), H'(4.5, 4.5), T'(4.5, -3)$

Write the coordinates of the vertices after the given transformation.

- |   |   |
|---|---|
| <p>18. Dilation of 4<br/><math>N(0, 1), O(1, 1), P(0, 8)</math></p>                             | <p>19. Dilation of 1.5<br/><math>V(-2, -2), I(1, 2), F(2, 0)</math></p>                       |
| <p>20. Dilation of <math>\frac{1}{2}</math><br/><math>U(3, 2), C(4, 4), E(5, 2)</math></p>      | <p>21. Dilation of 2<br/><math>H(-1, -2), A(-2, 2), W(2, 2)</math></p>                        |
| <p>22. Dilation of <math>\frac{1}{4}</math><br/><math>W(-4, -5), X(-5, -1), T(-3, 0)</math></p> | <p>23. Dilation of 5<br/><math>Q(-3, -3), M(0, -1), H(1, -3)</math></p>                       |
| <p>24. Dilation of 3<br/><math>Q(-3, -3), M(0, -1), H(1, -3)</math></p>                         | <p>25. Dilation of <math>\frac{5}{2}</math><br/><math>C(-1, -2), V(-2, 2), N(2, 0)</math></p> |

# Homework

Finish Classwork