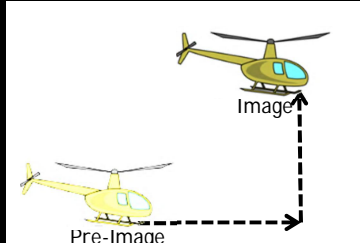
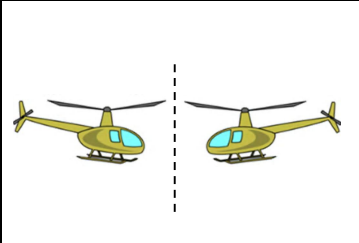
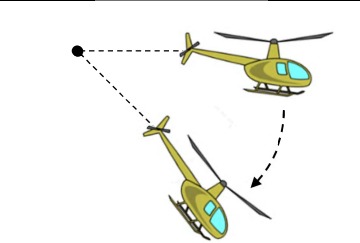
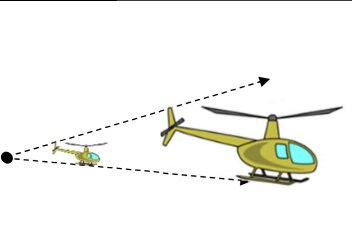


**Transformation Types:**

Translation Translation	Reflection REFLECTION	Rotation Rotation	Dilation Dilation
			

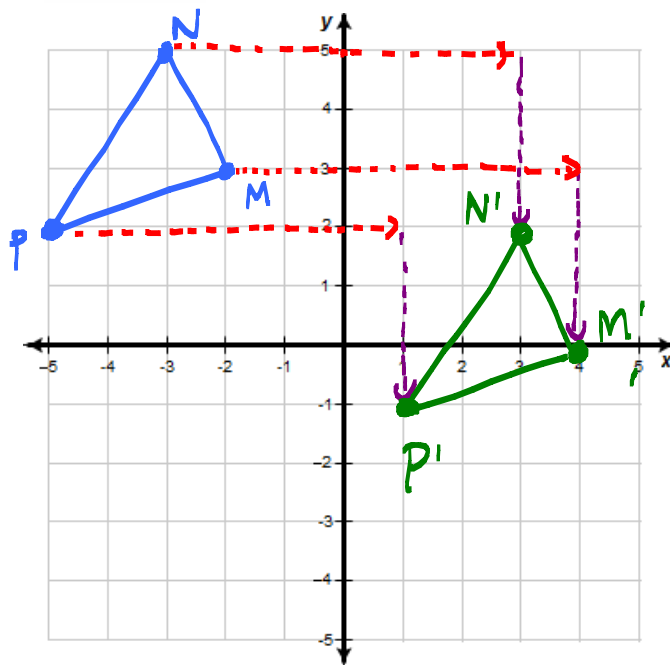
**Translations**

- Plot the points and create the pre-image triangle with vertices  $M(-2, 3)$ ,  $N(-3, 5)$ , and  $P(-5, 2)$ . Then, determine the coordinates  $M'$ ,  $N'$ , and  $P'$  of the image triangle that has been translated right 6 and down 3. Explain what you did to each of the coordinates.

$$(-2 + 6, 3 - 3) \rightarrow M'(4, 0)$$

$$(-3 + 6, 5 - 3) \rightarrow N'(3, 2)$$

$$(-5 + 6, 2 - 3) \rightarrow P'(1, -1)$$



**Reflections**

- List the coordinates of the triangle ABC

$$A(1, 2)$$

$$B(4, 1)$$

$$C(5, 4)$$

- Reflect the triangle ABC over the y-axis and list the coordinates of the vertex  $A'$ ,  $B'$ , and  $C'$ . Describe what happened to the coordinates from the pre-image to the image.

$$A'(-1, 2)$$

$$B'(-4, 1)$$

$$C'(-5, 4)$$

FROM THE PRE-IMAGE TO THE IMAGE, ALL OF X-COORDINATES CHANGED SIGNS.

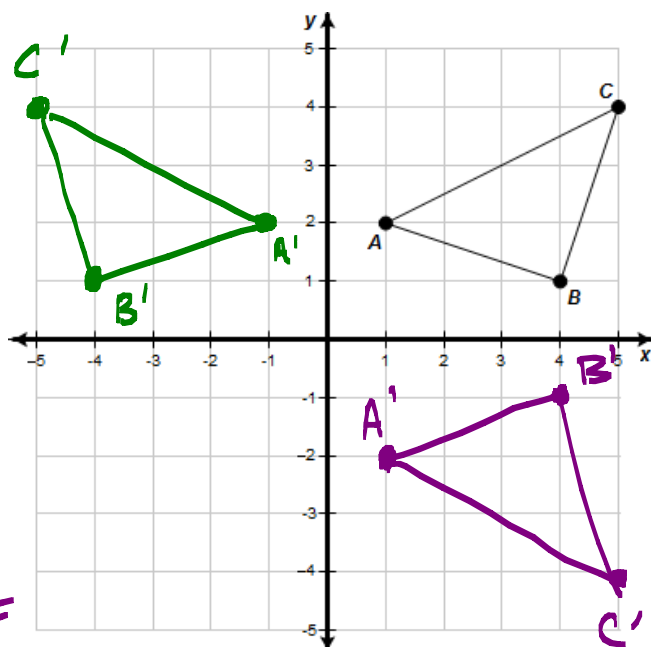
- Reflect the triangle ABC over the x-axis and list the coordinates of the vertex  $A'$ ,  $B'$ , and  $C'$ . Describe what happened to the coordinates from the pre-image to the image.

$$A'(1, -2)$$

$$B'(4, -1)$$

$$C'(5, -4)$$

FROM THE PRE-IMAGE TO THE IMAGE, ALL OF Y-COORDINATE CHANGED SIGNS



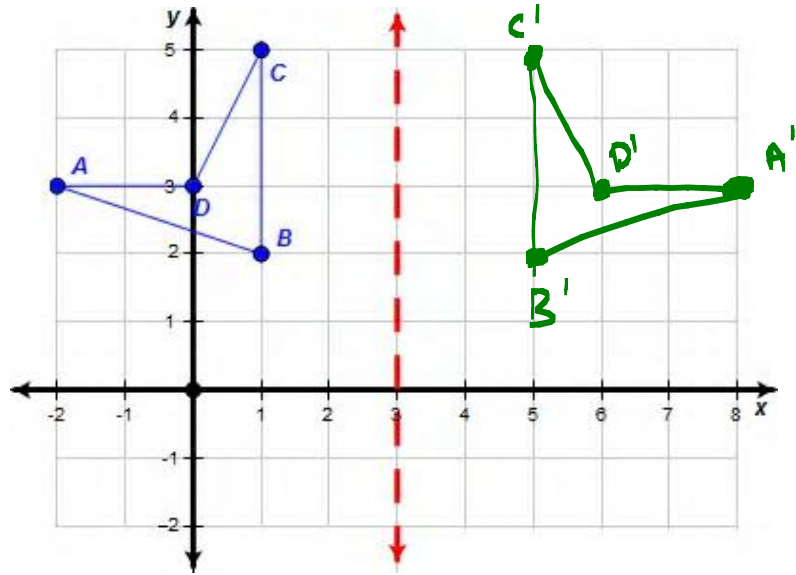
## Reflections

5. List the coordinates of the quadrilateral ABCD

$$\begin{aligned} A &(-2, 3) \\ B &(1, 2) \\ C &(1, 5) \\ D &(0, 3) \end{aligned}$$

6. Reflect the quadrilateral ABCD over the line  $x=3$  and list the coordinates of the vertex  $A'$ ,  $B'$ ,  $C'$ , and  $D'$ .

$$\begin{aligned} A' &(8, 3) \\ B' &(5, 2) \\ C' &(5, 5) \\ D' &(6, 3) \end{aligned}$$



## Reflections

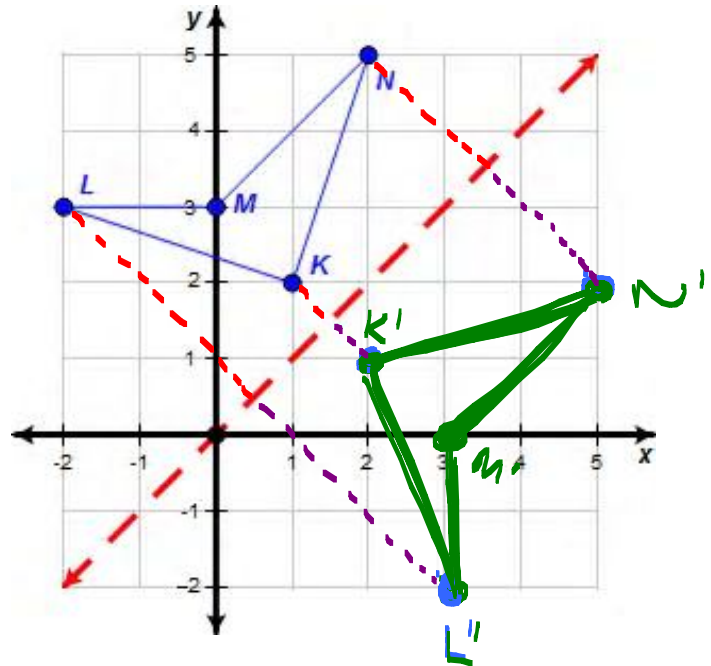
7. List the coordinates of the quadrilateral KLMN

$$\begin{aligned} K &(1, 2) & M &(0, 3) \\ L &(-2, 3) & N &(2, 5) \end{aligned}$$

8. Reflect the quadrilateral KLMN over the line  $y=x$  and list the coordinates of the vertex  $K'$ ,  $L'$ ,  $M'$ , and  $N'$ . Describe what happened to the coordinates from the pre-image to the image.

$$\begin{aligned} K' &(2, 1) & M' &(3, 0) \\ L' &(3, -2) & N' &(5, 2) \end{aligned}$$

FROM PRE-IMAGE TO IMAGE  
THE COORDINATE FLIP PLACES  
 $(x, y) \rightarrow (y, x)$



## Reflections

9. If the point A is located at  $(-3, 2)$  and  $A'$  is the image of A after being reflected over the  $x$ -axis, what are the coordinates of  $A'$ ?

$$A'(-3, -2)$$

↑  
CHANGE  
SIGN OF  
Y-COORDINATE

10. If the point B is located at  $(-4, -1)$  and  $B'$  is the image of B after being reflected over the  $y$ -axis, what are the coordinates of  $B'$ ?

$$B'(4, -1)$$

↑  
CHANGE  
SIGN OF  
X-COORDINATE

11. If the point C is located at  $(2, -3)$  and  $C'$  is the image of C after being reflected over the line  $y=x$ , what are the coordinates of  $C'$ ?

$$C'(-3, 2)$$

↑  
FLIP X & Y  
COORDINATES

**Rotations**

12. List the coordinates of the quadrilateral ABCD.

A(2, 1)      C(5, 3)  
 B(2, 3)      D(1, 4)

13. Rotate the quadrilateral **ABCD** about the **origin by 90°** and list the coordinates of the vertex A', B', C', and D'. Describe what happened to the coordinates from the pre-image to the image.

A'(-1, 2)      C'(-3, 5)  
 B(-3, 2)      D'(-4, 1)

$$(x, y) \xrightarrow[\text{90° ABOUT ORIGIN}]{\text{ROTATE}} (-y, x)$$

14. Rotate the quadrilateral **ABCD** about the **origin by 180°** and list the coordinates of the vertex A', B', C', and D'. Describe what happened to the coordinates from the pre-image to the image.

A'(-2, -1)      C'(-5, -3)  
 B(-2, -3)      D'(-1, -4)

$$(x, y) \xrightarrow[\text{ABOUT ORIGIN}]{\text{ROTATE 180°}} (-x, -y)$$

15. Rotate the quadrilateral **ABCD** about the **origin by 270°** and list the coordinates of the vertex A', B', C', and D'. Describe what happened to the coordinates from the pre-image to the image.

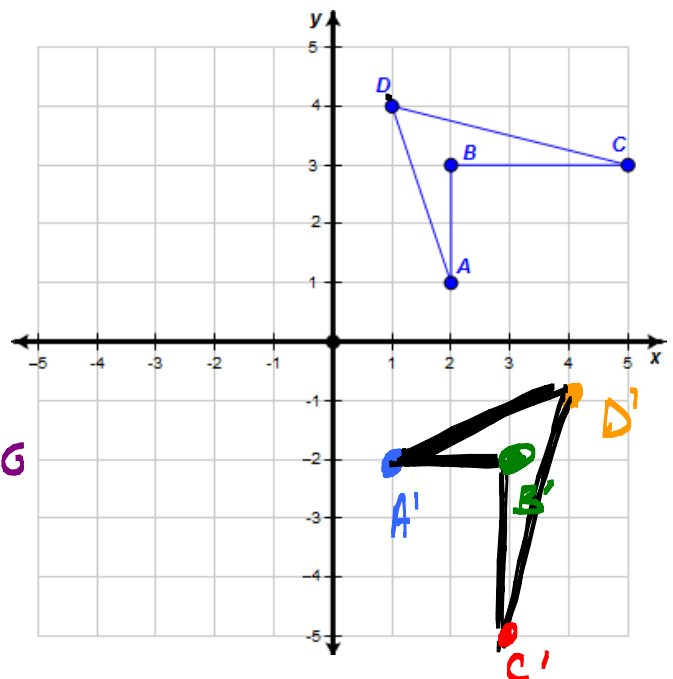
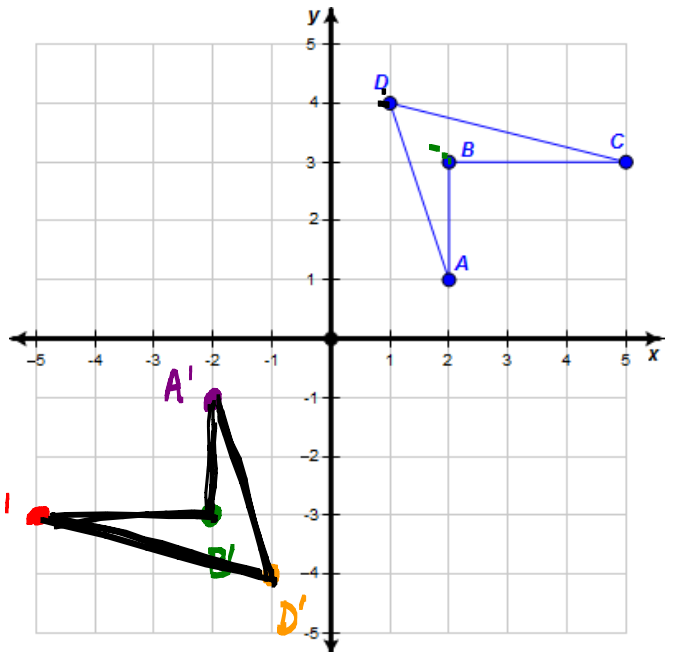
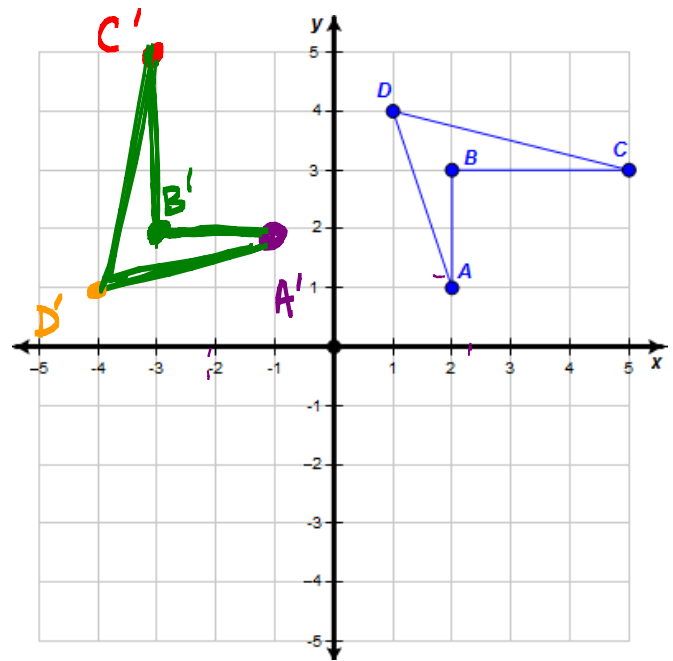
A'(1, -2)      C'(3, -5)  
 B'(3, -2)      D'(4, -1)

$$(x, y) \xrightarrow[\text{ABOUT ORIGIN}]{\text{ROTATE 270°}} (y, -x)$$

16. If the point A is located at (-3, 2) and A' is the image of A after being rotated about the **origin by 270°**. What are the coordinates of A'?

(2, 3)

SUGGESTS CHANGING  
 PRE-IMAGE  
 COORDINATES  
 $(x, y) \rightarrow (y, -x)$   
 PRE-IMAGE      IMAGE



**Dilations**

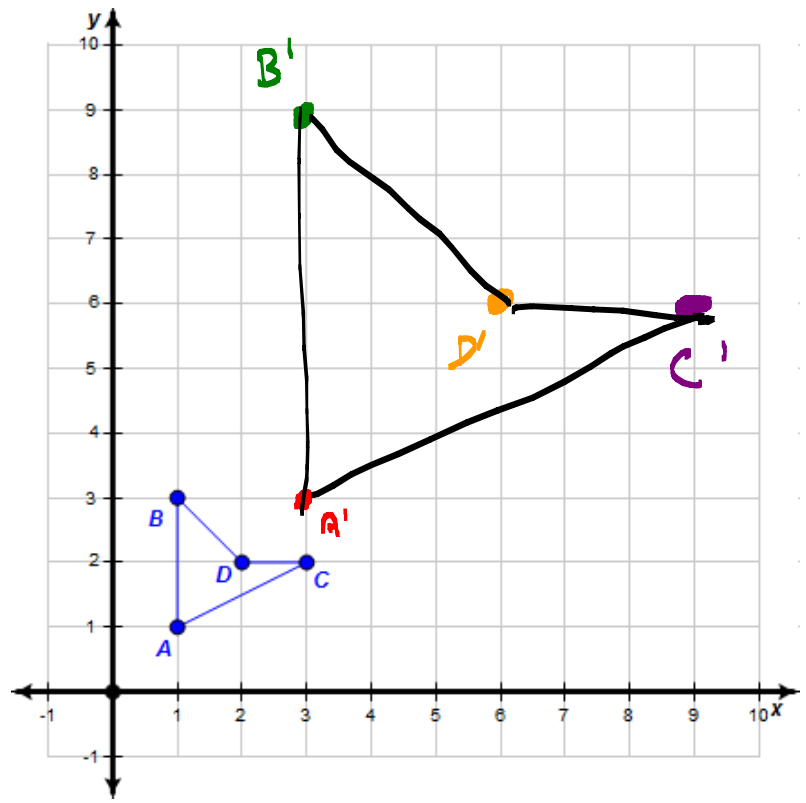
17. List the coordinates of the quadrilateral ABCD.

$$\begin{matrix} A(1, 1) & C(3, 2) \\ B(1, 3) & D(2, 2) \end{matrix}$$

18. Dilate the quadrilateral ABCD **by a scale factor of 3 from the origin** and list the coordinates of the vertex A', B', C', and D'. Describe what happened to the coordinates from the pre-image to the image.

$$\begin{matrix} A'(3, 3) & C'(9, 6) \\ B'(3, 9) & D'(6, 6) \end{matrix}$$

$$(x, y) \xrightarrow[\substack{\text{DILATE FACTOR} \\ 3 \text{ FROM} \\ \text{ORIGIN}}]{\substack{\text{PRE} \\ \text{IMAGE}}} (3x, 3y) \xrightarrow{\text{IMAGE}}$$



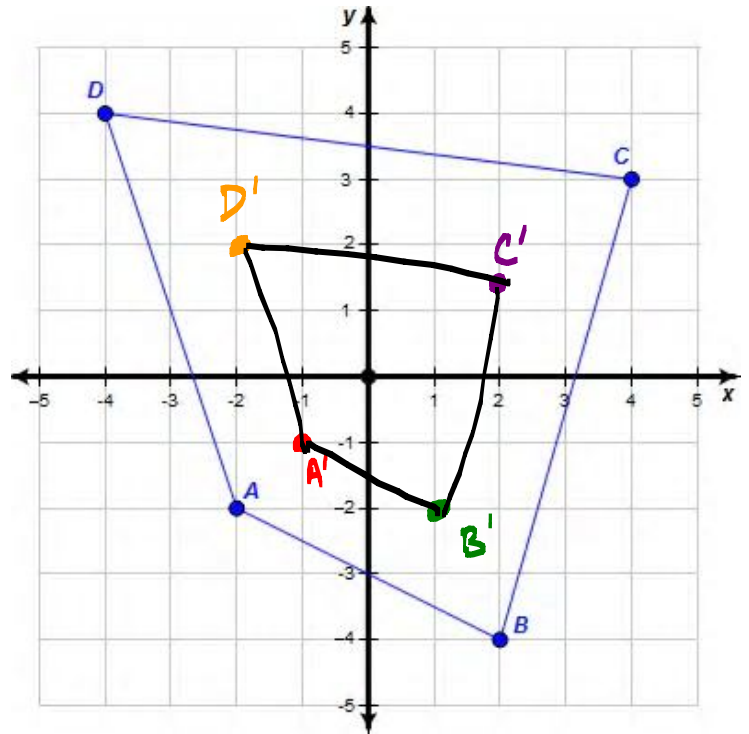
19. List the coordinates of the quadrilateral ABCD.

$$\begin{matrix} A(-2, -2) & C(4, 3) \\ B(2, -4) & D(-4, 4) \end{matrix}$$

20. Dilate the quadrilateral ABCD **by a scale factor of 1/2 from the origin** and list the coordinates of the vertex A', B', C', and D'. Describe what happened to the coordinates from the pre-image to the image.

$$\begin{matrix} A'(-1, -1) & C'(2, 1.5) \\ B'(1, -2) & D'(-2, 2) \end{matrix}$$

$$(x, y) \xrightarrow[\text{TO ORIGIN}]{\text{DILATE FACTOR } 1/2} (\frac{1}{2}x, \frac{1}{2}y)$$



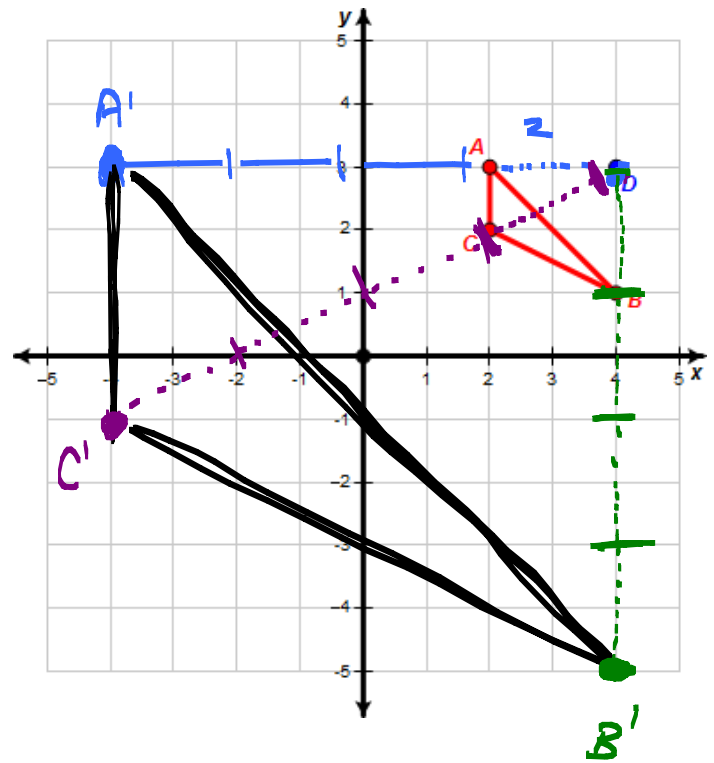
21. If the point A is located at (3, -2) and A' is the image of A after being dilated by a scale factor of 5 from the origin. What are the coordinates of A'?

$$(x, y) \xrightarrow[\text{FROM ORIGIN}]{\text{DILATE FACTOR } 5} (5x, 5y)$$

$$A(3, -2) \xrightarrow{\text{PRE IMAGE}} A'(15, -10) \xrightarrow{\text{IMAGE}}$$

$$A'(15, -10)$$

22. Dilate the triangle ABC by a scale factor of 4 from the point D and list the coordinates of the vertex A', B', and C'.



Create a list of all of the basic coordinate transformation rules:

**TRANSLATION:**  $(x, y)$   $\longrightarrow$   $(x+h, y+k)$ , TRANSLATE  
 PRE IMAGE IMAGE HORIZONTALLY BY  $h$   
 VERTICALLY BY  $k$

[e.g. TRANSLATE  $(1, 2)$  LEFT 3 & UP 4  $\longrightarrow$   $(1-3, 2+4) = (-2, 6)$  ]  
 PRE IMAGE IMAGE

<p><u>REFLECT OVER Y-AXIS</u></p> <p><math>(x, y)</math> <math>\longrightarrow</math> <math>(-x, y)</math>            PRE IMAGE IMAGE</p>	<p><u>REFLECT OVER X-AXIS</u></p> <p><math>(x, y)</math> <math>\longrightarrow</math> <math>(x, -y)</math>            PRE IMAGE IMAGE</p>	<p><u>REFLECT OVER LINE <math>y=x</math></u></p> <p><math>(x, y)</math> <math>\longrightarrow</math> <math>(y, x)</math>            PRE IMAGE IMAGE</p>
<p><u>ROTATE <math>90^\circ</math> ABOUT ORIGIN</u></p> <p><math>(x, y)</math> <math>\longrightarrow</math> <math>(-y, x)</math>            PRE IMAGE IMAGE</p>	<p><u>ROTATE <math>180^\circ</math> ABOUT ORIGIN</u></p> <p><math>(x, y)</math> <math>\longrightarrow</math> <math>(-x, -y)</math>            PRE IMAGE IMAGE</p>	<p><u>ROTATE <math>270^\circ</math> ABOUT ORIGIN</u></p> <p><math>(x, y)</math> <math>\longrightarrow</math> <math>(y, -x)</math>            PRE IMAGE IMAGE</p>

DILATION OF A SCALE FACTOR OF  $M$  FROM ORIGIN.

$(x, y)$   $\longrightarrow$   $(M \cdot x, M \cdot y)$   
 PRE IMAGE IMAGE

## Translations

23. Point A (-3, 3) is on  $\overline{AB}$ . A translation moves the point A to its image A'(1,1).

$$\begin{array}{ccc} A(-3, 3) & & A'(1, 1) \\ x_1 \quad y_1 & & x_2 \quad y_2 \end{array}$$

ALL POINTS WILL BE TRANSLATED BY THE SAME DISTANCE.

What is the distance, in units, between any point on  $\overline{AB}$  and its image?

WE COULD USE THE DISTANCE FORMULA TO FIND THE DISTANCE BETWEEN POINT A & POINT A'

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(1 - (-3))^2 + (1 - 3)^2} = \sqrt{(4)^2 + (-2)^2}$$

$$d = \sqrt{16 + 4} = \sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5} = \boxed{2\sqrt{5}} \approx 4.47$$

ALTERNATELY, WE COULD JUST USE THE PYTHAGOREAN THEOREM TO FIND THE DISTANCE BETWEEN POINT A AND POINT A'.

$$2^2 + 4^2 = c^2$$

$$4 + 16 = c^2$$

$$\sqrt{20} = \sqrt{c^2}$$

$$\sqrt{20} = c$$

$$\boxed{2\sqrt{5} = c}$$

$$4.47 \approx c$$

