

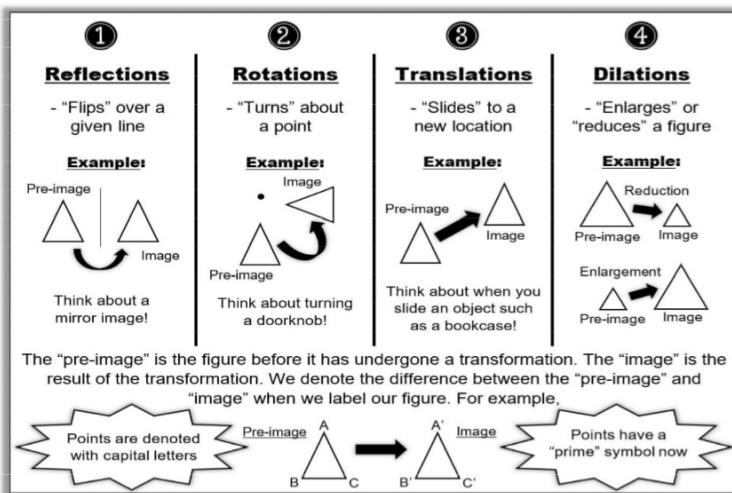
## Module 4: Transformations

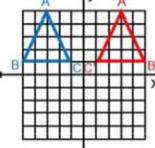
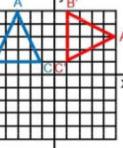
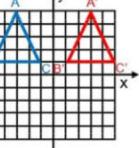
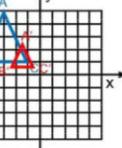
Sunday, December 11, 2022 4:28 PM

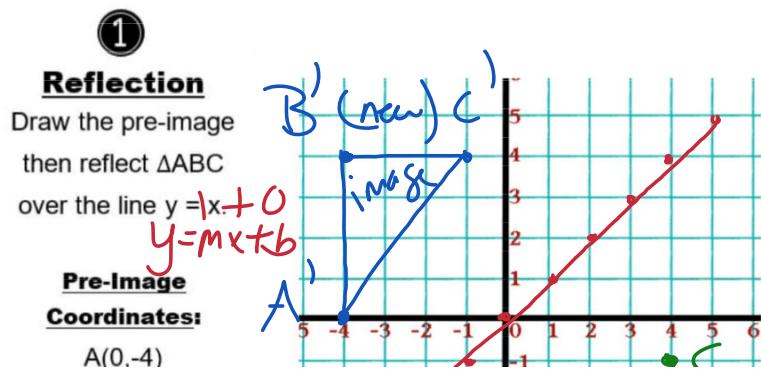


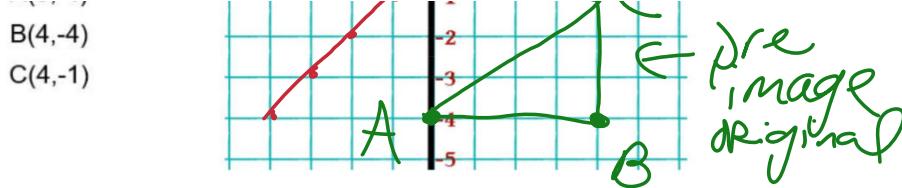
Module 4  
Notes

## Module 4: Transformations



1 <b>Reflection</b>	2 <b>Rotation</b>	3 <b>Translation</b>	4 <b>Dilation</b>
			
<p>The <u>pre-image</u> is reflected over the <u>y-axis</u> to create the resulting <u>image</u>.</p> <p>Note – Always make sure to pay very close attention to the label of each point. The pre-image was flipped over the y-axis because the bottom points have changed their position.</p>	<p>The <u>pre-image</u> is rotated 90° clockwise about the origin to create the resulting <u>image</u>.</p> <p>Note – Clockwise moves in the direction of the hands on a clock (Counterclockwise moves in the opposite direction). c.w. stands for clockwise and c.c.w stands for counterclockwise</p>	<p>The <u>pre-image</u> is shifted to the right 6 <u>units</u> to create the resulting <u>image</u>.</p> <p>Note – This graph looks very similar to a reflection, but if you pay close attention to the labeling of the points you will see that the points did not change their position.</p>	<p>The <u>pre-image</u> is dilated by a scale factor of <math>\frac{1}{2}</math> to create the resulting <u>image</u>.</p> <p>Note - The scale factor is denoted with "k".  <math>k = \frac{1}{2}</math></p> <p>A fraction represents a reduction  (A whole number would represent an enlargement).</p>





2

### Rotation

Draw the pre-image

then rotate  $\triangle DEF$

90° c.c.w.

-y  
x

Counterclockwise Rotation	Clockwise Rotation	Coordinate Rule
90° counterclockwise	270° clockwise	$(x, y) \rightarrow (-y, x)$
180° counterclockwise	180° clockwise	$(x, y) \rightarrow (-x, -y)$
270° counterclockwise	90° clockwise	$(x, y) \rightarrow (y, -x)$

Pre-Image

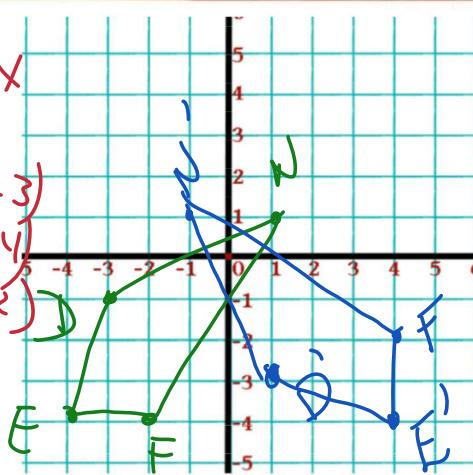
Coordinates:

D(-3, -1)

E(-4, -4)

F(-2, -4)

N(1, 1)



③

**Translation**

Draw the pre-image  
then translate KLMN  
3 units to the left  
and 5 units down.

**Pre-Image**

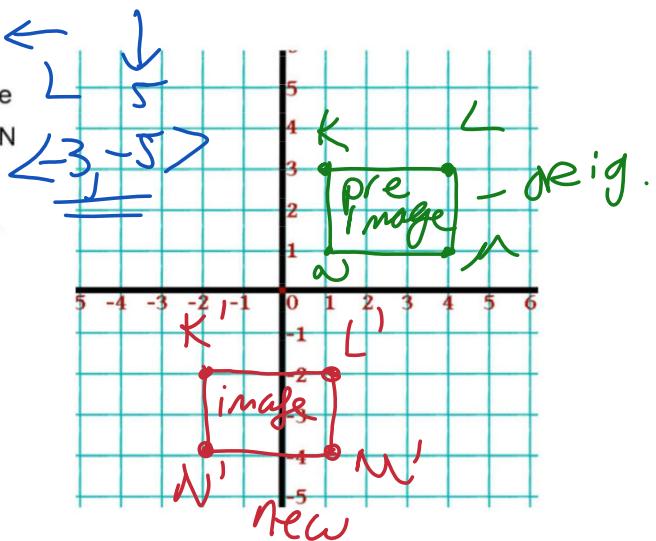
**Coordinates:**

$$K(1, 3)$$

$$L(4, 3)$$

$$M(4, 1)$$

$$N(1, 1)$$



④

### Dilation

Draw the pre-image  
then dilate  $\triangle XYZ$  by  
a scale factor of 2.

Multiply 2

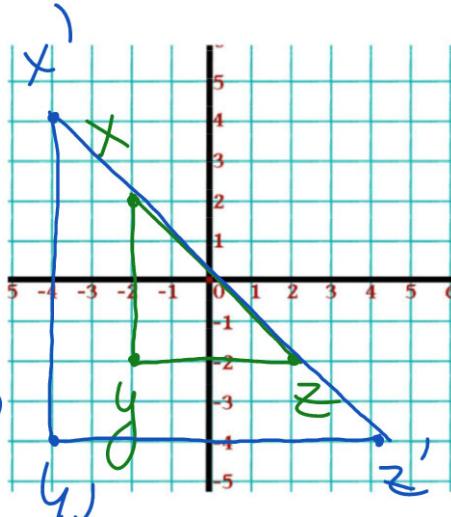
#### Pre-Image

#### Coordinates:

$$X(-2, 2) (-4, 4)$$

$$Y(-2, -2) (-4, -4)$$

$$Z(2, -2) (4, -4)$$



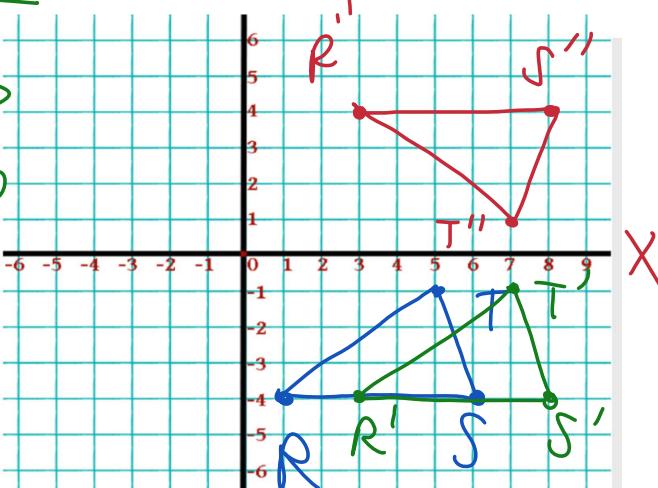
- #5 Graph each figure with the given vertices and its image after the indicated glide reflection.

$\triangle RST: R(1, -4), S(6, -4), T(5, -1)$

Translation: along  $\angle 2, 0$

Reflection: in x-axis

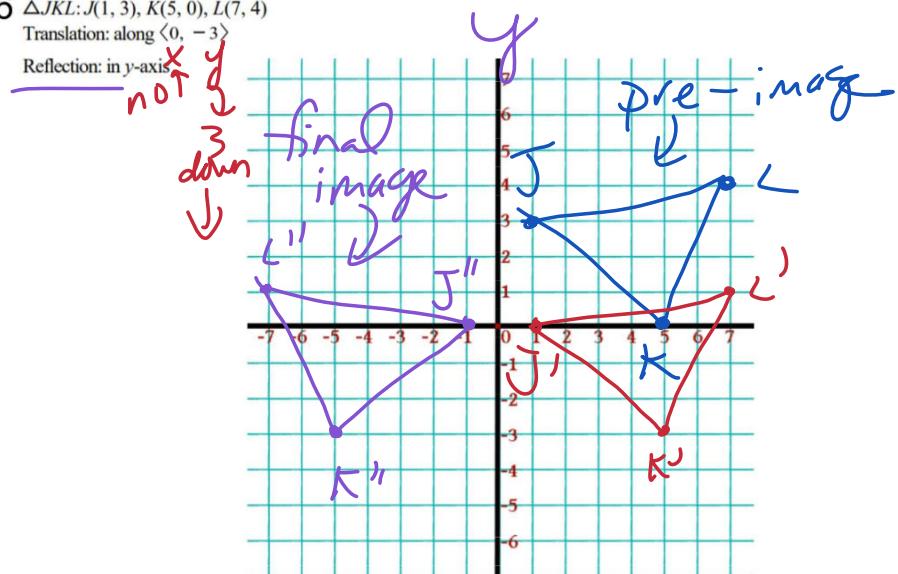
$\angle 2, 0$   
 $x$   
 $y$   
 $\rightarrow$



#6  $\triangle JKL$ :  $J(1, 3)$ ,  $K(5, 0)$ ,  $L(7, 4)$

Translation: along  $\langle 0, -3 \rangle$

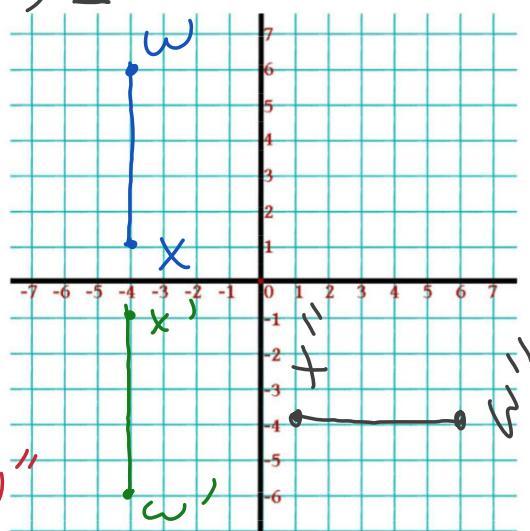
Reflection: in  $y$ -axis



#7  $\overline{WX}$ :  $W(-4, 6)$  and  $X(-4, 1)$   
Reflection: in x-axis  
Rotation: 90° about origin

$-y$ ,  $x$

$$x' \left( \begin{array}{l} +1 -4 \\ -4 -1 \end{array} \right) x''$$

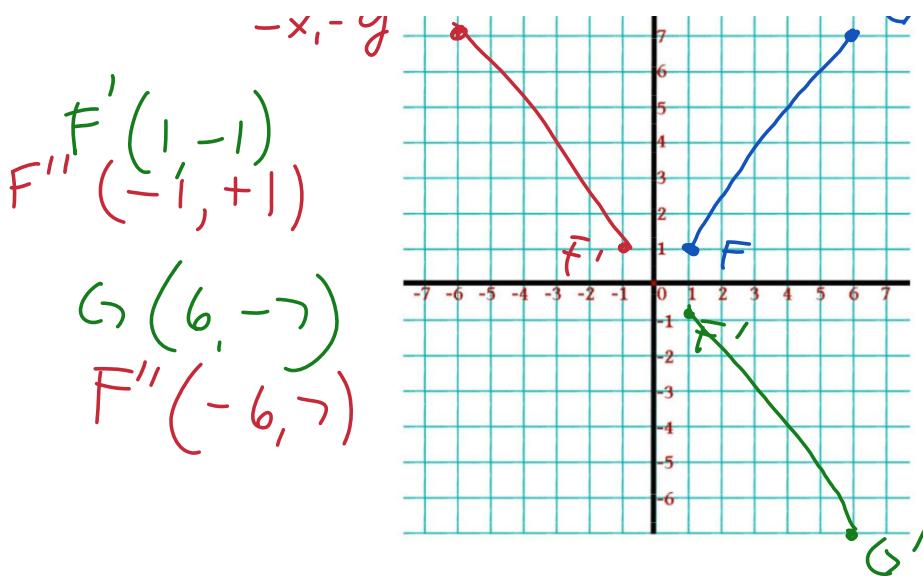


$$\omega' \left( \begin{array}{l} -4 -6 \\ +6 -4 \end{array} \right) \omega''$$

#8  $\overline{FG}$ :  $F(1, 1)$  and  $G(6, 7)$   
Reflection: in x-axis  
Rotation: 180° about origin

$G''$

(7)

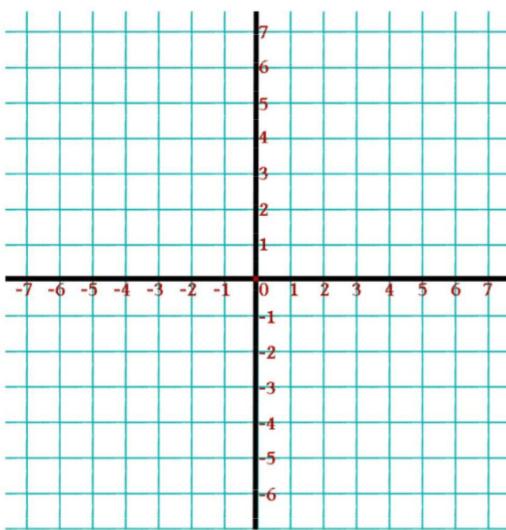


#9

$\overline{RS}$ :  $R(2, -1)$  and  $S(6, -5)$

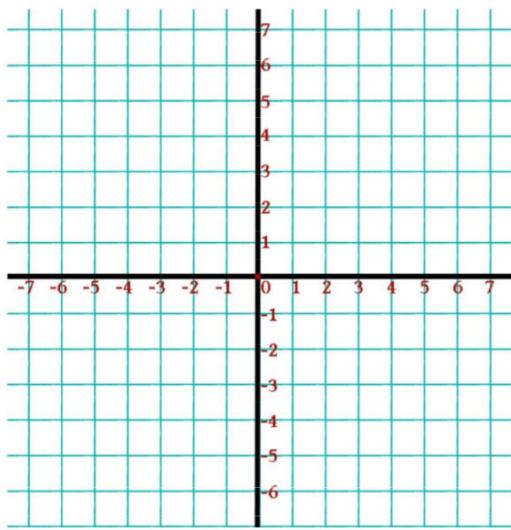
Translation: along  $\langle 3, 4 \rangle$

Reflection: in  $x = 2$



#10 270° counter clockwise rotation about the origin followed by a translation along  $\langle 2, -2 \rangle$

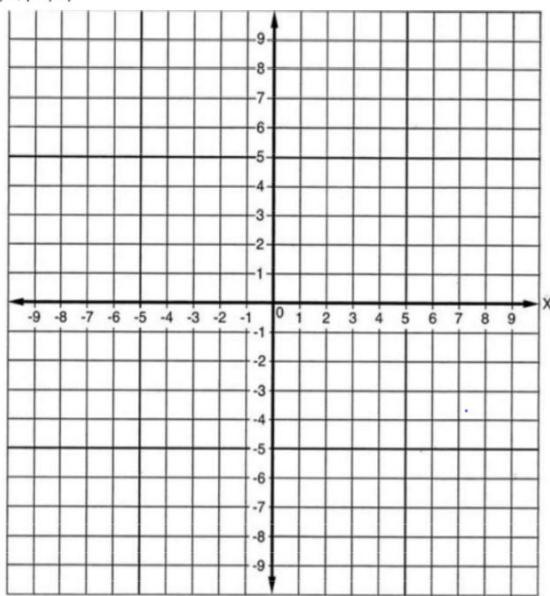
D: (0,2), E: (2,2), F (1,0)



#11  $\triangle MPQ$ : M (-4, 3), P (-5, 8), Q (-1, 6)

Translation: along  $\langle -4, -4 \rangle$

Reflection: in  $y = x$



### ① Reflections

$$\begin{aligned} R_{x\text{-axis}}(x,y) &= (x,-y) \\ R_{y\text{-axis}}(x,y) &= (-x,y) \\ R_{y=x}(x,y) &= (y,x) \end{aligned}$$

### ② Rotations

$$\begin{aligned} R_{90\text{cw}}(x,y) &= (y,-x) \\ R_{90\text{ccw}}(x,y) &= (-y,x) \\ R_{180}(x,y) &= (-x,-y) \end{aligned}$$

### ③ Translations

$$\begin{aligned} T_{a,b}(x,y) &= (x+a,y+b) \\ \text{"a"} &\text{ moves left or right} \\ \text{"b"} &\text{ moves up or down} \end{aligned}$$

### ④ Dilations

$$\begin{aligned} D_k(x,y) &= (kx,ky) \\ \text{Scale factor} &= k \\ \textbf{Example:} \\ \text{Determine the} \end{aligned}$$

$$y = -x \wedge y = -y \wedge$$

**Example:**

Determine the coordinates of  $\Delta A'B'C'$  given that  $\Delta ABC$  is reflected over the y-axis:  $A=(2,3)$ ,  $B=(-1,4)$ ,  $C=(3,-5)$

**Solution:**

The rule needed is:  
 $y\text{-axis}(x,y) = (-x,y)$   
 I will take the "opposite" of the x-coordinate and keep the y-coordinate the same. Hence,  
 $A=(2,3) \rightarrow A'=(-2,3)$   
 $B=(-1,4) \rightarrow B'=(1,4)$   
 $C=(3,-5) \rightarrow C'=(-3,-5)$

**Example:**

Determine the coordinates of  $\Delta F'G'H'$  given that  $\Delta FGH$  is rotated  $90^\circ$  c.c.w:  $F=(4,-2)$ ,  $G=(-7,1)$ ,  $H=(1,0)$

**Solution:**

The rule needed is:  
 $R_{90\text{ccw}}(x,y) = (-y,x)$   
 I will take the "opposite" of the y-coordinate and keep the x-coordinate the same, then SWITCH the position of the coordinates. Hence,  
 $F=(4,-2) \rightarrow F'=(2,4)$   
 $G=(-7,1) \rightarrow G'=(-1,-7)$   
 $H=(1,0) \rightarrow H'=(0,1)$

**Example:**

Determine the coordinates of  $\Delta X'Y'Z'$  given that  $\Delta XYZ$  is shifted left 5 units and up 3 units:  $X=(-4,-6)$ ,  $Y=(1,8)$ ,  $Z=(0,1)$

**Solution:**

The rule is:  
 $T_{a,b}(x,y) = (x+a, y+b)$   
 $T_{-5,3}(x,y) = (x-5, y+3)$   
 I will subtract 5 from the x-coordinate and add 3 to the y-coordinate. Hence,  
 $X=(-4,-6) \rightarrow X'=(-9,-3)$   
 $Y=(1,8) \rightarrow Y'=(-4,11)$   
 $Z=(0,1) \rightarrow Z'=(-5,4)$

coordinates of  $\Delta M'N'O'$

given that  $\Delta MNO$  is dilated by a scale factor of  $k = \frac{1}{3}$ :  $M=(-3,0)$ ,  $N=(6,-6)$ ,  $O=(3,1)$

**Solution:**

The rule is:  
 $D_k(x,y) = (kx, ky)$   
 $D_{1/3}(x,y) = (\frac{1}{3}x, \frac{1}{3}y)$   
 I will multiply both the x- and y-coordinate by a factor of  $\frac{1}{3}$  (Divide each coordinate by 3). Hence,  
 $M=(-3,0) \rightarrow M'=(-1,0)$   
 $N=(6,-6) \rightarrow N'=(2,-2)$   
 $O=(3,1) \rightarrow O'=(1, \frac{1}{3})$