Good ~~Morning~~ Afternoon!

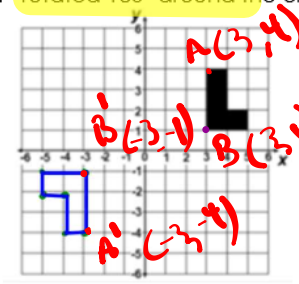
1. Make sure you are using First and Last name.
2. Type "here" for attendance.
3. Go over Rotations Practice.
4. Compositions of Transformations Notes.
5. Practice and Review for tomorrow's quiz.

Name: _____ Date: _____

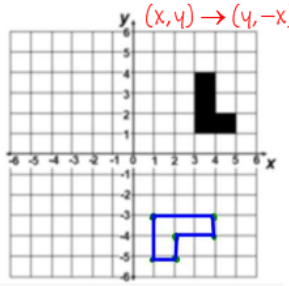
Rotations Practice

1. **Where will the L-Shape be if it is…**

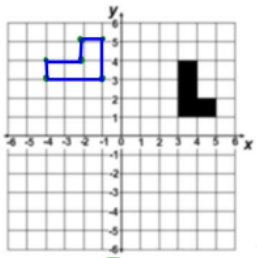
a. rotated 180° around the origin?



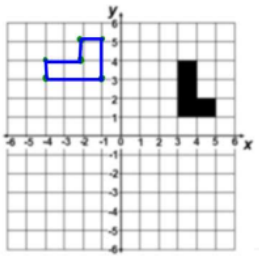
b. rotated 90° clockwise around the origin?



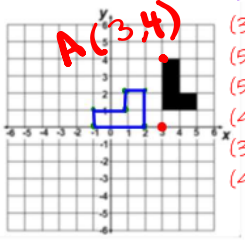
c. rotated 90° counterclockwise around the origin?



d. rotated 270° clockwise around the origin?



e. rotated 90° counterclockwise around the point (3, 0)?



Take original point(s) and subtract out the center of rotation:

(3,1) → (3-3,1-0) → (0,1)
(5,1) → (5−3,1−0) → (2,1)
(5,2) → (5−3,2−0) → (2,2)
(4,2) → (4−3,2−0) → (1,2)
(3,4) → (3-3,4-0) → (0,4)
(4,4) → (4-3,4-0) → (1,4)

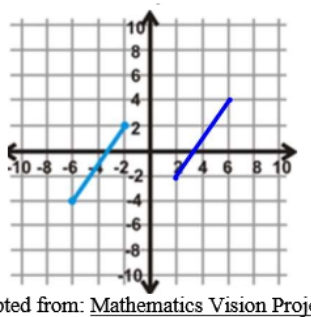
Apply the rule for 90CW, then add the center of rotation back in

(x,y) → (−y,x) → (+3,+0)
(−1,0) → (2,0)
(−1,2) → (2,2)
(−2,2) → (1,2)
(−2,1) → (1,1)
(−4,0) → (−1,0)
(−4,1) → (−1,1)

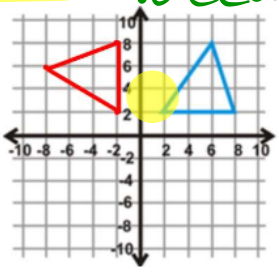
A(3,4)
−3 −0
0,4
switch
−4, 0
+3 +0
change 1st sign
A'(-1,0)

2. **Rotate each figure about the origin using the given clockwise angle.**

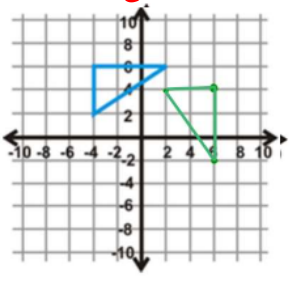
a. 180°



b. 270° 90 CCW

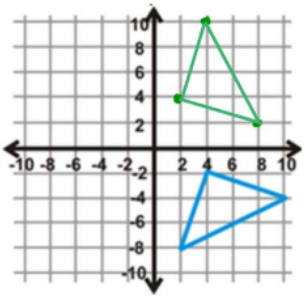


c. 90°

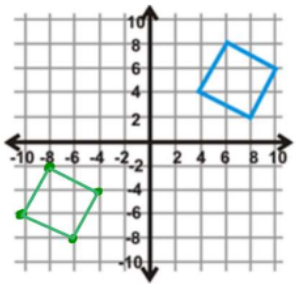


Adapted from: Mathematics Vision Project

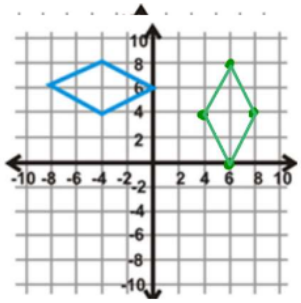
d. 270°



e. 180°

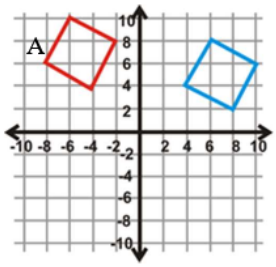


f. 90°

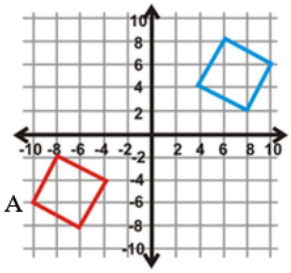


3. **Find the angle of rotation for the graphs below. The center of rotation is the origin, and the Image labeled A is the preimage. Your answer will be 90°, 180°, or 270°.**

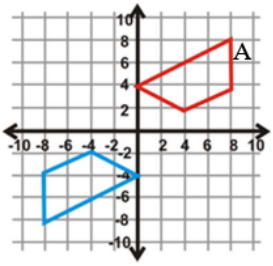
a. 270 CCW 90CW



b. 180



c.180



Adapted from: Mathematics Vision Project

Composition of Transformations

All the transformations we have done so far can be called **isometries** or **rigid motions.**

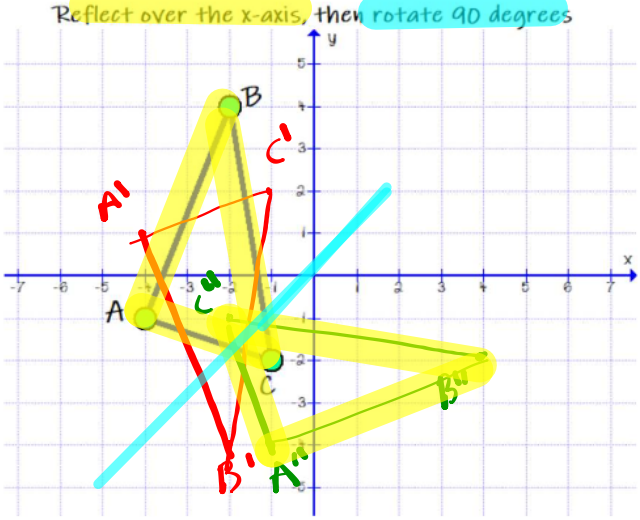
a. An **isometry** is a **transformation** where the pre-image and the **image** are **congruent**. When we perform the transformation, all the side lengths and angles stay the same length and measure. Its just the location and orientation of the figure that has changed. **Rigid Motion** is a **synonym** for isometry.

Our three isometries are **translations**, **reflections**, and **rotations**.

Compositions of Transformations: a combination of transformations happens when we apply multiple transformations to the same figure.

Example 1:

Reflect over the x-axis, then rotate 90 degrees CCW



Recall, what's the rule for reflect over x-axis? Change y

Recall? What's the rule for rotating 90 degrees? Switch & change 1st

A (-4 , -1) → A' (-4,1) → A'' (-1,-4)

B (-2,4) → B'(-2,-4) → B''(4,-2)

C (-1,2) → C'(-1,2) → C''(-2,-1)

Switch

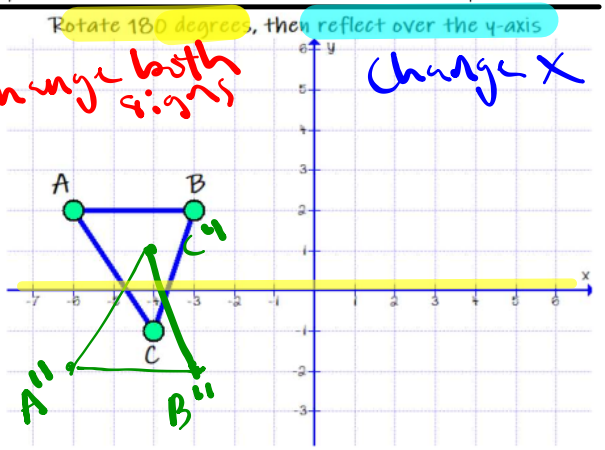
Identify the single reflection that could have produced this combination in one step.

...ion over the line y = x.

Example 2:

Rotate 180 degrees, then reflect over the y-axis

Change both signs Change X



A(-6,2)→A'(6,-2) → A''(-6,-2)

B(-3,2)→B'(3,-2) → B''(-3,-2)

C(-4,-1)→C'(4,1) → C''(-4, 1)

- What one transformation could have produced this combination in one step?
  Reflection over the x-axis

Another notation: For Compositions, there is a special type of notation that tells us how to work a pr[redacted] $(x,y) \rightarrow (x+a, y+b)$

Example 3:

a. $T_{x,y}$ denotes a translation. The x value tells you to go right when it's positive and left when it's negative. The y value tells you to go up when its positive and down when its negative.

b. R_{θ} denotes a rotation. There will be a 90, 270, or 180 instead of the θ. The default direction for a rotation is always counter-clockwise.

c. r_{line} denotes a reflection. The line of reflection will be give where you see the word "line". We often reflect over the following lines: x-axis, y-axis, y = x, y = -x, horizontal lines (y = #) , vertical lines (x = #).

[redacted]

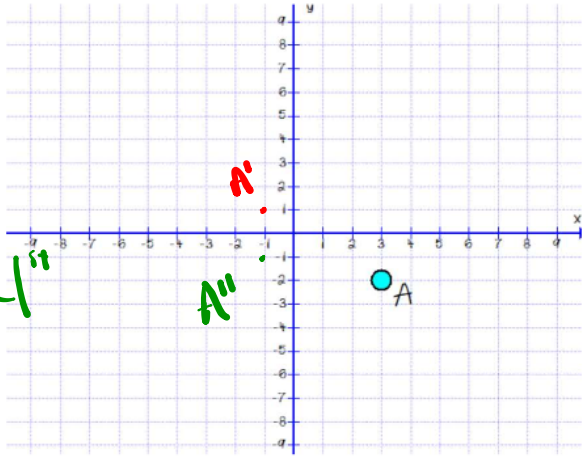
d. When working in composition notation we have to work from RIGHT to LEFT, which is the opposite of what we are used to!

Example 4:

What is the image of the point A(3, -2) under the transformation $R_{90°} \circ T_{-4,3}$? (② ①)

- Step 1: Work from Right to left! So first we will translate the point, and then we will rotate it.

A (3,-2) will be moved 4 to the left, and 3 up. To become A' (-1,1). A'(-1,1)



- Step 2: Now we will rotate the point 90 degrees **counterclockwise**, using the rule (x,y)→(-y , x) switch & change!!

A' (-1,1) becomes A'' (-1,-1). (-1, -1)

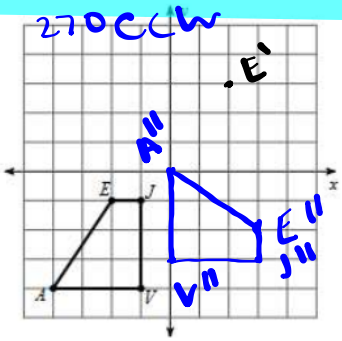
Remember we work **right to left** in this notation only!

Name: _____ Date: _____

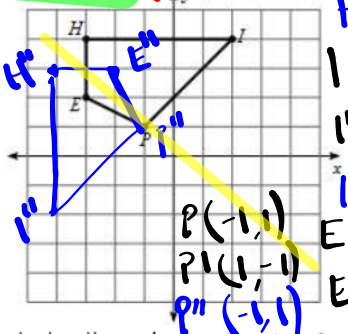
Composition of Transformations

Draw each of the figures after each of the composition is performed.

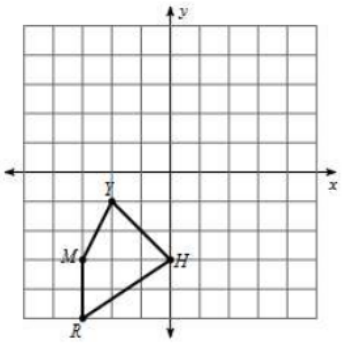
1) Translate by the rule $(x, y) \rightarrow (x+4, y+4)$, then rotate 90^0 clockwise about the origin



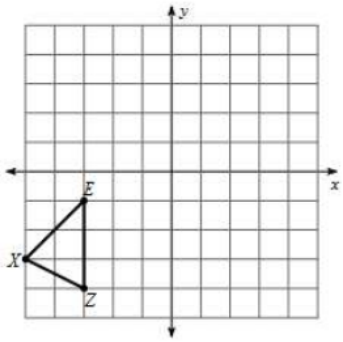
2) Rotate 180^0 about the origin, then reflect across y = x



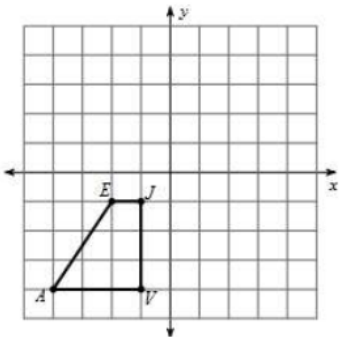
3) Reflect across the x-axis, then translate by the rule $(x, y) \rightarrow (x-1, y-3)$



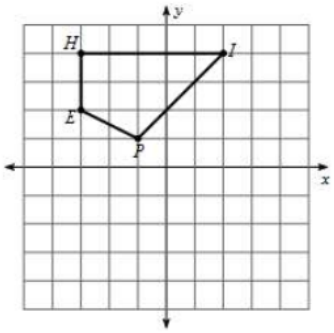
4) Translate by the rule $(x, y) \rightarrow (x+6, y+3)$, then by the rule $(x, y) \rightarrow (x-2, y-4)$



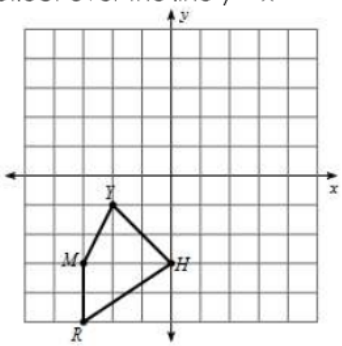
5) Reflect over x = -2, then reflect over the y-axis



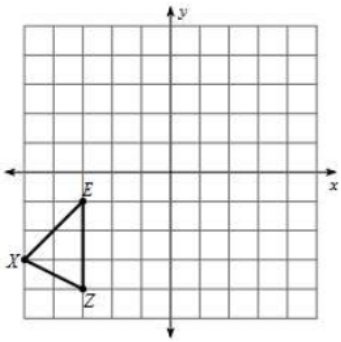
6) Translate by the rule $(x, y) \rightarrow (x-2, y-5)$, then rotate 90^0 clockwise about the origin



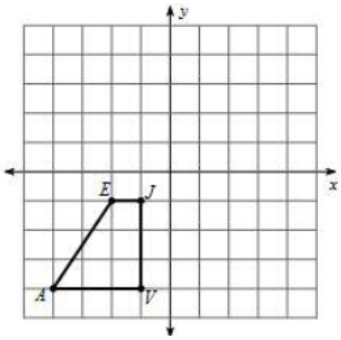
7) Translate by the rule $(x, y) \rightarrow (x+1, y+5)$, then reflect over the line y = x



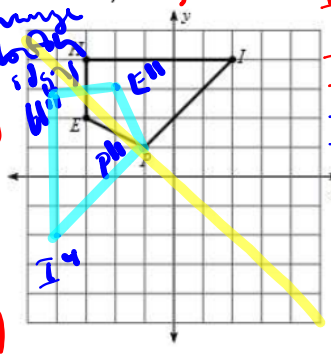
8) $r_{x-axis} \circ R_{90}$



9) Rotate 90^0 clockwise about the origin, then translate by the rule $(x, y) \rightarrow (x+5, y)$

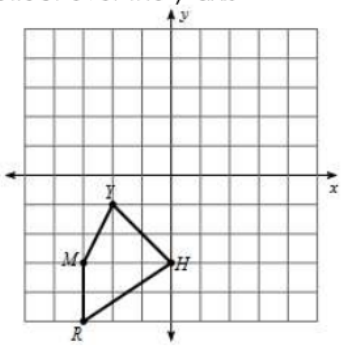


10) $R_{180} \circ r_{y=x}$ switch!

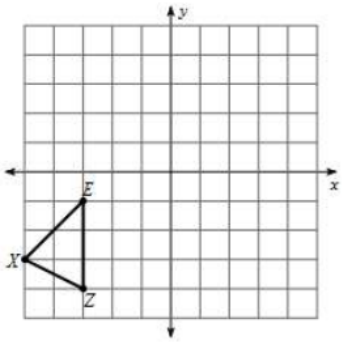


E (-3,2)
E' (2,-3)
E'' (-3,3)
H (-3,4)
H' (4,-3)
H'' (-4,3)
I (2,4)
I' (4,2)
I'' (-4,-2)
P (-1,1)
P' (1,-1)
P'' (-1,1)

11) Translate by the rule $(x, y) \rightarrow (x+4, y+1)$, then reflect over the y-axis



12) Reflect over the x-axis, then reflect over the line x = -2



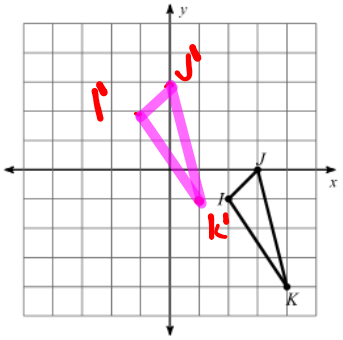
Geometry Name_____ ID: 1

Transformations Review

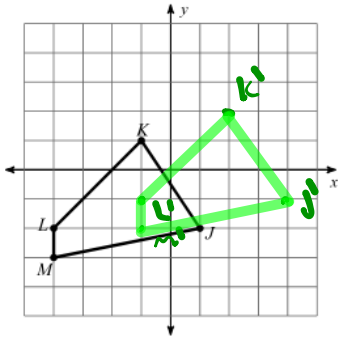
Date_____ Period____

Graph the image of the figure using the transformation given.

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



2) translation: $(x, y) \rightarrow (x + 3, y + 1)$



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

3) translation: $(x, y) \rightarrow (x - 2, y - 5)$
$K(1, 3)$

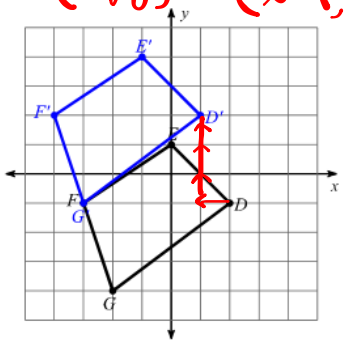
$K'(-1, -2)$

4) translation: $(x, y) \rightarrow (x - 4, y)$
$E(2, 0), D(0, 5), C(3, 5), B(4, 2)$

$E'(-2, 0), D'(-4, 5), C'(-1, 5), B'(0, 2)$

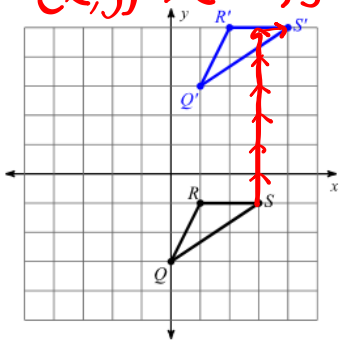
Write a rule to describe each transformation.

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



$T_{-1,3}$

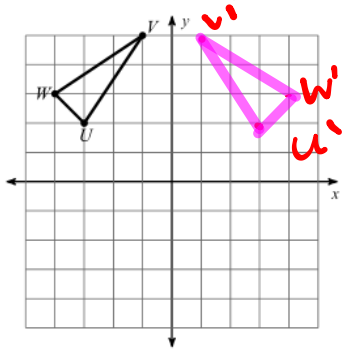
6) $(x, y) \rightarrow (x + 1, y + 6)$



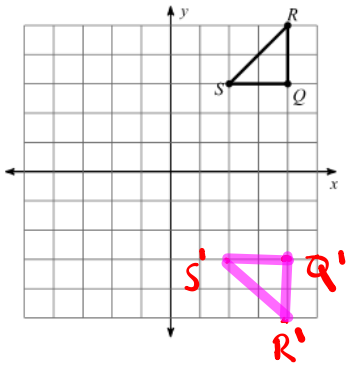
$T_{1,6}$

Graph the image of the figure using the transformation given.

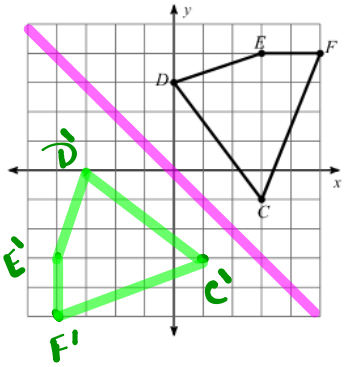
7) reflection across the y-axis



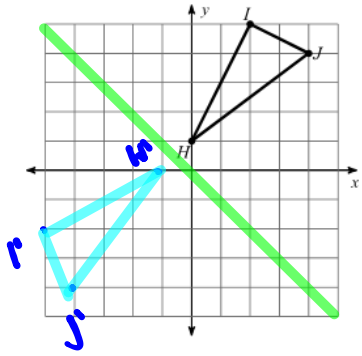
8) reflection across the x-axis



9) reflection across $y = -x$



10) reflection across $y = -x$



Write a rule to describe each transformation.

11) $J(-5, -1), I(-2, 2), H(0, -3)$ to $I'(-2, 2), H'(3, 0), J'(1, 5)$

Switch & change

$r_{y=-x}$ / reflect over $y=-x$

12) $I(-3, -5), H(-3, -4), G(-1, -4)$ to $H'(3, -4), G'(1, -4), I'(3, -5)$

change X

$r_{y\text{-axis}}$

reflect over y-axis

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

13) reflection across the x-axis
$Z(2, -4), Y(5, 0), X(5, -3)$

$Z'(2, 4)$

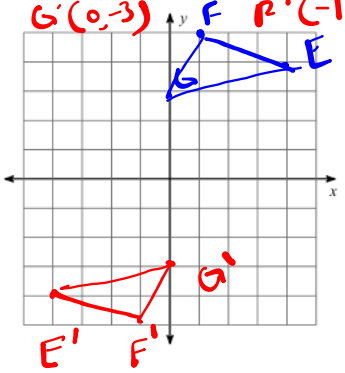
14) reflection across $y = x$
$I(2, -4), J(1, -2), K(5, -4)$

switch

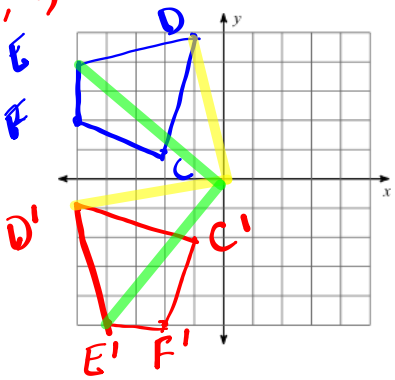
$J'(-2, 1)$

Graph the image of the figure using the transformation given.

15) rotation 180° about the origin
$G(0, 3), F(1, 5), E(4, 4)$



16) rotation 90° counterclockwise about the origin
$F(-5, 2), E(-5, 4), D(-1, 5), C(-2, 1)$



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

17) rotation 180° about the origin
$G(1, -5), F(1, -4), E(3, -5)$

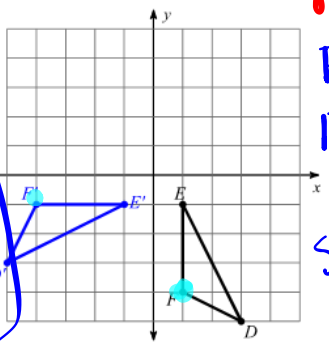
18) rotation 90° counterclockwise about the origin
$A(0, -2), B(1, 1), C(4, -2), D(3, -4)$

Write a rule to describe each transformation.

19) $P(-1, 1), Q(-3, 4), R(-2, 5), S(0, 1)$
to
$P'(-1, -1), Q'(-4, -3), R'(-5, -2), S'(-1, 0)$

20) $S(-4, -1), T(-2, 3), U(0, 0), V(-3, -4)$
to
$S'(4, 1), T'(2, -3), U'(0, 0), V'(3, 4)$

21)



22)