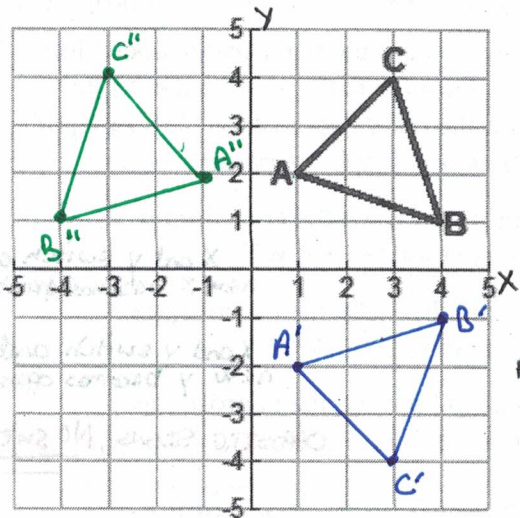


Unit # 4 – Geometric Transformations: Reflections and Rotations

Geometric Transformations – Reflections: Discovery Activity



Step 1 – On patty paper: Trace the x-axis, the y-axis, and triangle ABC. Label both axes and the triangle appropriately.

Step 2 – Reflect Across the x-axis ($R_{x\text{-axis}}$): Flip the patty paper “down”.
 Reflect Across the y-axis ($R_{y\text{-axis}}$): Flip the patty paper “left”.
 Complete the tables below and graph the points:

Preimage of ΔABC	
x	y
A	1, 2
B	4, 1
C	3, 4

$R_{x\text{-axis}}$ Image	
x	y
A'	1, -2
B'	4, -1
C'	3, -4

$R_{y\text{-axis}}$ Image	
x	y
A''	-1, 2
B''	-4, 1
C''	-3, 4

- Step 3** – a.) What is the relationship between the x- and y-coordinates when have $R_{x\text{-axis}}$ (reflection about x-axis)?
 b.) What is the relationship between the x- and y-coordinates when have $R_{y\text{-axis}}$ (reflection about y-axis)?

x's: x-coordinates STAY THE SAME
 y's: y-coordinates CHANGE TO OPPOSITE SIGN
 x's: x-coordinates CHANGE TO OPPOSITE SIGN
 y's: y-coordinates STAY THE SAME

Geometric Reflections: RULES

Reflect About x-axis	Reflect About y-axis	Reflect About a Hort Line	Reflect About a Vert Line
Symbolization: $R_{x\text{-axis}}$	Symbolization: $R_{y\text{-axis}}$	Symbolization: $R_{y=\#}$ (Horizontal)	Symbolization: $R_{x=\#}$ (Vertical)
Geometrically → Count distance of each point to the appropriate axis (x-axis or y-axis). Go the same number of spaces in opposite direction.	Geometrically →	Geometrically →	Geometrically →
Algebraically → For $R_{x\text{-axis}}$: multiply y's by -1 For $R_{y\text{-axis}}$: multiply x's by -1		1.) Draw a dotted to represent the line of reflection. 2.) Count the distance of each point to the dotted line. Go the same number of spaces in opposite direction.	Algebraically → There is NO algebraic method for these!

Example 1: Graph the figure with the given reflection. Show algebraically where appropriate.

a.) $R_{y\text{-axis}}$ (EKPI)

b.) $R_{x\text{-axis}}$ (CWEF)

c.) $R_{x=1}$ (ΔVUQ)

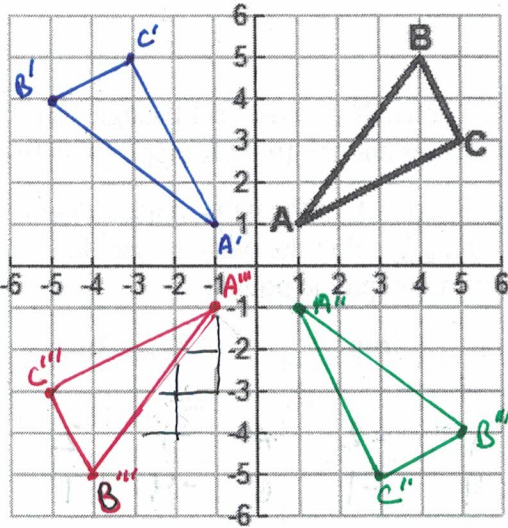
d.) $R_{y=-2}$ (ΔYJM)

X	Y	X	Y
2	4	-2	4
5	4	-5	4
3	-1	-3	-1
2	0	2	0

X	Y	X	Y
2	2	-2	2
1	3	1	3
0	-2	0	-2
-3	0	-3	0

Geometric Transformations – Rotations: Discovery Activity

CCW = counter-clockwise ↺
 CW = clockwise ↻



- Step 1** – On patty paper: Trace the x-axis, the y-axis, and triangle ABC. Label both axes and the triangle appropriately.
- Step 2** – Rotate 90° CCW ($r_{90^\circ \text{CCW}}$): Turn the patty paper once “left”.
 Rotate 90° CW ($r_{90^\circ \text{CW}}$): Turn the patty paper once “right”.
 Rotate 180° (r_{180°): Turn the patty paper twice “left or right”.
 Complete the tables below and graph the points:

- Step 3** – a.) What is the relationship between the coordinates when have $r_{90^\circ \text{CCW}}$ (rotation 90° CCW)? *X and y switch and new x becomes opposite sign*
- b.) What is the relationship between the coordinates when have $r_{90^\circ \text{CW}}$ (rotation 90° CW)? *X and y switch and new y becomes opposite sign*
- c.) What is the relationship between the coordinates when have r_{180° (rotation 180°)? *OPPOSITE SIGNS, NO SWITCHING*

Preimage of ΔABC	
x	y
A	1
B	4
C	5

$r_{90^\circ \text{CCW}}$ Image	
x	y
A'	-1
B'	-4
C'	-5

$r_{90^\circ \text{CW}}$ Image	
x	y
A''	1
B''	4
C''	5

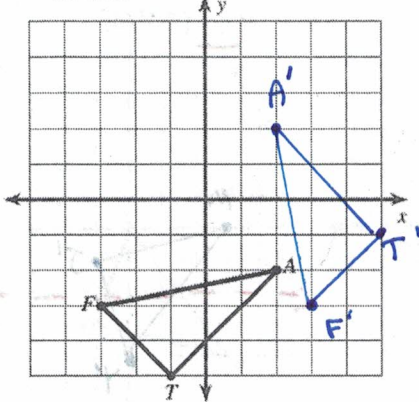
r_{180° Image	
x	y
A'''	-1
B'''	-4
C'''	-5

Geometric Rotations: RULES

Rotation 90° Counterclockwise (CCW)	Rotation 90° Clockwise (CW)	Rotation 180° either direction
Symbolization: $r_{90^\circ \text{CCW}}$	Symbolization: $r_{90^\circ \text{CW}}$	Symbolization: r_{180°
Geometrically/Algebraically \rightarrow 1.) <u>switch x's and y's</u> 2.) <u>new x becomes opposite sign</u>	Geometrically/Algebraically \rightarrow 1.) <u>switch x's and y's</u> 2.) <u>new y becomes opposite sign</u>	Geometrically/Algebraically \rightarrow 1.) <u>DO NOT SWITCH!!</u> 2.) <u>take opposite signs of both</u>

Example 2: Graph the figure with the given rotation. Show algebraically where appropriate.

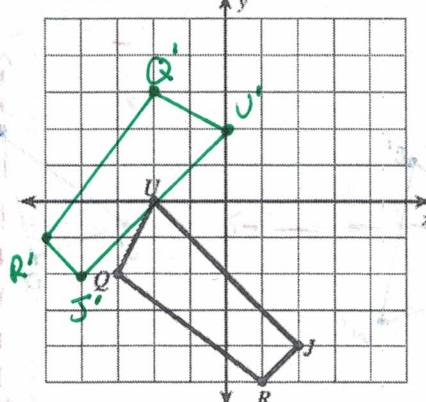
a.) $r_{90^\circ \text{CCW}} (\Delta FAT)$



	X/Y	X/Y	X/Y	
F	-3 -3	-3 -3	3 -3	F'
A	-1 -5	-1 -5	-1 -5	A'
T	-2 -2	-2 -2	2 -2	T'

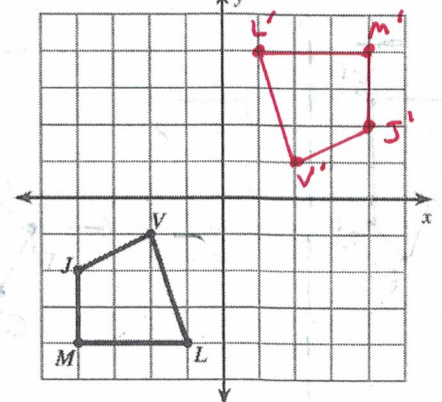
switch x/y
↑ opposite signs

b.) $r_{90^\circ \text{CW}} (\Delta UJRQ)$



	X/Y	X/Y	X/Y	
U	-2 0	0 -2	0 2	U'
J	2 -4	-4 2	-4 -2	J'
R	1 -5	-5 1	-5 -1	R'
Q	-3 -2	-2 3	-2 3	Q'

c.) $r_{180^\circ} (\Delta JVL M)$



	X/Y	X/Y	X/Y	
J	-4 -2	4 2	4 2	J'
V	-2 -1	2 1	2 1	V'
L	-1 -4	1 4	1 4	L'
M	-1 -4	1 4	1 4	M'