

**6.0 Student Activity: Reflections**

**Overview:** In this activity, students explore reflections on a coordinate plane in order to develop algebraic generalizations for reflections.

**Objective: Mathematics TEKS**

(6.7) Locate and name points on a coordinate plane using ordered pairs of non-negative rational numbers

(6.8.B) Select and use appropriate units, tools, or formulas to measure and to solve problems involving length...

(7.7.A) Locate and name points on a coordinate plane using ordered pairs of integers

(8.6.B) Graph dilations, reflections, and translations on a coordinate plane

(6.11.D, 7.13.D, 8.14.D) Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems

(6.12.A, 7.14.A, 8.15.A) Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models

(6.13.A, 7.15.A, 8.16.A) Make conjectures from patterns or sets of examples and nonexamples

**Mathematics TAKS Grades 6-8**

Objective 3: The student will demonstrate an understanding of geometry and spatial reasoning. (6.7, 7.7.A, 8.6.B)

Objective 4: The student will demonstrate an understanding of the concepts and uses of measurement. (6.8B)

Objective 6: The student will demonstrate an understanding of the mathematical processes and tools used in problem solving. (6.11.D, 7.13.D, 8.14.D, 6.12.A, 7.14.A, 8.15.A, 6.13.A, 7.15.A, 8.16.A)

**Terms:** reflection, isometry, original image, new image, congruence

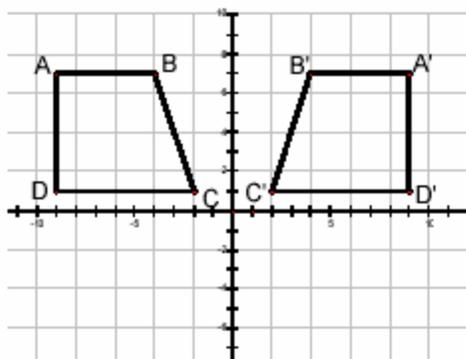
**Materials:** patty paper, straight edge, ruler, protractor, graphing calculator

**Procedures:**

1. Have students work in pairs to complete problems 1 & 2.
2. Debrief as a whole group.
3. Have students work in pairs to complete problem 3.
4. Debrief as a whole group.
5. Have students work in pairs to complete problem 4.
6. Debrief as a whole group.

## Student Activity: Reflections

1. Reflect the given figure across the  $y$ -axis.
- a. Complete the table to compare the coordinates of the points in the new image to the corresponding points in the original image.

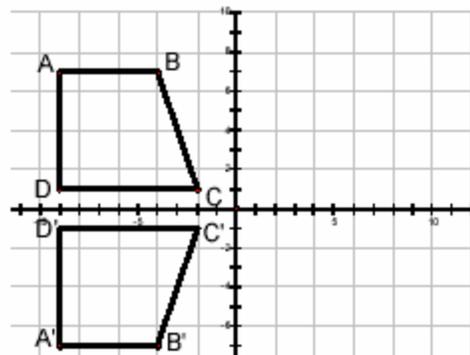


Original image	New Image
A (-9, 7)	A' (9, 7)
B (-4, 7)	B' (4, 7)
C (-2, 1)	C' (2, 1)
D (-9, 1)	D' (9, 1)
(x, y)	(-x, y)

- b. Write a generalization in  $(x, y)$  form for points in the new image, compared to corresponding points in the original image.  
 $(-x, y)$   
*Use straight edge to show with a horizontal line that  $y$ -coordinates stay the same*
- c. Explore the characteristics of the original image and new image. How do they compare?
- **Length of corresponding sides**  
 They are congruent.  
*Confirm with patty paper or by measurement.*
  - **Corresponding angle measurements**  
 They are congruent.  
*Confirm with patty paper or by measurement.*
  - **Perimeter**  
 They are congruent.
  - **Area**  
 They are congruent.

2. Reflect the given figure across the  $x$ -axis.

- a. Complete the table to compare the coordinates of the points in the new image to the corresponding points in the original image.



Original image	New Image
A (-9, 7)	A' (-9, -7)
B (-4, 7)	B' (-4, -7)
C (-2, 1)	C' (-2, -1)
D (-9, 1)	D' (-9, -1)
(x, y)	(x, -y)

- b. Write a generalization in  $(x, y)$  form for points in the new image, compared to corresponding points in the original image.

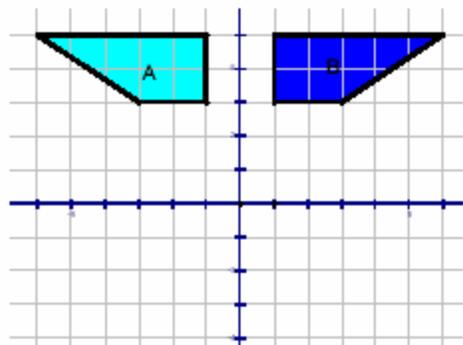
$(x, -y)$

*Use a straight edge to show with a vertical line that the  $x$ -coordinates stay the same.*

- c. Explore the characteristics of the original image and new image. How do they compare?
- **Length of corresponding sides**  
They are congruent.
  - **Corresponding angle measurements**  
They are congruent.
  - **Perimeter**  
They are congruent.
  - **Area**  
They are congruent.

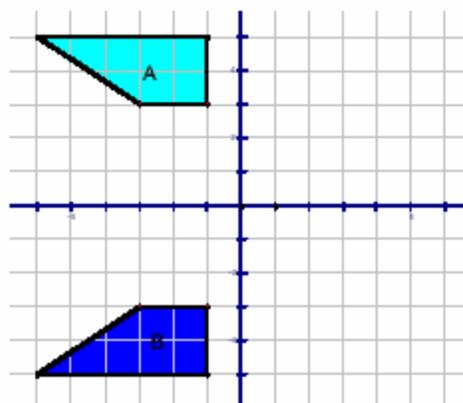
3. For each problem,  
 a. perform the given transformation and  
 b. record ordered pairs of corresponding points in the table.

i) Reflect the given figure across the  $y$ -axis



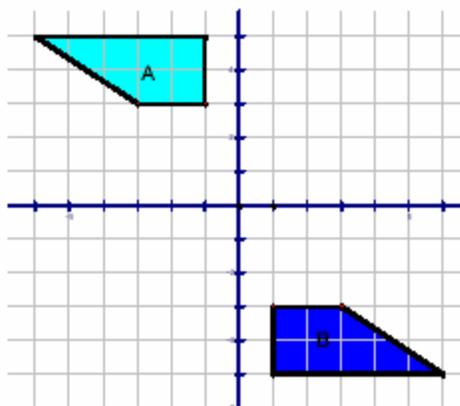
Original image	New Image
$(-6, 5)$	$(6, 5)$
$(-1, 5)$	$(1, 5)$
$(-1, 3)$	$(1, 3)$
$(-3, 3)$	$(3, 3)$
$(x, y)$	$(-x, y)$

(ii.) Reflect the given figure across the  $x$ -axis



Original image	New Image
$(-6, 5)$	$(-6, -5)$
$(-1, 5)$	$(-1, -5)$
$(-1, 3)$	$(-1, -3)$
$(-3, 3)$	$(-3, -3)$
$(x, y)$	$(x, -y)$

(iii.) Reflect the given image across the  $y$ -axis and then across the  $x$ -axis



Original image	New Image
$(-6, 5)$	$(6, -5)$
$(-1, 5)$	$(1, -5)$
$(-1, 3)$	$(1, -3)$
$(-3, 3)$	$(3, -3)$
$(x, y)$	$(-x, -y)$

6. Using a graphing utility,

- a. Given the ordered pairs of points on the original image in lists 1 and 2, create the corresponding ordered pairs of the new image in lists 3 and 4 if the figure is reflected across the  $y$ -axis.

List 1	List 2	List 3	List 4
3	5	-3	5
-1	7	1	7
-4	-5	4	-5
0	-7	0	-7
2	-2	-2	2

- Create a scatter plot of the original image and new image.  
You will need to re-enter the first point as the last point and select the connected plotting.

- b. Given the ordered pairs of points on the original image in lists 1 and 2, create the corresponding ordered pairs of the new image in lists 3 and 4 if the figure is reflected across the  $x$ -axis.

*This will require a horizontal shift at least 3 units to the left and a vertical shift at least 7 units down*

List 1	List 2	List 3	List 4
3	5	3	-5
-1	7	-1	-7
-4	-5	-4	5
0	-7	0	7
2	-2	2	2

- Create a scatter plot of the original image and new image.  
*You will need to re-enter the first point as the last point and select the connected plotting.*

- d. Given the ordered pairs of points on the original image in lists 1 and 2, create the corresponding ordered pairs of the new image in lists 3 and 4 if the figure is reflected across the  $y$ -axis and then the  $x$ -axis.

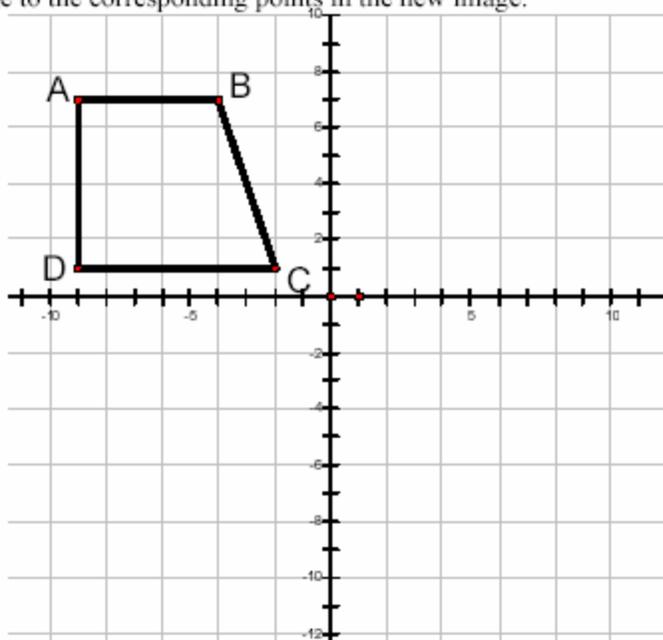
List 1	List 2	List 3	List 4
3	5	-3	-5
-1	7	1	-7
-4	-5	4	5
0	-7	0	7
2	-2	-2	2

- Create a scatter plot of the original image and new image.  
*You will need to re-enter the first point as the last point and select the connected plotting.*

## Student Activity: Reflections

1. Reflect the given figure across the  $y$ -axis.

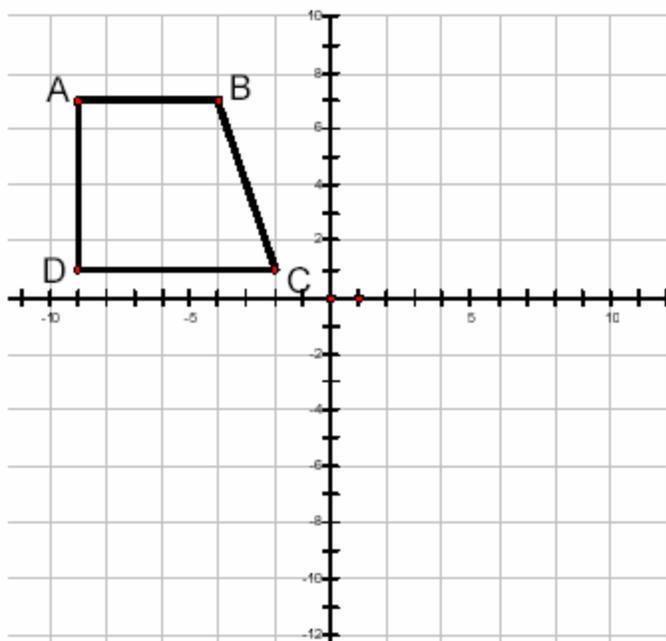
- a. Complete the table to compare the coordinates of the points in the original image to the corresponding points in the new image.



Original image	New Image
A (-9, 7)	A' ( , )
B (-4, 7)	B' ( , )
C (-2, 1)	C' ( , )
D (-9, 1)	D' ( , )
(x, y)	( , )

- b. Write a generalization in  $(x, y)$  form for points in the original image, compared to corresponding points in the new image.
- c. Explore the characteristics of the original image and new image. How do they compare?
- Length of corresponding sides
  
  
  - Corresponding angle measurements
  
  
  - Perimeter
  
  
  - Area

2. Reflect the given figure across the  $x$ -axis.
- a. Complete the table to compare the coordinates of the points in the new image to the corresponding points in the original image.

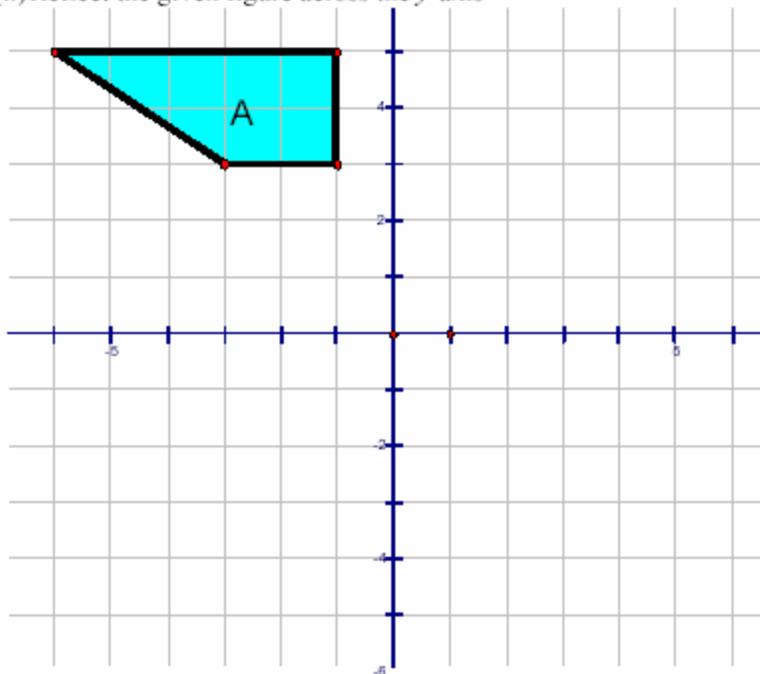


Original image	New Image
A (-9, 7)	A' (     ,     )
B (-4, 7)	B' (     ,     )
C (-2, 1)	C' (     ,     )
D (-9, 1)	D' (     ,     )
( $x$ , $y$ )	(     ,     )

- b. Write a generalization in  $(x, y)$  form for points in the new image, compared to corresponding points in the original image.
- c. Explore the characteristics of the original image and new image. How do they compare?
- Length of corresponding sides
  
  - Corresponding angle measurements
  
  - Perimeter
  
  - Area

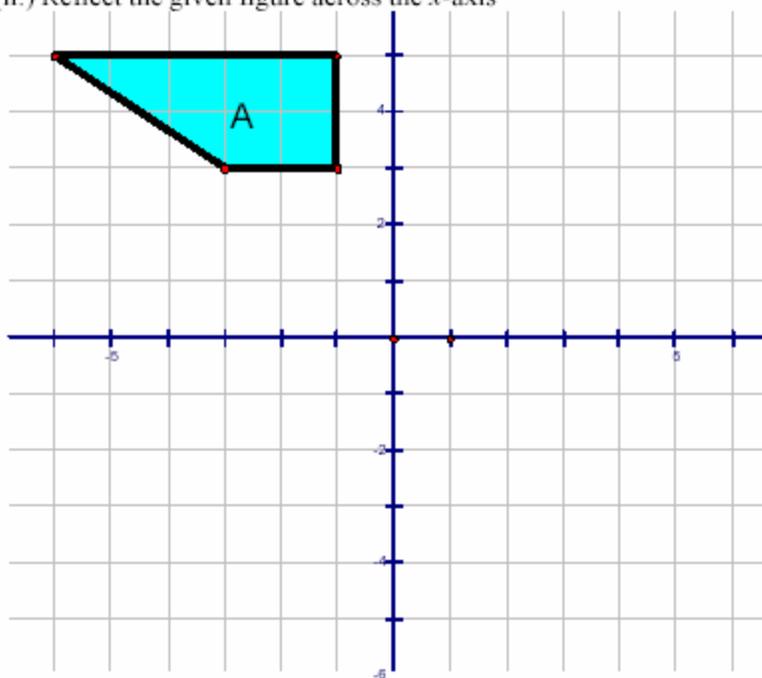
3. For each problem,
- Perform the given transformation and
  - Record ordered pairs of corresponding points in the table.

(i.) Reflect the given figure across the  $y$ -axis



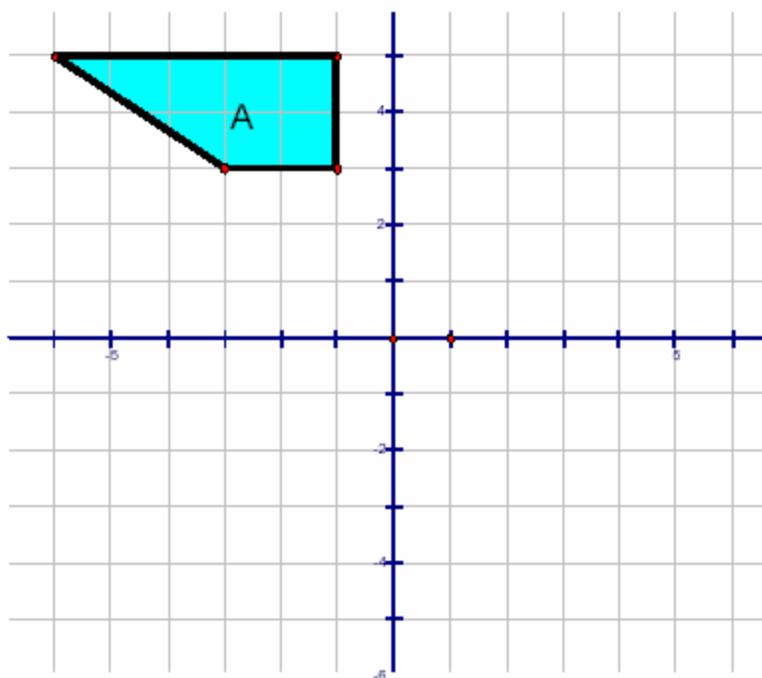
Original image	New Image
(     ,     )	(     ,     )
(     ,     )	(     ,     )
(     ,     )	(     ,     )
(     ,     )	(     ,     )
( $x$ , $y$ )	(     ,     )

(ii.) Reflect the given figure across the  $x$ -axis



Original image	New Image
(     ,     )	(     ,     )
(     ,     )	(     ,     )
(     ,     )	(     ,     )
(     ,     )	(     ,     )
( $x, y$ )	(     ,     )

(iii.) Reflect the given image across the  $y$ -axis and then across the  $x$ -axis.



Original image	New Image
(     ,     )	(     ,     )
(     ,     )	(     ,     )
(     ,     )	(     ,     )
(     ,     )	(     ,     )
( $x, y$ )	(     ,     )

4. Use your graphing calculator to complete the following questions.
- a. Given the ordered pairs of points on the original image in lists 1 and 2, create the corresponding ordered pairs of the new image in lists 3 and 4 if the figure is reflected across the  $y$ -axis.

List 1	List 2	List 3	List 4
3	5		
-1	7		
-4	-5		
0	-7		
2	-2		

- Create a scatter plot of the original image and new image.
- b. Given the ordered pairs of points on the original image in lists 1 and 2, create the corresponding ordered pairs of the new image in lists 3 and 4 if the figure is reflected across the  $x$ -axis.

List 1	List 2	List 3	List 4
3	5		
-1	7		
-4	-5		
0	-7		
2	-2		

- Create a scatter plot of the original image and new image.
- c. Given the ordered pairs of points on the original image in lists 1 and 2, create the corresponding ordered pairs of the new image in lists 3 and 4 if the figure is reflected across the  $y$ -axis and then the  $x$ -axis.

List 1	List 2	List 3	List 4
3	5		
-1	7		
-4	-5		
0	-7		
2	-2		

- Create a scatter plot of the original image and new image.