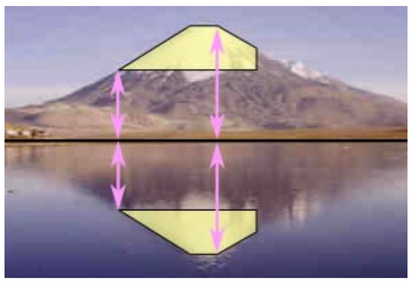
Reflection Investigation!

Name:____________________
Date:____________________

Reflections can be seen in mirrors, windows, and over water! In this activity you will observe the properties of reflections through reflecting objects over lines of symmetry, exploring what happens to the coordinates as they are reflected. You will explore and test predictions on the properties of reflections using Geogebra.



Pictures from: http://www.mathsisfun.com/geometry/reflection.html

Part I: Making Predictions on Reflections:

- What is your working definition of a **reflection?**

  ____.

- From the two images above, what do you notice about the distances between the points on the image and the central line, also known as the **mirror line**?

  ____.

- What other observations do you notice about reflections?

  ____

  ____

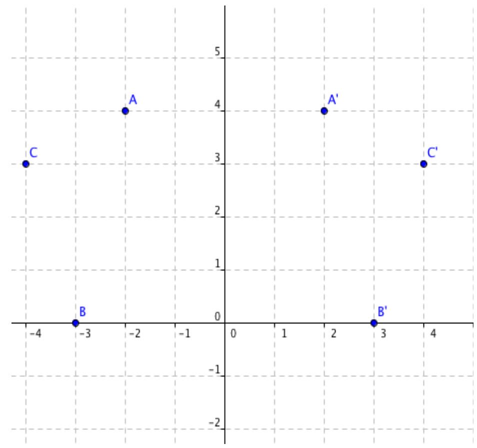
  ____

  ____.

Part II: Reflecting on the Coordinate Grid

Investigation I:

1. Open up **Coordinate Grid I** with labeled points. Points that are labeled with a tick mark indicates that it is reflected (i.e A', B', C').



2. Write the coordinates of the points of the original and reflected image.

Original	Reflected
A_______	A'_______
B_______	B'_______
C_______	C'_______

3. On what axis is the image being reflected over?
_______________.

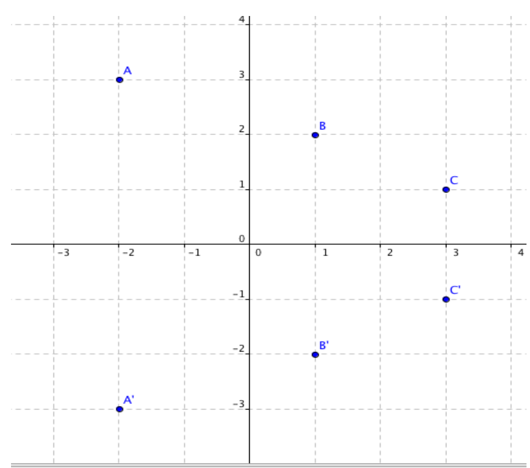
4. Drag the points to observe the behavior of the coordinates.

5. Describe your observations about the original points when dragged. What about reflected points, can they be dragged? Explain.
____.

6. Write a general rule that describes the reflected coordinates in terms of x and y.
____.

Investigation II:

1. Open up **Coordinate Grid II** with labeled points. Points that are labeled with a tick mark indicates that it is reflected (i.e A', B', C').



2. Write the coordinates of the points of the original and reflected image.

Original	Reflected
A_______	A'_______
B_______	B'_______
C_______	C'_______

3. On what axis is the image being reflected over?
_______________.

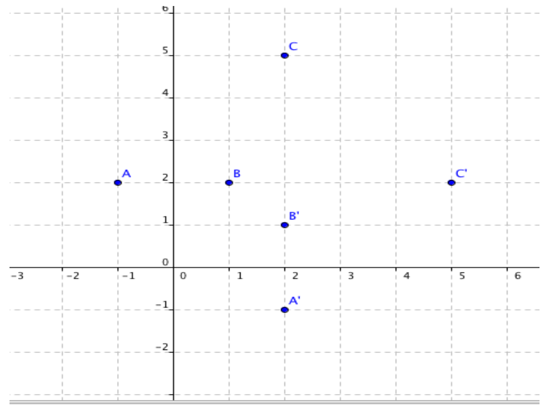
4. Drag the points to observe the behavior of the coordinates.

5. Describe your observations about the original points when dragged. What about reflected points, can they be dragged? Explain.
____.

6. Write a general rule that describes the reflected coordinates in terms of x and y.
____

Investigation III:

1. Open up **Coordinate Grid III** with labeled points. Points that are labeled with a tick mark indicates that it is reflected (i.e A', B', C').



2. Write the coordinates of the points of the original and reflected image.

Original	Reflected
A______	A'______
B______	B'______
*C*______	C'______

3. On what line is the image being reflected over? ______________________________________.

4. Drag the points to observe the behavior of the coordinates.
5. Describe your observations about the original points when dragged. What about reflected points, can they be dragged? Explain.____.

6. Write a general rule that describes the reflected coordinates in terms of x and ____.

Part III: Creating and Examining Reflections

Let's Sketch on GeoGebra

1. Open a new sketch and construct a polygon.
2. Construct a line of reflection.
3. Reflect the polygon over the line of reflection by first selecting the reflection tool, then selecting the polygon, and select the line of reflection.

Summarizing Properties of Reflections:

4. What do you notice about the distance of the point and reflected point in relation to the mirror line? Was this similar to your prediction?

   ____

   ____.

5. What do you notice about the measure of the angles between the segments connecting the original points and reflected points on the polygon in relation to the mirror line?

   ____.

6. Move the vertices of the polygon and line of reflection. Observe what happens to the polygon. Can the reflected image or line of symmetry move? Explain.

   ____

   ____.

7. What is the name of the line of reflection in relation to the segments formed by each point and its corresponding image? ____.

ANSWER KEY

Part I: Making Predictions on Reflections:

- What is your working definition of a **reflection?**

Reflection: flipped image (may or may not recognize specific properties i.e. same size, points equidistant from mirror line, segment connecting original and reflected points is perpendicular to mirror line therefore mirror line is perpendicular bisector of line segment AA', BB', CC')

- From the two images above, what do you notice about the distances between the points on the image and the central line, also known as the **mirror line**?

Distance is the same; they are Equidistant

- What other observations do you notice about reflections?

May or may not recognize specific properties (i.e. same size, points equidistant from mirror line, segment connecting original and reflected points is perpendicular to mirror line therefore mirror line is perpendicular bisector of line segment AA', BB', CC')

Part II: Reflecting on the Coordinate Grid

Investigation I:

1. Open up **Coordinate Grid I** with labeled points. Points that are labeled with a tick mark indicates that it is reflected (i.e A', B', C').
2. Write the coordinates of the points the original and reflected image.

Original	Reflected
A *(-2,4)*	A' *(2,4)*
B *(-3,0)*	B' *(3,0)*
C (-4,3)	C' *(4,3)*

3. On what axis is the image being reflected over? *y-axis.*
4. Students work on dragging points to observe behavior
5. Describe your observations about the original points when dragged. What about reflected points, can they be dragged? Explain. *Original points: x changes, y stays same when drag up and down. Y-coordinate remains the same, and x-coordinate becomes opposite. Reflected coordinates cannot be dragged because dependent on move of original point*
6. Write a general rule that describes the reflected coordinates in terms of x and y. *(x,y)--> (-x, y).*

Investigation II:

1. Open up **Coordinate Grid II** with labeled points. Points that are labeled with a tick mark indicates that it is reflected (i.e A', B', C')
2. Write the coordinates of the points the original and reflected image.

Original	Reflected
A *(-2,3)*	A' *(-2,-3)*
B *(1,2)*	B' *(1,-2)*
C *(3,1)*	C' *(3,-1)*

3. On what axis is the image being reflected over? *X-axis.*
4. Drag points to observe behavior
5. Describe your observations about the original points when dragged. What about reflected points, can they be dragged? Explain. *Original points: x stays same, y remains opposite sign when drag*

up and down(drag up and down points become far or close; side by side points follow each other)Y-coordinate remains the same, and x-coordinate becomes opposite. Reflected coordinates cannot be dragged because dependent on move of original point. X-coordinate remains the same, and y-coordinate becomes opposite.

6. Write a general rule that describes the reflected coordinates in terms of x and y.

(x,y)-->(x,-y).

Investigation III:

1. *Open up **Coordinate Grid III** with labeled points. Points that are labeled with a tick mark indicates that it is reflected (i.e A', B', C').*
    1. Open up coordinate Grid III with image.
    2. Write the coordinates of the points the original and reflected image.

Original	Reflected
A *(-1,2)*	A' *(2,-1)*
B *(1,2)*	B' *(2,1)*
C *(2,5)*	C' *(5,2)*

3. On what line is the image being reflected over? *y=x*.
4. Drag the points to observe the behavior of the coordinates.
5. Describe your observations about the original points when dragged. What about reflected points, can they be dragged? Explain. *Drag up and down causes reflected point to move in opposite direction; side by side reflected point moves in opposite direction. x and y switch positions. Reflected coordinates cannot be dragged because dependent on move of original point.*
6. Write a general rule that describes the reflected coordinates in terms of x and y. *(x,y)--> (y, x)*

Part III: Creating and Examining Reflections

Let's Sketch on GeoGebra

1. Open a new sketch and Construct a polygon.
2. Construct a line of reflection.
3. Reflect the polygon over the line of reflection by first selecting the reflection tool, then selecting the polygon, and select the line of reflection.
4. What do you notice about the distance of the point and reflected point in relation to the mirror line? Was this similar to your prediction?

They are the same distance; equidistant (yes or no)

5. What do you notice about the measure of the angles between the segments connecting the original points and reflected points on the polygon in relation to the mirror line?

Segment is 180 degrees, mirror line cuts in half so 90 degree angles

6. Observe what happens to the polygon. Describe your observations in the lines below. Can the reflected image or line of symmetry move? Explain.

The polygon is reflected across the line. The reflected image or line of symmetry cannot move.

7. What is the name of the line of reflection in relation to the segments formed by each point and its corresponding image?

Perpendicular bisector

The mathematical objective of this activity is for students to explore visually what it means to reflect across a line of symmetry. This includes recognizing the behavior of coordinates as they are reflected

on the coordinate grid over different lines of symmetry, including the x-axis, y-axis, and y=x line. This activity should allow students to become more familiar with reflections and to determine how points are reflected on the cartesian plane through the behavior of coordinates. Moreover, the activity aims to distinguish reflected images from different lines and axes. Possible misconceptions that may arise include students examining incorrect file (i.e. Coordinate Grid III instead of Coordinate Grid II). Students may label or put the wrong axis or line for the line of reflection; sometimes actually drawing a line may help students see the line of reflection. To counter this, Part II was divided into three investigations which clearly distinguished the x-axis, y-axis, and y=x line/axes of reflection.
The activity will help prepare students in further problems of lines of symmetry on the cartesian plane. An extension problem could be having students reflect across the y=-x line. Using Geogebra allows students to have concrete access to explore and test their predictions on reflections by dragging points and constructing their own reflection of polygons in the third part of the activity. Students may be able to complete some questions on this worksheet without using dynamic geometry; however they will not have the opportunity to explore, or test and justify heir predictions if they do not use Geogebra.