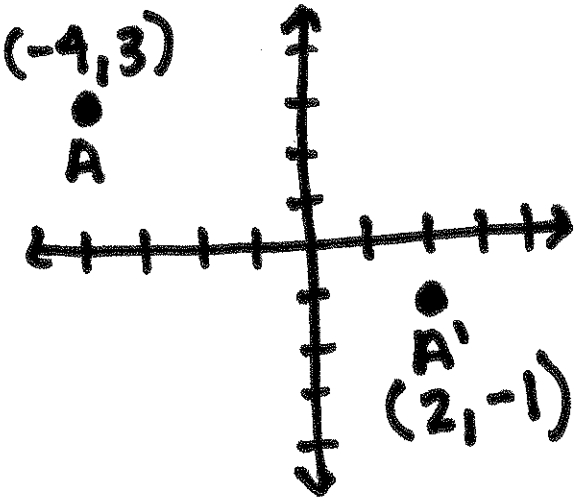
Vector Notation

$\langle h, k \rangle$ ← arrows indicate a vector

h: horizontal change

k: vertical change

1. What is the image of (0,0) under the following translation: $\langle 5, -6 \rangle$?

2. 

Write the vector translation that maps A to A'.

Day 3 Investigation - Reflections

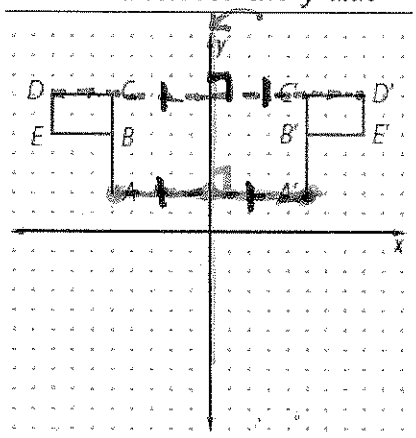
Name: _____

Reflecting Shapes

Line reflections can also be expressed using coordinates. A **line reflection** is determined by a "mirror line" (or line of reflection) that is the perpendicular bisector of the segment connecting a point and its reflected image. A point on the line of reflection is its own image. In the following problems, you will build coordinate models for reflections across vertical and horizontal lines, as well as across the lines $y = x$ and $y = -x$.

(8) A flag $ABCDE$ and its reflected image across the y-axis are shown on the screen below.

Reflected Across the y-axis



* NEED MORE INSTRUCTIONS - LIST POINTS

(a) Investigate patterns in the coordinates of preimage and image pairs when points are reflected across the y-axis.

b. Explain why the reflected image of the flag could be produced using only the reflected images of points A, B, C, D, and E.

c. Write a rule which tells how to take any point (x, y) and find its reflected image across the y-axis. State your rule in words and in symbols.

* (d.) HONORS On a copy of the diagram, use dashed segments to connect point A to point A' and point D to point D'. Use coordinates to verify that the y-axis is the perpendicular bisector of $\overline{AA'}$ and $\overline{DD'}$.

Answers:

8a. A (-5, 2) A' (5, 2)
B (-5, 5) B' (5, 5)
C (-5, 7) C' (5, 7)
D (-8, 7) D' (8, 7)
E (-8, 5) E' (8, 5)

b. OMIT

c. opposite of x, y stays the same
$(x, y) \rightarrow (-x, y)$

d. SEGMENTS ARE HORIZONTAL AXES ARE VERTICAL
∴ PERPENDICULAR. DISTANCE IS |-5| : 5, |-8| : 8 ∴ BISECTS

(9) The table below shows coordinates of six preimage points and coordinates (a, b) of a general point. Plot each of the six points and its reflected image across the x-axis.

a. Record the coordinates of the image points in a table like the one below.

Preimage	Reflected Image Across x-axis
$(-4, 1)$	$(-4, -1)$
$(3, -2)$	$(3, 2)$
$(-2, -5)$	$(-2, 5)$
$(4, 5)$	$(4, -5)$
$(0, 1)$	$(0, -1)$
$(-3, 0)$	$(-3, 0)$
(a, b)	$(a, -b)$

b. What pattern relating coordinates of preimage points to image points do you observe? Use the pattern to give the coordinates of the image of (a, b).

9b. x-coordinates are the same ; y-coordinates are opposite

c. Write a rule that tells how to take any point (x, y) and find its reflected image across the x-axis. State your rule in words and in symbols.

★ (d) How is the x-axis related to the segment determined by any point (a, b) not on the x-axis and its reflected image? Justify your answer using coordinates.

(10) Draw the graph of $y = x$. Plot each preimage point in the table below and its reflected image across that line. Connect each preimage/image pair with a dashed segment.

a. Record the coordinates of the image points in a copy of the table below.

Preimage	Reflected Image Across $y = x$
$(-4, 1)$	$(1, -4)$
$(3, -2)$	$(-2, 3)$
$(-2, -5)$	$(-5, -2)$
$(4, 5)$	$(5, 4)$
$(0, 1)$	$(1, 0)$
$(-3, 0)$	$(0, -3)$
(a, b)	(b, a)

b. Describe a pattern relating coordinates of preimage points to image points.

c. Write a rule relating the coordinates of any preimage point (x, y) to its reflected image across the line $y = x$. State your rule in words and in symbols.

★ (d) How is the line of reflection, $y = x$, related to the segment determined by any point (a, b) not on the line and its image? Justify your answer.

(11) Next, investigate patterns in the coordinates of the preimage and image pairs when points are reflected across the line $y = -x$.

a. Draw the graph of $y = -x$. Then plot the six preimage points in the table in Problem 10 and their reflected images across the line.

b. Describe a pattern relating coordinates of preimage points to coordinates of image points.

c. Write a rule relating the coordinates of any preimage point (x, y) and its reflected image across the line $y = -x$. State your rule in words and in symbols.

★ (d) How is the segment determined by a point and its reflected image related to the line $y = -x$?

9c. $(x, y) \rightarrow (-x, -y)$

d. omit

10b. x & y interchanged

c. $(x, y) \rightarrow (y, x)$

d. omit

11a. on graph

b. x & y interchanged & made opposite

c. $(x, y) \rightarrow (-y, -x)$

d. omit

(12) * Honors

You now have coordinate models for the following line reflections.

- reflection across the x-axis
- reflection across the y-axis
- reflection across the line $y = x$
- reflection across the line $y = -x$

Sharing the workload among your classmates, develop planning algorithms that would guide a programmer in the development of line reflection programs for each of these four line reflections. Identify the input, processing, and output portions of each of your algorithms.

#12 - Each group member should choose one reflection from choices to the left.

Write the algorithms (steps - refer to Question #5 from Day 2) for that reflection.

12. * Be able to list the steps to reflect an object over a line *

Summarize Mathematics Unit 1A #2 - Write your answers in your notebook

Summarize the coordinate rules for line reflections:

i. Across the x-axis: $(x, y) \rightarrow (\_\_, \_\_)$
ii. Across the y-axis: $(x, y) \rightarrow (\_\_, \_\_)$
iii. Across the line $y = x$: $(x, y) \rightarrow (\_\_, \_\_)$
iv. Across the line $y = -x$: $(x, y) \rightarrow (\_\_, \_\_)$

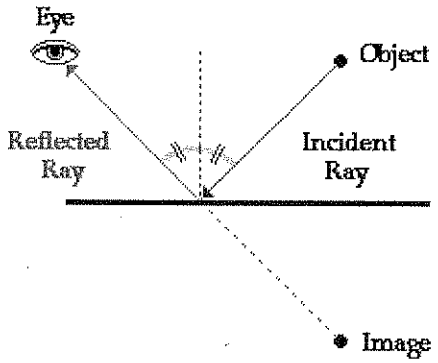
Be prepared to explain your coordinate rules and strategies you could use to remember or redevelop them.

i. $(x, y) \rightarrow (x, -y)$
ii. $(x, y) \rightarrow (-x, y)$
iii. $(x, y) \rightarrow (y, x)$
iv. $(x, y) \rightarrow (-y, -x)$

Day 3 Classwork Name:_____

Miniature Golf Reflections: Most miniature golf holes are designed so that the golfer cannot aim the golf ball from the tee directly into the hole. Instead, the golfer must bounce the ball off of one or more walls in order to pass various obstacles in its path. In this activity, you will determine the angle (or angles) you will need to bounce a ball in miniature golf. Pretty soon you will be a pro!

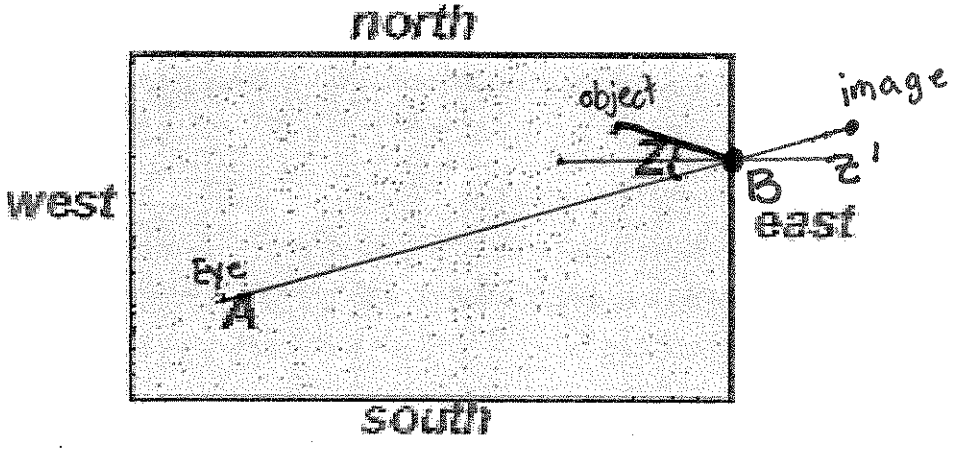
The principles used to determine where to hit your golf ball is based on another situation: you viewing the reflection of an object in a mirror as shown in the figure below. The angles created have special names in the study of light. They are called the angle of incidence (angle created by the incident ray and the perpendicular line to the line of reflection) and the angle of reflection (angle created by the reflected ray and the perpendicular line to the line of reflection). As you can see in the figure, the angle of incidence and angle of reflection are congruent.



Step 1: Hole 1 is shown in the figure with A as the tee and Z as the hole. You can't hit the ball straight into the hole because there is an obstacle in the way. Therefore, you will bank the ball off the east wall in order to get your hole-in-one! To find the angle at which you need to hit the ball on the wall, let's work backwards. Using the east wall as your line of reflection, reflect Z over the line. Label this Z'.

Step 2: Draw a segment from A to Z'. Label the point of intersection of this segment and the east wall as point B. That's it! You found the point to which you want to aim the golf ball! If you hit the ball without spin and with the proper velocity to this point, it will bounce off the wall and go into the hole.

Step 3: Show the path of the ball by drawing a segment from the point of intersection (B) to the hole (Z). Label the angle of incidence and angle of reflection. Verify that they are congruent.



Kuta Software - Infinite Geometry

Name_____

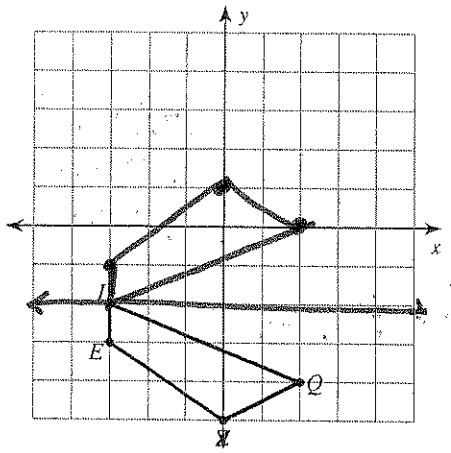
Reflections

DAY 3 HOMEWORK

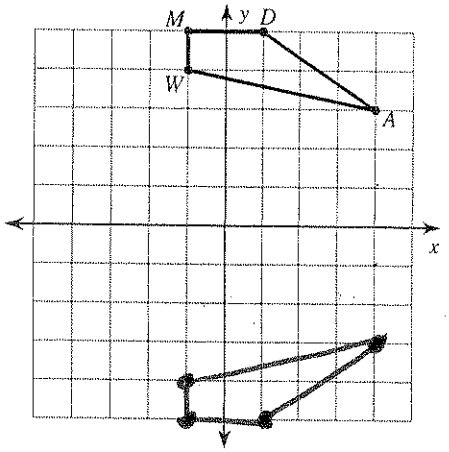
Date_____ Period____

Graph the image of the figure using the transformation given.

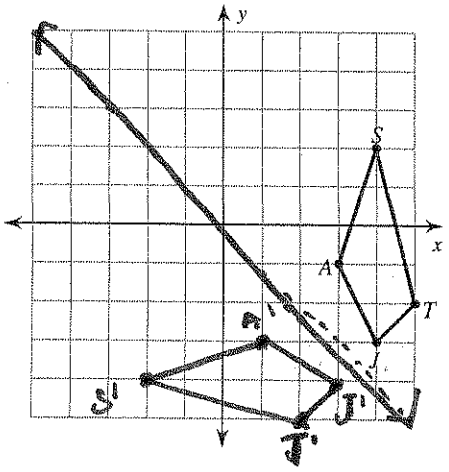
1) reflection across $y = -2$



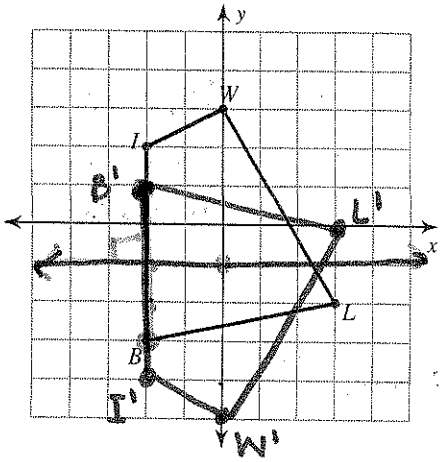
2) reflection across the x-axis



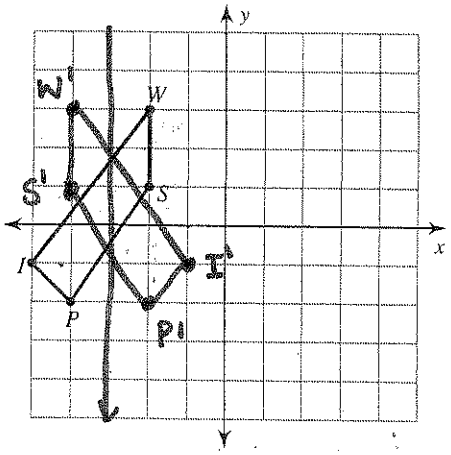
3) reflection across $y = -x$



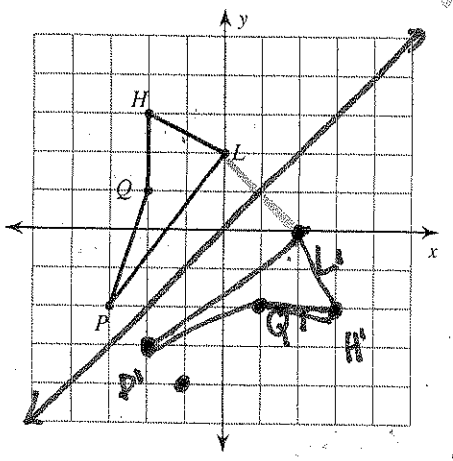
4) reflection across $y = -1$



5) reflection across $x = -3$

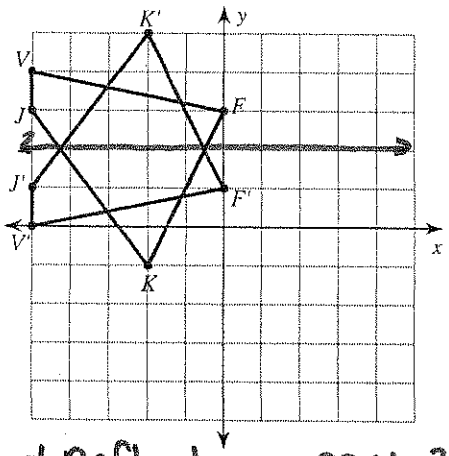


6) reflection across $y = x$ $(x, y) \rightarrow (y, x)$



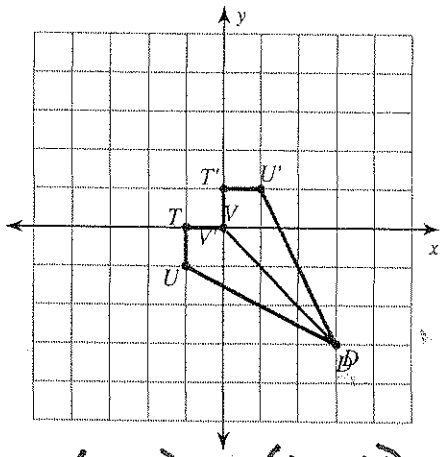
Write a rule to describe each transformation.

7)



*Reflect across $y=2$

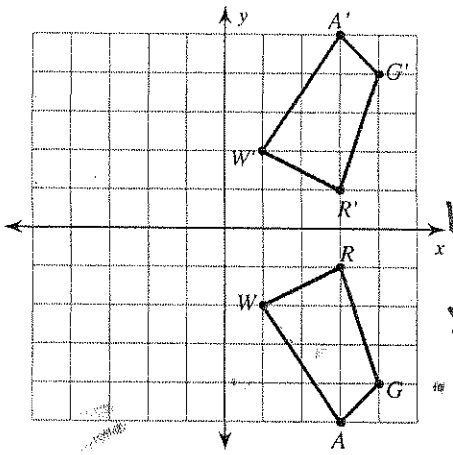
8)



reflect across $y=-x$

$(x,y) \rightarrow (-y,-x)$

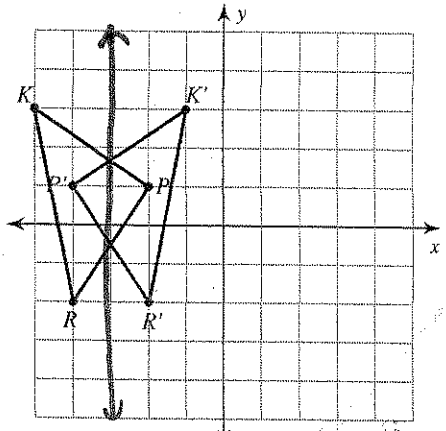
9)



reflect across x-axis

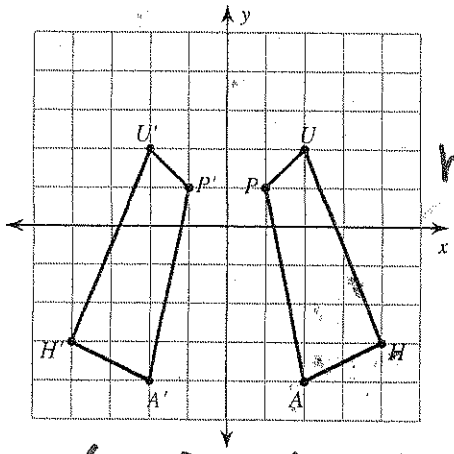
$(x,y) \rightarrow (x,-y)$

10)



*reflect across $x=-3$

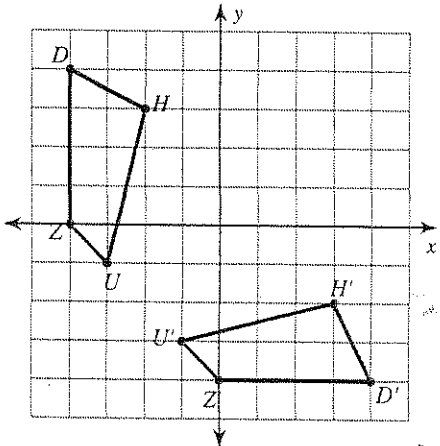
11)



reflect across y axis

$(x,y) \rightarrow (-x,y)$

12)



reflect across $y=x$

$(x,y) \rightarrow (y,x)$