Junior Circle Meeting #8 - Rigid Motions of the Plane

February 28, 2010

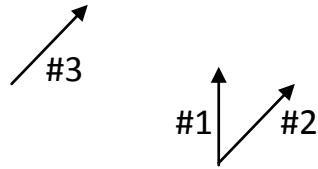1. a.) Rotate the arrow below clockwise one quarter turn. Then translate it north (up) by 1 centimeter.

   b.) Now do the opposite order (translate then rotate).
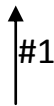
   c.) What do you observe?

2. a.) Now we rotate the arrow below by the angle shown and then translate it (from arrow #1 to #2 to #3).

#3

#1 #2

b.) Now do the opposite order below (first translate, then rotate).

#1

c.) What do you observe?

3. a.) Rotate the image below a half turn around the center of rotation below.
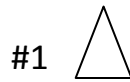
Center-> ●

b.) Now physically rotate your piece of paper a half turn to see how the image changes. Did you draw the correct image in part (a.)?
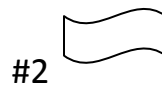
●

4. Find the center of the given rotation.

5. a.) What is the least number of steps (using rotation and translation) to move image #1 to image #2?

#2

#1

b.) Can we get image #2 from image #1 using only rotation and translation? If so, what is the least number of steps to move it? If not, why not?
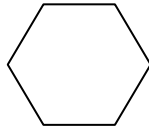
#2

#1

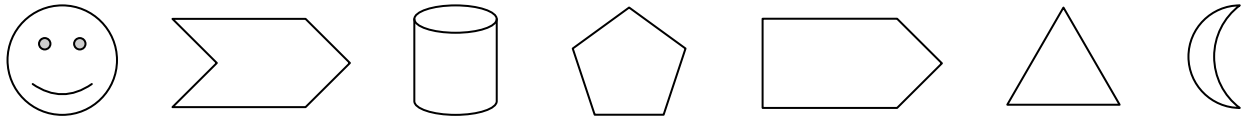6. a.) We now reflect the image below with respect to the point below. Draw the resulting image.

Point -> ●

b.) Symmetry with respect to a point means that we can choose a point and reflect any point on our image across the center point and get another point on the image. Is the image below symmetric with respect to a point?

c.) What are letters in the alphabet that are symmetric with respect to a point?

7. What do you notice about the images below? Sort the objects into groups based on what you notice.

8. Symmetry with respect to a line means we can reflect the object across a line (horizontal, vertical, or diagonal) and get the same image.

By reflecting an object, we can make it symmetric. Reflect the objects below across the vertical line:
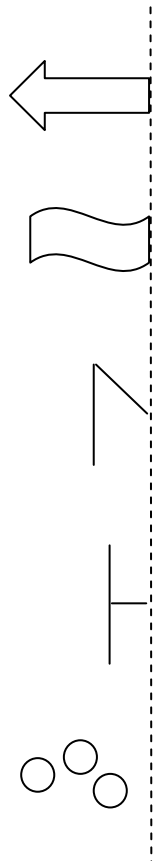
9. There are 7 coins placed on a table so that the picture is symmetric with respect to a line.

a. Show that there is at least one coin in the line.

b. How many coins can be on the line?

c. What if there are 6 coins?

10. Do the following images represent rotations or reflections?

a.

b.

c.

d.

11. a. Which letters of the alphabet have vertical symmetry?

b. Which letters of the alphabet have horizontal symmetry?

c. What are the "most symmetric" letters? Why?

d. Can a letter have only one line of symmetry and a center of symmetry? Why or why not?
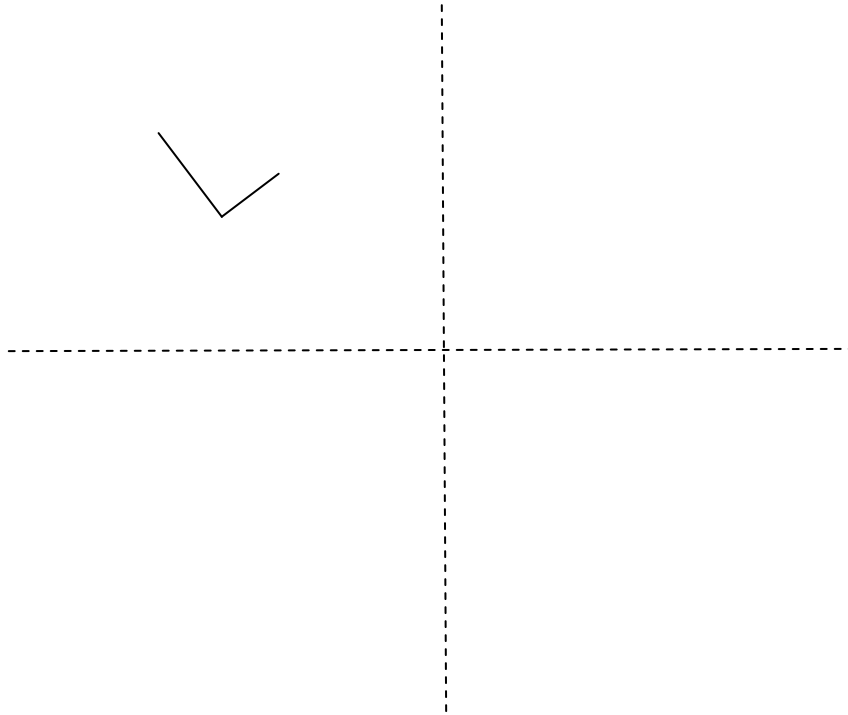
12. a. Rotate the below arrow twice: one quarter clockwise turn around
   the first center point, then another one quarter clockwise turn around
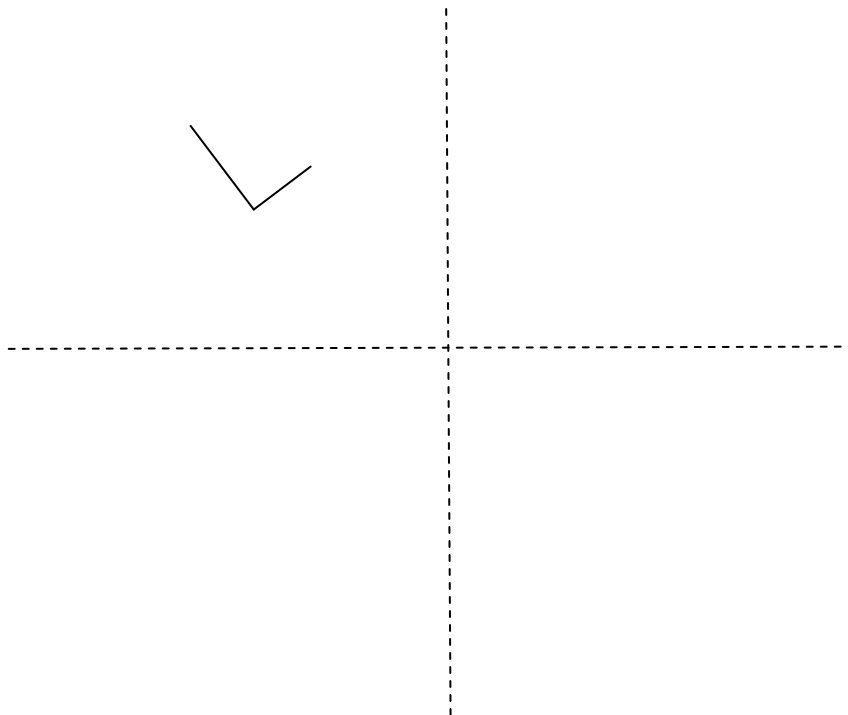   the second point.

   #2 -> ●

Center #1 ->   ●

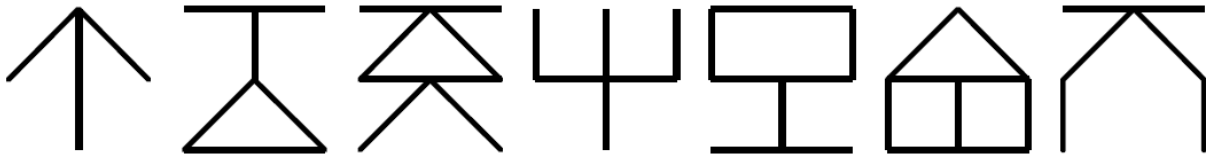b. Now do it in the opposite order. Do you get the same result?

   #1 -> ●

#2 -> ●
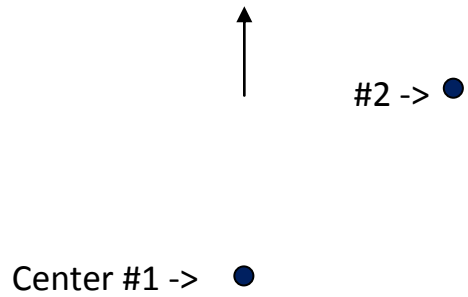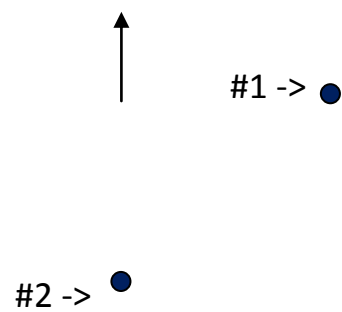
13. a. Rotate the below letter "L" clockwise one quarter turn, than reflect it across the horizontal line.

b. Now do it in the opposite order. Do you get the same result?

14. Can you continue the sequence below?

15. Two Junior Circle students are playing a game. Each player alternates placing circular tiles on the circular table below. The player who places the last tile wins. How can Player 1 always win?