ACCELERATED CCGPS ALGEBRA/GEOMETRY

UNIT 5: Transformations in the Coordinate Plane

Essential Question Unit EQ: How can the coordinate plane help me understand properties of refelctions, translations, and rotations?

Standards

- **MCC9-12.G.CO.1** Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
- **MCC9-12.G.CO.2** Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
- **MCC9-12.G.CO.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
- **MCC9-12.G.CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- **MCC9-12.G.CO.5** Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Date	Topic	Assignment
12-2	Go over test Geometry Vocab Practice	Pages 1 thru 3
12-3	Translations and Reflections	Pages 4 thru 8
12-4	Rotations	Pages 9 thru 11
12-5	QUICK QUIZ Combinations of Transformations Practice	Pages 12 and 13
12-6	Rotational Symmetry Combinations of Transformations	Pages 14 and 15
12-9	Transformations Task	Pages 16 and 17
12-10	Applying rotations, reflections, and Translations CFA	Extra review in packet
12-11	Review	Pages 18-20
12-12	TEST	
12-13	Final Exam Review	
12-16	Final Exam Review	

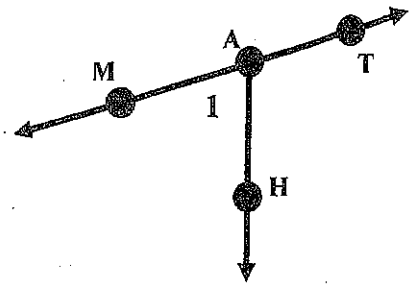
Name: _____ Date: _____

Geometry Vocabulary Practice

MCC9-12.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc

Practice Problems:

1. Name an example of each of the following:



Line Segment: _____

A Line: _____

A Ray: _____

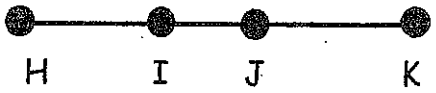
2. Name the angle represented with the number 1 using 3 letters. _____

Is this angle an obtuse, acute, or right angle? _____

3. Which geometric object is suggested by a car's headlights?

a. Line b. point c. ray d. segment

If HK = 9, HI = JK, AND IJ = 1, find the following lengths.



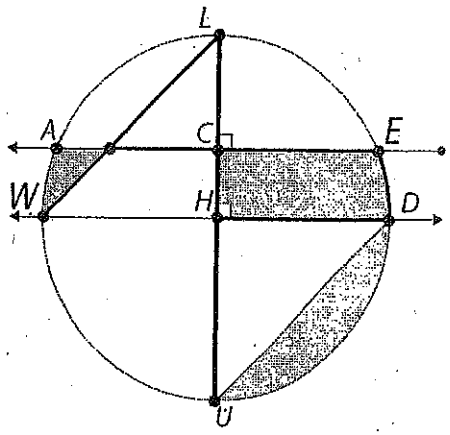
4. HI _____

5. JK _____

6. HJ _____

7. IK _____

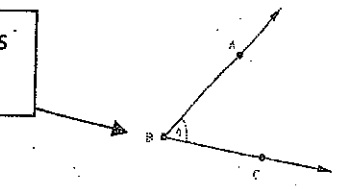
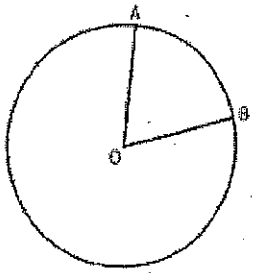
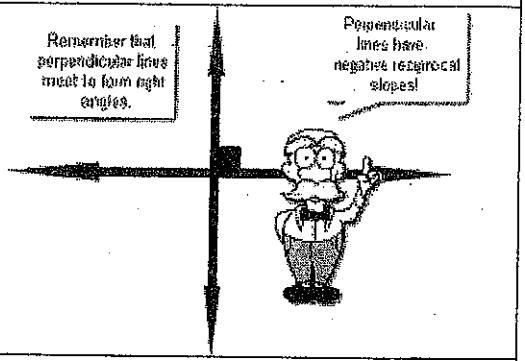
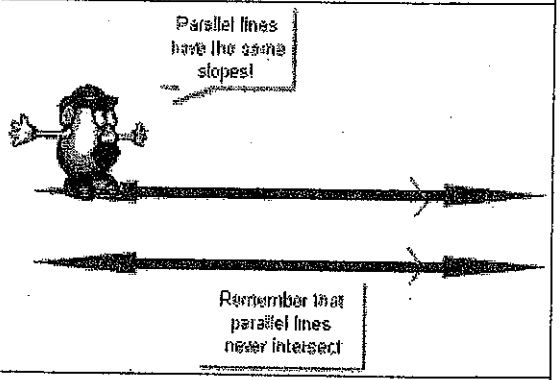
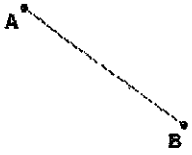
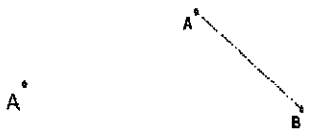
8. Walch Education contracted Ryan Icons to design a logo for the company. They requested the logo be circular and contain the following elements:
   - a line
   - a ray
   - a line segment
   - 2 pairs of parallel lines
   - 1 pair of perpendicular lines
   - Identify the elements requested in the submitted logo shown.

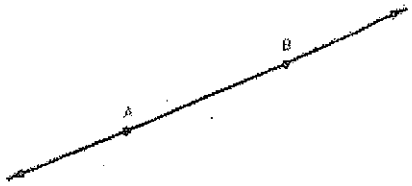
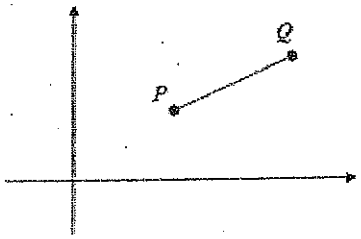
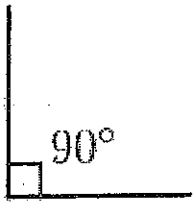
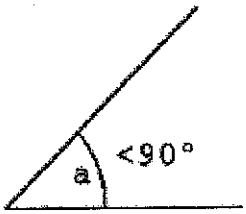
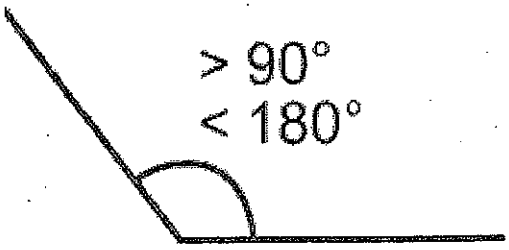


Problem #8 Adapted from: Walch Education Resources: CCGPS Coordinate Algebra Teacher Resource Binder

Name: _____ Unit 5 Vocabulary Coordinate Algebra

MCC9-12.G.CO.1, MCC9-12.G.CO.2, and MCC9-12.G.CO.3

Term	Describe	Example
Angle		The angle is $\angle ABC$ 
Circle		
Perpendicular Line		
Parallel Line		
Line Segment		
Point		

Line		
Distance along a line		
Right Angle		
Acute Angle		
Obtuse Angle		 Obtuse Angle

AC CCGPS Alg/Geo Name:_____
Unit 5: Transformations in the Coordinate Plane
Quick Reference

REFLECTIONS

Over x-axis

Over the y-axis

Over the y = x

Over the y = -x

Over the x = -2

ROTATIONS

90 degree counter clockwise:

90 degree clockwise:

180 degree:

270 counter clockwise:

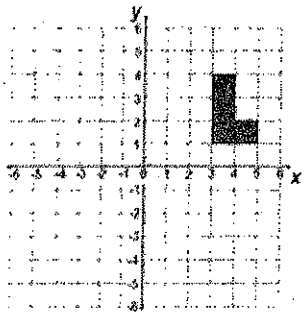
270 clockwise:

Name: _____ Date: _____

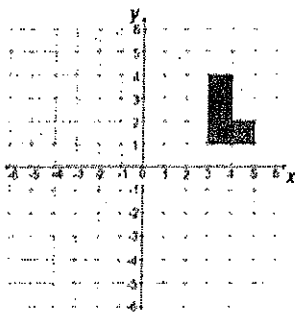
Reflections by Hand Practice

1. Where will the L-Shape be if it is...

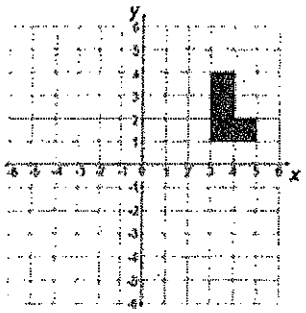
a. reflected over the x-axis?



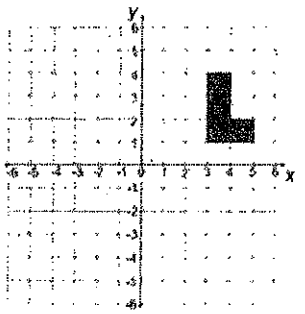
b. reflected over the y-axis?



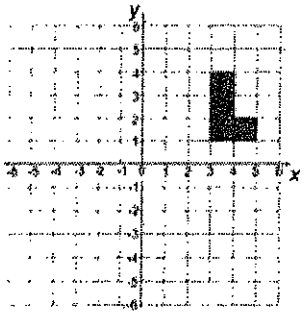
c. reflected over the line y = x?



d. reflected over the line y =- x?

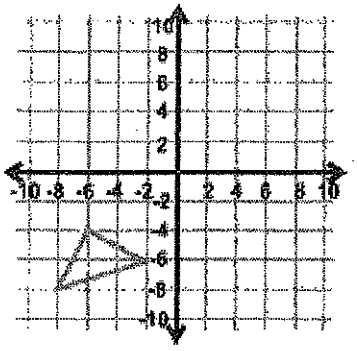


e. reflected over the line x = 2?

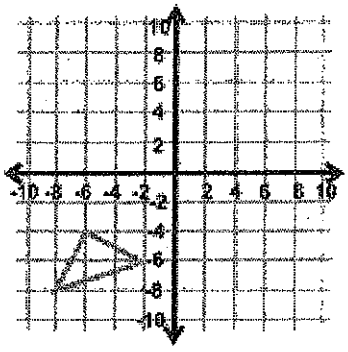


2. Reflect each shape over the given line.

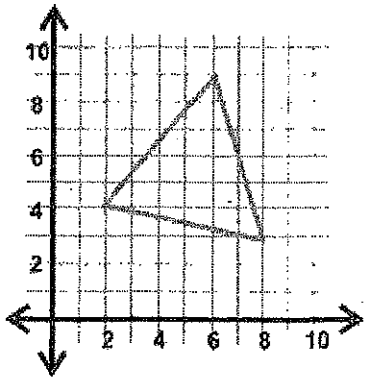
a. y – axis



b. x – axis



c. x = 5



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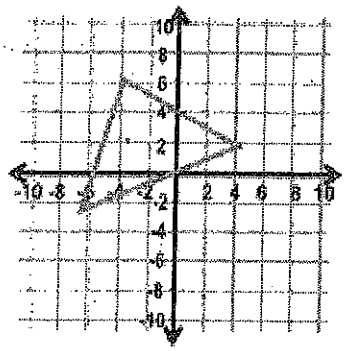
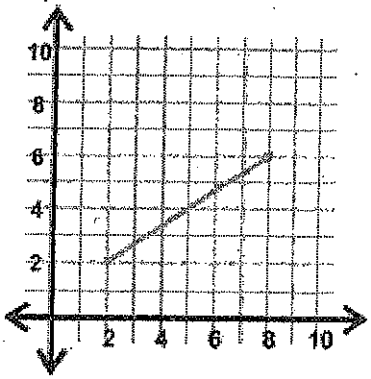
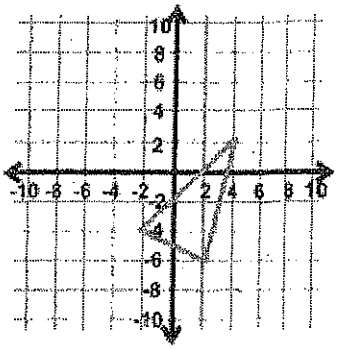
d. $x = -1$



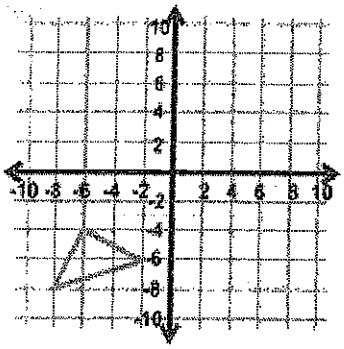
e. $y = x$



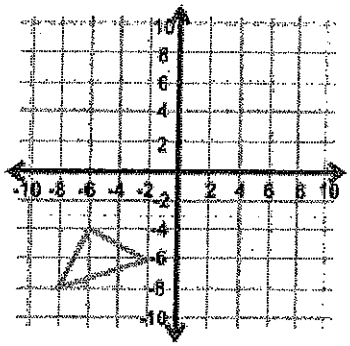
f. $x = -2$



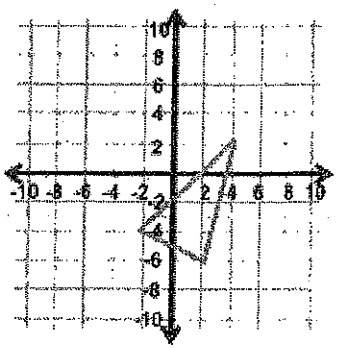
g. y - axis



h. x - axis



i. x - axis



Translations

$(x, y) \rightarrow (x-3, y+2)$ (x', y')

$(2, 7) \rightarrow (-1, 9)$

$(-3, -2) \rightarrow (-6, 0)$

$(0, 9) \rightarrow$ _____

$(-5, -1) \rightarrow$ _____

$(-1, 17) \rightarrow$ _____

Find the preimage

$(x-3, y+2)$

(x', y') (x, y)

$(3, 5) \rightarrow (6, 3)$

$(-2, -5) \rightarrow (1, -7)$

$(6, -1) \rightarrow$ _____

$(-5, -9) \rightarrow$ _____

$(0, 8) \rightarrow$ _____

Name: _____ Date: _____

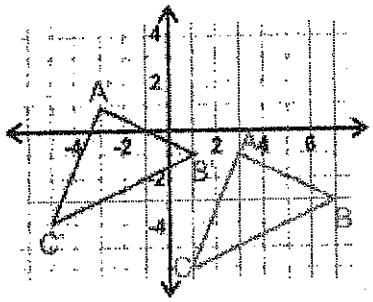
Translations and Reflections Homework

1. **Use the translation (x, y) → (x + 5, y – 9) for questions a-e.**
   a. What is the image of A (-6, 3)?
   b. What is the image of (4, 8)?
   c. What is the image of (5, -3)?
   d. What is the image of A' from #1, which would be called A''?
   e. What is the pre-image of D'(12, 7)?

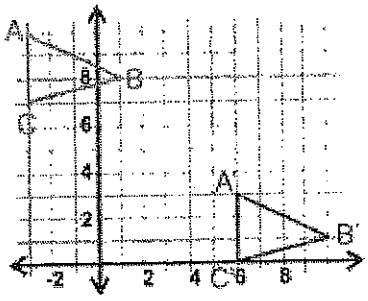
2. **The vertices of $\triangle ABC$ are A(-6, -7), B(-3, -1), and C(-5, 2). Find the vertices of $\Delta A'B'C'$, given the translation rules below.**
   a. (x, y) → (x – 2, y – 7)
   b. (x, y) → (x + 11, y + 4)
   c. (x, y) → (x, y - 3)
   d. (x, y) → (x – 5, y + 8)

3. **$\Delta A'B'C'$ is the image of ΔABC. Write the translation rule.**

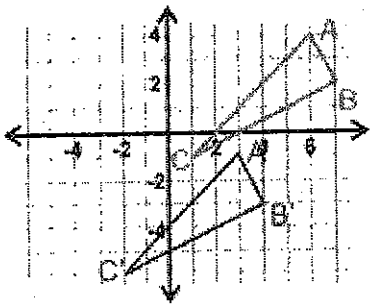
a.



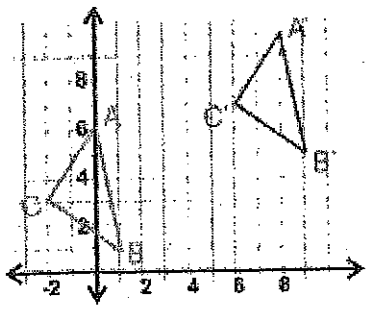
b.



c.



d.

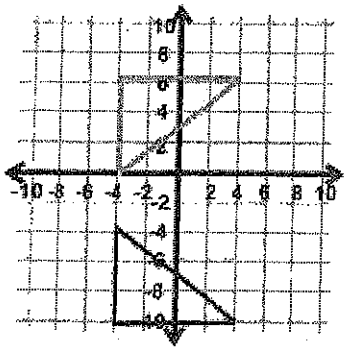


Adapted from: Mathematics Vision Project

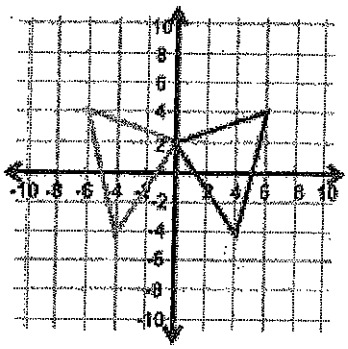
(6)

4. Find the line of reflection between the pre-image and the image.

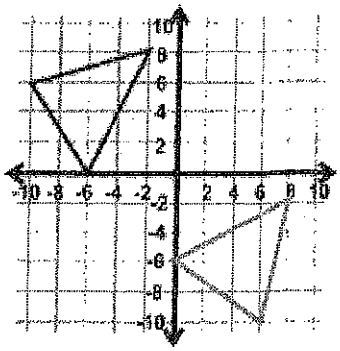
a.



b.

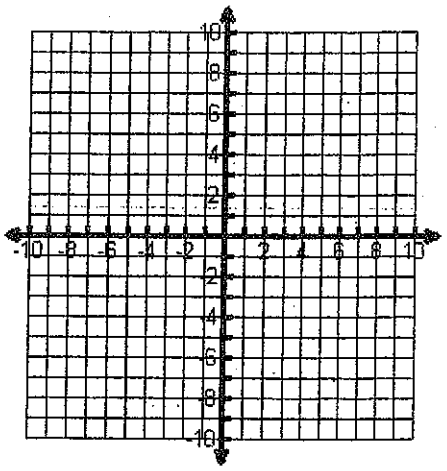


c.



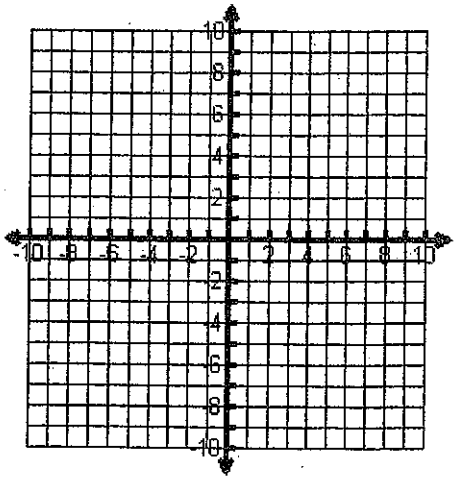
5. Two Reflections The vertices of $\triangle ABC$ are A(-5, 1), B(-3, 6), and C(2, 3). Use this information to answer questions a-d.

a. Plot ΔABC on the coordinate plane.
b. Reflect ΔABC over y =1. Find the coordinates of $\Delta A'B'C'$.
c. Reflect $\Delta A'B'C'$ over y = -3. Find the coordinates of $\Delta A''B''C''$.
d. What <u>one</u> transformation would be the same as this double reflection?



6. Two Reflections The vertices of $\triangle ABC$ are A(6, -2), B(8, -4), and C(3, -7). Use this information to answer questions a-d.

a. Plot $\triangle ABC$ on the coordinate plane.
b. Reflect $\triangle ABC$ over x = 2. Find the coordinates of $\triangle A'B'C'$.
c. Reflect $\triangle A'B'C'$ over x = -4. Find the coordinates of $\triangle A''B''C''$.
d. What <u>one</u> transformation would be the same as this double reflection?



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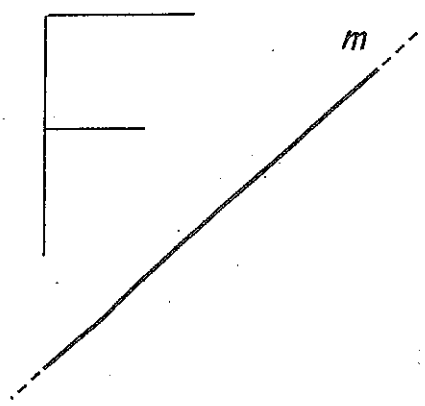

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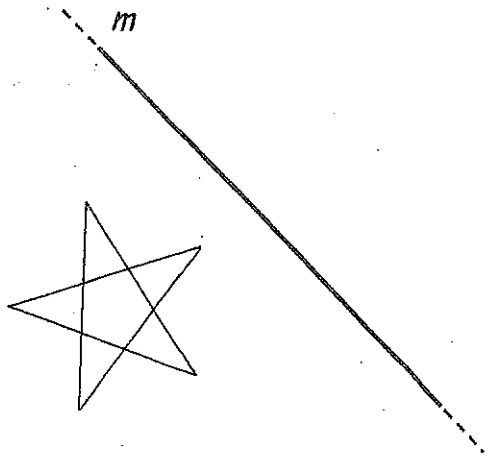
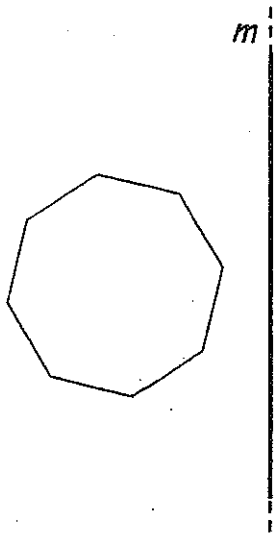
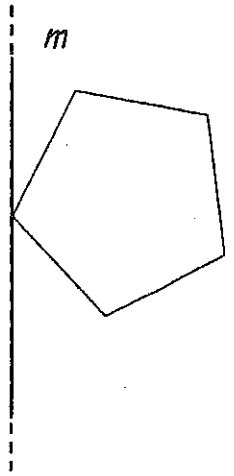


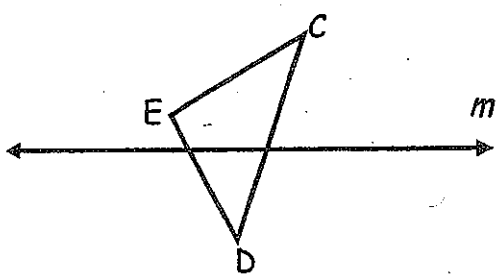
9.



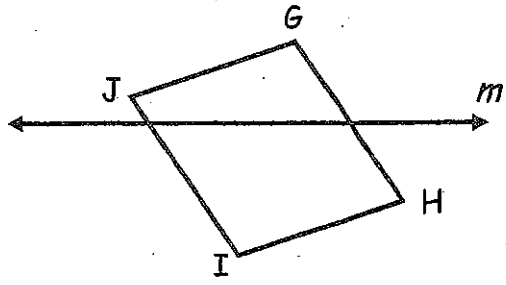
10.



11.



12.

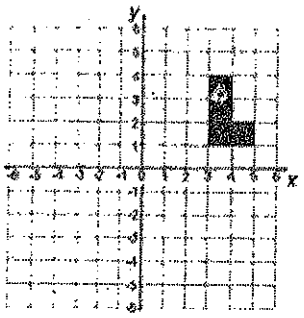


Name: _____ Date: _____

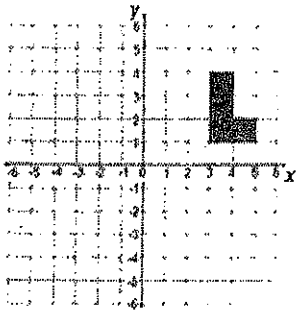
Rotations Practice

1. Where will the L-Shape be if it is...

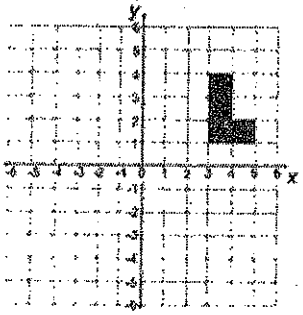
a. rotated 180° around the origin?



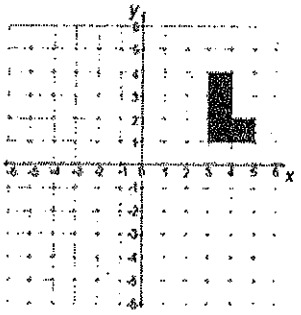
b. rotated 90° **clockwise** around the origin?



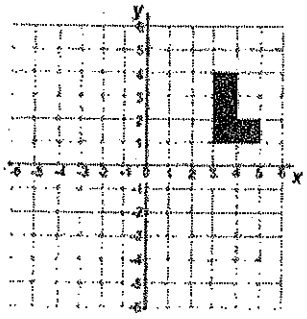
c. rotated 90° **counterclockwise** around the origin?



d. rotated 270° **clockwise** around the origin?



e. rotated 90° **counterclockwise** around the point (3, 0)?



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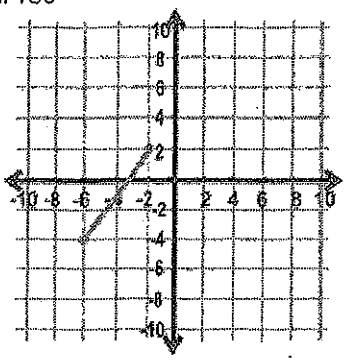
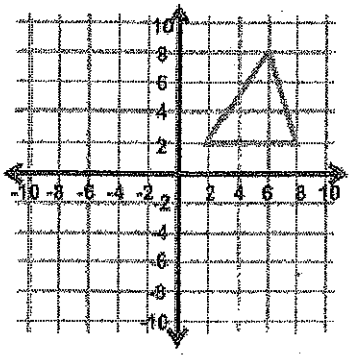
2. Rotate each figure about the origin using the given clockwise angle.

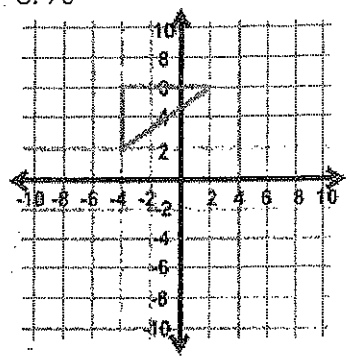
a. 180°



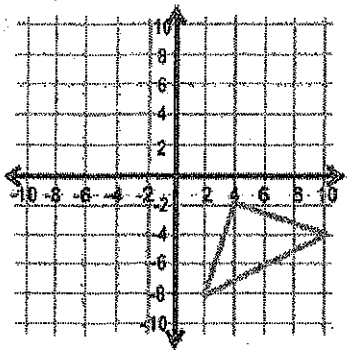
b. 270°



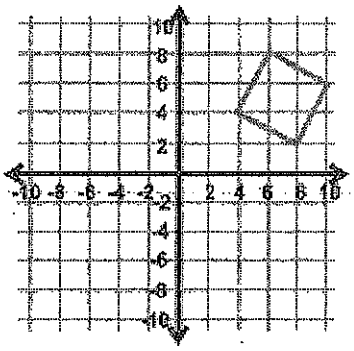
c. 90°



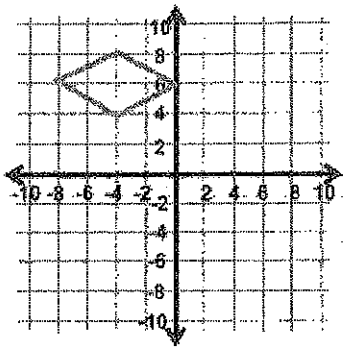
d. 270°



e. 180°

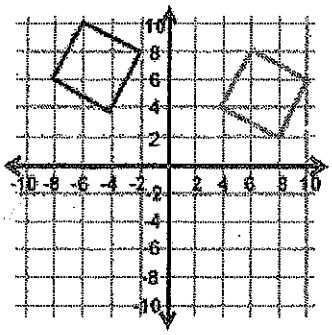


f. 90°

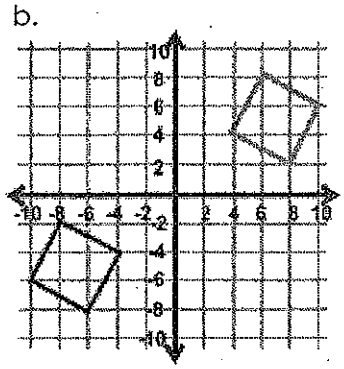


3. Find the angle of rotation for the graphs below. The center of rotation is the origin, and the darker image is the preimage. Your answer will be 90°, 270°, or 180° counterclockwise.

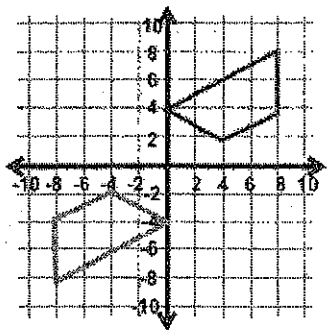
a.



b.



c.



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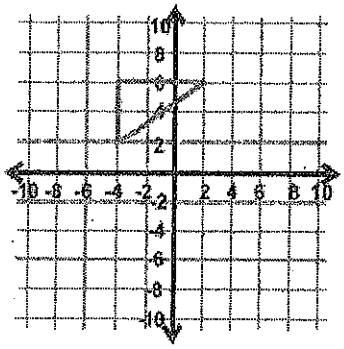
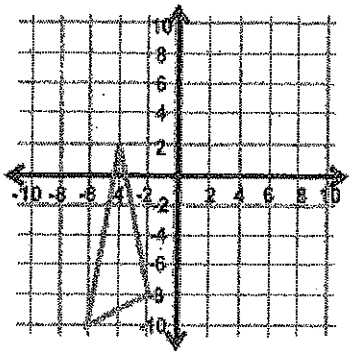
Rotations Homework

1. Rotate each figure about the origin using the given clockwise angle.

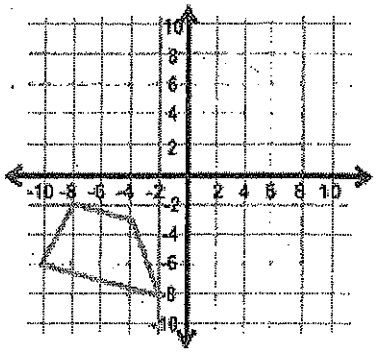
a. 90°



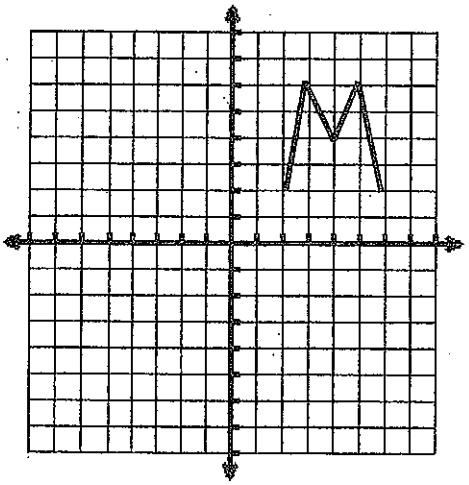
b. 180°



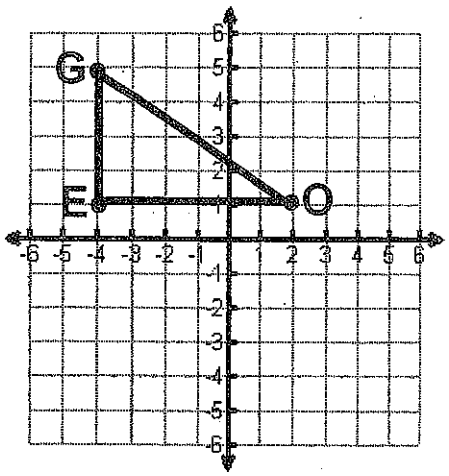
c. 270°



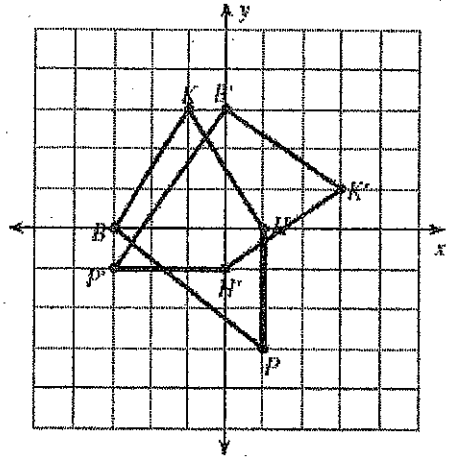
d. 90°; 180°; and 270°

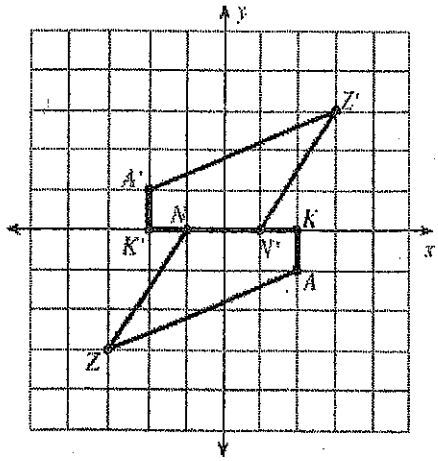


e. 180°



2. Write a rule to describe each transformation.





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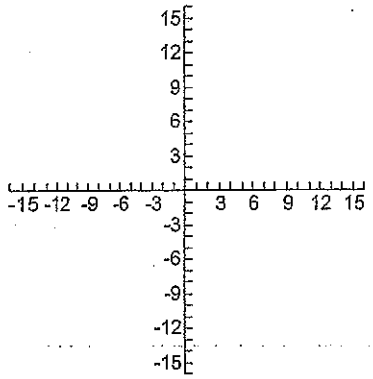
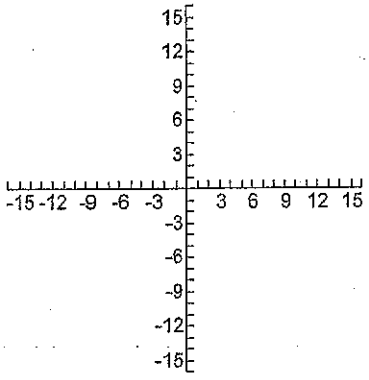
Bridget Blockhead

Plot and connect the following points in order. To complete your picture, connect the last point to the first point. Then, rotate Bridget 90° clockwise so she is on her side.

(0, 3) (2, 3) (2, 7) (-2, 7) (-2, 3) (0, 3) (-½, 2) (-4 ½, 2) (-8, 0) (-4, 0) (-½, 2) (-4, -4) (-2, -4) (-2, -8) (-4, -11) (4, -11) (2, -8) (2, -4) (4, -4) (½, 2) (4, 0) (8, 0) (4 ½, 2) (½, 2)

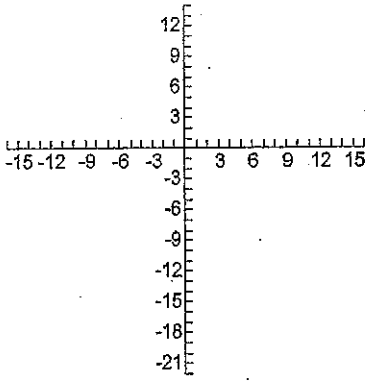


90° Clockwise Rotation

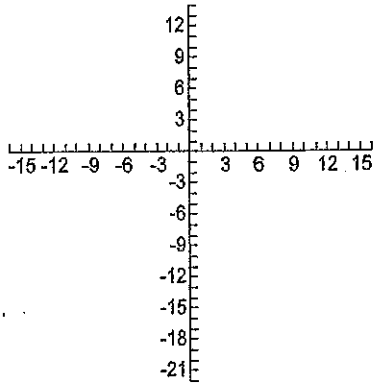


What is Bridget's line of reflection?

Draw "Bob Blockhead" using the rule (2x, 2y). Is this an isometry? Is it a dilation?



Draw "Block Blockhead" using the rule (x, 2y). Is this an isometry? Is it a dilation? How does "Block Blockhead" compare to Bridget Blockhead?



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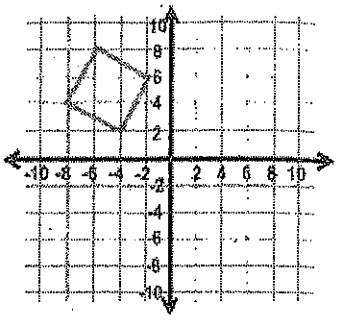
Combinations of Transformations Practice

Use the graph of the square to the right to answer questions 1-3.

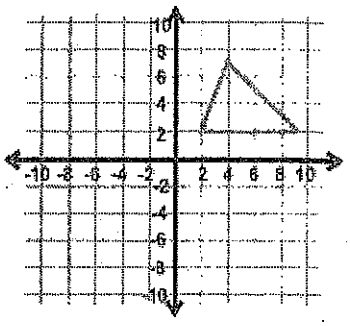


1. Perform a glide reflection over the x-axis and a translation to the right 6 units. Write the new coordinates.

2. What is the rule for this glide reflection?

3. What glide reflection would move the image back to the pre-image?

Use the graph of the triangle to the right to answer questions 4-6.

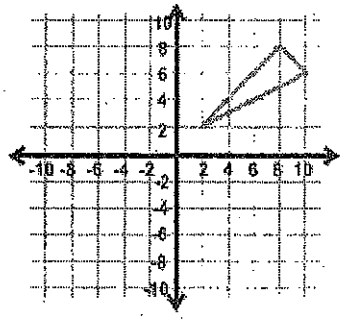


4. Perform a glide reflection over the y-axis and down 5 units. Write the new coordinates.

5. What is the rule for this glide reflection?

6. What glide reflection would move the image back to the pre-image?

Use the graph of the triangle to the right to answer questions 7-9.

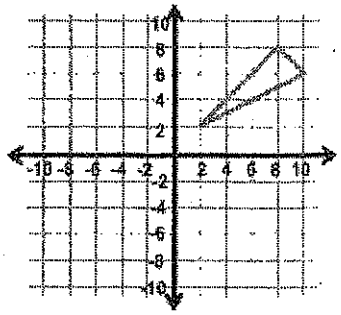


7. Reflect the pre-image over y = -1 followed by y = -7. Draw the new triangle.

8. What one transformation is this double reflection the same as?

9. Write the rule.

Use the graph of the triangle to the right to answer questions 10-13.



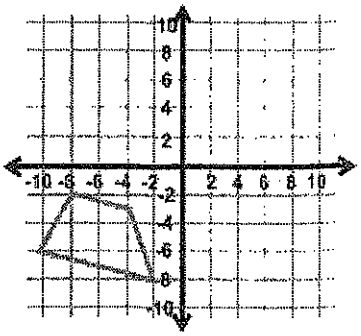
10. Reflect the pre-image over y = -7 followed by y = -1. Draw the new triangle.

11. What one transformation is this double reflection the same as?

12. Write the rule.

13. How do the final triangles in #7 and #10 differ?

Use the trapezoid in the graph to the right to answer questions 14-16.



14. Reflect the pre-image over the x-axis then the y-axis. Draw the new trapezoid.

15. Now, start over. Reflect the trapezoid over the y-axis then the x-axis. Draw this trapezoid.

16. Are the final trapezoids from #14 & #15 different? Why do you think that is?

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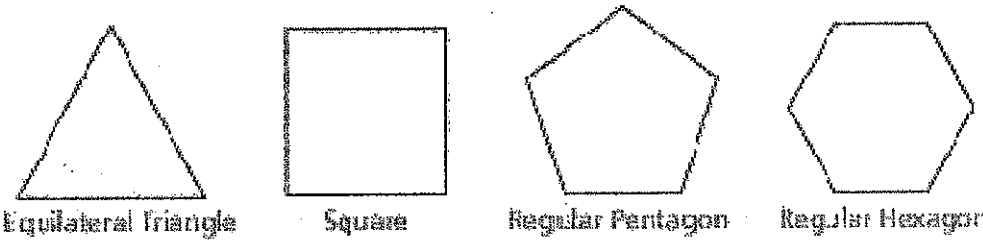
Rotational Symmetry

If you can rotate (or turn) a figure around a center point by fewer than 360° and the figure appears unchanged, then the figure has **rotational symmetry**. The point around which you rotate is called the center of rotation, and the smallest angle you need to turn is called the angle of rotation.

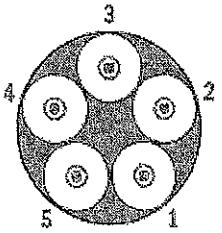
This figure has rotation symmetry of 72°, and the center of rotation is the center of the figure:

Do the regular polygons have rotation symmetry? For each polygon, what are the center and angle of rotation?



CD Player: Your CD player can hold five compact discs on a rotating tray like the one shown.

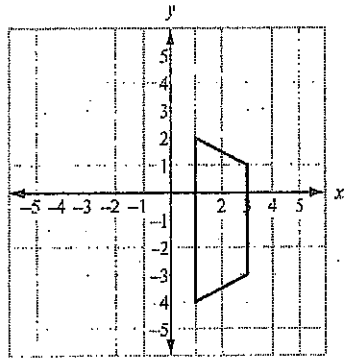
a. Does the tray have rotational symmetry? Explain.



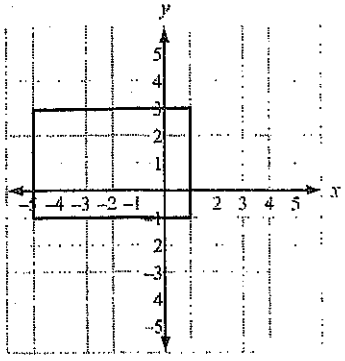
b. The tray can move only clockwise. A CD in position 1 is currently playing. How many degrees must the tray rotate to play a CD in position 3?

Describe every transformation that maps the given figure to itself.

a)

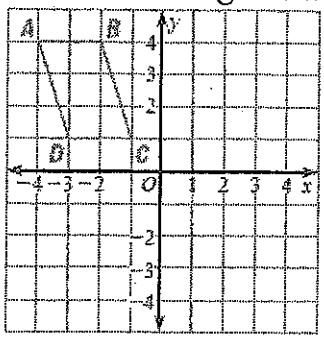


b)

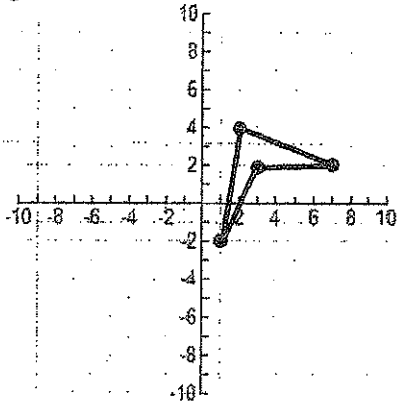


Combinations of Transformations

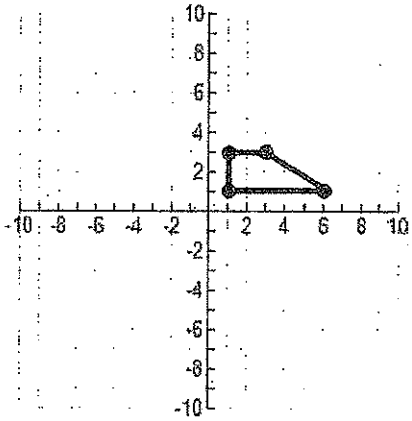
1. Rotate the polygon 180°, then reflect the image in the y-axis.



2. Reflect across the line y = x, Reflect across the y-axis, and Rotate 90° counterclockwise about the origin.

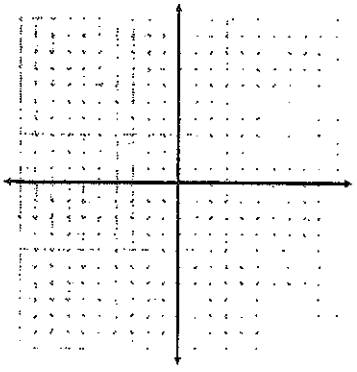


3. Rotate 270° clockwise about the origin, Translate (x,y) → (2x-3, 2y), and Reflect across the line y = 2.



4. **Treasure Hunt**: You are located at the point (3, 4) in a coordinate plane. You need to find your way to a treasure chest. Starting at (3, 4), move from one image point to the next by following the order of the transformations listed. The final image point is the location of the treasure chest.

1. Rotate 180°.
2. Reflect in the y-axis.
3. Translate 5 units to the left and 4 units up.
4. Reflect in the x-axis.
5. Rotate 90° clockwise.



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Task: Transformations in the Coordinate Plane

Figure 1:

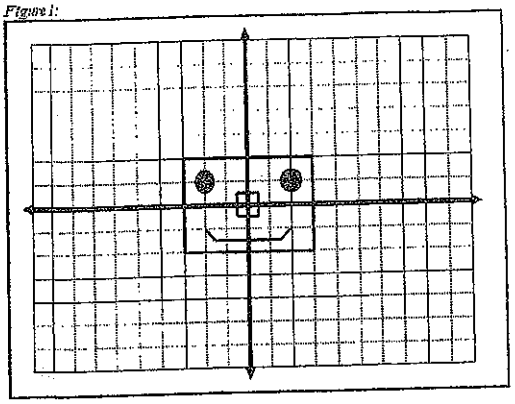


Figure 2:

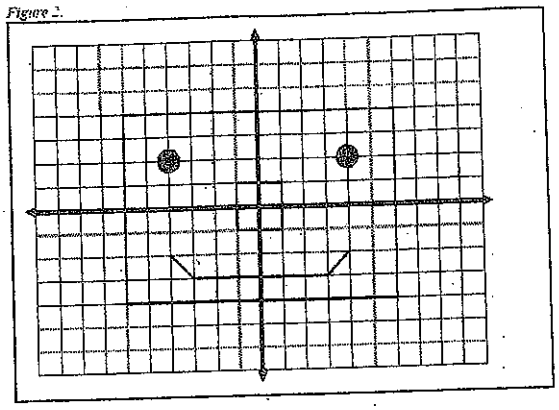


Figure 3:

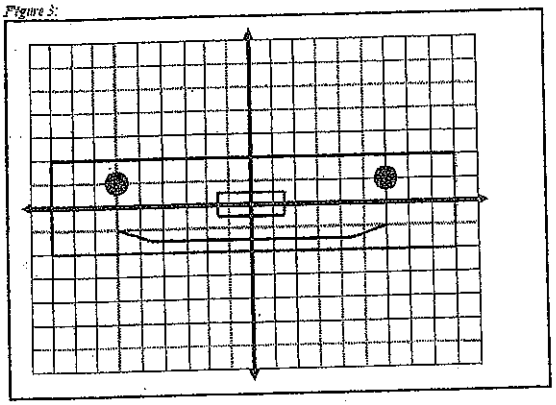


Figure 4:

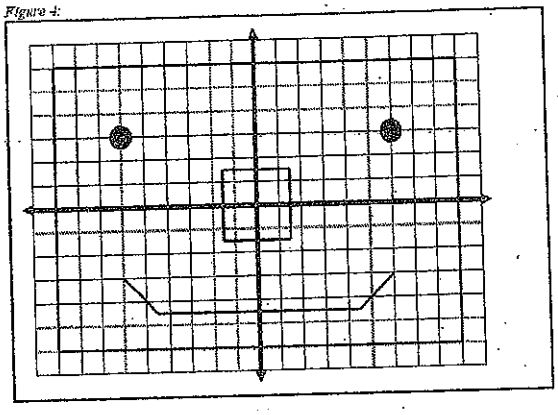


Figure 5:

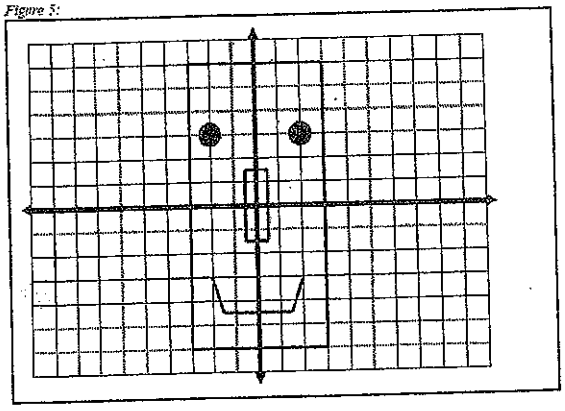
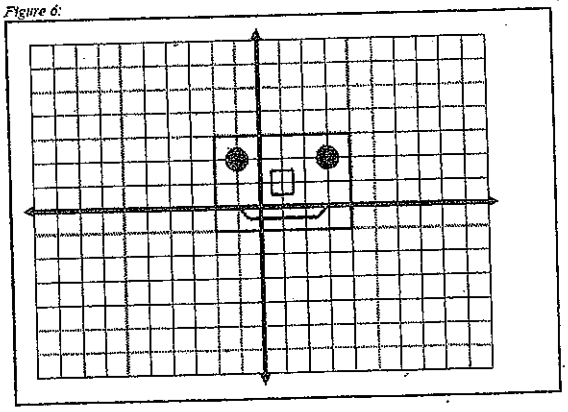


Figure 6:



Compare Figure 1 to each of the other figures and answer the following questions.

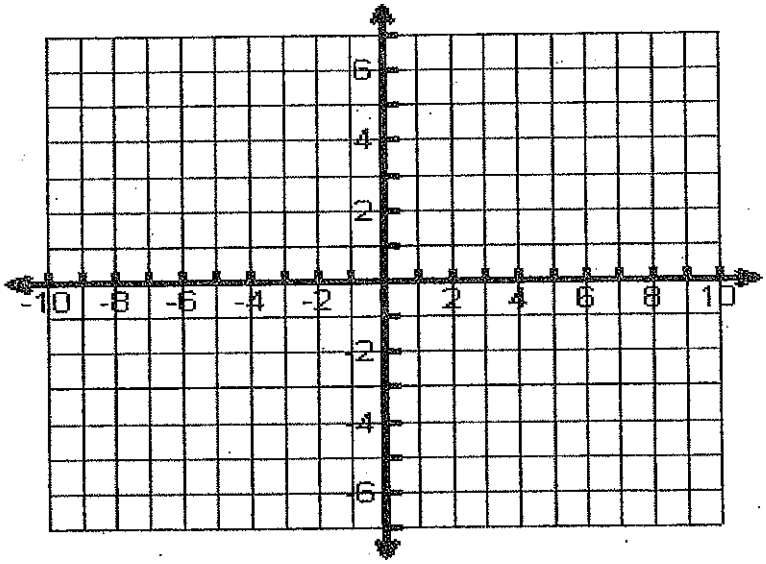
1. Which figures are similar? Explain your thinking.

2. Describe any similarities and/or differences between Figure 1 and each of the other figures, identifying how corresponding sides and angles compare.

3. How do the coordinates of each figure compare to the coordinates of Figure 1? Write general rules for making Figures 2-6.

4. Is having the same angle measure for all angles enough to make two figures similar? Why or why not?

5. Translate, reflect, rotate (between 0 and 90°), and dilate Figure 1 so that it lies entirely in Quadrant III on the coordinate plane. You may perform the transformations in any order that you choose. Draw a picture of the new figure at each step and explain the procedures you followed to get the new figure. Use coordinates to describe the transformations and give the scale factor you used.



6. Describe the similarities and differences between your new figures in question 5 and Figure 1.