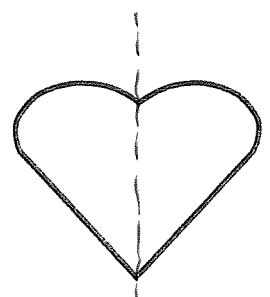
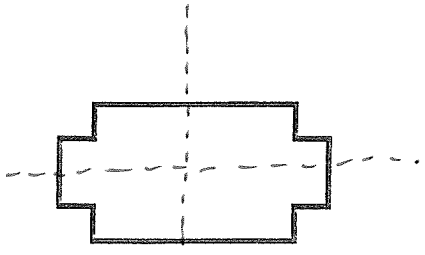
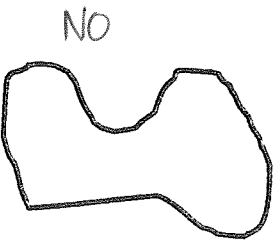
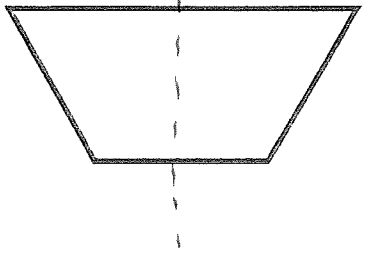
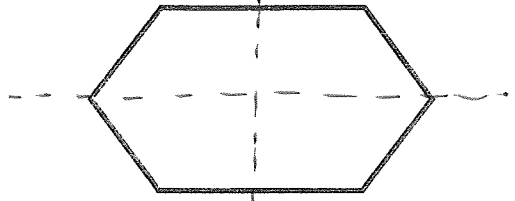
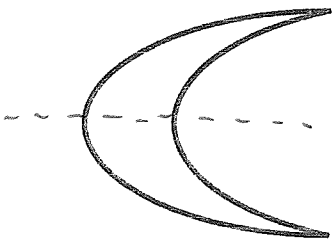


8.1 Line Symmetry Worksheet

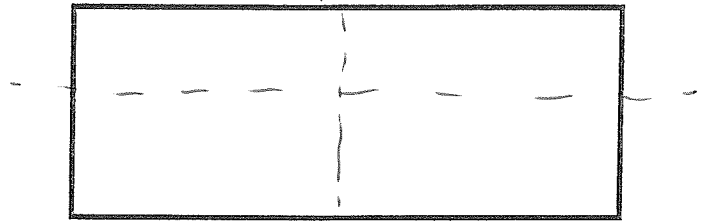
1. Identify if the following objects have any line symmetry?



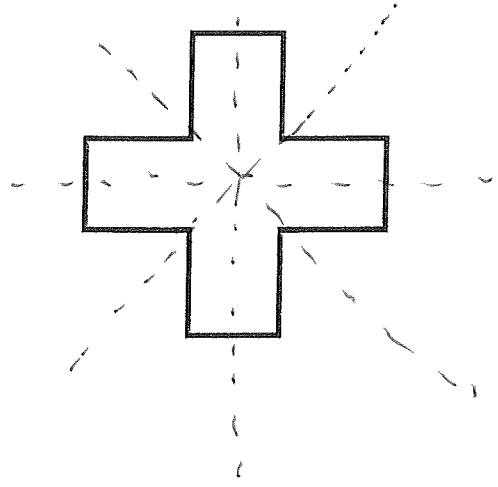
2. How many lines of symmetry do the following objects have?
Draw them!



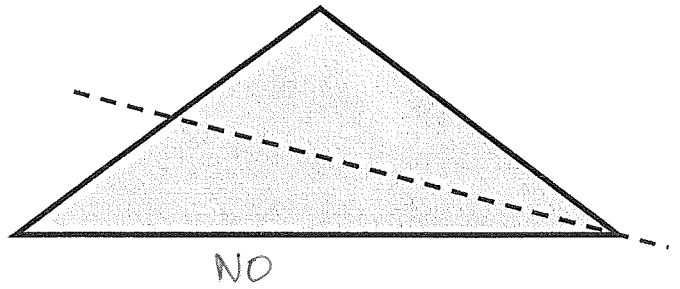
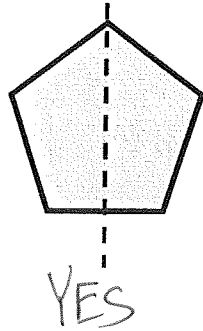
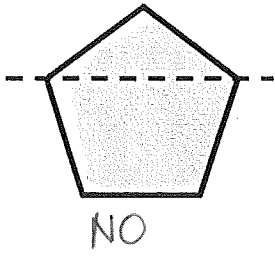
3. Draw the lines of symmetry for each object:
a)



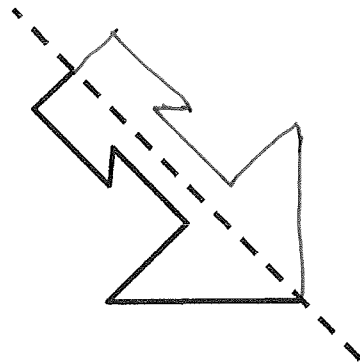
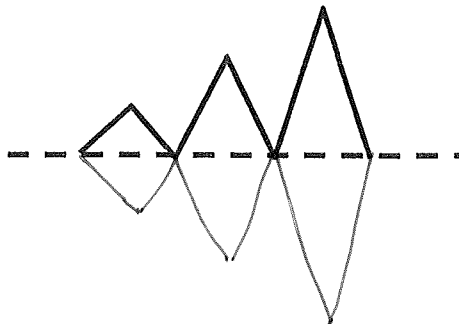
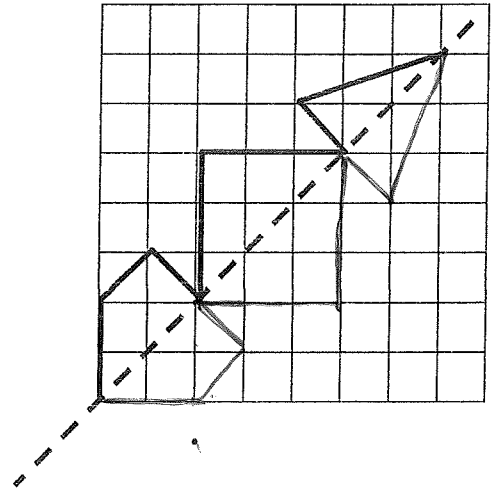
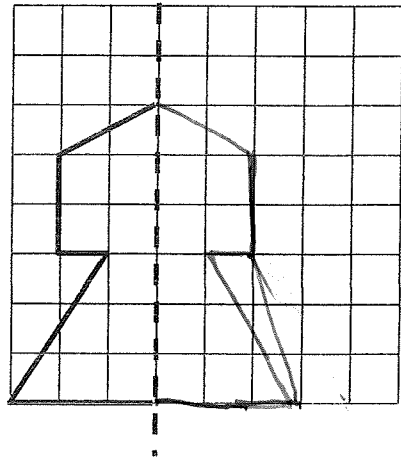
b)





4. Do the following diagrams show symmetry? Yes or No.



5. Complete the following symmetry drawings:



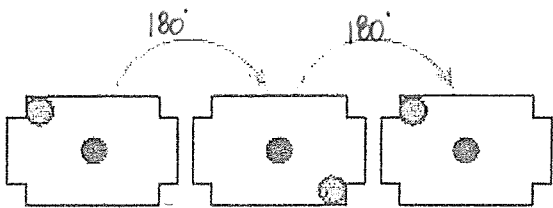
clockwise

 CW

counterclockwise

 CCW

8.2 Rotation Symmetry

Definitions:

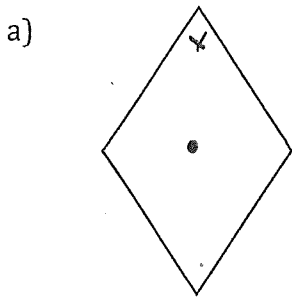
- Rotation symmetry - when a shape fits ~~into itself~~ exactly over itself with a turn of less than 360°
- Order of rotation symmetry - number of times a shape can rotate onto itself within a 360°
 $\frac{360^\circ}{\text{angle of rotation}}$
- Angle of rotation symmetry - number of degrees needed for a shape to rotate onto itself.



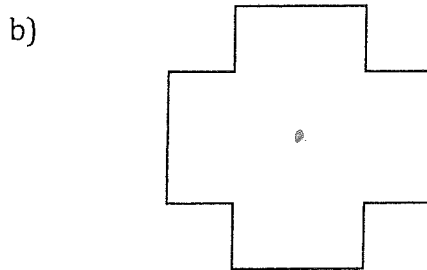
This shape has a rotation angle of 180° and a rotation order of 2.

$$\frac{360^\circ}{180^\circ} = 2$$

Ex: 1) Find the i) order of rotation and ii) the angle of rotation.

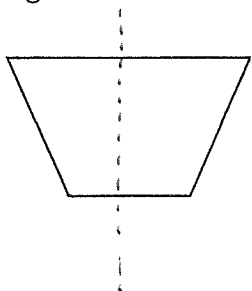


i) order: 2
 ii) angle: 180°



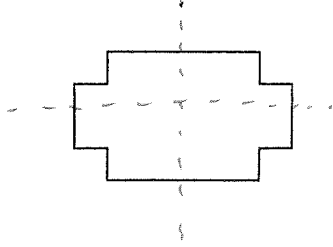
i) order: 4
 ii) angle: 90°

Ex: 2) For each shape, determine the number of lines of symmetry, its order of rotation, and the angle of rotation.

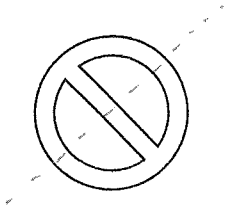


Lines of symmetry: 1
 Order of rotation: 1
 Angle of rotation: ~~360°~~ 360°

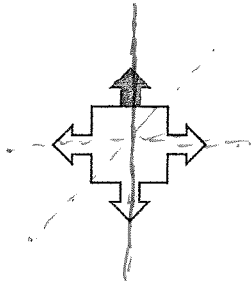
Math 9 - Chapter 8: Symmetry



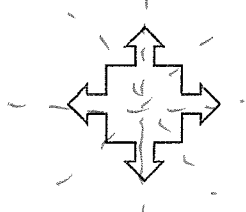
Lines of symmetry: 2
Order of rotation: 2
Angle of rotation: 180°



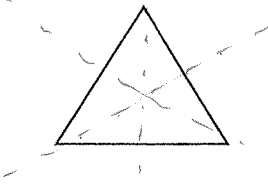
Lines of symmetry: 1
Order of rotation: 2
Angle of rotation: 180°



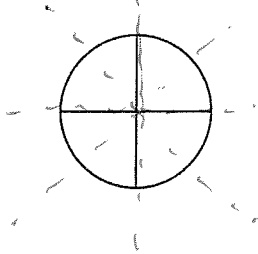
Lines of symmetry: 1
Order of rotation: 1
Angle of rotation: 360°



Lines of symmetry: 4
Order of rotation: 4
Angle of rotation: 90°



Lines of symmetry: 3
Order of rotation: 3
Angle of rotation: 120°

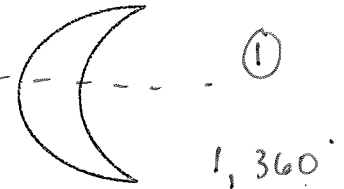
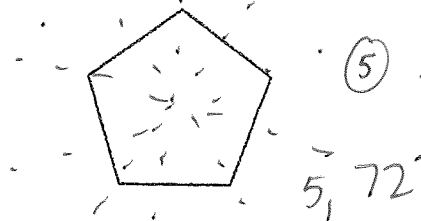
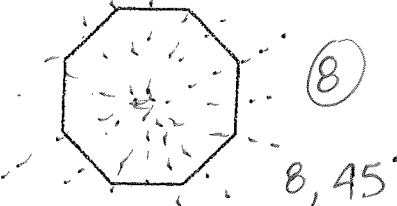
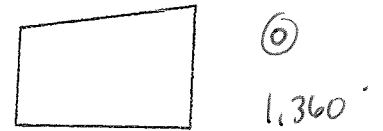
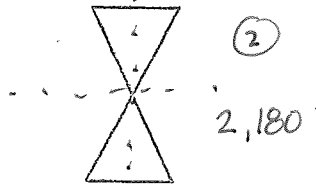
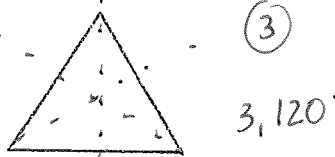
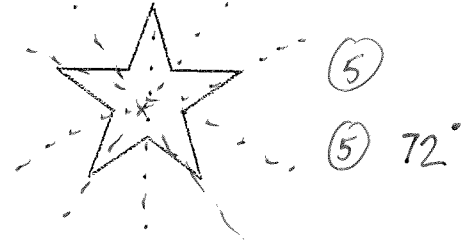
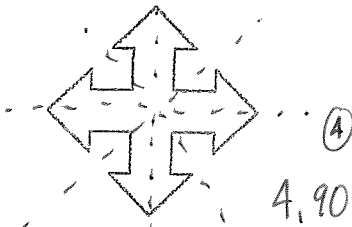
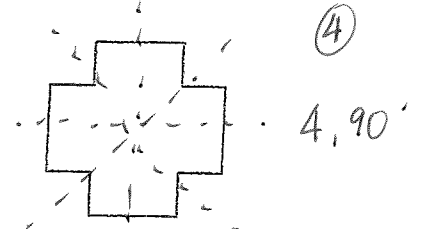
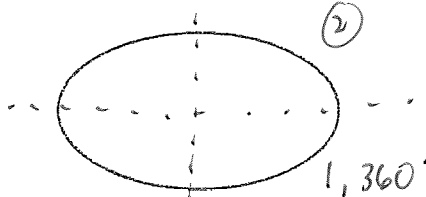
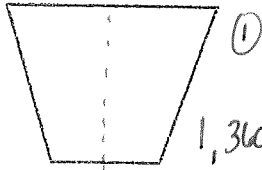


Lines of symmetry: 4
Order of rotation: 4
Angle of rotation: 90°

ROTATIONAL SYMMETRY

A shape has rotational symmetry if it fits onto itself two or more times in one turn.
 The order of rotational symmetry is the number of times the shape fits onto itself in one turn.
 A 2D shape has a line of symmetry if the line divides the shape into two halves – one being the mirror image of the other.

Write the order of rotational symmetry under each shape & letter. Also draw dotted lines to indicate lines of symmetry.



M

A

T

H

S

1, 360°

1, 360°

1, 360°

2, 180°

2, 180°

8.4 Symmetry on the Co-ordinate Plane Pt. 1

Translations, Reflections and Rotations

A. Translations:

Translation - movement of an object up/down and left/right
 - order of points remain same
 - all points move same amount

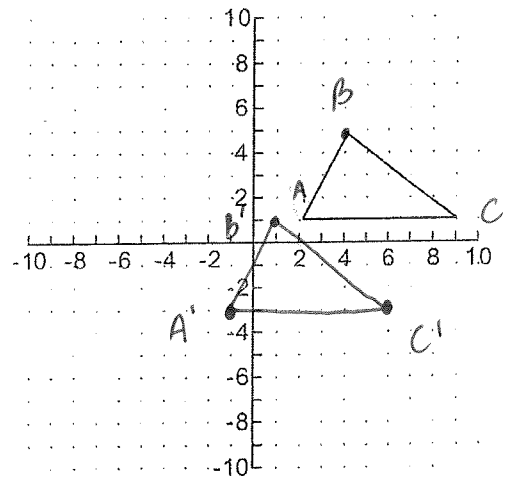
Ex: 1) Translate $\triangle ABC$, $A(2,1)$, $B(4,5)$, $C(9,1)$, (Left 3, Down 4)

Mapping diagram $(x,y) \rightarrow (x-3, y-4)$

$A(2,1) \rightarrow (2-3, 1-4) \rightarrow (-1, -3) A'$

$B(4,5) \rightarrow (4-3, 5-4) \rightarrow (1, 1) B'$

$C(9,1) \rightarrow (9-3, 1-4) \rightarrow (6, -3) C'$



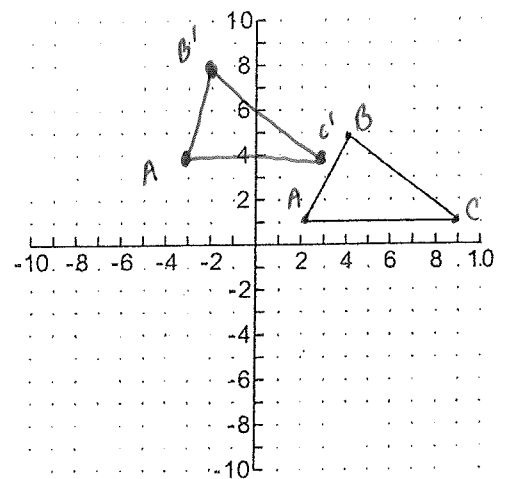
Ex:2) Translate $\triangle ABC$ (Left 6, Up 3)

$(x,y) \rightarrow (x-6, y+3)$

$A(2,1) \rightarrow (2-6, 1+3) \rightarrow (-4, 4) A'$

$B(4,5) \rightarrow (4-6, 5+3) \rightarrow (-2, 8) B'$

$C(9,1) \rightarrow (9-6, 1+3) \rightarrow (3, 4) C'$



B. Reflections:

Reflections - the flipping of a shape over a line
 - each point flips to the opposite side of the line of reflection, but stays same distance away @ 90° to line
 - order of points change

Math 9 - Chapter 8: Symmetry

Shapes can be reflected over:

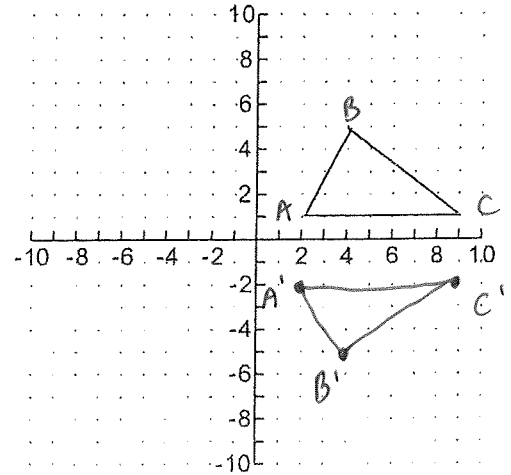
- x-axis, the line $y=0$ \longleftrightarrow
- y-axis, the line $x=0$ \updownarrow
- $y=x$, the line through points $(-2,-2)(-1,-1)(0,0)(1,1)(2,2)$ 45°
- any other horizontal/vertical line $x=3$ $y=-2$

Ex: 1) Reflect $\triangle ABC$, $A(2,1)$, $B(4,5)$, $C(9,1)$ over the x-axis.

When you reflect over the x-axis:

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

$$\begin{aligned} A(2,1) &\rightarrow A'(2, -1) \\ B(4,5) &\rightarrow B'(4, -5) \\ C(9,1) &\rightarrow C'(9, -1) \end{aligned}$$

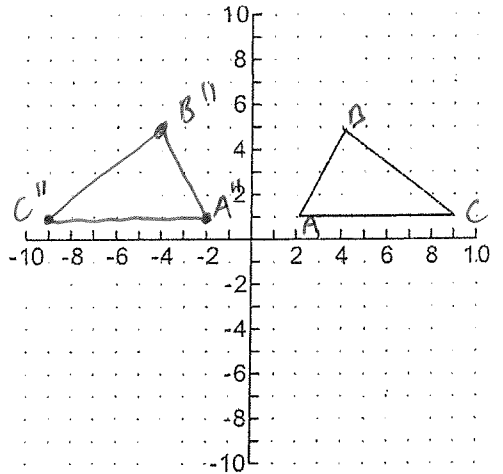


Ex: 2) Now reflect $\triangle ABC$ over the y-axis:

When you reflect over the y-axis:

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

$$\begin{aligned} A(2,1) &\rightarrow A''(-2, 1) \\ B(4,5) &\rightarrow B''(-4, 5) \\ C(9,1) &\rightarrow C''(-9, 1) \end{aligned}$$

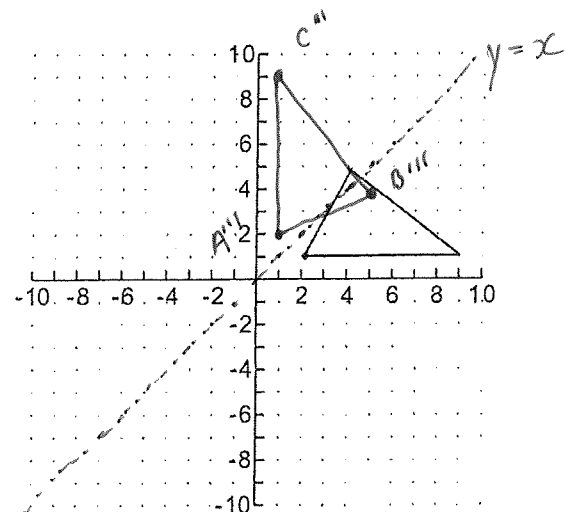


Ex: 3) Now, reflect $\triangle ABC$ over the line $y=x$

When you reflect over $y=x$:

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

$$\begin{aligned} A(2,1) &\rightarrow A'''(1, 2) \\ B(4,5) &\rightarrow B'''(5, 4) \\ C(9,1) &\rightarrow C'''(1, 9) \end{aligned}$$

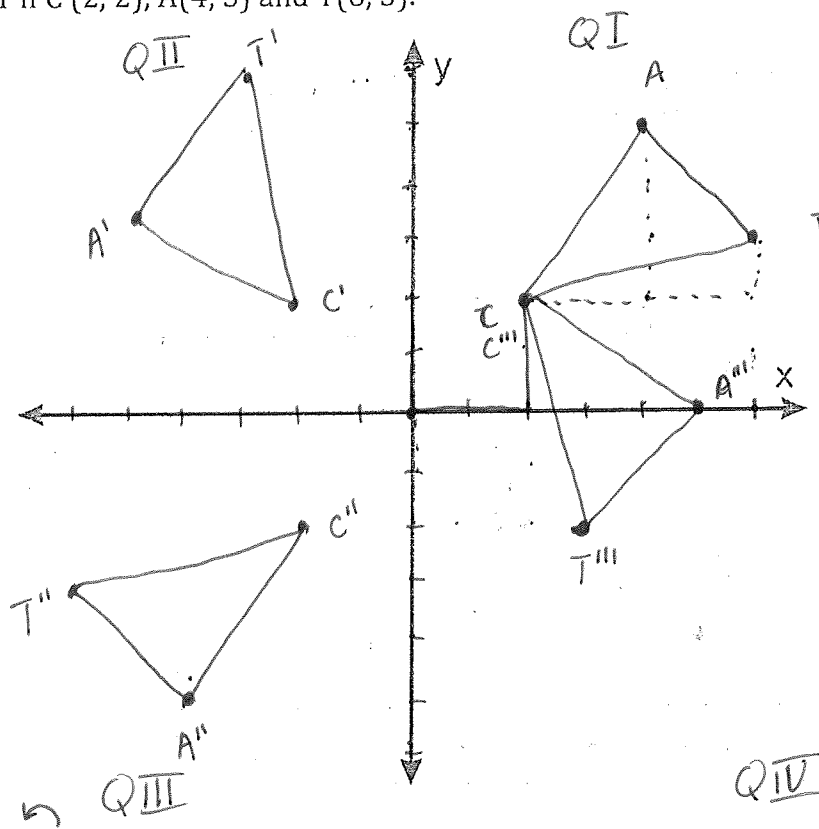


8.4 Symmetry on the Co-ordinate Plane Pt. 2

C. Rotations

Rotations – each point in a shape is moved about a fixed point through the same angle.
 - order of points change

Ex:1) Sketch $\triangle CAT$ if $C(2, 2)$, $A(4, 5)$ and $T(6, 3)$.



- a) Rotate $\triangle CAT$ 90° CCW around the origin $(0, 0)$. $C'A'T'$
- b) Rotate $\triangle CAT$ 180° CW around the origin. $C''A''T''$
- c) Rotate $\triangle CAT$ 90° CW about point C . $C'''A'''T'''$

Reflect this shape over the line $y = x$

A (3, 1), B (7, 3), C (7, 0), D (4, -1)

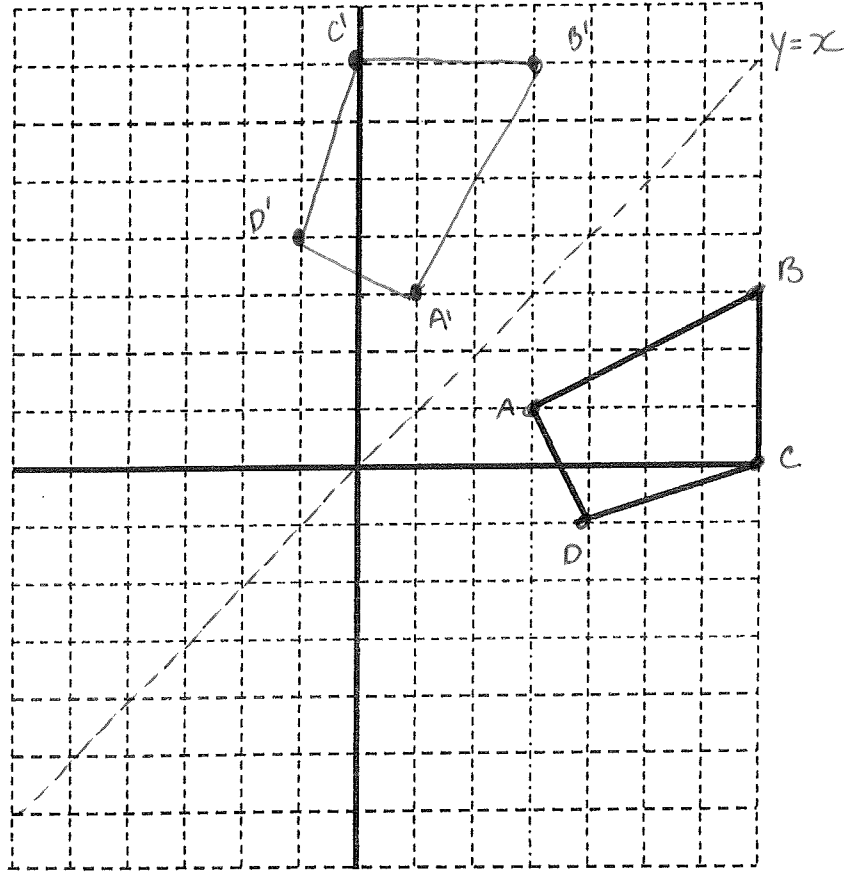
$A (3, 1) \rightarrow A' (1, 3)$

$B (7, 3) \rightarrow B' (3, 7)$

$C (7, 0) \rightarrow C' (0, 7)$

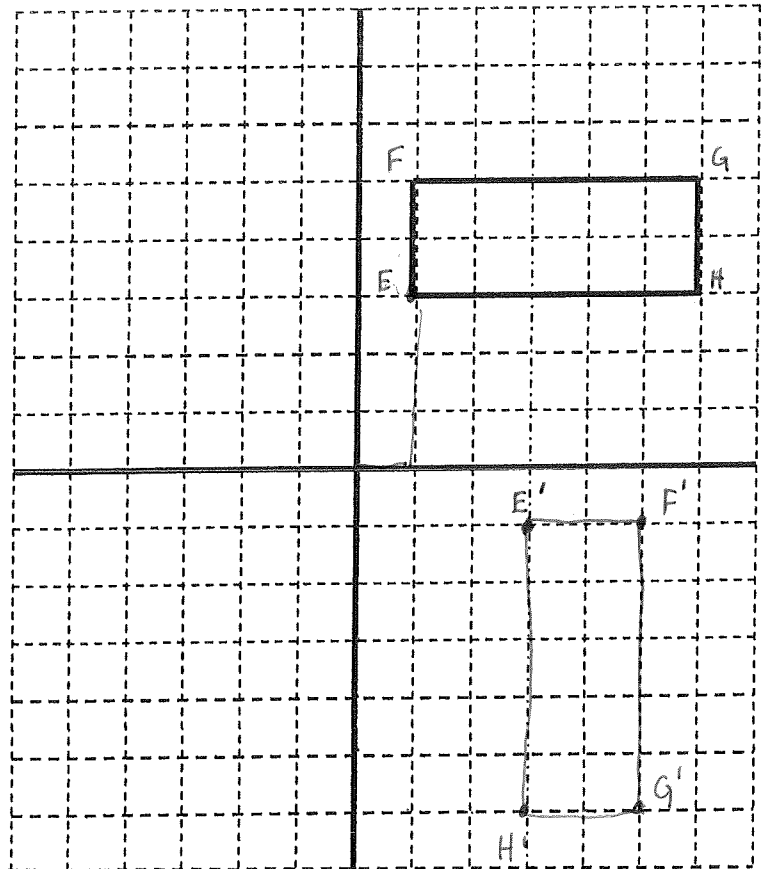
$D (4, -1) \rightarrow D' (-1, 4)$

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

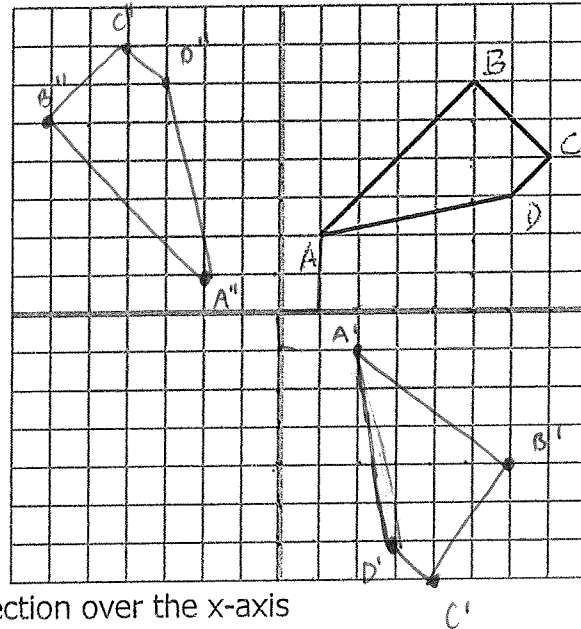
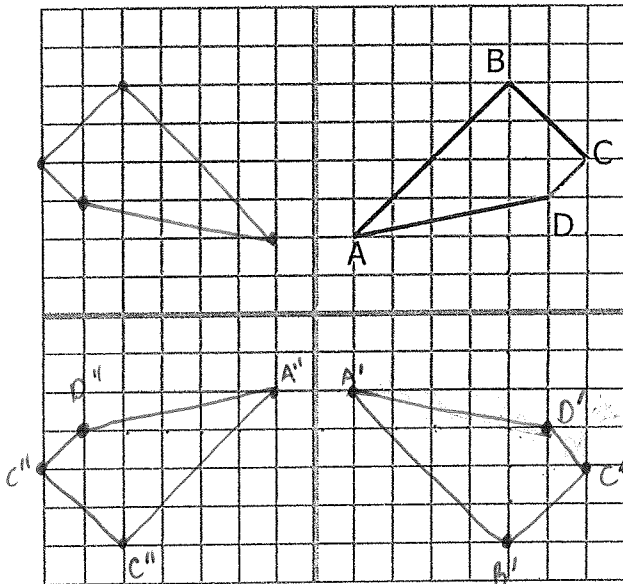


Rotate this shape 90° CW ↷

E (1, 3), F (1, 5), G (6, 5), H (6, 3)



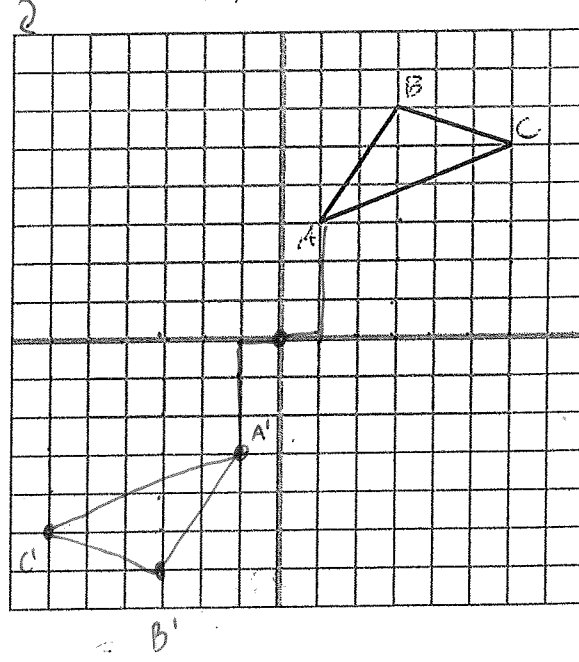
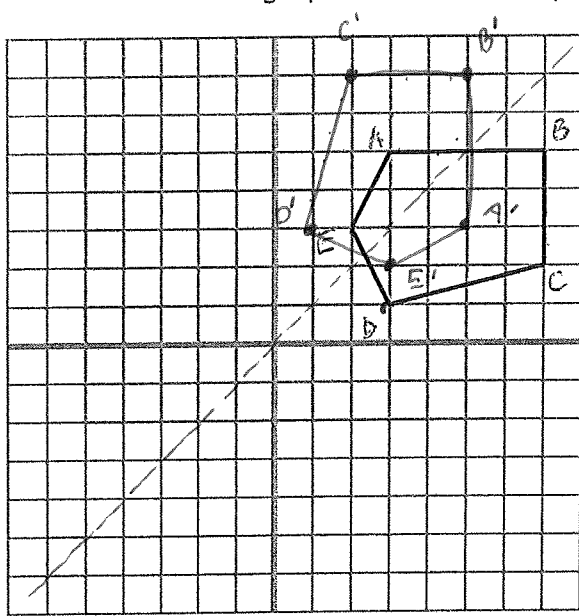
- 1) a) On the first graph, reflect the following shape over a) the x-axis and then b) the y-axis
 b) On the second graph, rotate the same shape 90° CW and then 90° CCW around (0,0)



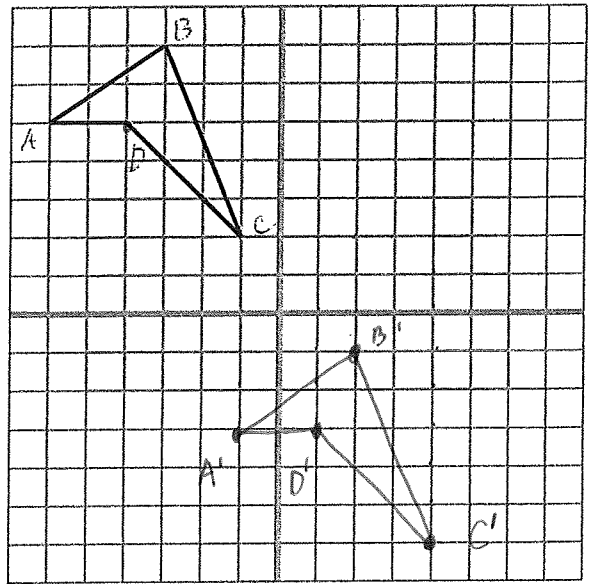
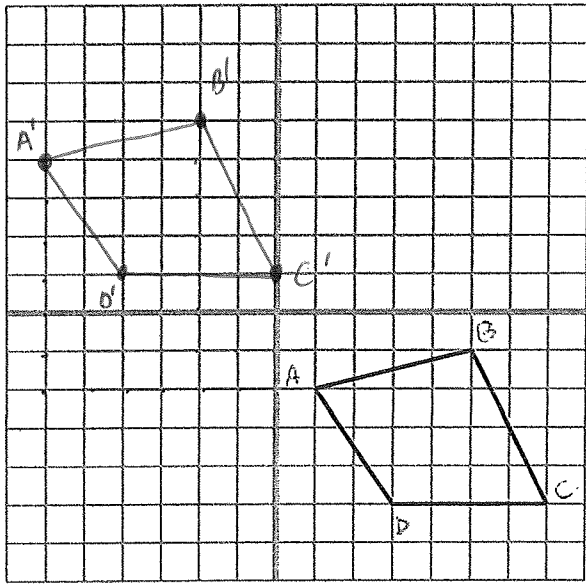
Complete a mapping diagram for the reflection over the x-axis

- $A(1,2) \rightarrow A'(1,-2)$
 $B(5,6) \rightarrow B'(5,-6)$
 $C(7,4) \rightarrow C'(7,-4)$
 $D(6,3) \rightarrow D'(6,-3)$
 $(x,y) \rightarrow (x,-y)$

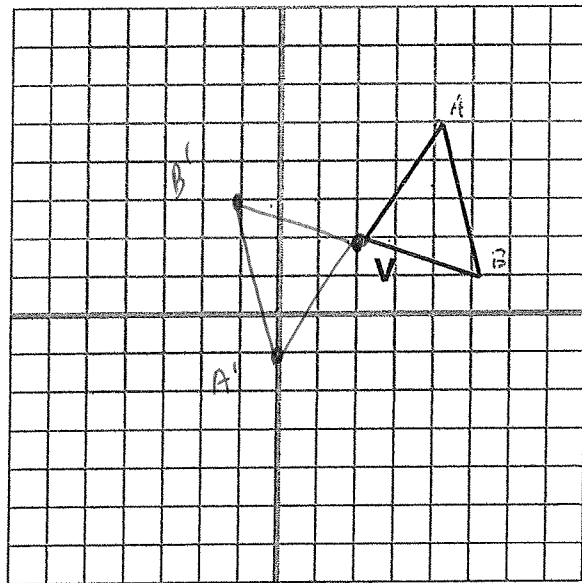
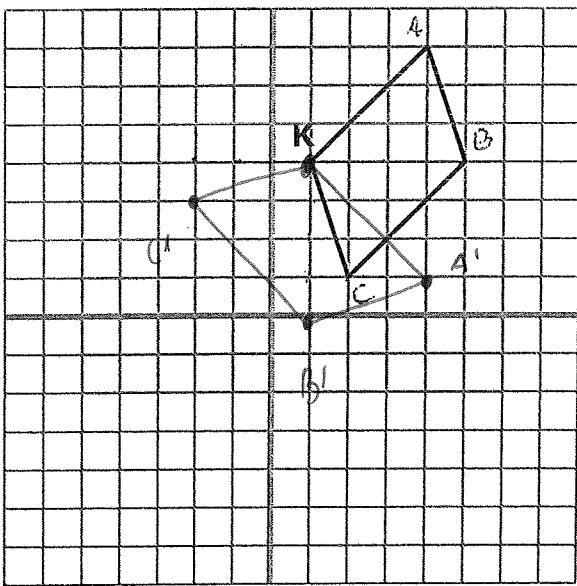
- 2) a) On the first graph, reflect the shape over $y = x$.
 b) On the second graph rotate the shape 180° CW. (around (0,0))



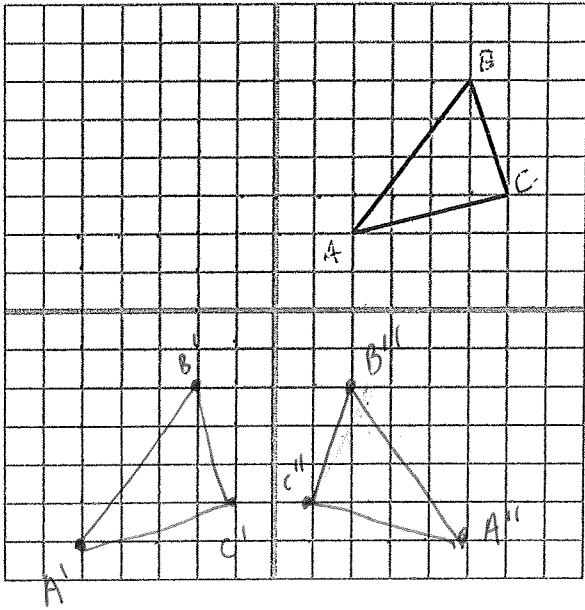
- 3) a) On the first graph, translate the following shape $(x, y) \longrightarrow (x - 7, y + 6)$
 b) On the second graph, translate the shape $(x, y) \longrightarrow (x + 5, y - 8)$



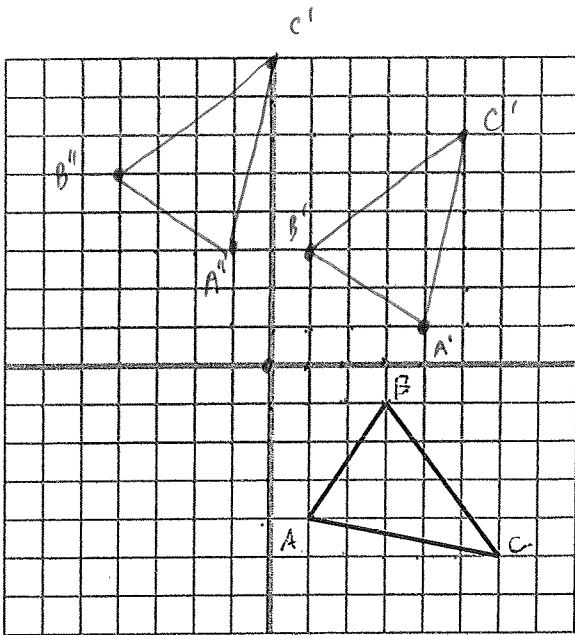
- 4) a) Rotate the shape in the first graph 90° CW around point K
 b) Rotate the shape in the second graph 180° CCW around point V



- 5) Translate the following shape $(x, y) \longrightarrow (x - 7, y - 8)$, then reflect the translated shape over the x-axis

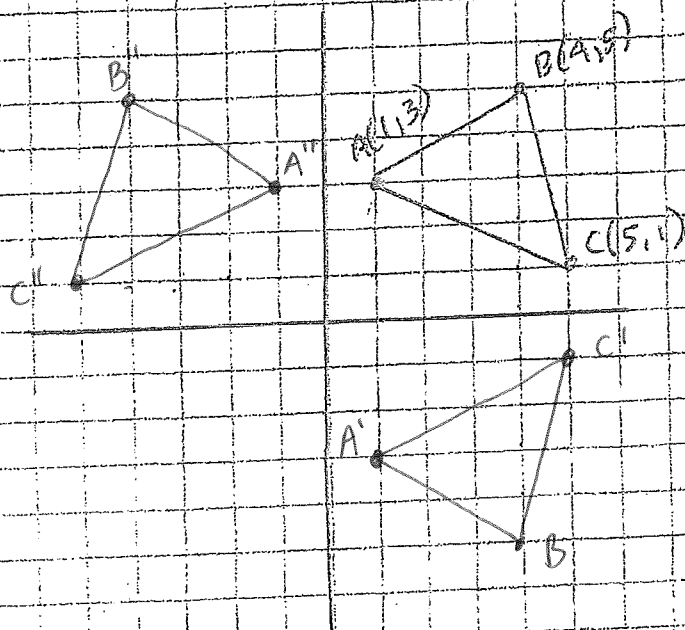


- 6) Rotate the following shape 90° CCW around the origin, and then translate the rotated shape $(x, y) \longrightarrow (x - 5, y + 2)$

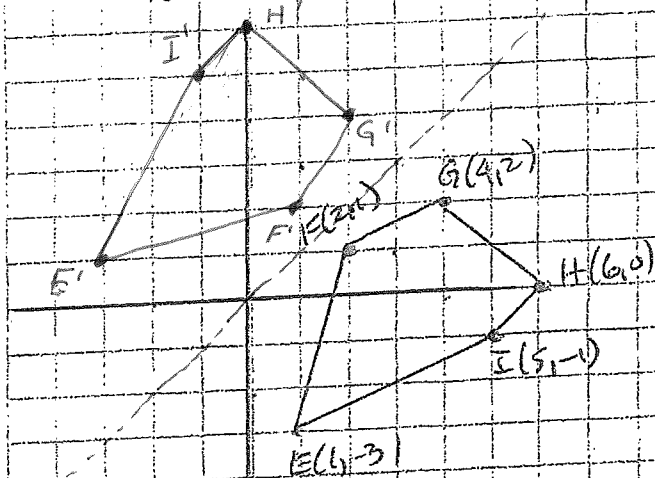


1. NO THE PICH

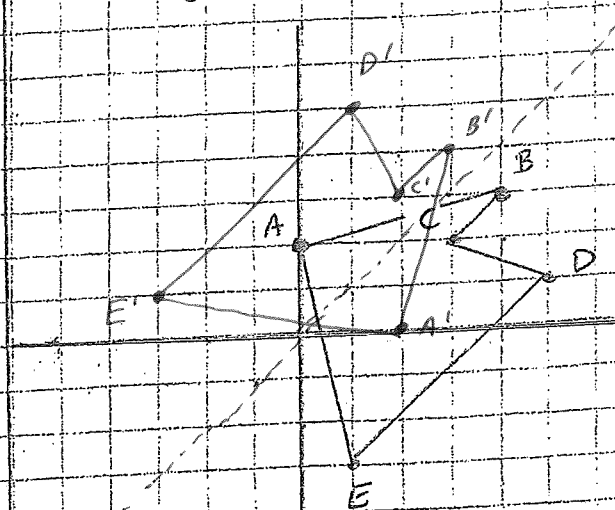
1. Reflect $\triangle ABC$ over a) x -axis b) y -axis
 Show mapping diagrams. Describe the symmetry, if any



2. Reflect $\triangle EFGHI$ over $y=x$. Include a mapping diagram. Describe the symmetry, if any



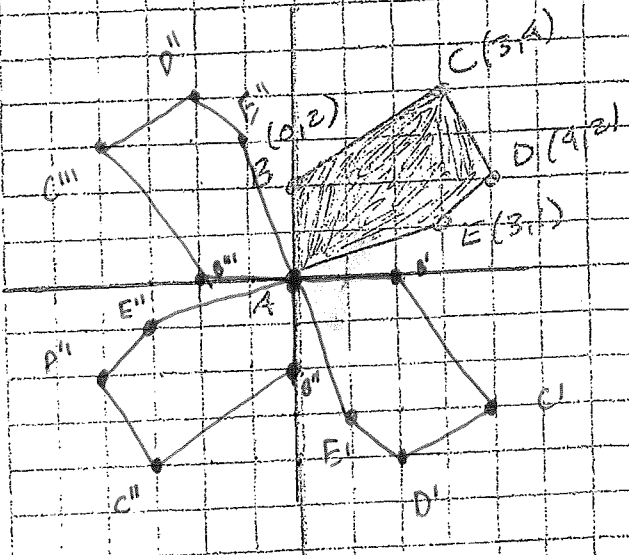
3. Reflect the shape below over $y=x$



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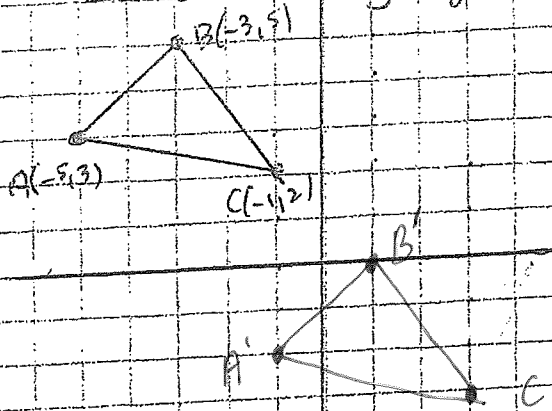
4. TO THE RIGHT

4. Rotate the following figure cw 90° into G_{IV} , then cw 90° into G_{III} , then cw 90° into G_{II} . Show the mapping diagram for G_I to G_{IV} .
 a) Describe the symmetry b) What is the order of rotation

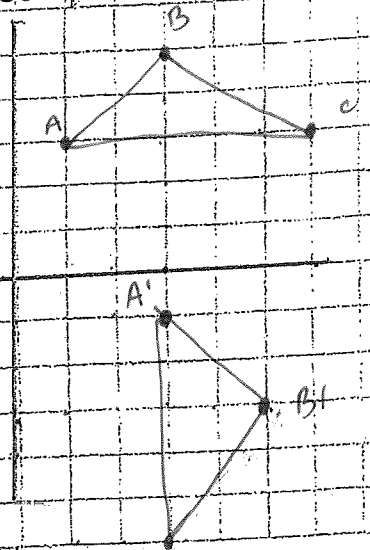


- $A(0,0) \rightarrow (0,0)$
- $B(0,2) \rightarrow (2,0)$
- $C(3,4) \rightarrow (4,-3)$
- $D(4,2) \rightarrow (2,-4)$
- $E(3,1) \rightarrow (-1,-3)$

5. Translate the following triangle as follows $(x,y) \rightarrow (x+4, y-5)$. Show a mapping diagram. Is there any symmetry? Explain



(a) Sketch $\triangle ABC$, $A(1,3)$, $B(3,5)$, $C(6,3)$. Translate so A is $(0,0)$, then rotate cw 90°

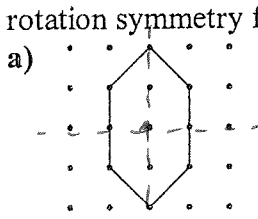


- $A(-5,3) \rightarrow (-1,-2)$
- $B(-3,5) \rightarrow (1,0)$
- $C(-1,2) \rightarrow (3,-3)$

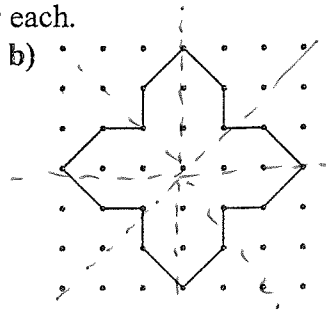
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Name _____

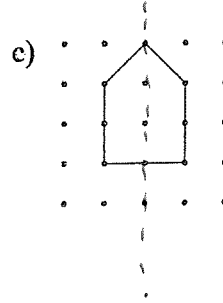
1. Which polygons have rotational symmetry? State the order of rotation and the angle of rotation symmetry for each.



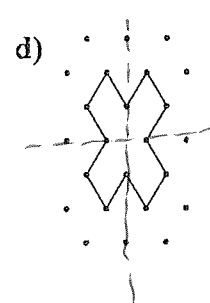
order: 2
angle: $\frac{360^\circ}{2} = 180^\circ$



order: 4
angle: $\frac{360^\circ}{4} = 90^\circ$



order: 1
angle: 360°
No?



order: 2
angle: $\frac{360^\circ}{2} = 180^\circ$

2. What is the order of rotation and the angle of rotation symmetry, if any, for:

a) an equilateral triangle



order: 3
angle: $\frac{360^\circ}{3} = 120^\circ$

b) a regular pentagon



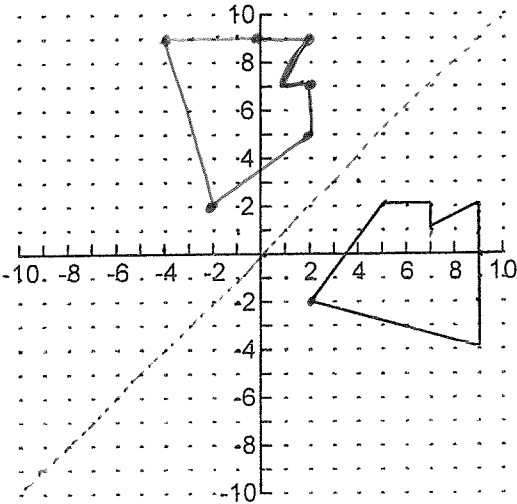
order: 5
angle: $\frac{360^\circ}{5} = 72^\circ$

c) the plus sign +



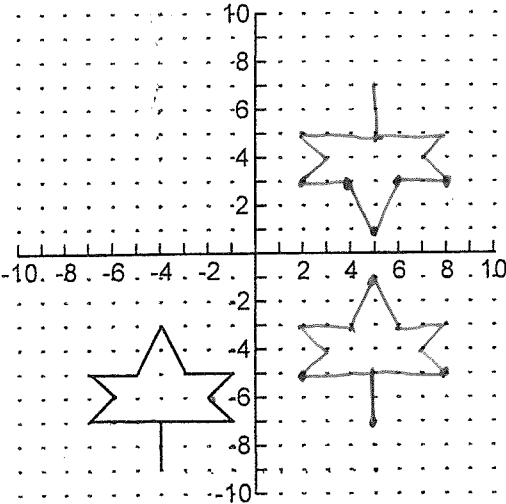
order 4
angle: $\frac{360^\circ}{4} = 90^\circ$

b) Reflect this shape over the line $y = x$

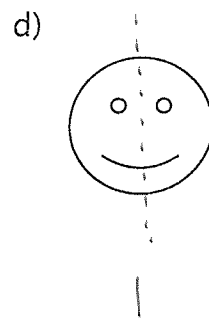
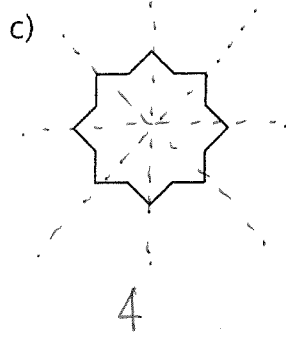
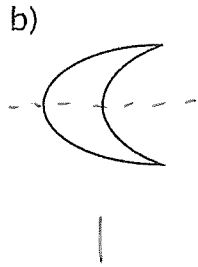
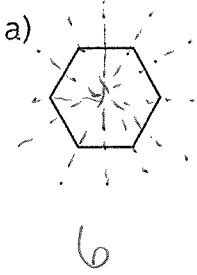


c) Translate this shape as follows $(x, y) \longrightarrow (x + 9, y + 2)$

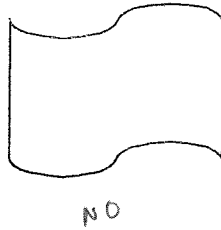
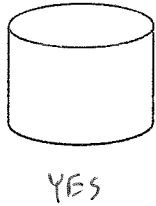
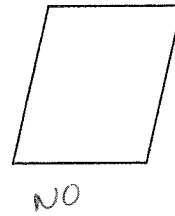
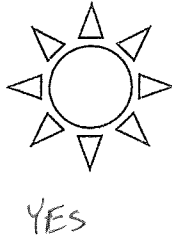
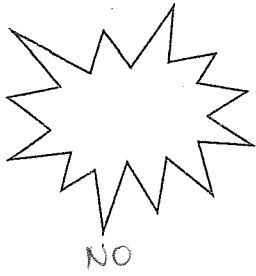
Then reflect the new shape over the x - axis



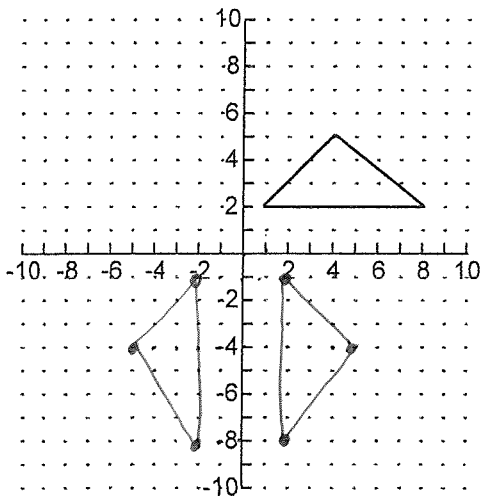
3. Determine the number of lines of symmetry for the following shapes



4. Which of the following shapes have line symmetry and which do not?



5. a) Rotate this shape 90° CW, and then reflect the rotation over the y-axis. Include a mapping diagram for the rotation



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

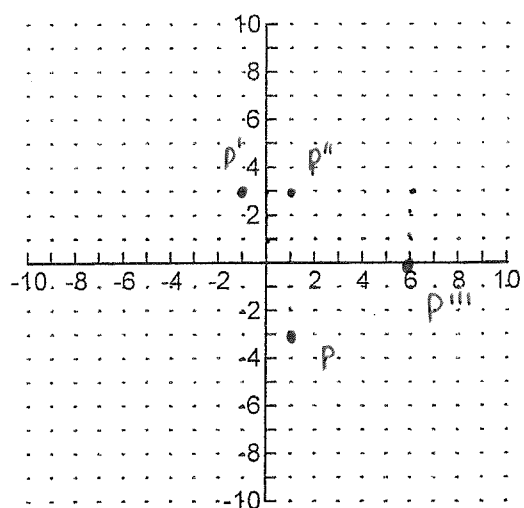
$$(x, y) \rightarrow (y, -x) \rightarrow (-y, -x)$$

6. The point $P(1, -3)$ undergoes the transformations listed below. Determine the co-ordinates of the final point P''' using a series of mapping diagrams. (You can sketch the graph first to help you with the mapping)

a) rotated 180° CW $\curvearrowright (1, -3) \rightarrow (-1, 3)$

b) reflected over the x axis $(-1, 3) \rightarrow (-1, -3)$

c) translated as follows $(x, y) \rightarrow (x + 5, y - 3)$ $(-1, -3) \rightarrow (4, -6)$



$P'''(6, 0)$