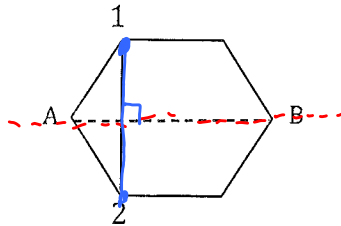


8.1 Line Symmetry

A line of symmetry:

- line that divides the object into two equal and identical pieces
- halves are mirror images of each other
- shown with dashed lines

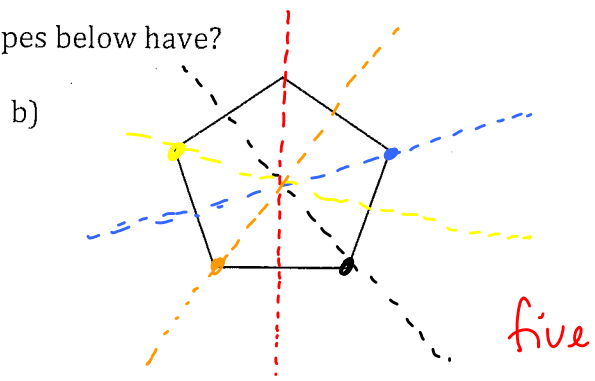
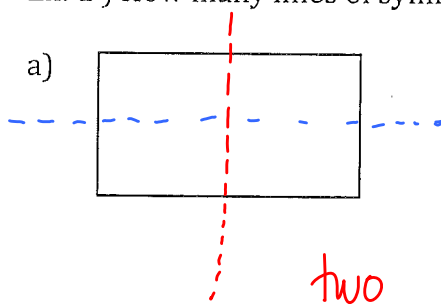


AB is a line of symmetry. Corresponding points 1 and 2 are perpendicular to the line.

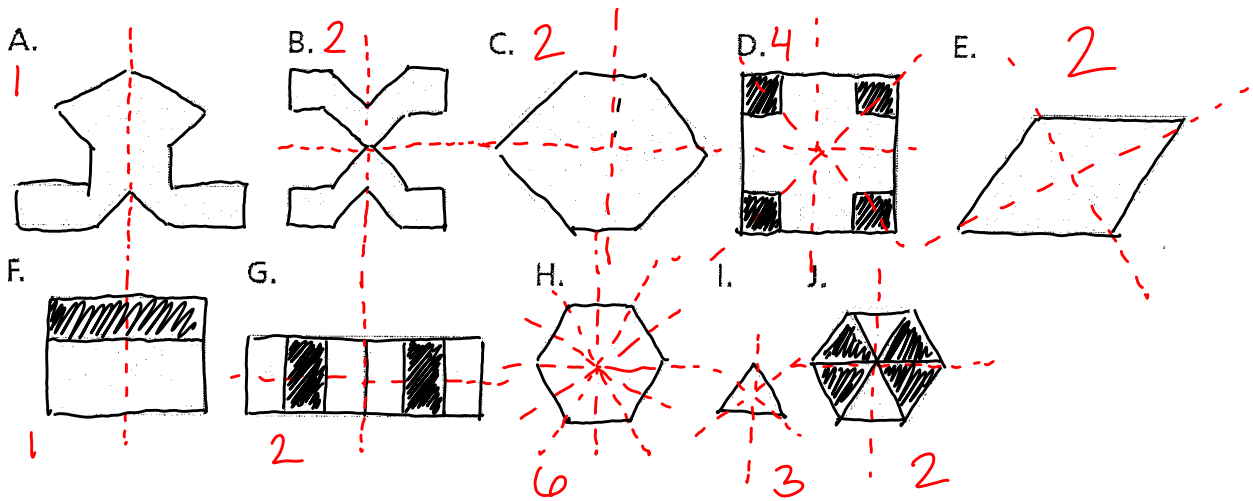
In a design, each corresponding point must be the same colour.

A shape can have more than 1 line of symmetry.

Ex: 1) How many lines of symmetry do the shapes below have?

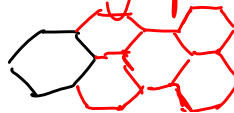
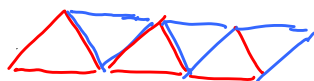


Ex: 2) How many lines of symmetry does each shape have?



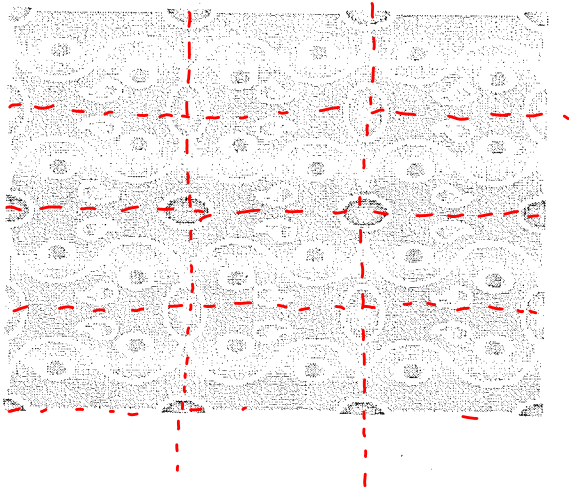
Tessellation:

- regular
- arranging a shape or shapes in a regular pattern to fill an area with no gaps or overlap

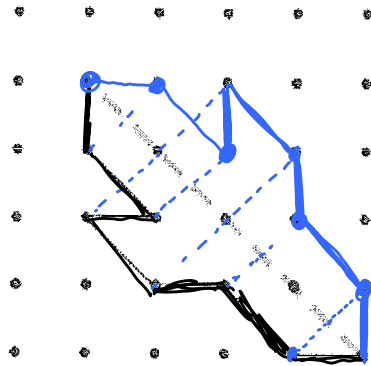


Math 9 – Chapter 8: Symmetry

Ex: 3) Identify the lines of symmetry in this tessellation:

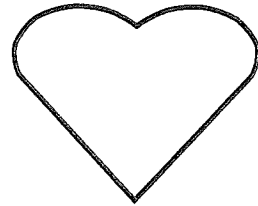
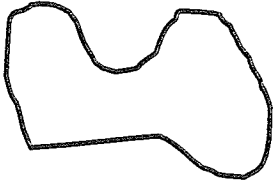


Ex: 4) If we know that a shape is symmetrical and its line of symmetry, we can sketch the other half. Complete the object below:

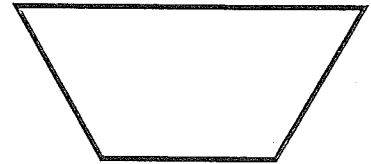
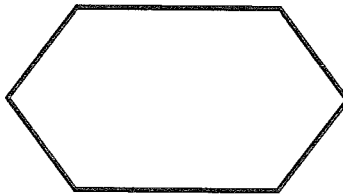
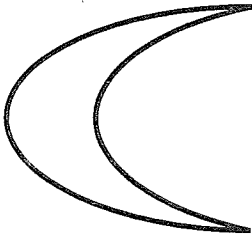


8.1 Line Symmetry Worksheet

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

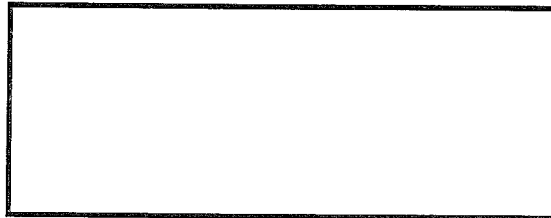


2. How many lines of symmetry do the following objects have?
Draw them!

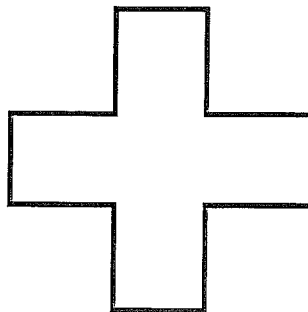


3. Draw the lines of symmetry for each object:

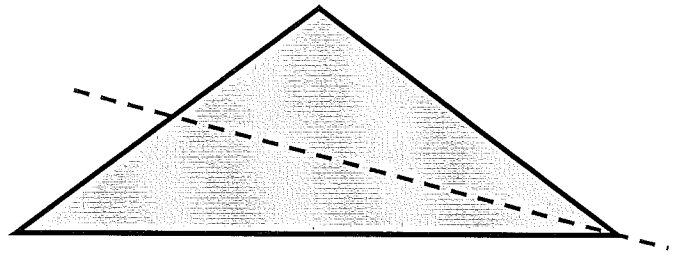
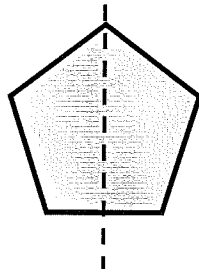
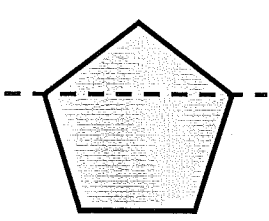
a)



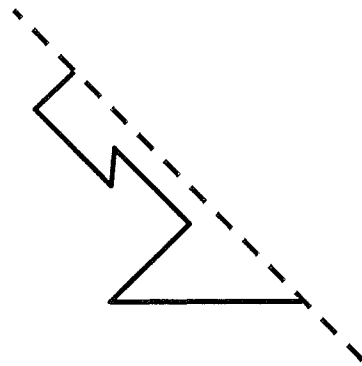
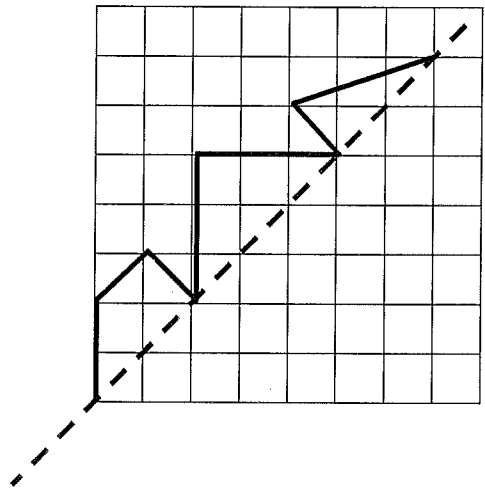
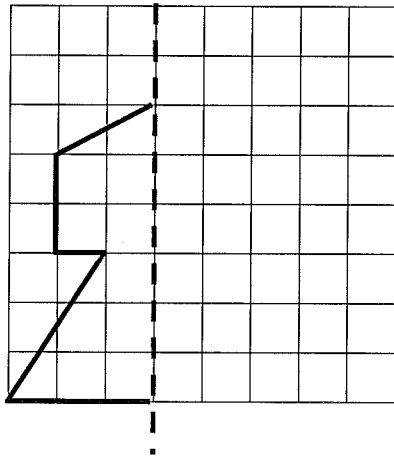
b)



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



5. Complete the following symmetry drawings:



8.2 Rotation Symmetry

Definitions:

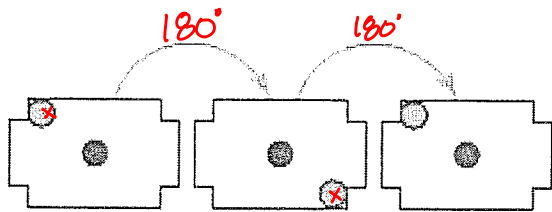
- Rotation symmetry - when a shape fits exactly over itself with a turn of less than 360°

Clockwise ↻ "CW" counterclockwise ↺ "CCW"

- Order of rotation symmetry - number of times a shape can rotate onto itself in 360°

order = $\frac{360^\circ}{\text{angle}}$ angle = $\frac{360^\circ}{\text{order}}$

- Angle of rotation symmetry - number of degrees needed for a shape to rotate on to itself



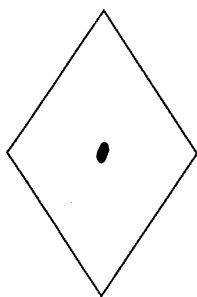
This shape has a rotation angle of 180° and a rotation order of 2.

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

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

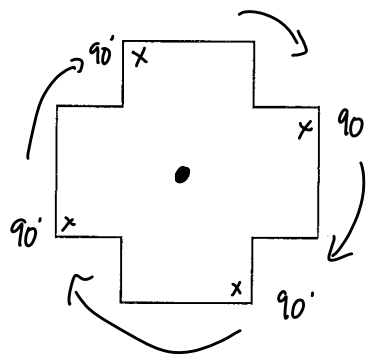
Ex: 1) Find the i) order of rotation and ii) the angle of rotation.

a)



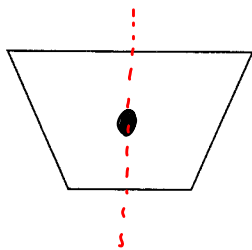
order: 2
angle: 180°

b)



order: 4
angle: 90°

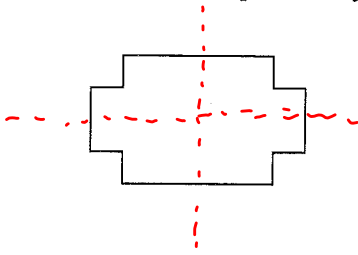
Ex: 2) For each shape, determine the number of lines of symmetry, its order of rotation, and the angle of rotation.



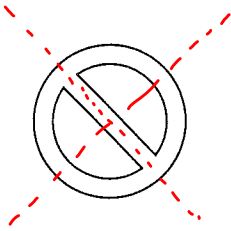
When have to go around full 360° to have shape

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

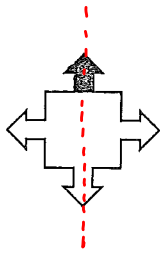
Math 9 - Chapter 8: Symmetry



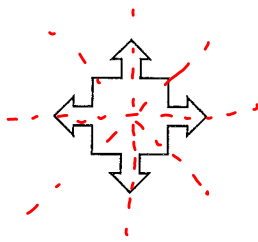
Lines of symmetry: 2
 Order of rotation: 2
 Angle of rotation: 180°



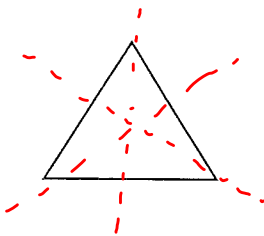
Lines of symmetry: 2
 Order of rotation: 2
 Angle of rotation: 180°



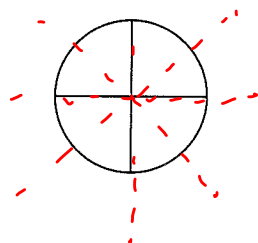
Lines of symmetry: 1
 Order of rotation: 1
 Angle of rotation: 360°



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



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

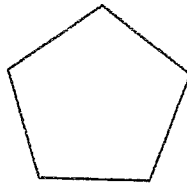
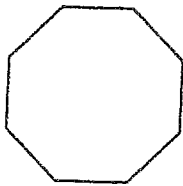
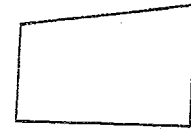
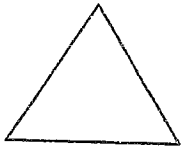
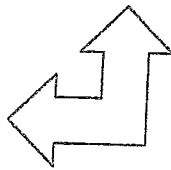
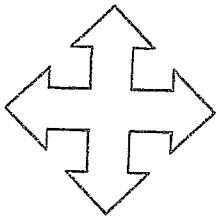
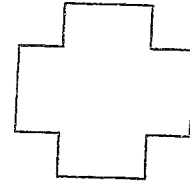
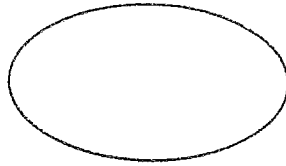
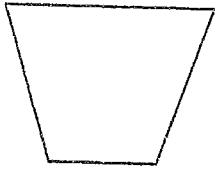


Lines of symmetry: 4
 Order of rotation: 4
 Angle of rotation: 90°

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

8.4 Symmetry on the Co-ordinate Plane Pt. 1

Translations, Reflections and Rotations

A. Translations:

Translation -

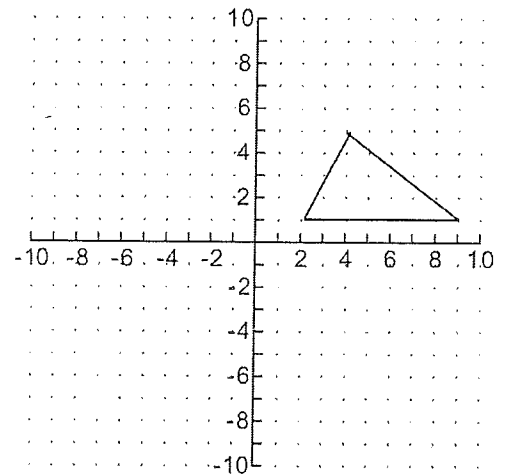
Ex: 1) Translate $\triangle ABC$, A(2,1), B(4,5), C(9,1), (Left 3, Down 4)

Mapping diagram

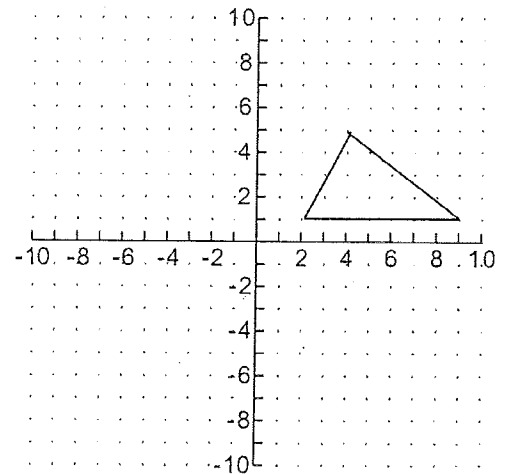
$$A(2,1) \rightarrow (2 - 3 ; 1 - 4) \rightarrow (-1, -3)$$

$$B(4,5) \rightarrow \dots\dots\dots$$

$$C(9,1) \rightarrow \dots\dots\dots$$



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



B. Reflections:

Reflections -

Math 9 – Chapter 8: Symmetry

Shapes can be reflected over:

-
-
-
-

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

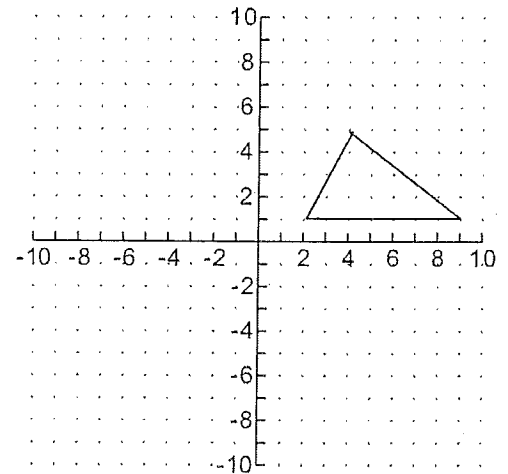
When you reflect over the x-axis:

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

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

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

$$C(9,1) \rightarrow C'(9,-1)$$



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

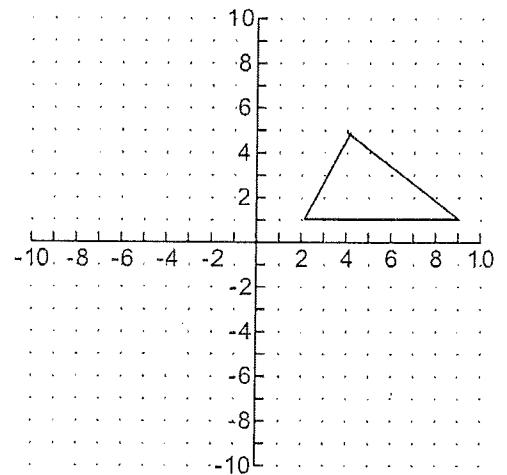
When you reflect over the y-axis:

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

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

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

$$C(9,1) \rightarrow C''(-9,1)$$



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

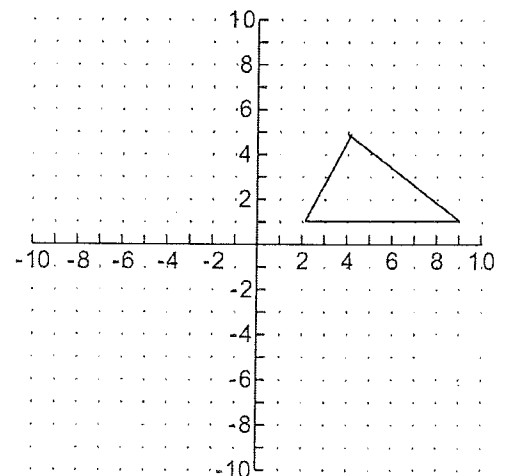
When you reflect over $y = x$:

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

$$A(2,1) \rightarrow A'''(1,2)$$

$$B(4,5) \rightarrow B'''(5,4)$$

$$C(9,1) \rightarrow C'''(1,9)$$

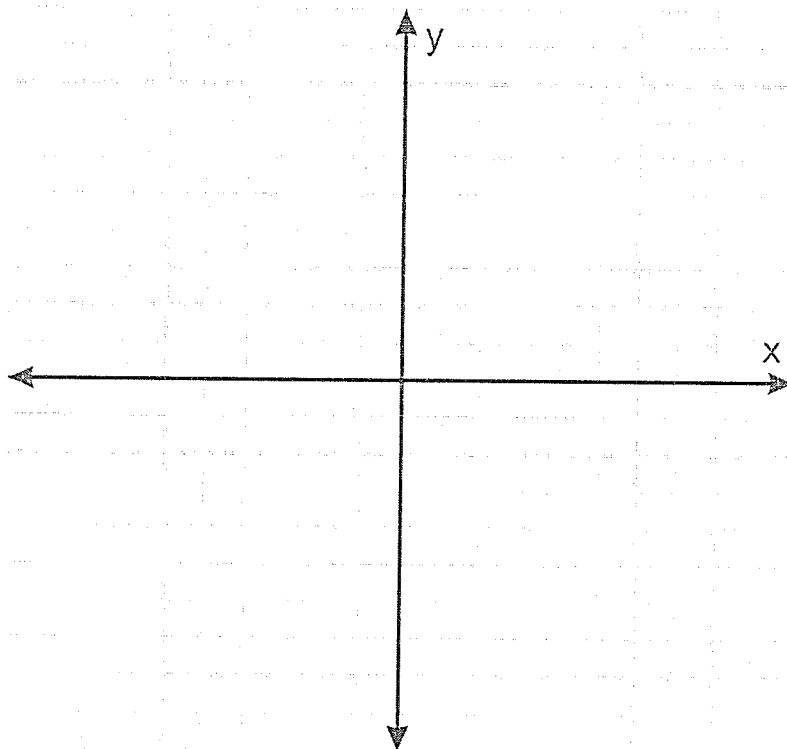


8.4 Symmetry on the Co-ordinate Plane Pt. 2

C. Rotations

Rotations –

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 $(0, 0)$.
- b) Rotate $\triangle CAT$ 180° CW around the origin.
- c) Rotate $\triangle CAT$ 90° CW about point C.

Reflect this shape over the line $y = x$

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

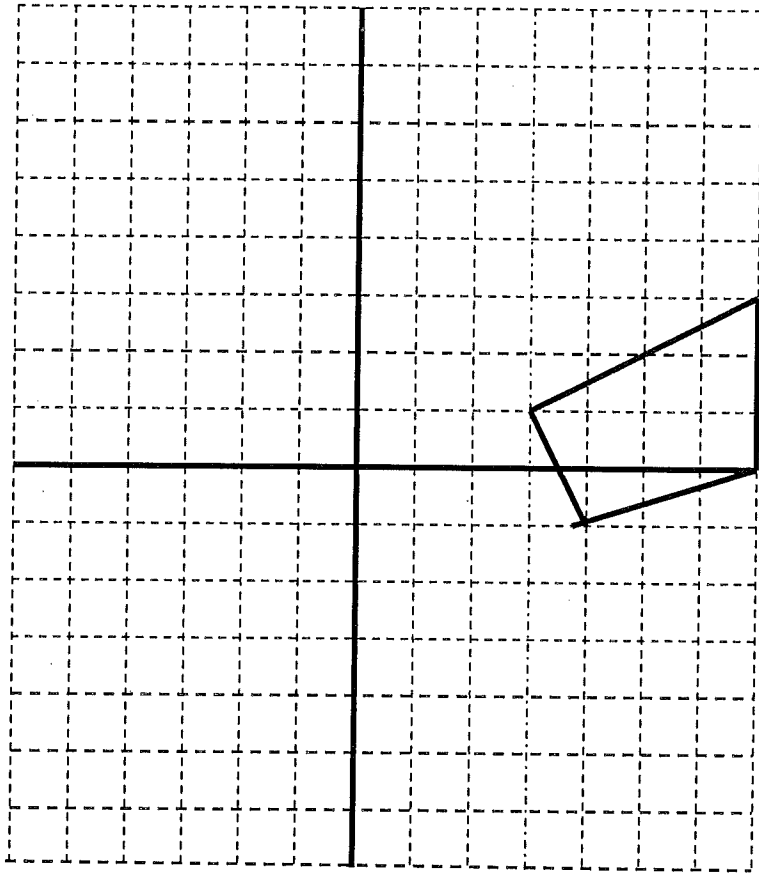
A (3, 1)

B (7, 3)

C (7, 0)

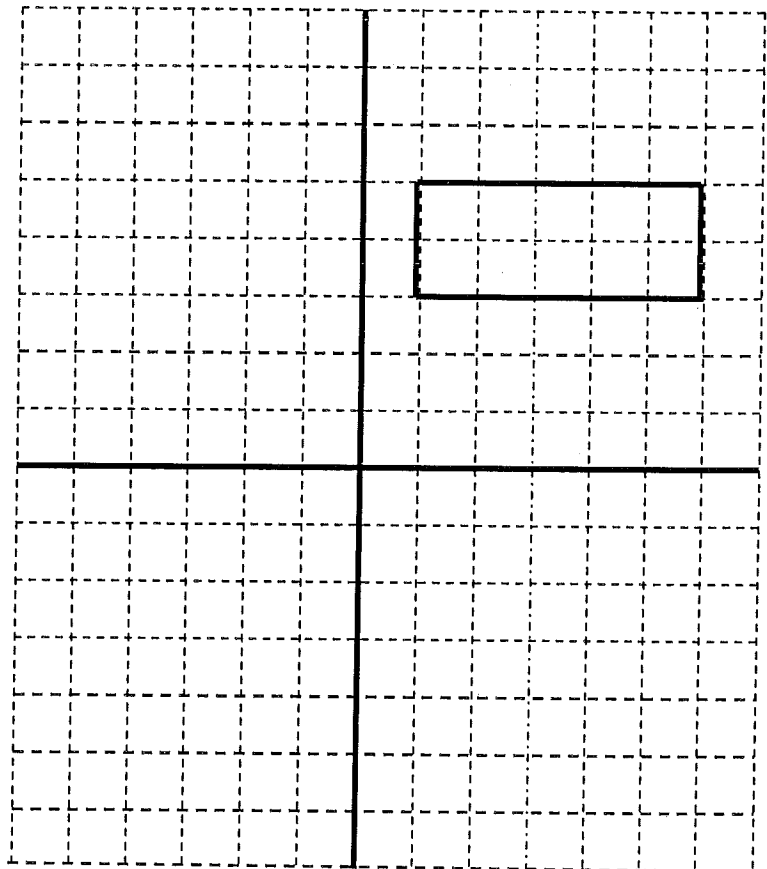
D (4, -1)

(x, y)

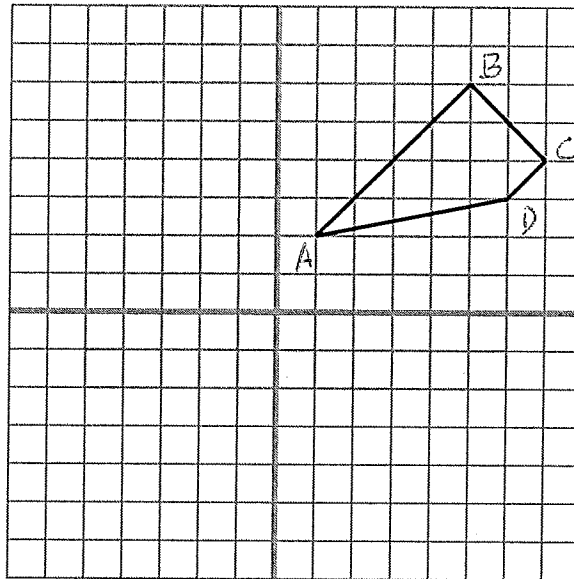
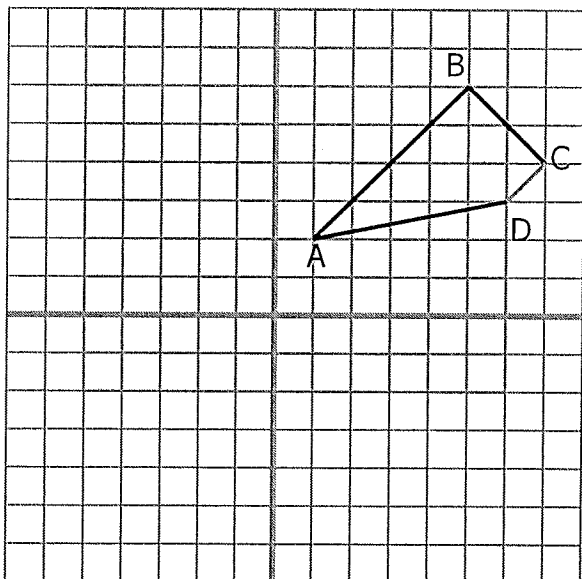


Rotate this shape 90° CW

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



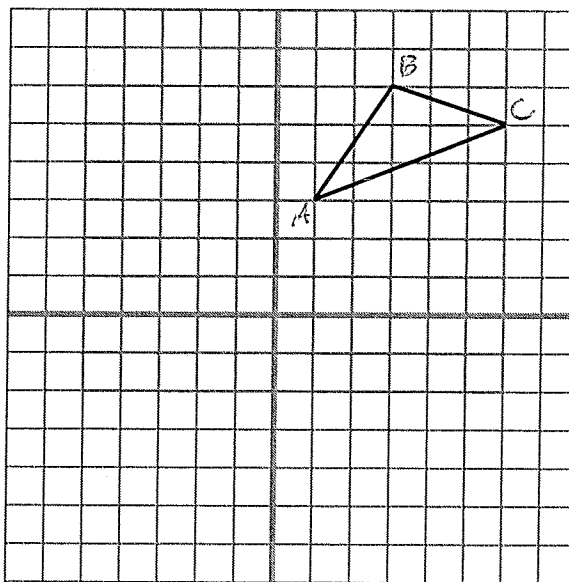
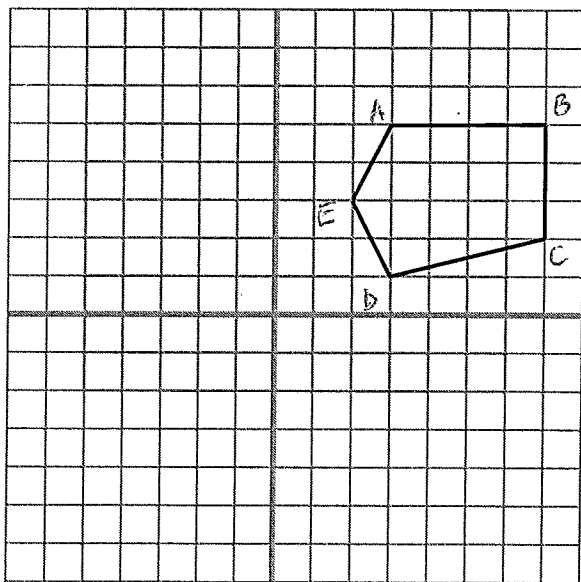
- 1) a) On the first graph, reflect the following shape over a) the x-axis and then b) the y-axis
 b) On the second graph, rotate the same shape 90° CW and then 90° CCW around (0,0)



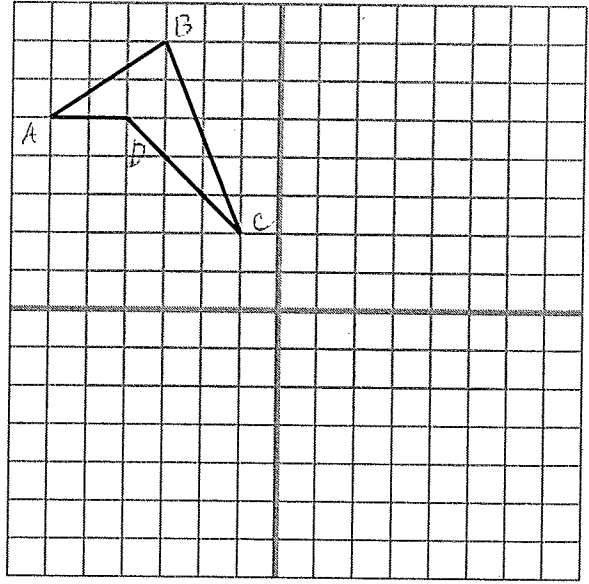
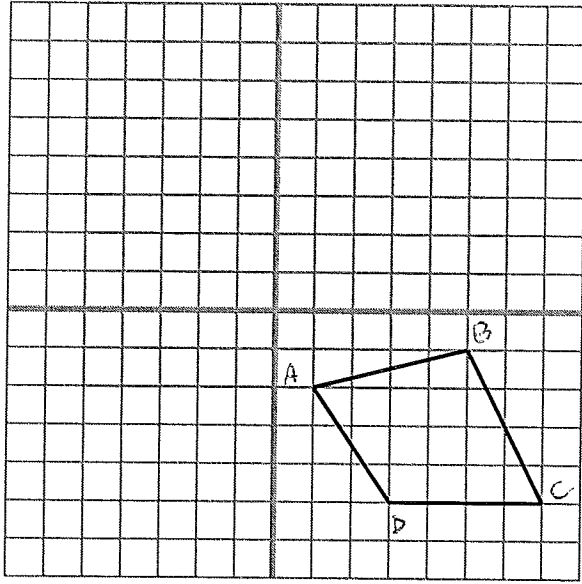
Complete a mapping diagram for the reflection over the x-axis

- A(1,2) → A'
 B(5,6) → B'
 C(7,4) → C'
 D(6,3) → D'

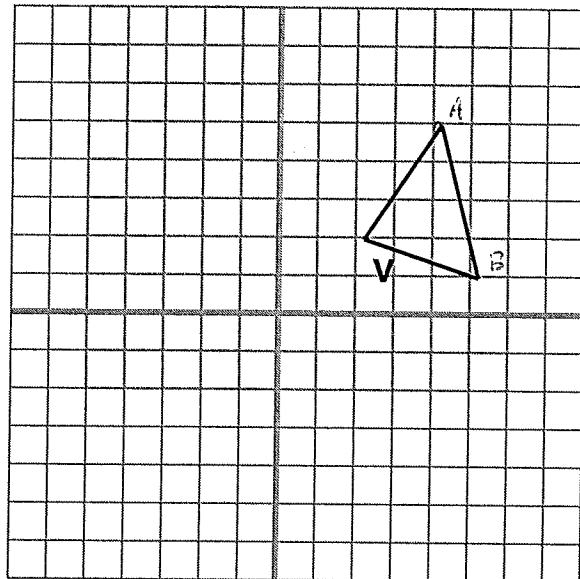
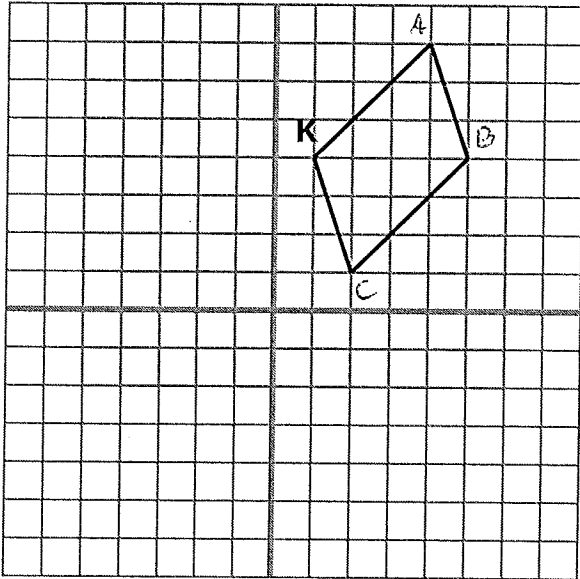
- 2) a) On the first graph, reflect the shape over $y = x$.
 b) On the second graph rotate the shape 180° CW. (around (0,0))



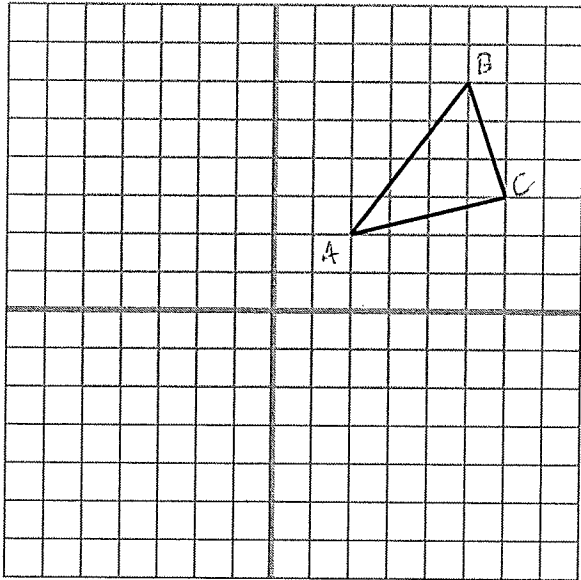
- 3) a) On the first graph, translate the following shape $(x, y) \longrightarrow (x - 7, y + 6)$
 b) On the second graph, translate the shape $(x, y) \longrightarrow (x + 5, y - 8)$



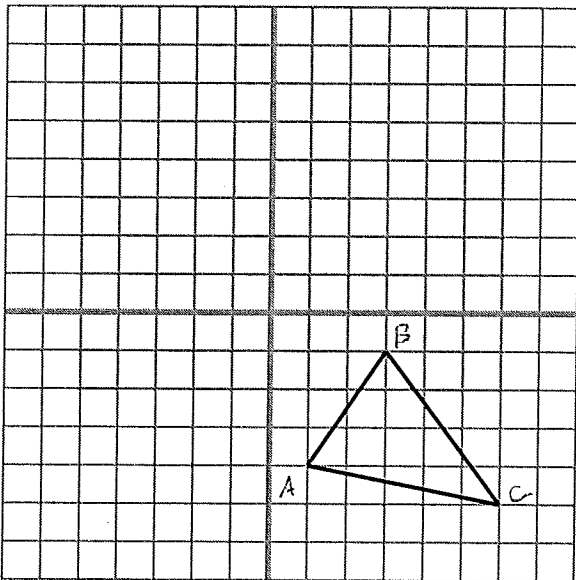
- 4) a) Rotate the shape in the first graph 90° CW around point K
 b) Rotate the shape in the second graph 180° CCW around point V



- 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 $(x, y) \longrightarrow (x - 5, y + 2)$

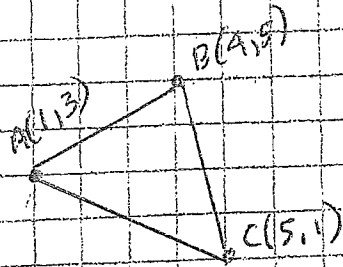


Pm 9

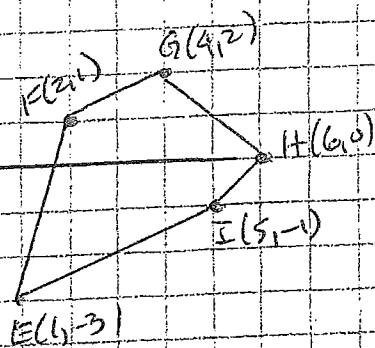
8.4

1 TO THE END

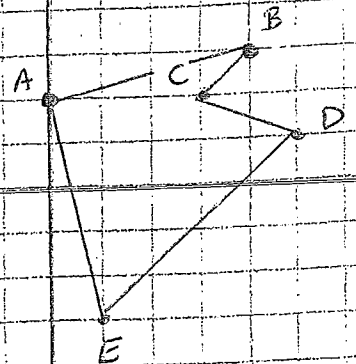
1. Reflect $\triangle ABC$ over a) x -axis b) y -axis
Show mapping diagrams. Describe the symmetry, if any



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



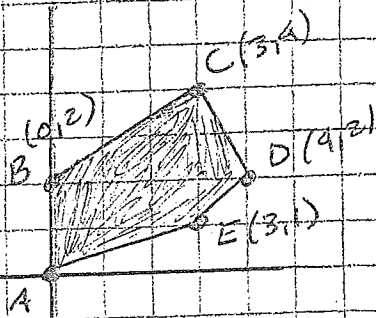
3. Reflect the shape below over $y=x$



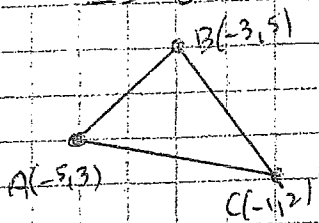
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4 TO THE BUCH

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



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

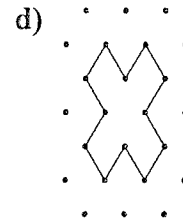
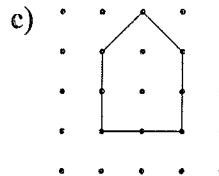
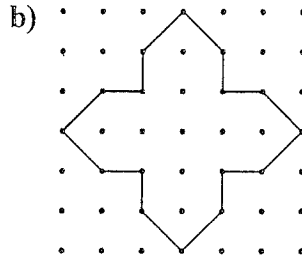
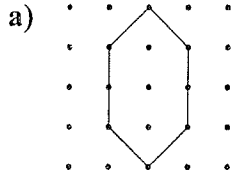


(a) Sketch $\triangle ABC$, $A(1,3)$, $B(3,5)$, $C(6,3)$. Translate so A is $(0,0)$, then rotate cw 90°

MEGA MATHS SOURCE © Mrs. TESSENGER PRESS

Name _____

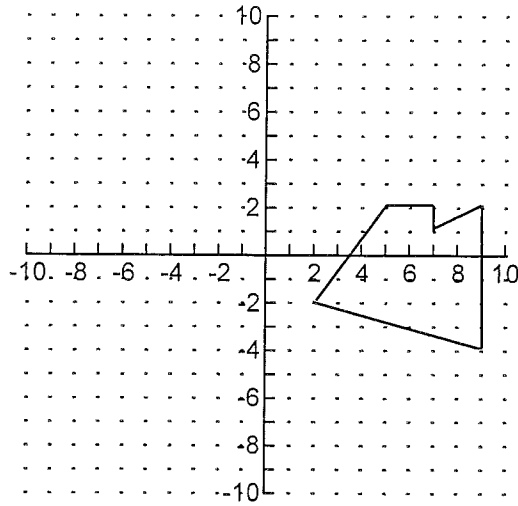
1. Which polygons have rotational symmetry? State the order of rotation and the angle of rotation symmetry for each.



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

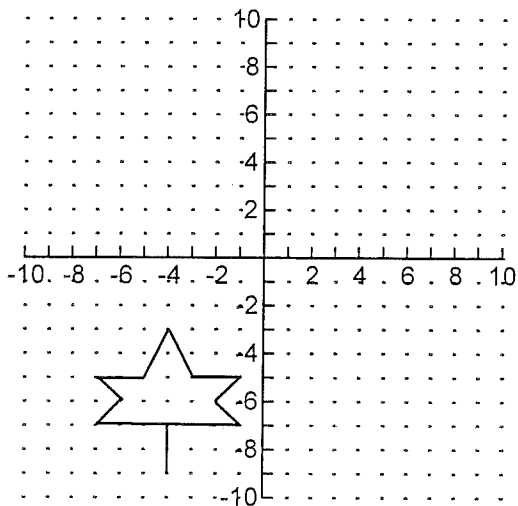
a) an equilateral triangle b) a regular pentagon c) the plus sign +

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

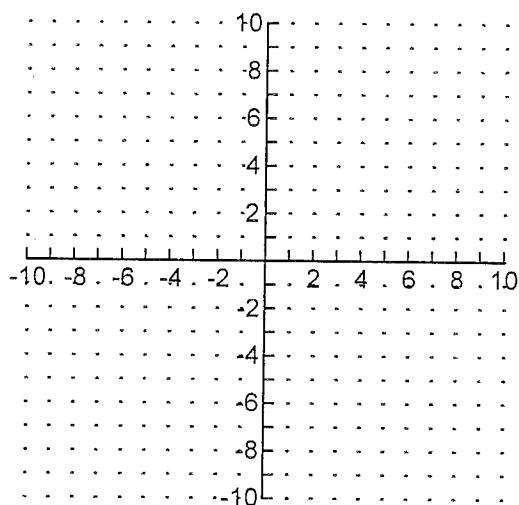


6. The point $P(1, -3)$ undergoes the transformations listed below. Determine the co-ordinates of the final point P''' using a series of mapping diagrams. (You can sketch the graph first to help you with the mapping)

a) rotated 180° CW

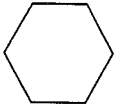
b) reflected over the x axis

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

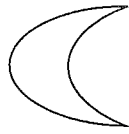


3. Determine the number of lines of symmetry for the following shapes

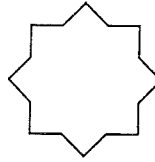
a)



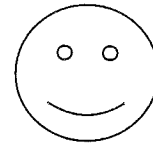
b)



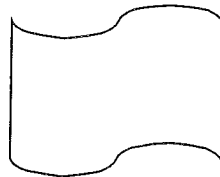
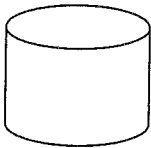
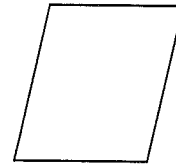
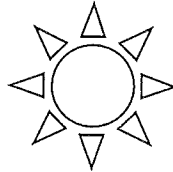
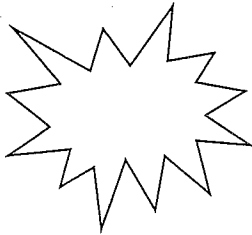
c)



d)



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

