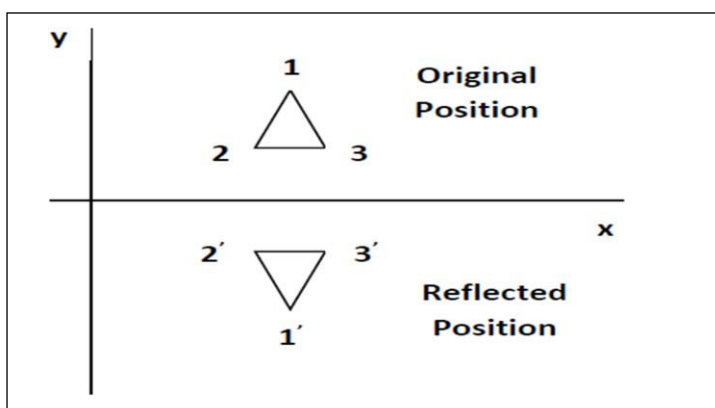


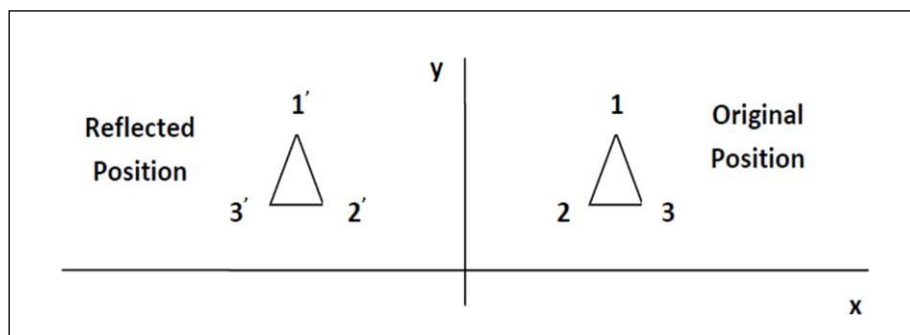
3- Reflection

A reflection is a transformation that produces a mirror image of an object. In other words, we can say that it is a rotation operation with 180° . In reflection transformation, the size of the object does not change. The following figures show reflections with respect to x and y axes, and about the origin respectively.

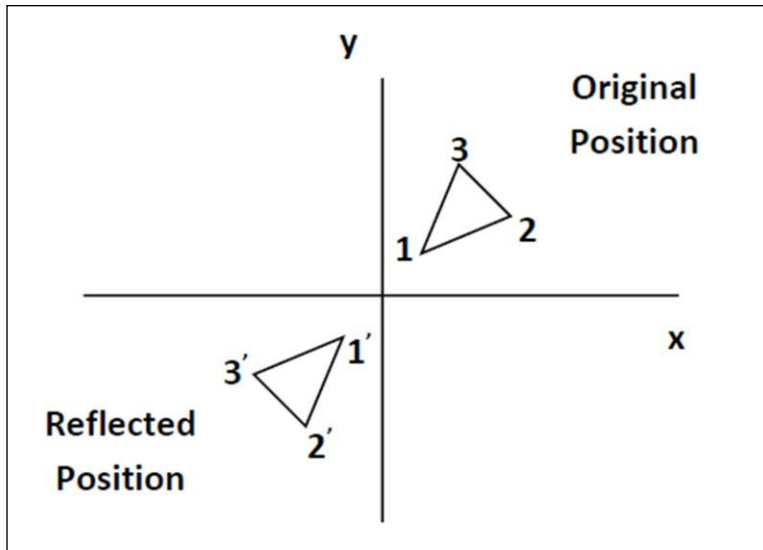
Thereflectionaboutthex-axisis: $x'=x;y'=-y$;



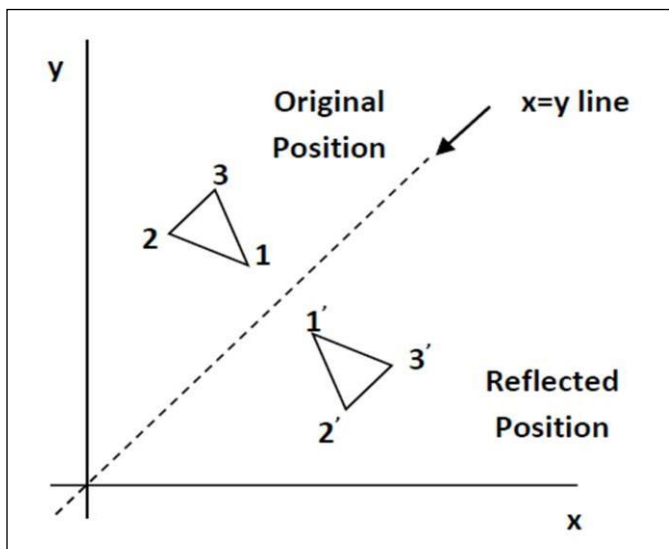
Thereflectionaboutthey-axisis: $x'=-x;y'=y$;



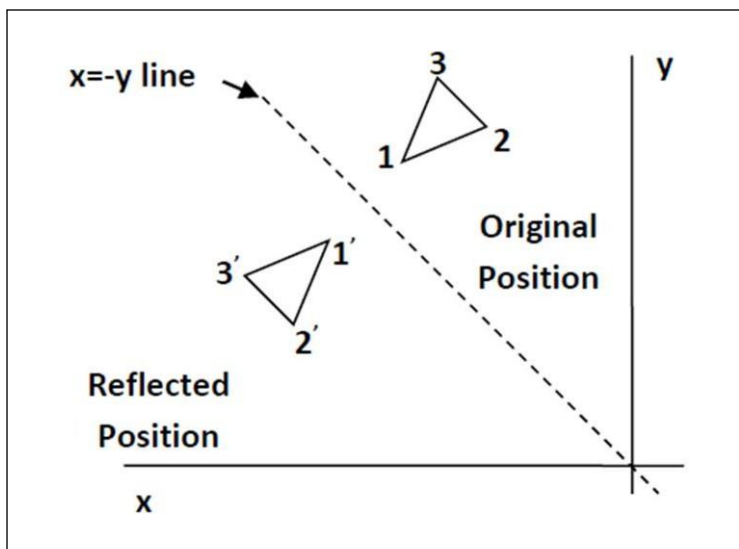
Thereflectionabouttheoriginpointis: $x'=-x;y'=-y$;



Thereflectionabouttheline $x=y:x'=y;y'=x$;



Thereflectionabouttheline $x=-y:x'=-y;y'=x$;



Matrix representation:

Forreflectionaboutx-axis:

$$\begin{pmatrix} x' \\ y' \\ 1 \end{pmatrix} = \begin{pmatrix} x \\ y \\ 1 \end{pmatrix} * \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

For reflection about y-axis:

$$(x' y' 1) = (x y 1) * \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

For reflection about the origin(0,0):

$$(x' y' 1) = (x y 1) * \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

For reflection about the line $y=x$:

$$\begin{pmatrix} x' & y' & 1 \end{pmatrix} = \begin{pmatrix} x & y & 1 \end{pmatrix} * \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

For reflection about the line $x=-y$:

$$\begin{pmatrix} x' & y' & 1 \end{pmatrix} = \begin{pmatrix} x & y & 1 \end{pmatrix} * \begin{bmatrix} 0 & -1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Example: Find the coordinates after reflection of the triangle $[A(10,10), B(15,15), C(20,10)]$ about x-axis.

$$\begin{array}{cccccc} 1 & 0 & 0 & 10 & 15 & 20 \\ P' = [& 0 & -1 & 0 &] & [10 & 15 & 10] \\ & 0 & 0 & 1 & 1 & 1 & 1 \\ & 10 & 15 & 20 \\ P' = [& -10 & -15 & -10] \\ & 1 & 1 & 1 \end{array}$$

Thus, the final coordinate after reflection are $[A(10,-10), B(15,-15), C(20,-10)]$