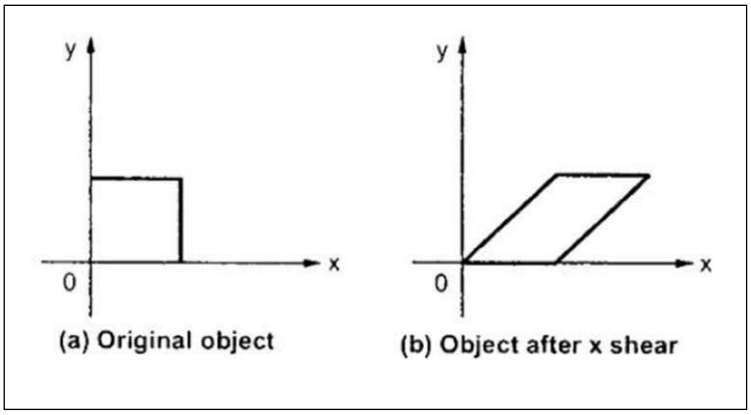
3- Shear

A transformation that slants the shape of an object is called the shear transformation. There are two shear transformations**X-Shear**and**Y-Shear**. One shifts x coordinate values and other shifts y coordinate values. However; in both cases only one coordinate changes itsvalues and other preserves its values. Shearing is also termedas **Skewing**.

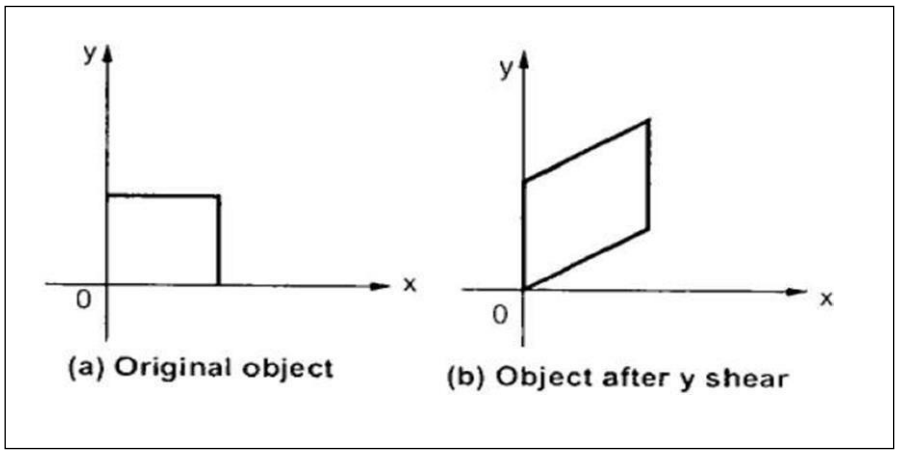
X-Shear

TheX-Shearpreservestheycoordinateandchangesaremadeto xcoordinates,which causes the vertical lines to tilt right or left as shown in below figure.



Y-Shear

The Y-Shear preserves the x coordinates and changes are made to y coordinates, which causes the horizontal lines to transform into lines which slopes up or down as shown in the following figure.

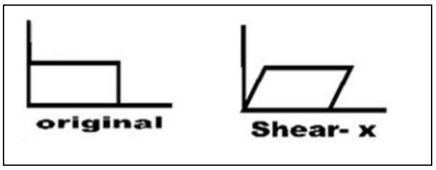


Matrix representation:

1- Toshearinxdirectiononlyuseshearingmatrixintheequationas: x′=x

$+shx$*y , y′=y

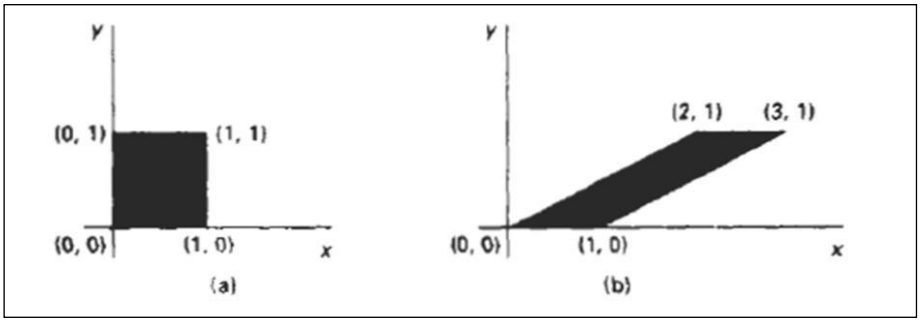
$$(x\acute{y}1)=(xy1)*\begin{bmatrix}1 & 0 & 0\\ shx & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$$



$$[x', \ y', \ 1]=[x+shx*y, \ y, \ 1]$$

Any real number can be assigned to the shear parameter *shx*. A coordinate position (x, y) is then shifted horizontally by an amount proportional to its distance (y value) form x coordinate.

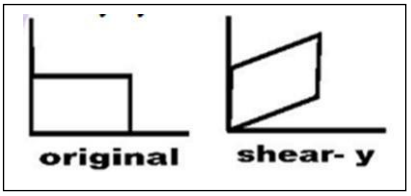
Forexample,Setting*shx*to2,changesthesquareinthefollowingfigureintoa parallelogram. Negative values for *shx*, shift coordinate positions to the left.



2- Toshearinydirectiononly,useshearingmatrixintheequationas:

$$x' = x \quad , \quad y' = x * shy + y$$

$$(x\acute{y}1) = (xy1) * \begin{bmatrix} 1 & shy & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

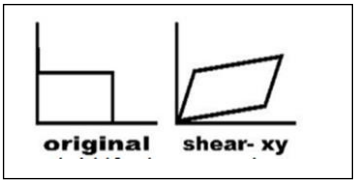


$$[x', \ y', \ 1] = [x, \ x * shx + y, \ 1]$$

3- Toshearinbothxandydirections:

$$x' = x + shx * y \quad , \quad y' = x * shy + y;$$

$$(x\acute{y}1) = (xy1) * \begin{bmatrix} 1 & shy & 0 \\ shx & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$



$$[x', \quad y', \quad 1]=[x+shx*y, \qquad x*shx+y, \qquad 1]$$