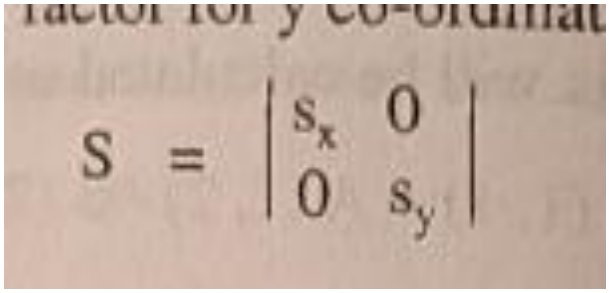
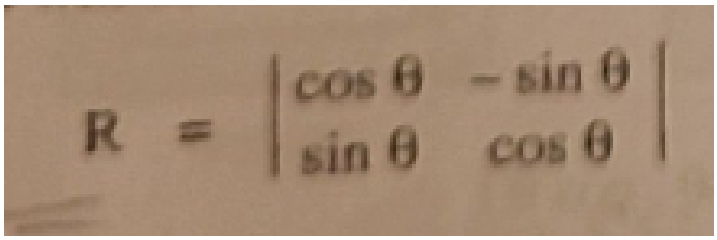
2D TRANSFORMATIONS

1)SCALING TRANSFORMATION



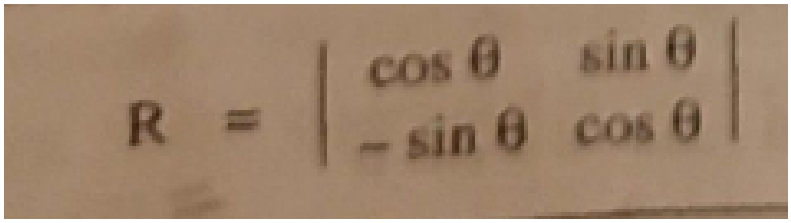
$$S = \begin{vmatrix} s_x & 0 \\ 0 & s_y \end{vmatrix}$$

2)ROTATION CLOCKWISE



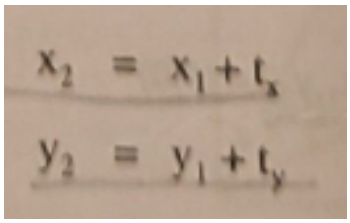
$$R = \begin{vmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{vmatrix}$$

3)ROTATION ANTICLOCKWISE



$$R = \begin{vmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{vmatrix}$$

4) TRANSLATION

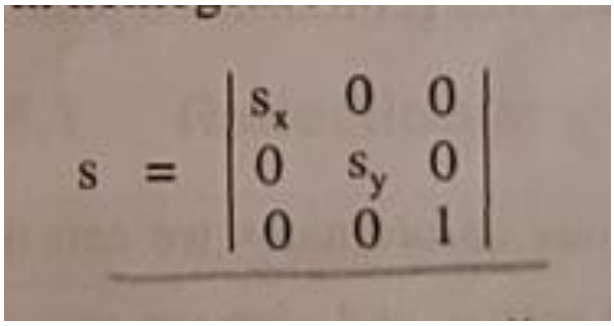


$$x_2 = x_1 + t_x$$

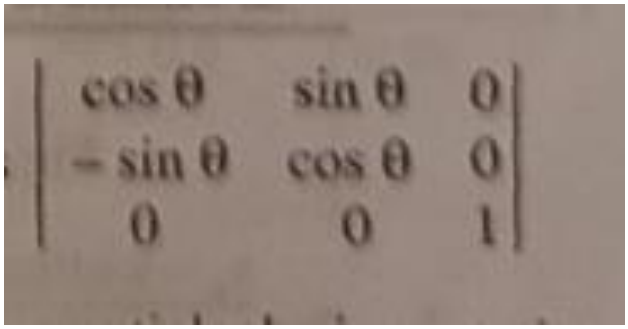
$$y_2 = y_1 + t_y$$

HOMOGENOUS COORDINATES SYSTEM

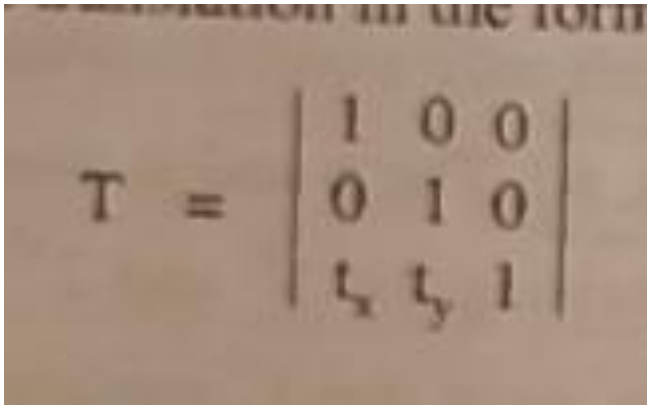
1) SCALING



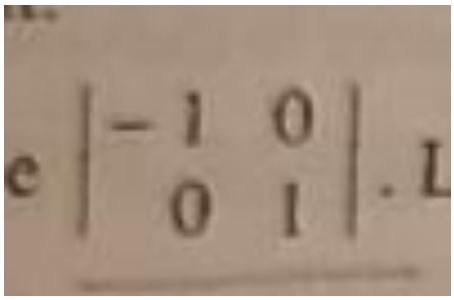
2) ROTATION ANTICLOCKWISE



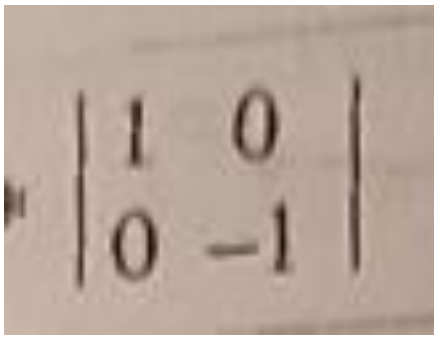
3) TRANSLATION



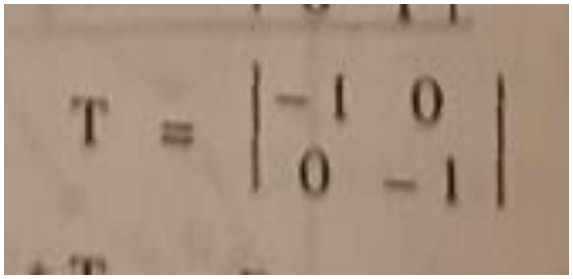
REFLECTION AT Y-AXIS



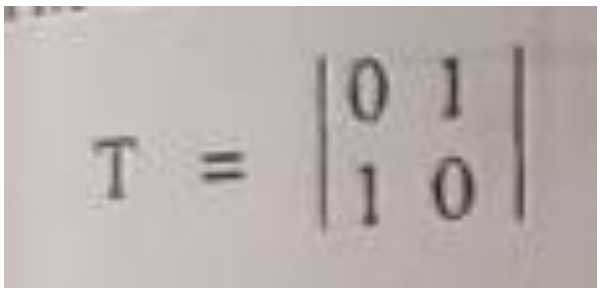
REFLECTION AT X-AXIS



REFLECTION IN THE ORIGIN



REFLECTION IN Y=X



Y-SHEAR

∴ Transformation matrix for y-shear will be $\begin{vmatrix} 1 & a \\ 0 & 1 \end{vmatrix}$

X-SHEAR

$$|x, y| * \begin{vmatrix} 1 & 0 \\ b & 1 \end{vmatrix} = |x + yb, y|$$

3D SCALING

$$\begin{vmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \\ 0 & 0 & s_z \end{vmatrix}$$

where s_x, s_y and s_z represents the scaling factors for the three dimensions.

3D scaling matrix with homogeneous co-ordinate system will be,

$$\begin{vmatrix} s_x & 0 & 0 & 0 \\ 0 & s_y & 0 & 0 \\ 0 & 0 & s_z & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

TRANSLATION

$$\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ t_x & t_y & t_z & 1 \end{vmatrix}$$

3D ROTATION ABOUT Z-AXIS

$$R_z = \begin{vmatrix} \cos\theta & \sin\theta & 0 & 0 \\ -\sin\theta & \cos\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$ (For anticlockwise)

$$R_z = \begin{vmatrix} \cos\theta & -\sin\theta & 0 & 0 \\ \sin\theta & \cos\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$ (For clockwise)

3D ROTATION ABOUT X-AXIS

$$R_x = \begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & \sin\theta & 0 \\ 0 & -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$ (For Anticlockwise)

$$\text{nd } R_x = \begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta & 0 \\ 0 & \sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$ (For clockwise)

3D ROTATION ABOUT Y-AXIS

$$R_y = \begin{vmatrix} \cos\theta & 0 & -\sin\theta & 0 \\ 0 & 1 & 0 & 0 \\ \sin\theta & 0 & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$ (For Anticlockwise)

$$\text{And } R_y = \begin{vmatrix} \cos\theta & 0 & \sin\theta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin\theta & 0 & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$ (For clockwise)