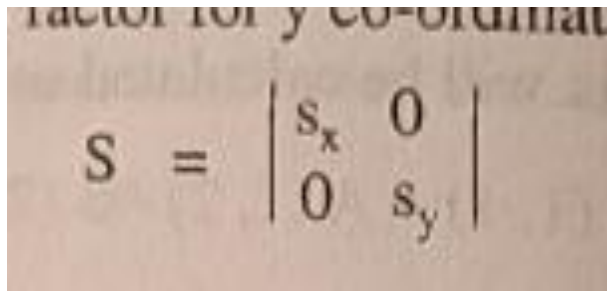


2D TRANSFORMA TIONS

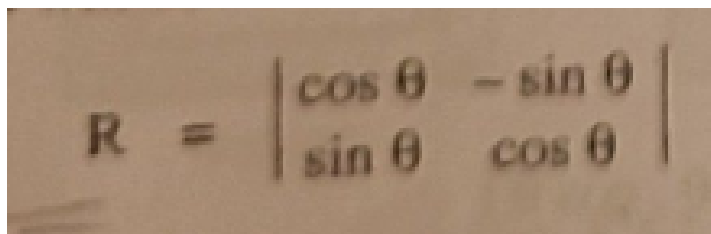
1) SCALING TRANSFORMATION



A handwritten equation for a scaling transformation matrix S. The matrix is a 2x2 determinant with elements s_x , 0, 0, and s_y . Above the equation, the text "factor for y co-ordinate" is partially visible.

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

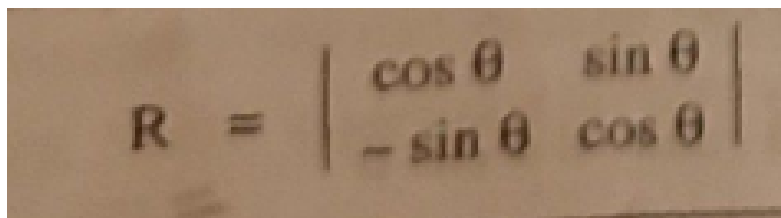
2) ROTATION CLOCKWISE



A handwritten equation for a clockwise rotation matrix R. The matrix is a 2x2 determinant with elements $\cos \theta$, $-\sin \theta$, $\sin \theta$, and $\cos \theta$.

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

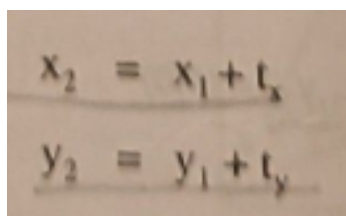
3) ROTATION ANTICLOCKWISE



A handwritten equation for an anticlockwise rotation matrix R. The matrix is a 2x2 determinant with elements $\cos \theta$, $\sin \theta$, $-\sin \theta$, and $\cos \theta$.

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

4) TRANSLATION



Two handwritten equations for translation. The first equation is $x_2 = x_1 + t_x$ and the second equation is $y_2 = y_1 + t_y$.

$$x_2 = x_1 + t_x$$
$$y_2 = y_1 + t_y$$

HOMOGENOUS COORDINATES SYSTEM

1) SCALING

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

2) ROTATION ANTICLOCKWISE

$$R = \begin{vmatrix} \cos \theta & \sin \theta & 0 \\ -\sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

3) TRANSLATION

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

REFLECTION AT Y-AXIS

$$T = \begin{vmatrix} -1 & 0 \\ 0 & 1 \end{vmatrix}$$

REFLECTION AT X-AXIS

$$T = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}$$

REFLECTION IN THE ORIGIN

$$T = \begin{vmatrix} -1 & 0 \\ 0 & -1 \end{vmatrix}$$

REFLECTION IN Y=X

$$T = \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix}$$

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

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

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

3D ROTATION ABOUT X-AXIS

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

3D ROTATION ABOUT Y-AXIS

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

