Tutorial 1

Transformations

1. Prove that the given transformation matrix, T is equivalent to a rotation matrix.

$$[T] = \begin{bmatrix} \dfrac{1-t^2}{1+t^2} & \dfrac{2t}{1+t^2} \\ \dfrac{-2t}{1+t^2} & \dfrac{1-t^2}{1+t^2} \end{bmatrix}$$

2. Matrix, X is transformed by a 2×2 matrix, T. The resulting matrix is x':

$$[X] = \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 1 \\ 0 & 1 \end{bmatrix} \quad [x'] = \begin{bmatrix} 0 & 0 \\ 2 & 3 \\ 8 & 4 \\ 6 & 1 \end{bmatrix}$$

   Determine the transformation matrix used. What is X called?

3. Is it true that a shear along x axis followed by a shear along y axis is not the same as shear in x and y axis together? Prove. [Hint: In a 2x2 matrix, the elements at [0,1] and [1,0] determines shearing along x and y respectively].

4. Given three unique vertices (2 2), (4 2) and (4 4). Find [x'] after performing 90-degree rotation about the origin followed by a reflection through the line y = -x. Comment on the sequence of transformations.

5. A triangle with vertices (1,0), (0,1) and (-1,0) is transformed by, T,

$$[T] = \begin{bmatrix} 3 & 2 \\ -1 & 2 \end{bmatrix}$$

   What happens to the area of triangle after the transformation?