

Homework 2 - Transformations

1. Using the labels **Translate**, **Rotation**, **Scale**, or **Reflect**, label the transformation of point **p** when multiplied by matrix **M** ($p' = Mp$):

(a)

$$M = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$$

(b)

$$M = \begin{bmatrix} \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \\ -\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{bmatrix}$$

(c)

$$M = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 4 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(d)

$$M = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$$

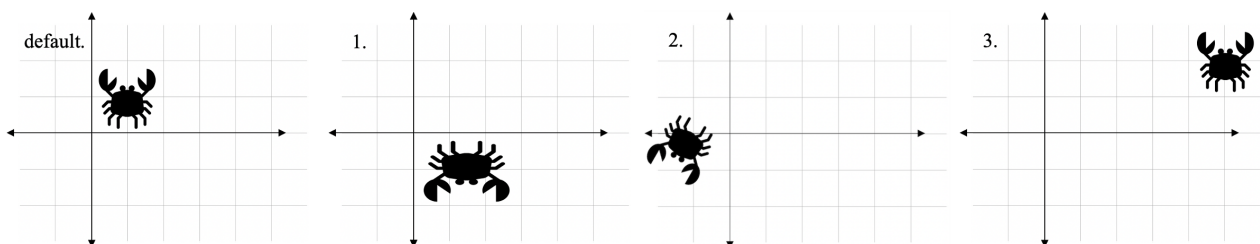
(e)

$$M = \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$$

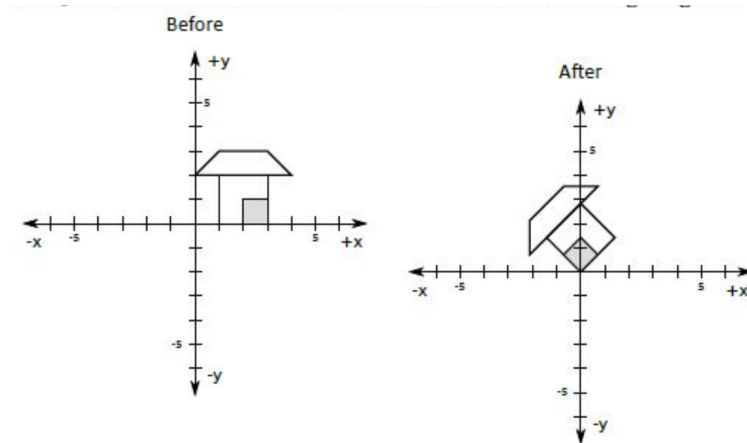
2. Find the matrix for a 120° rotation about the axis defined by the vector $r = (1,1,0)$.

3. Match the following 2D homogeneous matrices to the transformations in the image:

a. $\begin{bmatrix} -\frac{\sqrt{3}}{2} & -\frac{\sqrt{1}}{2} & 0 \\ \frac{\sqrt{1}}{2} & -\frac{\sqrt{3}}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$ b. $\begin{bmatrix} 1.5 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ c. $\begin{bmatrix} 1 & 0 & 4 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

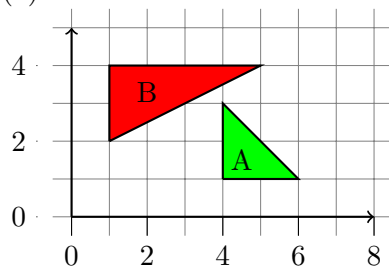


4. Describe a sequence of Translate(x,y), Rotate(degrees), and/or Scale (by a value of) that when multiplied describe the below transformation to go from the 'Before' to 'After'.



5. (a) Describe (using a sequence of (3 x 3) matrix multiplications) the transformations needed to transform the triangle from A to B in the figure below:

(a)



$$\begin{bmatrix} x' \\ y' \\ w' \end{bmatrix} = \begin{bmatrix} & & \\ & & \\ & & \end{bmatrix} * \begin{bmatrix} & & \\ & & \\ & & \end{bmatrix} * \begin{bmatrix} x \\ y \\ w \end{bmatrix}$$

- (b) Using the transformations found in part (a), multiply the following points with the matrix.

$$P_1.(4, 1)P_2.(4, 3)$$