Homework 7

Thursday, April 1, 2021 11:07 AM

1. $A = \begin{bmatrix} 1 & 0 & 0 & 6 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ Translation

$B = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ $\theta = 270^\circ$ rotation about the x-axis

$C = \begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ rotation about the z-axis

$D = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ Uniform scaling

$E = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ differential (non-uniform) scaling

$F = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ Shearing along z with respect to the xy plane

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

$H = \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ rotation about the y-axis with non-uniform scaling

$I = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 0.6 & 0.8 & 0 \\ 0 & -0.8 & 0.6 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ rotation about the x-axis and translation

2. $(-6, 8)$ rotated 90° clockwise from the origin

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos 90 & -\sin 90 \\ \sin 90 & \cos 90 \end{bmatrix} \begin{bmatrix} -6 \\ 8 \end{bmatrix}$$

$x' = -6\cos 90 - 8\sin 90$

$y' = -6\sin 90 + 8\cos 90$

$x' = 0 - 8(1)$

$y' = -6$

$\boxed{x' = -8 \quad y' = -6}$

3. $(7, 4)$ 2 units left and 4 units up

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & -2 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 7 \\ 4 \\ 1 \end{bmatrix} = \begin{matrix} x' = 7(1) + 4(0) + 1(-2) = 5 \\ y' = 7(0) + 4(1) + 1(4) = 8 \end{matrix}$$

4. $(0, 6)$ 6 units down and 3 units right

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & -6 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 6 \\ 1 \end{bmatrix} = \begin{matrix} x' = 0(1) + 6(0) + 1(3) = 3 \\ y' = 0(0) + 6(1) - 6(1) = 0 \end{matrix}$$

5. $(-8, -2)$ 180° around the origin

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos 180 & -\sin 180 \\ \sin 180 & \cos 180 \end{bmatrix} \begin{bmatrix} -8 \\ -2 \end{bmatrix} = \begin{bmatrix} -8\cos 180 + 2\sin 180 \\ -8\sin 180 - 2\cos 180 \end{bmatrix} = \begin{bmatrix} 8 \\ 2 \end{bmatrix}$$