

Assignment 3. Homogeneous coordinates

NO:

Date:

$$A = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} \quad B = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \quad C = \begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix}$$

$$M_1 = \begin{pmatrix} 1 & 0 & 0 & -2 \\ 0 & 1 & 0 & -3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$M_2 = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ & 0 & 0 \\ \sin 90^\circ & \cos 90^\circ & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A \cdot M_1 = \begin{pmatrix} 1-2 \\ 1-3 \\ 0-0 \\ 1 \end{pmatrix} = \begin{pmatrix} -1 \\ -2 \\ 0 \\ 1 \end{pmatrix}$$

$$A \cdot M_2 = \begin{pmatrix} 1 \cdot 0 - 1(-1) \\ 1 \cdot 1 + 1 \cdot 0 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 0 \\ 1 \end{pmatrix}$$

$$B \cdot M_1 = \begin{pmatrix} 3-2 \\ 1-3 \\ 0-0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \\ 0 \\ 1 \end{pmatrix}$$

$$B \cdot M_2 = \begin{pmatrix} 3 \cdot 0 - 1(-1) \\ 3 \cdot 1 + 1 \cdot 0 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 3 \\ 0 \\ 1 \end{pmatrix}$$

$$C \cdot M_1 = \begin{pmatrix} 2-2 \\ 3-3 \\ 0-0 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

$$C \cdot M_2 = \begin{pmatrix} 2 \cdot 0 - 3(-1) \\ 2 \cdot 1 + 3 \cdot 0 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 0 \\ 1 \end{pmatrix}$$

$$M_3 = (M_1)(M_2)(N) \quad N = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$(M_1)(M_2) = \begin{pmatrix} 0 & -1 & 0 & -2 \\ 1 & 0 & 0 & -3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \cdot N = \begin{pmatrix} 0 & -1 & 0 & -5 \\ 1 & 0 & 0 & -3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & -2 \\ 0 & 1 & 0 & -3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Same results as M_1

$$A \cdot M_3 = \begin{pmatrix} -1 \\ -2 \\ 0 \\ 1 \end{pmatrix} \quad B \cdot M_3 = \begin{pmatrix} 1 \\ -2 \\ 0 \\ 1 \end{pmatrix} \quad C \cdot M_3 = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

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$$M_4 = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos 90 & \sin 90 & 0 \\ 0 & -\sin 90 & \cos 90 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & +1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A \cdot M_4 = \begin{pmatrix} 1 \cdot 1 + 0 \\ 0 + 0 \\ 0 + 0 \\ 1 \cdot 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

$$B \cdot M_4 = \begin{pmatrix} 3 \cdot 1 + 0 \\ 0 + 0 \\ 0 + 1 \cdot 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 0 \\ 1 \\ 1 \end{pmatrix}$$

$$C \cdot M_4 = \begin{pmatrix} 2 \cdot 1 + 0 \\ 0 + 0 \\ 0 + 3 \cdot 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ 0 \\ 3 \\ 1 \end{pmatrix}$$

$$M_5 = \begin{pmatrix} \cos 90 & 0 & -\sin 90 & 0 \\ 0 & 1 & 0 & 0 \\ \sin 90 & 0 & \cos 90 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 & 0 & +1 & 0 \\ 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A \cdot M_5 = \begin{pmatrix} 0 + 0 + 0 \\ 0 + 1 \cdot 1 \\ 1(-1) + 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ -1 \\ 1 \end{pmatrix}$$

$$B \cdot M_5 = \begin{pmatrix} 0 + 0 \\ 0 + 1 \cdot 1 \\ 3(-1) + 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ -3 \\ 1 \end{pmatrix}$$

$$C \cdot M_5 = \begin{pmatrix} 0 + 0 \\ 0 + 3 \cdot 1 \\ 2(-1) + 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 3 \\ -2 \\ 1 \end{pmatrix}$$





