CS174A Discussion 1C

Week 1 Notes

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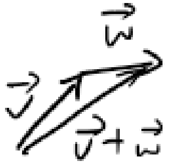
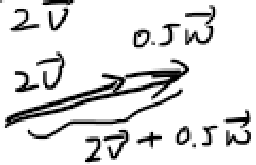
Homogeneous Representation:

- $\vec{v}+\vec{w}$



- $a\vec{v}$

- $a\vec{v}+b\vec{w}$



- $P+\vec{v}$

- $P-Q$

Matrix Transformation:

trans. $\begin{cases} x' = x + t_x \\ y' = y + t_y \\ z' = z + t_z \end{cases}$

$$\begin{bmatrix} S_x & 0 & 0 & t_x \\ 0 & S_y & 0 & t_y \\ 0 & 0 & S_z & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Scale:

$x' = S_x \cdot x$

$y' = S_y \cdot y$

$z' = S_z \cdot z$

$\overbrace{\underset{2}{M_s} \cdot \underset{1}{M_t}} \cdot P_0$

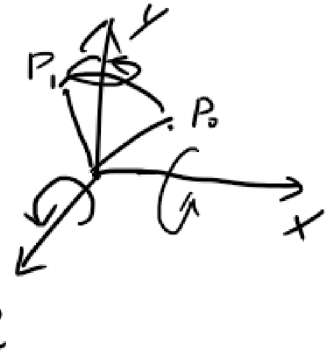
$M_t \cdot M_s \cdot P_0$

Rotation: θ : counter clockwise

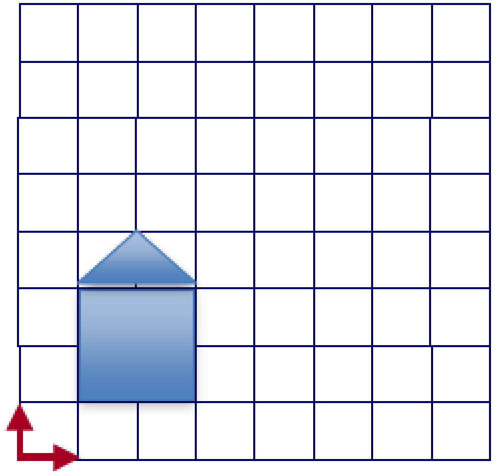
$x' = x\cos\theta - y\sin\theta$

$y' = x\sin\theta + y\cos\theta$

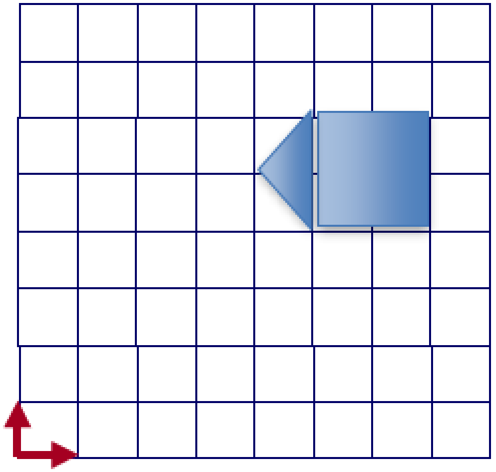
$z' = z$



Problem 2: Suppose we started with the following image



And we want to end up with the following image:



What transformations would we need to apply? Give matrix

3×3

$$M_{T_1} = \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\underline{\underline{M_{T_2} \cdot M_R \cdot M_{T_1} \cdot P_0}}$$

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

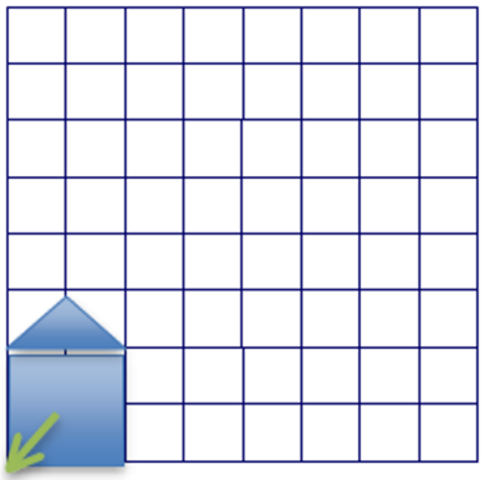
$$M_{T_2} = \begin{array}{c} \qquad\qquad\quad t_x \\ \begin{bmatrix} 1 & 0 & 7 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix} \end{array}$$

Model Transform:

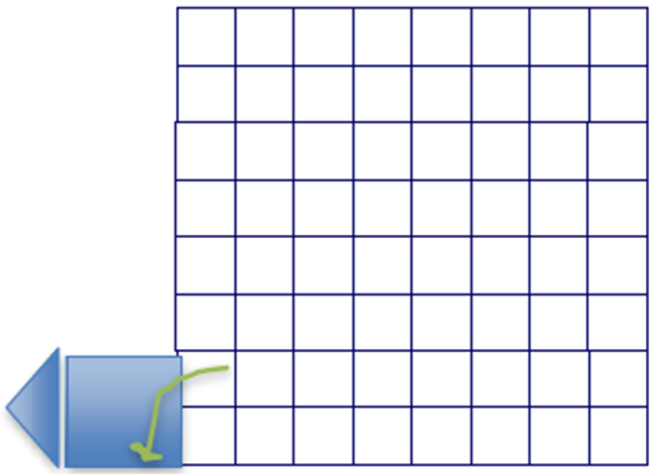
$$\mathbf{M} = \begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

new_house = **M** * house

Step 1 (Translation by (-1,-1) to Origin):



Step 2 (Rotation by 90):



Step 3 (Translation by (7,4) to new destination):