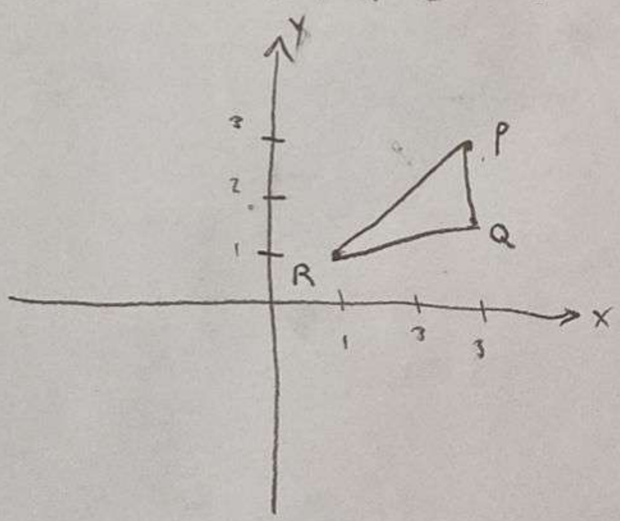
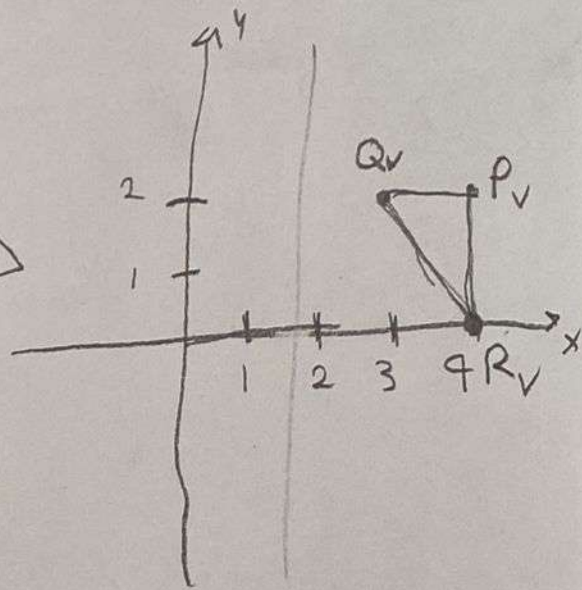
Alan Malagón 2021630433 Problem 3

$R = [1 \ 1]$, $P = [3 \ 3]$, $Q = [3 \ 2]$



$\Rightarrow$



$P = Q = (3,2)$

Cambiar punto de pivote al origen

$R' = (1-3,\ 1-2) = (-2,-1)$

$P' = (3-3,\ 3-2) = (0,1)$

$Q' = (3-3,\ 2-2) = (0,0)$

Rotation Matrix ↺ counter clockwise

$$R_V = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} x\cos\theta - y\sin\theta \\ x\sin\theta + y\cos\theta \end{bmatrix}$$

$\cos 90 = 0 \qquad \sin 90 = 1$

$$R_V = \begin{bmatrix} 3 + (-2)(0) - (-1)(1) \\ 2 + (-2)(1) + (-1)(0) \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$$

$$P_V = \begin{bmatrix} 3 + (0)(0) - (1)(1) \\ 2 + (0)(1) + (1)(0) \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$$

$$Q_V = \begin{bmatrix} 3 + (0)(0) - (0)(1) \\ 2 + (0)(1) + (0)(0) \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

Alan Malagón Baeza 2021630433 Problem 4

$A = [-1 \ -1 \ 0] \quad B = [2 \ 1 \ 0] \quad C = [2 \ 0 \ 0]$

1 $-A[-1 \ 1 \ 0]$

$$T = \begin{pmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad T^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

inverse

Translation matrix

$$\cos w = \frac{(0,0,c)\cdot(0,b,c)}{cd} = \frac{c}{d}$$

$$\sin(w) = \frac{\|(0,0,c)\times(0,b,c)\|}{cd} = \frac{b}{d}$$

Δ

$$\cos t = \frac{\hat{u}''\cdot\hat{k}}{|\hat{u}''||\hat{k}|} = \frac{d}{1} = d$$

$$\sin t = \frac{|\hat{u}''\times\hat{k}|}{|\hat{u}''||\hat{k}|} = \frac{a}{1} = a$$

2

$$U = \frac{B-A}{|B-A|} = \frac{(2-1,\ 1-(-1),\ 0-0)}{(1,\ 2,\ 0)} = \frac{(1,2,0)}{\sqrt{1+4}} = \left(\frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}}, 0\right)$$

B-A

a b c

Rotation matrix

$$R_x = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos(w) & -\sin(w) & 0 \\ 0 & \sin(w) & \cos(w) & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad R_x^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos(w) & \sin(w) & 0 \\ 0 & -\sin(w) & \cos(w) & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Δ

3

$$R_y = \begin{pmatrix} \cos(t) & 0 & -\sin(t) & 0 \\ 0 & 1 & 0 & 0 \\ \sin(t) & 0 & \cos(t) & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad R_y^{-1} = \begin{pmatrix} \cos(t) & 0 & \sin(t) & 0 \\ 0 & 1 & 0 & 0 \\ -\sin(t) & 0 & \cos(t) & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

4

$$R_z = \begin{pmatrix} \cos(180) & \sin(180) & 0 & 0 \\ -\sin(180) & \cos(180) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

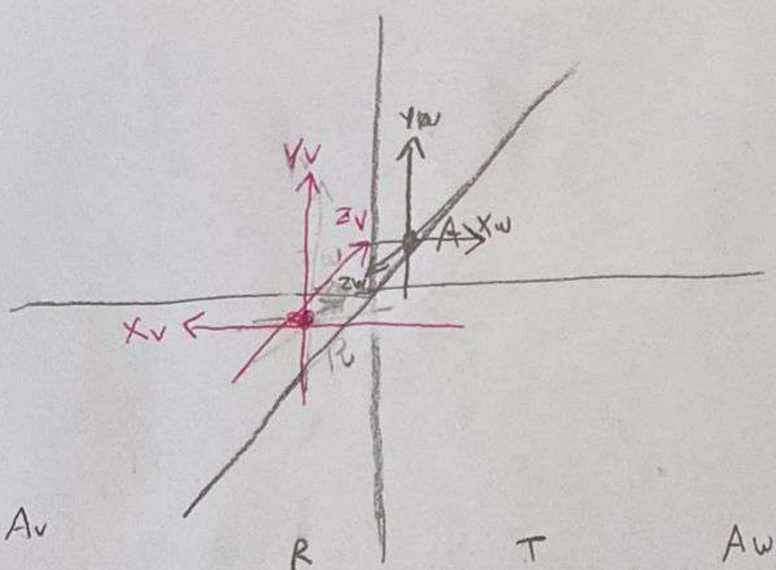
$$\begin{pmatrix} x' \\ y' \\ z' \\ 1 \end{pmatrix} = T^{-1} R_x^{-1} R_y^{-1} R_z R_y R_x T \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$

C

C'

2021630433 Problem 5

3. $A_w = [1\ 1\ 1]$, $P_v = [-1\ -1\ -1]$



$i_v = (-1, 0, 0)$
$j_v = (0, 1, 0)$
$k_v = (0, 0, -1)$

$$\underset{A_v}{\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}} = \underset{R}{\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}} \underset{T}{\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}} \underset{A_w}{\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}}$$

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

$$= \begin{bmatrix} -2 \\ 2 \\ -2 \\ 1 \end{bmatrix}$$

$A_v = (-2, 2, 2)$

$A_p = [1-(-1), 1-(-1), 1-(-1)]$

$[2, 2, 2]$

Alan Malagón

Alan Malagón 202163043 3

Problem 8

AGB → CMY

$W = [1 \quad 0.5 \quad 0.25]$

$(R, G, B) = (1, 1, 1) - (C, M, Y)$

$(1, 0.5, 0.25) - (1, 1, 1) = -(C, M, Y)$

$(0, -0.5, -0.75) = -(C, M, Y)$

$(0, 0.5, 0.75) = (C, M, Y)$

Problem 9

CMY ⟶ RGB

$W = [0.5 \quad 0.25 \quad 0.75)$

$(R, G, B) = (1, 1, 1) - (0.5, 0.25, 0.75)$

$(R, G, B) = (0.5, 0.75, 0.25)$