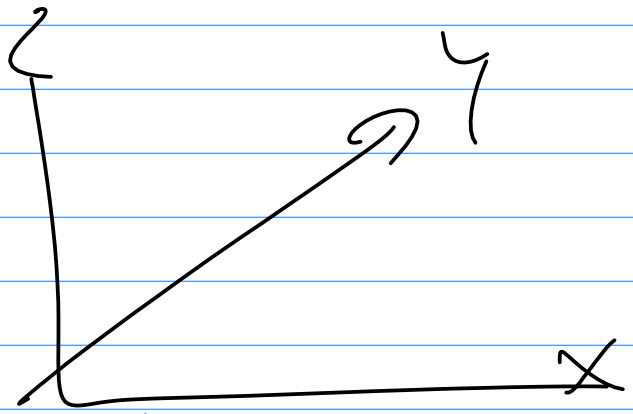
3D ROTATION

9/25/17 Q1

EULER ANGLES



3 2-D ROTS 1ST ABOUT X AXIS

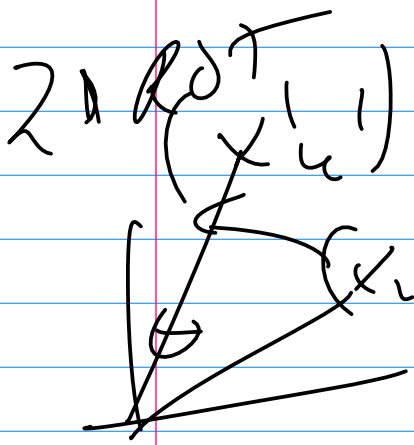
2

3

Y

Z

2D ROT



$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos\theta & \sin\theta \\ \sin\theta & \cos\theta \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

⇒ 3D ABOUT Z AXIS

$$\begin{pmatrix} x' \\ y' \\ z' \end{pmatrix} = \begin{pmatrix} \cos\theta & \sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

About X axis

$$\begin{pmatrix} x' \\ y' \\ z' \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & +\sin\theta & \cos\theta \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

About Y axis

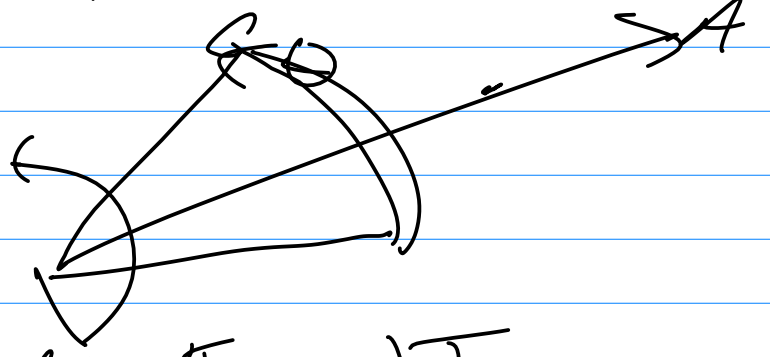
$$\begin{pmatrix} x' \\ y' \\ z' \end{pmatrix} = \begin{pmatrix} \cos\theta & 0 & +\sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

SPEC ROTATION AS

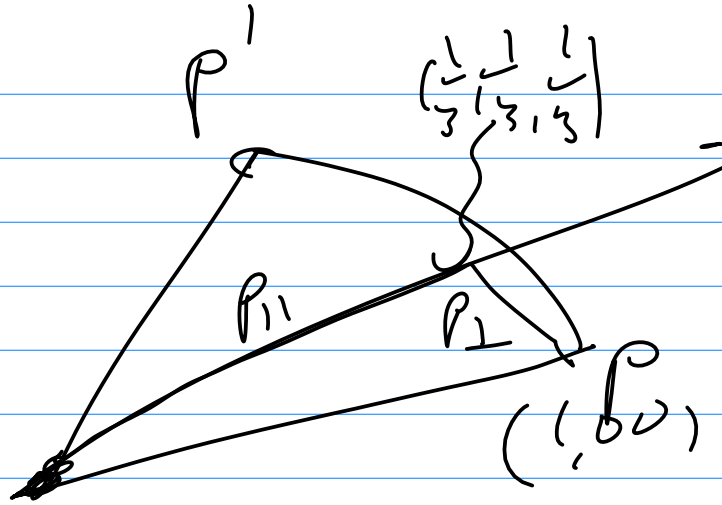
AXIS

+

ANGLE ABOUT IT.



3



$A = (1,1,1)$

$|A| = \sqrt{3}$

$\hat{A} = \left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

$P = (1,0,0)$

$A \cdot P = \frac{1}{\sqrt{3}}$

$P = P_{11} + P_\perp$

$P_{11} = A \cdot P\, A$

$\beta_1 = A \cdot PA \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$

$P_\perp = P - P_{11}$

$= \left(\frac{2}{3}, -\frac{1}{3}, -\frac{1}{3}\right)$