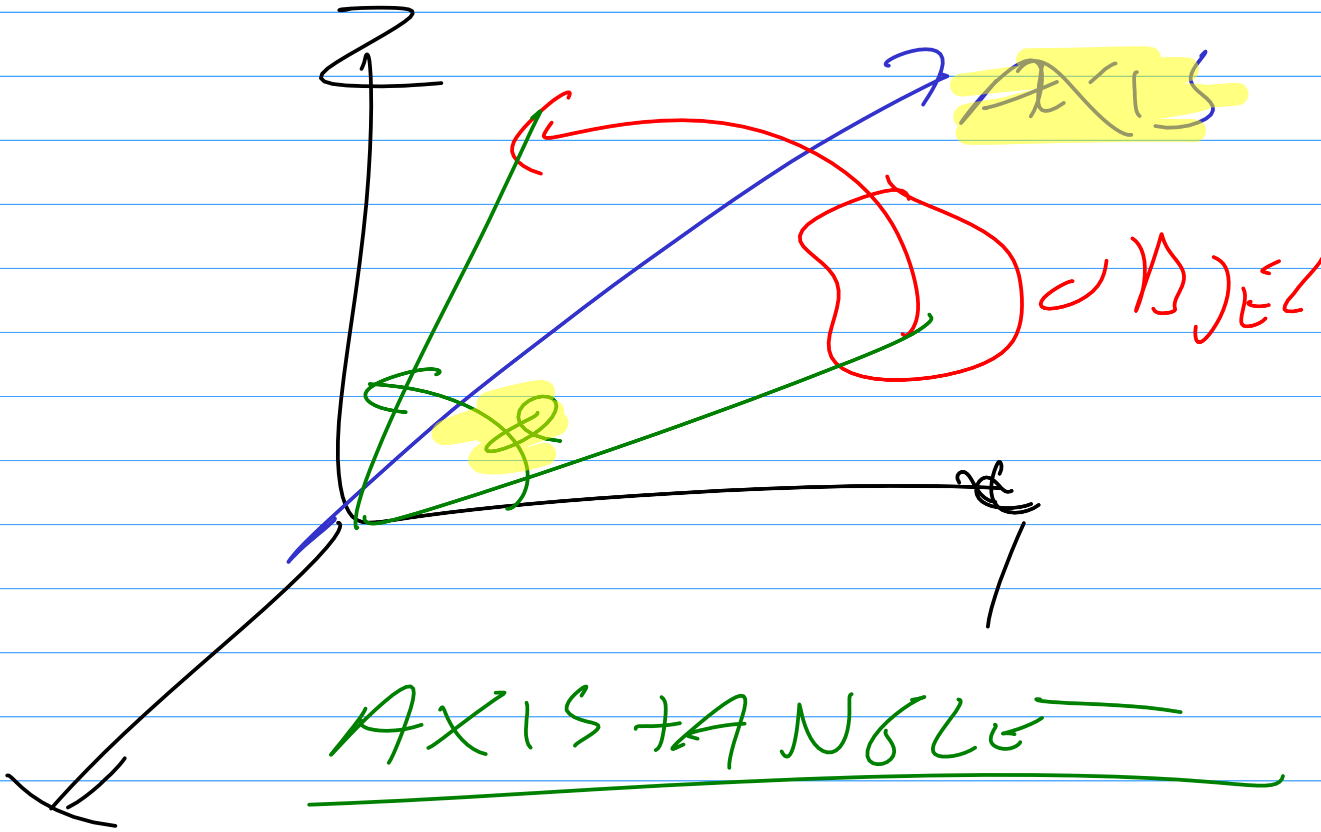
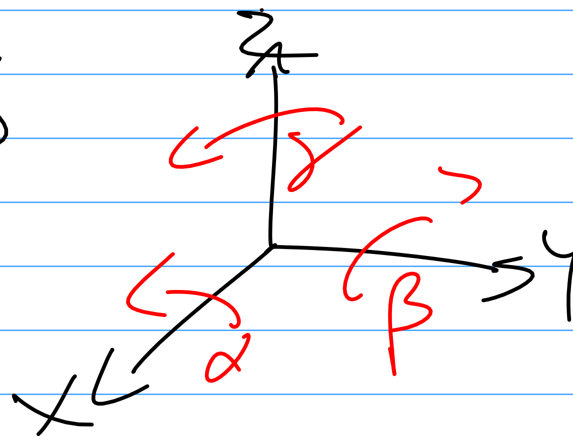
9/17/14 – 1



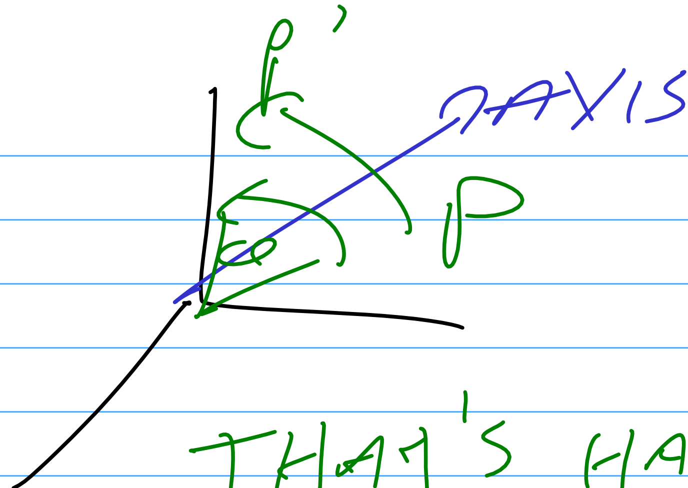
AXIS + ANGLE

EULER ANGLES



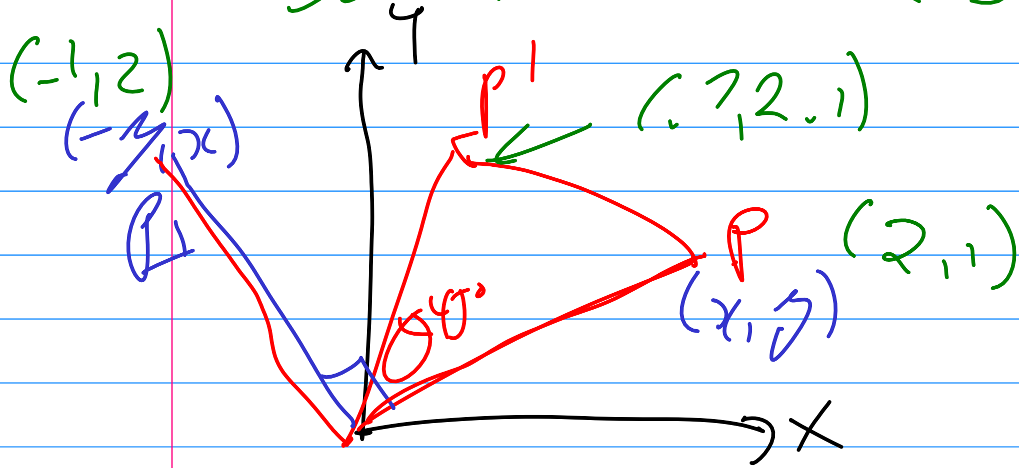
OPENGL WANTS A MATRIX

$$p' = M p$$



THAT'S HARD

DO IT IN 2D FIRST



CREATE $P_\perp$: IT'S PERPENDICULAR TO P

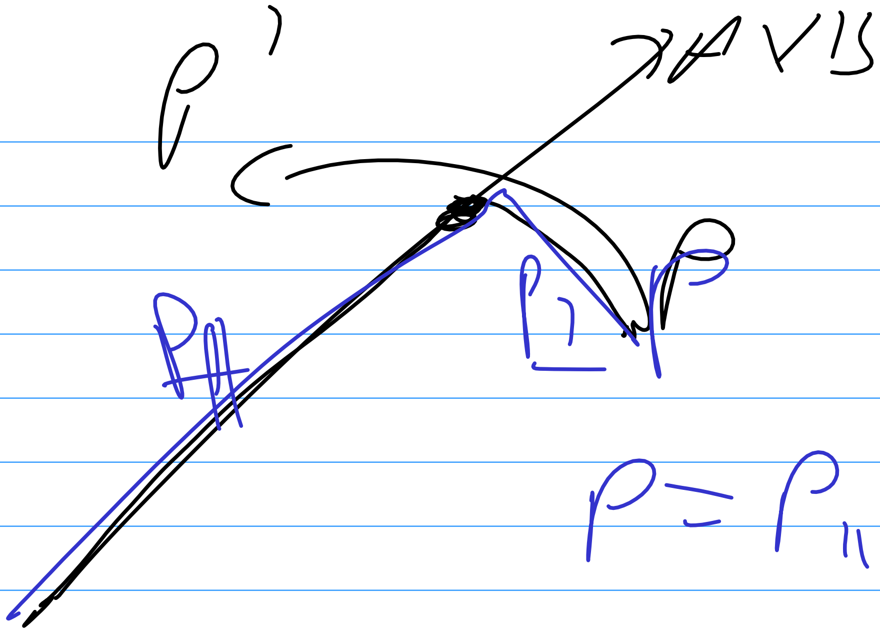
$$P' = P\cos\theta + P_\perp \sin\theta$$

45° $P' = (2,1) \times .7 + (-1,2)\,.7$

$= (.7, 2.1)$

MATRIX $P' = \begin{pmatrix} \cos\theta & -\sin\theta \\ +\sin\theta & \cos\theta \end{pmatrix} P$ ✓

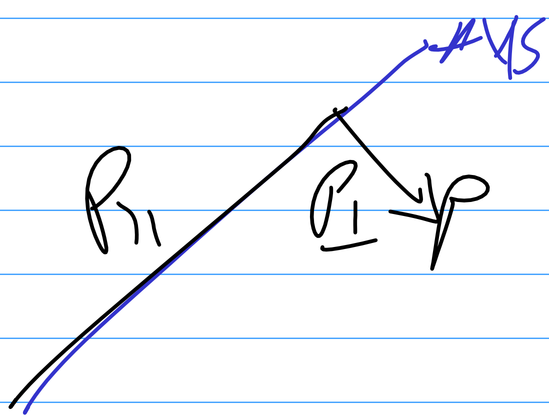
$$\begin{pmatrix} .7 \\ 2.1 \end{pmatrix} = \begin{pmatrix} .7 & -.7 \\ .7 & .7 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \end{pmatrix}$$



$$p = p_\parallel + p_\perp$$

IF p IS ON AXIS $p' = p$

IF p IS $\perp$ AXIS, IT'S A 2D PROBLEM IN PLANE $\perp$ AXIS

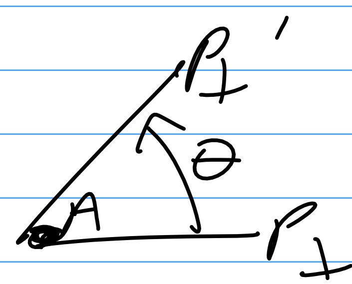


$|A| = 1$

$$p_\parallel = A \cdot p \; p$$

$$p_\perp = p - p_\parallel$$

$$p_\parallel{}' = p_\parallel$$



$$p_\perp{}' = p_\perp \cos\theta + a \times p \sin\theta$$

$P_{\parallel}' = A \cdot P A$

$P_{\perp}' = P_{\perp} \cos\theta + A \times P_{\perp} \sin\theta$

$(P - A \cdot P \cancel{A})$ $\quad$ $A \times P$

$P' = A \cdot PA + (P - A \cdot PA)\cos\theta + A \times P \sin\theta$

I WANT A MATRIX M

M IS COMPUTED FROM A, θ

$P' = MP$

$$\vec{P}\cos\theta = \begin{pmatrix} \cos\theta & 0 & 0 \\ 0 & \cos\theta & 0 \\ 0 & 0 & \cos\theta \end{pmatrix} \begin{pmatrix} P_1 \\ P_2 \\ P_3 \end{pmatrix}$$

CAN I MAKE $2P$ INTO A MATRIX

MULTI $\begin{pmatrix} 2 & 2 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{pmatrix} P$

$$P\cos\theta = \left(\cos\theta\, I\right) P$$

$\underline{A \cdot P A}$ IF $A = \begin{pmatrix}1\\2\\3\end{pmatrix}$

$$A \cdot P A = \begin{pmatrix}1 & 2 & 3\\ 2 & 4 & 6\\ 3 & 6 & 9\end{pmatrix} P$$

IF M IS ROTATION

$$|Mp| = |p|$$

TRUE IF $p = \begin{pmatrix}1\\0\end{pmatrix}$ OR $\begin{pmatrix}0\\1\end{pmatrix}$ ETC.

$$\left| M \begin{pmatrix}1\\0\end{pmatrix} \right| = 1$$

$$\begin{pmatrix} M_{11} & M_{12} & M_{13} \\ M_{21} & M_{22} & M_{23} \\ M_{31} & M_{32} & M_{33} \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} M_{11} \\ M_{21} \\ M_{31} \end{pmatrix} = C_1$$

$|C_1| = 1$

$|C_2| = 1$

$|C_3| = 1$

BEFORE $\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} \perp \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$

AFTER $C_1 \perp C_2$

$$C_i \cdot C_j = \delta_{ij} = \begin{cases} 1 & \text{IF } i = j \\ 0 & \text{IF } i \neq j \end{cases}$$