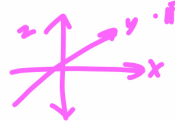


3D Transformations "Notation"

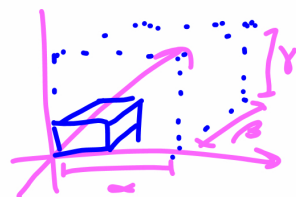
$P = \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} x \\ y \\ -w/x \end{pmatrix}$



1) Translation

$P' = \begin{pmatrix} x' \\ y' \\ z' \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$

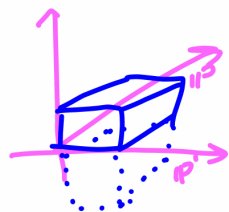
2) (Non-Uniform) Scaling



only the matrix
scale (α, β, γ) :

$$\begin{pmatrix} \alpha & 0 & 0 & 0 \\ 0 & \beta & 0 & 0 \\ 0 & 0 & \gamma & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

1) Rotate w.r.t. X-Y plane:



Rot $(x, y) =$

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Rot $(x, z) = \dots$

$$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

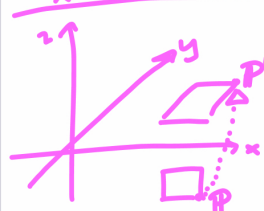
Rot $(y, z) = \dots$

$$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

Rotation...

→ using 3 coord. system axis

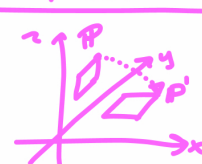
x-axis



Rot $x(\alpha) =$

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

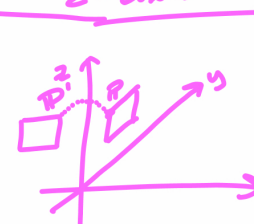
y-axis



Rot $y(\beta) =$

$$\begin{pmatrix} c\beta & 0 & s\beta & 0 \\ 0 & 1 & 0 & 0 \\ -s\beta & 0 & c\beta & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

z-axis



Rot $z(\delta) =$

$$\begin{pmatrix} c\delta & -s\delta & 0 & 0 \\ s\delta & c\delta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

