9/29/11

INTERESTING TRANSFORMS ARE MATRICES (4x4)

1. POINT $\begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$

2D ROT

ROTATE BY θ ABOUT Z AXIS $\begin{pmatrix} C & -S & 0 & 0 \\ S & C & 0 & 0 \\ 0 & 0 & C & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

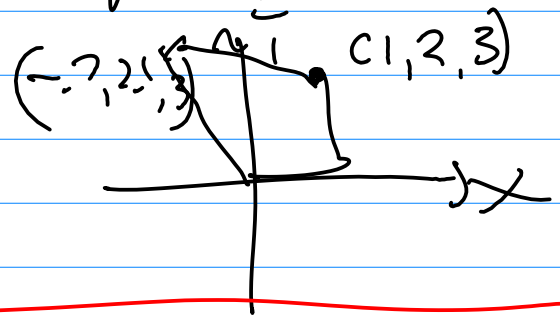
MAGIC — 2 INVAR

$\theta = 45°$

$\cos\theta = .7 = \sin\theta$

$M = \begin{pmatrix} .7 & -.7 & 0 & 0 \\ .7 & .7 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ $\begin{pmatrix} 1 \\ 2 \\ 3 \\ 1 \end{pmatrix} \rightarrow \begin{pmatrix} -.7 \\ 2.1 \\ 3 \\ 1 \end{pmatrix}$

TRY IT $P = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 1 \end{pmatrix} \rightarrow \begin{pmatrix} -.7 \\ 2.1 \\ 3 \\ 1 \end{pmatrix}$ $P' = MP$



TRANSLATION IS ALSO A MATRIX MULTIPLICATION

TO TRANSLATE BY D_x, D_y, D_z

MULT BY

$$\begin{pmatrix} 1 & 0 & 0 & D_x \\ 0 & 1 & 0 & D_y \\ 0 & 0 & 1 & D_z \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

EX

$$\begin{pmatrix} 4 \\ 5 \\ -1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 3 \\ 4 \\ -2 \\ 1 \end{pmatrix}$$

WHY IS THIS GOOD?

IF EVERYTHING IS A MATRIX MULTIPLY, THEN WE CAN COMBINE TRANSFORMATIONS BY MULTIPLYING THE MATRICES FIRST, THEN APPLYING TO OBJECT.

E.G. WE WANT TO

1st 1 TRANSLATE $(1,2,3)$ M_1

2 ROTATE BY $90°$ ABOUT (00) M_2

3 TRANS BY $(4,5,6)$ M_3

LAST 4. ROT BY $60°$ ABOUT (010) M_4

$M = M_4 M_3 M_2 M_1$

APPLY M TO POINTS

$P' = MP$