

Matrix Multiplication

$A \times B$

$$A \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 3 & 0 \\ 6 & 1 \end{bmatrix}$$

Calculation details:
 $1 \cdot 3 + 0 \cdot 0 = 3$
 $1 \cdot 0 + 0 \cdot 1 = 0$
 $2 \cdot 3 + 1 \cdot 0 = 6$
 $2 \cdot 0 + 1 \cdot 1 = 1$

GLSL: vec4 (vector with 4 values) - homogeneous coordinates

$$\begin{bmatrix} 2 & 1 & 0 & 1 \\ x & y & z & w \end{bmatrix}$$

↑
weight

1 means this vec4 is a 3D point
 0 means this vec4 is a vector

adding matrices is easy

$$\begin{bmatrix} 2 & 1 & 0 & 1 \end{bmatrix} + \begin{bmatrix} .2 & .2 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 2.2 & 1.2 & 0 & 1 \end{bmatrix}$$

"Identity Matrix"

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

$$\begin{bmatrix} 2 & 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & 1 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 3 & 4 & 1.5 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 5 & 5 & 1.5 & 1 \end{bmatrix}$$

effectively translates the 3D point!

Rotation

$$\begin{bmatrix} \cos \theta & \sin \theta & 0 & 0 \\ -\sin \theta & \cos \theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} \dots \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

rotated x
 rotated y
 unchanged z

This pivots around the z axis!

Equivalent function call is
 matrix.rotate($\theta, 0, 0, 1$)

$x \ y \ z \}$ where to pivot

$$\begin{bmatrix} \cos \theta & 0 & \sin \theta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin \theta & 0 & \cos \theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} \dots \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

y is unchanged
 (rotated around y axis)

matrix.rotate($\theta, 0, 1, 0$)

Scale

$$\begin{bmatrix} x & 0 & 0 & 0 \\ 0 & y & 0 & 0 \\ 0 & 0 & z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$