$$S\begin{bmatrix}x_1\\x_2\end{bmatrix}=\begin{bmatrix}x_1\\x_2\\x_1x_2\end{bmatrix},\quad T\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}=\begin{bmatrix}x_1+x_2\\x_2+x_3\end{bmatrix}=\begin{bmatrix}1x_1+1x_2+0x_3\\0x_1+1x_2+1x_3\end{bmatrix}$$

Define $S:\mathbb{R}^2\to\mathbb{R}^3$ $T:\mathbb{R}^3\to\mathbb{R}^2$

Find either (or both) of $S\circ T$ and $T\circ S$ that exist.

$$[T]=\left[\begin{array}{c|cc}1&1&0\\0&1&1\end{array}\right]$$

$$S \circ T \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = S\left(T\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}\right) = S\begin{bmatrix} x_1+x_2 \\ x_2+x_3 \end{bmatrix} = \begin{bmatrix} x_1+x_2 \\ x_2+x_3 \\ (x_1+x_2)(x_2+x_3) \end{bmatrix}$$

$$T \circ S \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = T\begin{bmatrix} x_1 \\ x_2 \\ x_1x_2 \end{bmatrix} = \begin{bmatrix} x_1+x_2 \\ x_2+x_1x_2 \end{bmatrix}$$

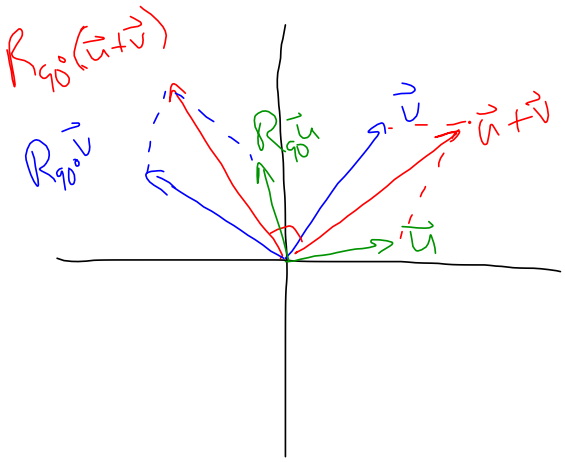
$$S \circ T \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} = S\left(T \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}\right) = S \begin{bmatrix} 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \\ 15 \end{bmatrix}$$

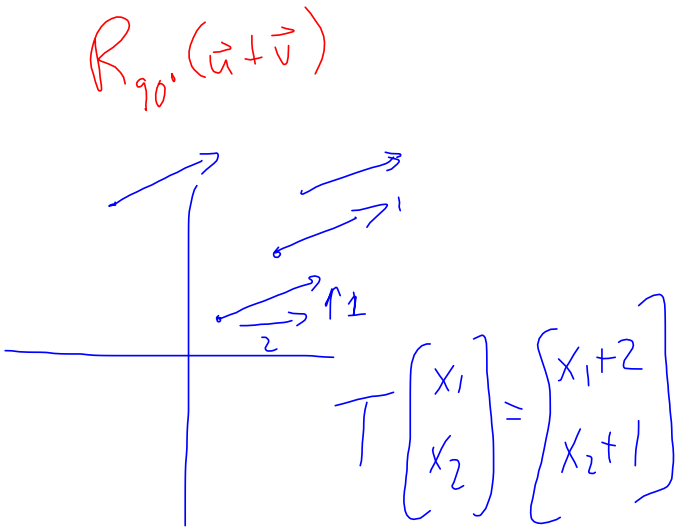
$$S \circ T \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \\ 15 \end{bmatrix}$$

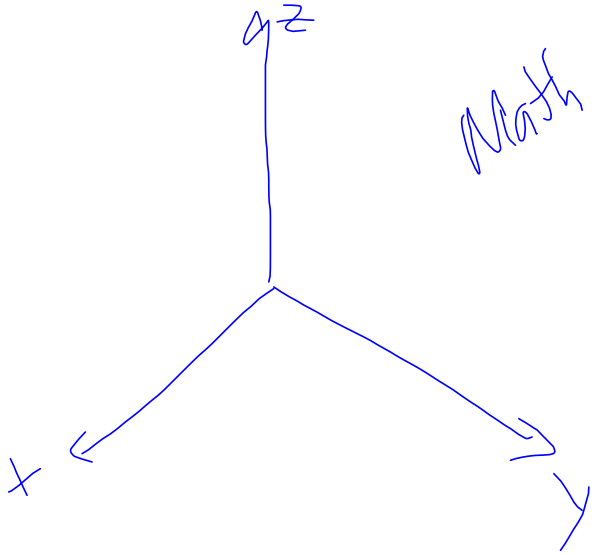
$$T(\vec{v}) = T(\vec{v} + \vec{0}) = T\vec{v} + T\vec{0}$$

linear

$T\vec{0} = \vec{0}$


$R_{90°}(\vec{u}+\vec{v})$
$R_{90°}\vec{v}$
$R_{90°}\vec{u}$
$\vec{v}$
$\vec{u}+\vec{v}$
$\vec{u}$


$R_{90°}(\vec{u}+\vec{v})$
1
2
$T\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} x_1+2 \\ x_2+1 \end{bmatrix}$



Math Affine transfomation

Homogeneous Coordinates