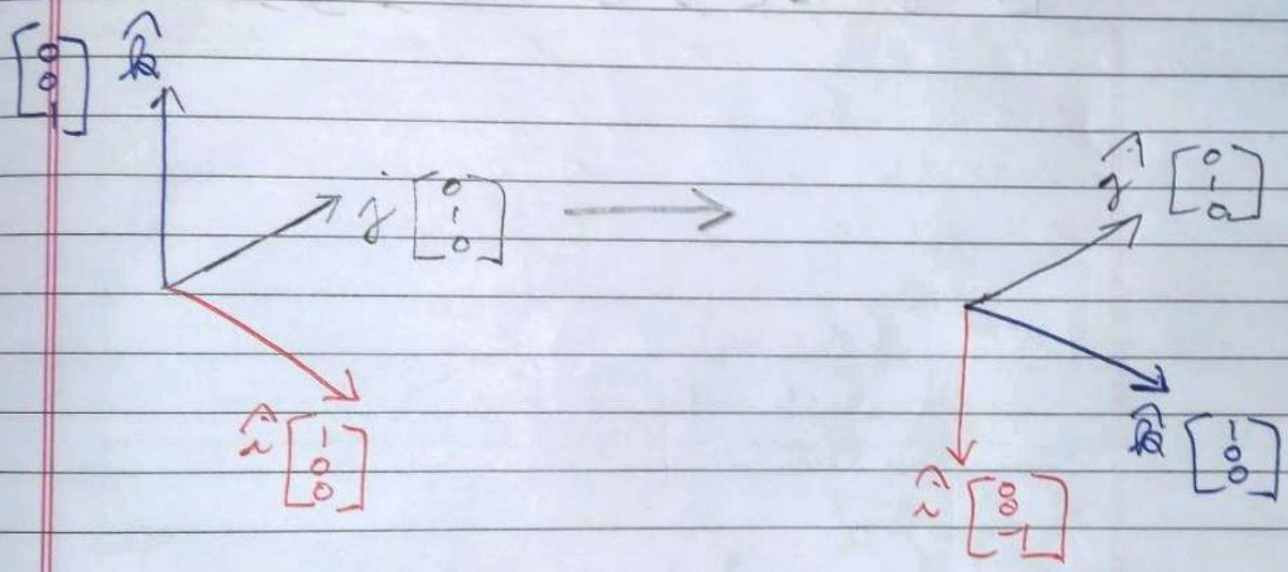
Lecture - 5

* 3-D linear transformations

Now there are 3 basis vectors to look out for $\hat{i}$, $\hat{j}$, $\hat{k}$.

Ex:
Transformation to rotate space 90° around y-axis (anti-clockwise)



$$\hat{i} \to \begin{bmatrix}0\\0\\-1\end{bmatrix}, \quad \hat{j} \to \begin{bmatrix}0\\1\\0\end{bmatrix}, \quad \hat{k} \to \begin{bmatrix}1\\0\\0\end{bmatrix}$$

Input Vector

$$\begin{bmatrix}0 & 1 & 2\\3 & 4 & 5\\6 & 7 & 8\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix} = x\begin{bmatrix}0\\3\\6\end{bmatrix} + y\begin{bmatrix}1\\4\\7\end{bmatrix} + z\begin{bmatrix}2\\5\\8\end{bmatrix}$$

Transformation

Output Vector

2nd transformation 1st transformation

$$\begin{bmatrix} 0 & -2 & 2 \\ 5 & 1 & 5 \\ 1 & 4 & -1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 2 \\ 3 & 4 & 5 \\ 6 & 7 & 8 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & -2 & 2 \\ 5 & 1 & 5 \\ 1 & 4 & -1 \end{bmatrix} \begin{bmatrix} 0 \\ 3 \\ 6 \end{bmatrix} + \begin{bmatrix} 0 & -2 & 2 \\ 5 & 1 & 5 \\ 1 & 4 & -1 \end{bmatrix} \begin{bmatrix} 1 \\ 4 \\ 7 \end{bmatrix} + \begin{bmatrix} 0 & -2 & 2 \\ 5 & 1 & 5 \\ 1 & 4 & -1 \end{bmatrix} \begin{bmatrix} 2 \\ 5 \\ 8 \end{bmatrix}$$