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3-D Linear Transformation

$$\begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix} \quad L(\vec{v}) \quad \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$$

Input output

Basis vectors here → $\hat{i}$, $\hat{j}$, $\hat{k}$

$\hat{i}$: x-dim, $\hat{j}$: y-dim, $\hat{k}$: z-dim.

$$\vec{v} = \begin{bmatrix} x \\ y \\ z \end{bmatrix} = x\hat{i} + y\hat{j} + z\hat{k}$$

Eg

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

→ second transformation

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

first transformation