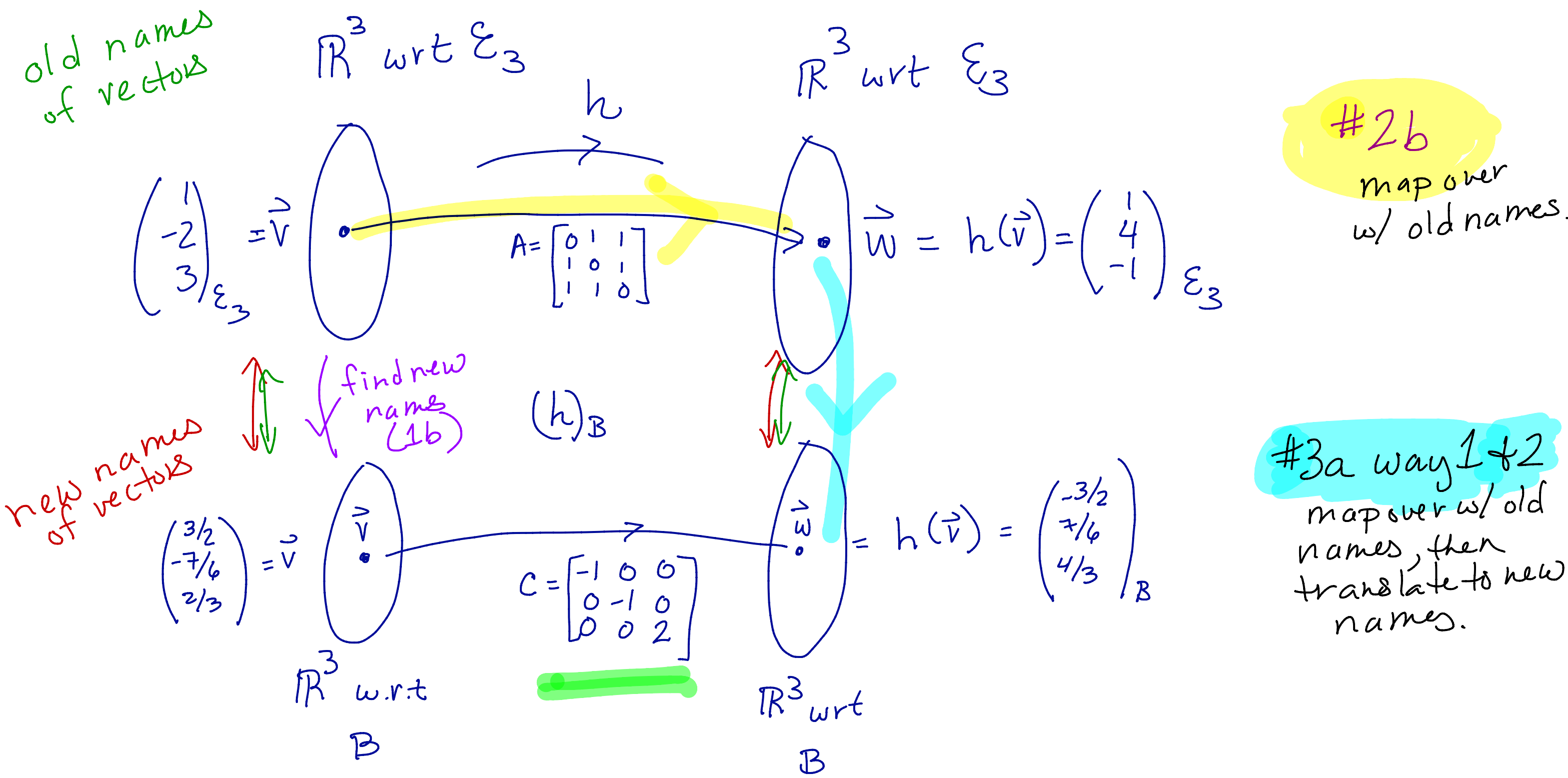
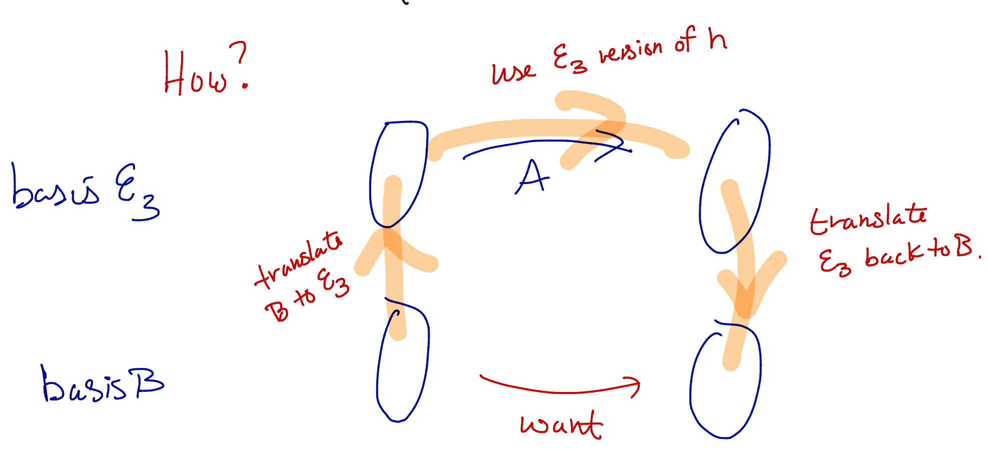
Example:

$$\mathcal{E}_3 = \left\langle \vec{e_1} = \begin{pmatrix}1\\0\\0\end{pmatrix}, \vec{e_2} = \begin{pmatrix}0\\1\\0\end{pmatrix}, \vec{e_3} = \begin{pmatrix}0\\0\\1\end{pmatrix} \right\rangle \qquad B = \left\langle \vec{b_1} = \begin{pmatrix}1\\-1\\0\end{pmatrix}, \vec{b_2} = \begin{pmatrix}1\\1\\-2\end{pmatrix}, \vec{b_3} = \begin{pmatrix}1\\1\\1\end{pmatrix} \right\rangle$$

$$h : \mathbb{R}^3 \to \mathbb{R}^3 \text{ defined by } \begin{pmatrix}x\\y\\z\end{pmatrix} \mapsto \begin{pmatrix}y+z\\x+z\\x+y\end{pmatrix} \text{ w.r.t } \mathcal{E}_3$$



But, if we committed to just using B (in both domain and codomain), the matrix representation is simple!



undo B to $\mathcal{E}_3$ = $\mathcal{E}_3$ to B = D^{-1} A B to $\mathcal{E}_3$ = D

$$C = \begin{bmatrix}\frac12 & -\frac12 & 0\\ \frac16 & \frac16 & -\frac13\\ \frac13 & \frac13 & \frac13\end{bmatrix} \begin{bmatrix}0 & 1 & 1\\ 1 & 0 & 1\\ 1 & 1 & 0\end{bmatrix} \begin{bmatrix}1 & 1 & 1\\ -1 & 1 & 1\\ 0 & -2 & 1\end{bmatrix}$$

$$D^{-1} \cdot A \cdot D$$