# SECTION 3.5.1 AND 3.5.2 CHANGE OF BASIS
## DO AN EXAMPLE ON YOUR OWN

**Example:**

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

$$h : \mathbb{R}^3 \to \mathbb{R}^3 \text{ has matrix representation } A = \begin{pmatrix}5 & -3 & -6\\3 & -1 & -6\\3 & -3 & -4\end{pmatrix} \text{ w.r.t } \mathcal{E}_3$$

1. Find $S = \text{Rep}_{B,\mathcal{E}_3}(id)$, the matrix that translates vectors in base $B$ to vectors in $\mathcal{E}_3$.

2. Find $T = \text{Rep}_{\mathcal{E}_3,B}(id)$, the matrix that translates vectors in base $\mathcal{E}_3$ to vectors in base $B$.

3. Find $C = \text{Rep}_{B,B}(h)$, the matrix representation of $h$ with respect to basis $B$.

4. Check that your answers are correct by mapping the vector $\vec{v} = \begin{pmatrix} 2 \\ -2 \\ 6 \end{pmatrix}_{\mathcal{E}_3}$ using matrix $A$ and using matrix $C$ and showing that those output vectors are the same.

5. Draw a "potato picture" of what the matrices $A, S, T$, and $C$ represent.