Linear Algebra 2

Homework 4 – Coordinates and Change of Basis

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Throughout this document, $E = (e_1, e_2, \ldots, e_n)$ shall denote the standard basis of $\mathbb{R}^n$ or $\mathbb{C}^n$, as appropriate according to the context in which it is used.

1. We are given the transformation $T : \mathbb{R}^2 \to \mathbb{R}^2$ such that $T(x, y) = (2x - y, x - 3y)$.

   (a) To find $[T]_E^E$, we simply construct a matrix whose column vectors are the transformation of each of the elements in the standard basis.

   $$\begin{bmatrix} \begin{pmatrix} \\ T(e_1) \\ \\ \end{pmatrix} & \begin{pmatrix} \\ T(e_2) \\ \\ \end{pmatrix} \end{bmatrix} = \begin{bmatrix} 2 & -1 \\ 1 & -3 \end{bmatrix}$$

   (b) To find $[T]_C^B$, where $B = ((1, 1), (2, 5))$ and $C = ((2, 2), (0, 1))$,