

Linear algebra, Exercise 6

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August 1, 2014

Exercise. Let V be a three-dimensional vector space with an ordered basis $\beta := (v_1, v_2, v_3)$. Let γ be the ordered basis $\gamma := ((1, 1, 0), (1, 0, 0), (0, 0, 1))$ of \mathbf{R}^3 . Let $T : V \rightarrow \mathbf{R}^3$ be a linear transformation whose matrix representation $[T]_{\beta}^{\gamma}$ is given by

$$[T]_{\beta}^{\gamma} = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}.$$

Compute $T(v_1 + 2v_2 + 3v_3)$.

Solve.

$$\begin{aligned} T(v_1 + 2v_2 + 3v_3) &= T(v_1) + 2T(v_2) + 3T(v_3) \\ &= (0, 0, 1) + 2(1, 0, 0) + 3(1, 1, 0) \\ &= (5, 3, 1). \end{aligned}$$

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