

SECTION 2.3  
EXERCISE #15

2.3.15 Consider  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$  defined as

$$T([x_1, x_2, x_3]) = [x_1 + x_2 + x_3, x_1 + x_2, x_1].$$

Find the standard matrix representation of  $T$ .

Solution

Well, to find the standard matrix representation  $A$  of linear transformation  $T$  we let the columns of  $A$  be  $T(\hat{i})$ ,  $T(\hat{j})$ ,  $T(\hat{k})$ :

$$T(\hat{i}) = T([1, 0, 0]) = [1, 1, 1]$$

$$T(\hat{j}) = T([0, 1, 0]) = [1, 1, 0]$$

$$T(\hat{k}) = T([0, 0, 1]) = [1, 0, 0].$$

Hence

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}.$$