

13. (4 points) Is

$$W = \left\{ \begin{bmatrix} x_1 \\ x_2 \\ 1 \end{bmatrix} \mid x_1 \text{ and } x_2 \text{ are real numbers} \right\}$$

a vector space? If so, explain why. If not, give an example to show that one of the rules of vector space fails to hold.

Not a vector space $\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \in W$ but $2 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \notin W$

14. (4 points) Is the function $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$, which is defined by

$$T \left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \right) = \begin{bmatrix} x_1 - x_2 + x_3 \\ -x_1 + 3x_2 - 2x_3 \end{bmatrix},$$

a linear transformation? If so, find a matrix A with $T(v) = Av$ for all $v \in \mathbb{R}^3$.
If not, give an example to show that one of the rules of linear transformation fails to hold.

is a linear transformation $Tv = Av$ for $A = \begin{bmatrix} 1 & -1 & 1 \\ -1 & 3 & -2 \end{bmatrix}$