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87

14. (10 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.

$$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \notin W$$

NO

15. (10 points) Is the function $F: \mathbb{R}^3 \rightarrow \mathbb{R}^2$, which is defined by

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

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

Yes

It is multiplication by

$$\begin{bmatrix} 1 & -1 & 1 \\ -1 & 3 & -2 \end{bmatrix}.$$

Matrix multiplication is always a linear transformation.