MATH 121A Prep: Subspaces

Facts to Know:

Definition: Let V be a *non-empty* subset of $\mathbb{R}^n$. V is called a Subspace of $\mathbb{R}^n$ if:

(1) For every $\vec{v_1}, \vec{v_2} \in V$ we have $\vec{v_1} + \vec{v_2} \in V$

(2) For every $\vec{v} \in V$ and $c \in \mathbb{R}$ we have $c\vec{v} \in V$

Examples:

1. Show that the line $V = \{(x, y) \in \mathbb{R}^2 : x + 2y = 0\}$ is a subspace of $\mathbb{R}^2$.

2. Show that the plane $V = \{(x, y, z) \in \mathbb{R}^3 : x + y + z = 1\}$ is NOT a subspace of $\mathbb{R}^3$.

3. Let $A = \begin{bmatrix} 1 & 1 & -2 \\ 2 & 3 & 0 \end{bmatrix}$ and let $V = \{\vec{v} \in \mathbb{R}^3 : A\vec{v} = \vec{0}\}$. Show that V is a subspace of $\mathbb{R}^3$ and find a vector that is in V and a vector that is not in V.