# SECTION TWO.I.2: SUBSPACES AND SPANNING SETS (DAY 2)

**Example Again:** Let $V = \mathbb{R}^3$, the vector space of 3-dimensional real-valued vectors under the usual vector and scalar operations. Let $W = \left\{ \begin{bmatrix} x \\ y \\ z \end{bmatrix} \ : \ x + y - z = 0 \right\}$. Show $W$ is a subspace of $V$.

**Lemma 2.9:** $V$ is a vector space. $S$ is a nonempty subset of the set $V$. The following are equivalent.

**definition:** Let $S$ be a nonempty subset of the vector space $V$. The *span of* $S$ (or $[S]$ or *linear closure of* $S$) is

Sample Problems

1. Let $S = \{(1,1,0),(0,1,0)\}$ be a subset of $\mathbb{R}^3$, the vector space of all real-valued 3-vectors under the usual vector addition and scalar multiplication. Which of the vectors below are in $span(S)$? (Show your work.)

   $\vec{v} = (8, -10, 0)$

   $\vec{w} = (1, 2, 3)$

   $\vec{x} = (a, b, 0)$

2. How would you know if the set

   $$T = \left\{ \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 2 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 1 & 2 \end{bmatrix} \right\}$$

   spanned the set of all $2 \times 2$ matrices?

**Lemma 2.15:**