Linear Combinations and Independence of Vectors – Section 4.3, 4.7

Math 81, Applied Analysis
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Definition:

Example: $\mathbf{v}_1 = (1, 0, 0),\ \mathbf{v}_2 = (0, 1, 0),\ \mathbf{v}_3 = (0, 0, 1)$.

Definition:

Examples:

(1) Do $\mathbf{v}_1 = (1, 0, 0),\ \mathbf{v}_2 = (0, 1, 0),\ \mathbf{v}_3 = (0, 0, 1)$ span $\mathbb{R}^3$?

(2) Do $\mathbf{v}_1 = (1, 0)$, $\mathbf{v}_2 = (1, 1)$, $\mathbf{v}_3 = (2, 1)$ span $\mathbb{R}^2$?

(3) Do $\mathbf{v}_1 = (1, 1, 0)$, $\mathbf{v}_2 = (0, 1, 1)$ span $\mathbb{R}^3$?

Theorem 1.

Example: Is $\mathbf{v} = (1, 2, 1)$ in $\text{span}\{(1, 0, 0), (1, 1, 1), (2, -1, 0)\}$?

Definition:

Examples:

(1) Are $\mathbf{v}_1 = (1, 0, 1)$, $\mathbf{v}_2 = (1, 1, 0)$, and $\mathbf{v}_3 = (0, 1, 1)$ linearly independent?

(2) Are $\mathbf{v}_1 = (1, 1, 1)$, $\mathbf{v}_2 = (1, 0, 1)$, and $\mathbf{v}_3 = (0, 1, 0)$ linearly independent?

(3) Are the functions $f_1(x) = \tan x$, $f_2(x) = \sec x$ linearly independent?

(4) Are $1 + x$, $1 - x$, $1 - x^2$ linearly independent?