

You may work with others to figure out how to do questions, and you are welcome to look for answers in the book, online, by talking to someone who had the course before, etc. However, you must write the answers on your own. You must also show your work (you may, of course, quote any result from the book).

1. Verify that each is a vector space by checking the conditions.

- (a) The collection of 2×2 matrices with 0's in the upper right and lower left entries.

$$\left\{ \begin{pmatrix} a & 0 \\ 0 & b \end{pmatrix} \mid a, b \in \mathbb{R} \right\}$$

- (b) The collection $\{a_0 + a_1x + a_3x^3 \mid a_0, a_1, a_3 \in \mathbb{R}\}$ of cubic polynomials with no quadratic term.

2. Determine if each set is linearly independent (in the natural vector space).

(a) $\left\{ \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}, \begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix} \right\}$

(b) $\{(1 \ 3 \ 1), (-1 \ 4 \ 3), (-1 \ 11 \ 7)\}$

(c) $\left\{ \begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}, \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ -1 & 4 \end{pmatrix} \right\}$

3. Is the vector in the span of the set?

$$\begin{pmatrix} 1 \\ 0 \\ 3 \end{pmatrix} \quad \left\{ \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}, \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} \right\}$$