1. Prove that if a list of vectors \((v_1, \ldots, v_n)\) spans \(\mathbb{F}^m\), then \(m \leq n\).

2. Is it true that the set of all eigenvectors of a linear map \(T \in \mathcal{L}(V)\), together with the 0 vector, must be a subspace of \(V\)? Give a proof or a counterexample.

3. Let \(D\) be the differentiation operator on \(C^\infty(\mathbb{R})\), the space of infinitely differentiable functions on \(\mathbb{R}\). What is the kernel of \(D\)?

4. If \(U_1\) and \(U_2\) are both subspaces of \(V\), then we define

\[ U_1 + U_2 := \{u_1 + u_2 | u_1 \in U_1, u_2 \in U_2\}. \]

(a) Suppose that \(S, T \in \mathcal{L}(V, W)\). Prove that

\[ \text{range}(S + T) \subseteq (\text{range } S) + (\text{range } T). \]

(b) Suppose that \(A, B \in \mathbb{M}_{m,n}(\mathbb{F})\). Prove that

\[ C(A + B) \subseteq C(A) + C(B). \]