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# 1 Subspaces of $\mathbb{R}^n$

## Learning Outcomes

After completing this chapter, students should be able to do the following.

- Determine whether sets are closed under addition and/or scalar multiplication.
- Determine whether a set of vectors is a basis of a subspace or  $\mathbb{R}^n$ .
- Write the coordinates of a vector with respect to a given basis of  $\mathbb{R}^n$ .
- Identify the dimension of the span of a given set of vectors.
- Find a basis for each of the following: the row space, the column space, and the null space of a given matrix.
- Prove elementary theorems concerning rank of a matrix and the relationship between rank and nullity.