

## 4.6 – Dimension

**Theorem 4.6.2** Let  $V$  be a finite-dimensional vector space, and let  $\{\mathbf{v}_1, \mathbf{v}_2, \dots, \mathbf{v}_n\}$  be any basis for  $V$ .

1. If a set in  $V$  has more than  $n$  vectors, then it is linearly dependent.
  2. If a set in  $V$  has fewer than  $n$  vectors, then it does not span  $V$ .
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**Theorem 4.6.1** All bases for a finite-dimensional vector space have the same number of vectors.

**Definition:** The **dimension** of a finite-dimensional vector space  $V$  is denoted by  $\dim(V)$  and is defined to be the number of vectors in a basis for  $V$  (in some physical contexts, “dimension” is referred to as **degrees of freedom**). In addition, the zero vector space is defined to have dimension zero.

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Find a basis for the solution space of each homogeneous linear system, and find the dimension of that space.

$$x_1 + x_2 - x_3 = 0$$

#1  $-2x_1 - x_2 + 2x_3 = 0$

$$-x_1 + x_3 = 0$$









