



examples that are **not** vector spaces



























# examples that are **not** vector spaces

- Vectors without zero vector:

The set of all  $n$ -tuples of real numbers (e.g.,  $\mathbb{R}^2, \mathbb{R}^3$ ) with standard addition and scalar multiplication

- Example: the set  $V = \{\vec{u} \in \mathbb{R}^2 \mid u_1 + u_2 = 1\}$  because  $\vec{0} \notin V$ , so it is not a vector space.
- Subset of  $\mathbb{R}^n$  closed under addition but not scalar multiplication
  - Example:  $W = \{\vec{u} \in \mathbb{R}^2 \mid u_1 \geq 0, u_2 \geq 0\}$  because  
 $\vec{u} = [1, 1] \in W$  but  $-1\vec{u} = [-1, -1] \notin W$
- Finite set of vectors
  - Example:  $F = \{[1, 0], [0, 1]\}$  because  
finite sets of vectors are generally not closed under addition and scalar multiplication
- Set of matrices without closure
  - Example:  $H = \{A \in M_{2 \times 2} \mid \det(A) = 1\}$  because  
adding two matrices in  $H$  does not necessarily result in another matrix with  $\det(A) = 1$

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## *exercise 1*

Why is the set of polynomials of degree  $n$  not a vector space?