

Mathematics study notes

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1 Function Analysis

1.1 Vector spaces

A vector space consists of: For a Vector space, the following 6 axioms must be satisfied:

1. A set V with elements known as vectors.
2. A field \mathbb{F} with elements known as scalars.
3. An operation called *vector addition* which takes two vectors $v, w \in V$ and produces a third vector $v + w \in V$.
4. An operation called *scalar multiplication* that takes a scalar $c \in \mathbb{F}$ and a vector $v \in V$ and produces a new vector $cv \in V$

Vector rules: for all $u, v, w \in V$ and scalars c, d

1. $\vec{u} + \vec{v} = \vec{v} + \vec{u}$
2. $\vec{u} + (\vec{v} + \vec{w}) = (\vec{u} + \vec{v}) + \vec{w}$
3. $\vec{u} + 0 = \vec{u}$
4. $\vec{u} + (-\vec{u}) = 0$
1. $c(\vec{u} + \vec{v}) = c\vec{u} + c\vec{v}$
2. $(c + d)\vec{u} = c\vec{u} + d\vec{u}$
3. $c(d\vec{u}) = (cd)\vec{u}$
4. $1\vec{u} = \vec{u}$
1. $\vec{u} + \vec{v} \in \vec{V}$
2. $c\vec{u} \in \vec{V}$