

Axioms For Vector Spaces

To show that a given set with two operations is **NOT** a vector space, we need to show properly that at least one property of the ten above is violated.

(1) If $u, v \in V$, then $u \oplus v \in V$ [CLOSURE UNDER ADDITION]

(2) If $u \oplus v = v \oplus u$ [COMMUTATIVE LAW]

(3) If $(u \oplus v) \oplus w = u \oplus (v \oplus w)$ [' $\oplus$ ' IS ASSOCIATIVE]

(4) V contains the object "0" which satisfies $u \oplus 0 = 0 \oplus u$

For each $u \in V$, there exist an object ' $-u$ ' such that $u \oplus -u = 0$ [ADDITIVE INVERSE]

(6) If $u \in V^*$ and $k \in K$, then $k \odot u \in V$ [CLOSURE UNDER MULTIPLICATION]

(7) $k \odot (u \oplus v) = (k \odot u) \oplus (k \odot v)$ [DISTRIBUTIVE LAW]

(8) $(k+l) \odot u = (k \odot u) \oplus (l \odot u)$

(9) $k \odot (l \odot u) = (kl) \odot u$

(10) $1 \odot u = u$

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Not published yet.
Last updated 29th September, 2022.
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