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1 | Broader vector spaces

- · Doesn't have to be physics vectors
- · maybe it's like matrices
- · or linear maps themselves

2 | The Linear Map 0

A linear map S=0 is a map where $Su=0 \forall u$.

3 | Axler 3.A ex7 (w/ Vienna + Mason)

Let w = Tv.

3.1 | If v = 0 then

$$Tv = 0$$

By Axler 3.11 (Maps take 0 to 0). Thus, λ can be anything in \mathbb{F} .

3.2 | Otherwise,

 $\frac{1}{v} \in \mathbb{F}$ because the field has multiplicative inverses for all elements except 0.

$$Tv = w = \left(w\frac{1}{v}\right)v$$

Let $\lambda = w \frac{1}{v}$, then

$$\lambda v = w \frac{1}{v} v = w$$

which is in \mathbb{F} because $w, \frac{1}{v} \in \mathbb{F}$ and fields are closed under multiplication.

4 | Axler 3.A ex10 (w/ Vienna + Mason)

The additivity of a linear map T requires T(u+v)=Tu+Tv. Because $U\subset V, U\neq V$, there must be some element $v\in V$ yet $v\notin U$.

For some element $u \in U$,

$$Tu + Tv = Su + 0 = Su$$

Yet $u + v \notin U$ because if it were, then (u + v) + (-v) = v would be in U. Thus,

$$T(u+v) = 0$$

Because for some u $Su \neq 0$, additivity does not hold over T and thus the map is not linear.

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