

Let V be a vector space and $R: V \rightarrow V$, $S: V \rightarrow V$, and $T: V \rightarrow V$ be linear maps. Prove that linear maps are associative under composition.

Problem Solving - What are the terms/strategies I may need? What do I know?

Definition of a linear map:

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

$$T(cu) = c T(u)$$

Definition of composition

$$RS(v) = R(S(v))$$

Definition of associative:

$$A(BC) = (AB)C$$

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Steps & Process – Try to answer the question writing in many steps to avoid small errors.

To show associative, we will want to show that $((AB)C)(v) = (A(BC))(v)$

$$\begin{aligned} ((AB)C)(v) &= (AB)(C(v)) \\ &= A(B(C(v))) \\ &= A(BC(v)) \\ &= (A(BC))(v) \end{aligned}$$

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Solidify Understanding – Explain why the steps makes sense by connecting to math you know.

Why is considering associativity helpful when dealing with linear transformations?

For Video Please click the link below:

[Video](#)