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First name _____

LARSON—MATH 310—WORKSHEET 11
Vector Spaces IV. A plane through the origin in \mathbb{R}^3 .

Let $V = \left\{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \mid x + y + z = 0 \right\}$.

Define “addition” and “scalar multiplication” in the obvious way.

1. Let $\vec{v}, \vec{u} \in V$.
 - What do \vec{v} and \vec{u} look like?

 - Find $\vec{v} + \vec{u}$. Is $\vec{v} + \vec{u}$ in V ?

2. Find $\vec{u} + \vec{v}$. Is $\vec{v} + \vec{u} = \vec{u} + \vec{v}$?

3. Let $\vec{v}, \vec{u}, \vec{w} \in V$.
 - Find $(\vec{v} + \vec{u}) + \vec{w}$.

 - Find $\vec{v} + (\vec{u} + \vec{w})$.

 - Does $(\vec{v} + \vec{u}) + \vec{w} = \vec{v} + (\vec{u} + \vec{w})$?

4. Is there a $\vec{0}$ in V such that $\vec{v} + \vec{0} = \vec{v}$ for every \vec{v} in V ?

5. Let \vec{v} be in V . Is there a \vec{w} in V so that $\vec{v} + \vec{w} = \vec{0}$? Explain. (What does \vec{w} look like?)

6. Let $r \in \mathbb{R}$. Is $r\vec{v}$ in V ? Explain.

7. Let $r, s \in \mathbb{R}$.
 - Find $(r + s)\vec{v}$.

- Find $s\vec{v}$.
- Find $r\vec{v} + s\vec{v}$.
- Does $(r + s)\vec{v} = r\vec{v} + s\vec{v}$?

8. Let $r \in \mathbb{R}$, $\vec{v}, \vec{w} \in V$.

- Find $r(\vec{v} + \vec{w})$.
- Find $r\vec{v}$.
- Find $r\vec{w}$.
- Find $r\vec{v} + r\vec{w}$.
- Does $r(\vec{v} + \vec{w}) = r\vec{v} + r\vec{w}$?

9. Let $r, s \in \mathbb{R}$.

- Find $(rs)\vec{v}$.
- Find $s\vec{v}$.
- Find $r(s\vec{v})$.
- Does $(rs)\vec{v} = r(s\vec{v})$?

10. Let $\vec{v} \in V$.

- Find $1\vec{v}$.
- Does $1\vec{v} = \vec{v}$?