

**LARSON—MATH 310—WORKSHEET 9**  
**Vector Spaces II. Vectors in  $\mathcal{M}_{2,2}$ .**

Let  $V$  be the set of matrices in  $\mathcal{M}_{2,2}$ . Let  $\vec{v}, \vec{u}, \vec{w} \in \mathcal{M}_{2,2}$ . 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  $1\vec{v} = \vec{v}$ ?