A matrix with only one column is called a __________________ and denoted $\mathbf{u} = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix}$

Ex:

The entries can be written as ______________________________ called an n-tuple.

Ex:

__________________________ is the set of all n-tuples where each entry is in _______ .

Ex: $n = 2$: (u_1, u_2) is an ________________ and defines a point in ____________________ .

Ex: $n = 3$: (u_1, u_2, u_3) is an _________________ and defines a point in ____________________ .

Graphical Representations of vectors in $\mathbb{R}^2$ and $\mathbb{R}^3$.

$\mathbf{u} = \begin{bmatrix} a \\ b \end{bmatrix}$ *can* be represented by a line segment w/ an arrow from the origin to the point (a, b). But

Addition of two vectors: Add corresponding entries $\mathbf{u}+\mathbf{v} = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix} + \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{bmatrix} =$

Examples and Graphical Representations

Scalar Multiplication ($c \in \mathbb{R}$ is a scalar): Multiply each element by c. $c\mathbf{u} = c\begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix} =$

Examples and Graphical Representations

Properties for vectors $\mathbf{u}, \mathbf{v}$, and $\mathbf{w}$ in $\mathbb{R}^n$ and scalars $c, d \in \mathbb{R}$.

1. $\mathbf{u}+\mathbf{v} = \mathbf{v}+\mathbf{u}$
2. $(\mathbf{u}+\mathbf{v})+\mathbf{w} = \mathbf{u}+(\mathbf{v}+\mathbf{w})$
3. $\mathbf{u}+\mathbf{0} = \mathbf{0}+\mathbf{u} = \mathbf{u}$
4. $\mathbf{u}+(-\mathbf{u}) = -\mathbf{u}+\mathbf{u} = \mathbf{0}$
5. $c(\mathbf{u}+\mathbf{v}) = c\mathbf{u}+c\mathbf{v}$
6. $(c+d)\mathbf{u} = c\mathbf{u}+d\mathbf{u}$
7. $c(d\mathbf{u}) = (cd)\mathbf{u}$
8. $1\mathbf{u} = \mathbf{u}$