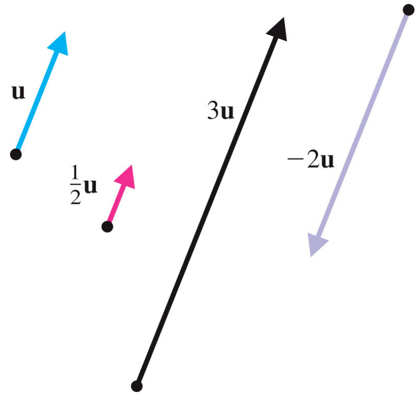

Vectors are parallel if one is a scalar multiple of the other.

$c\mathbf{a} \parallel \mathbf{a}$, in the same direction for $c \geq 0$, the opposite direction for $c \leq 0$.

Additive inverse:

$$-\mathbf{a} = -\langle a_1, a_2 \rangle = (-1)\langle a_1, a_2 \rangle = \langle -a_1, -a_2 \rangle$$
$$\|-\mathbf{a}\| = \|(-1)\langle a_1, a_2 \rangle\| = |-1| \cdot \|\langle a_1, a_2 \rangle\| = \|\mathbf{a}\|$$

DEFINITION. $V_2 = \big\{\langle x, y \rangle | x, y \in \mathbb{R}\big\}$, the set of all two-dimensional position vectors.

DEFINITION. A vector space is a set of vectors with the same dimension and a set of scalars (real or complex numbers) with addition and scalar multiplication such that for any vectors $\mathbf{u}, \mathbf{v}$, and $\mathbf{w}$, and any scalars α and β,

(1) $\mathbf{v} + \mathbf{w} = \mathbf{w} + \mathbf{v}$

(2) $(\mathbf{u} + \mathbf{v}) + \mathbf{w} = \mathbf{u} + (\mathbf{v} + \mathbf{w})$

(3) $\alpha(\beta\mathbf{v}) = (\alpha\beta)\mathbf{v}$

(4) $(\alpha + \beta)\mathbf{v} = \alpha\mathbf{v} + \beta\mathbf{v}$

(5) $\alpha(\mathbf{v} + \mathbf{w}) = \alpha\mathbf{v} + \alpha\mathbf{w}$

(6) $1\mathbf{v} = \mathbf{v}$

(7) $0\mathbf{v} = \mathbf{0}$

(8) $\mathbf{v} + \mathbf{0} = \mathbf{v}$

(9) For each $\mathbf{v}$ there is $-\mathbf{v}$ such that $\mathbf{v} + (-\mathbf{v}) = \mathbf{0}$