

Contents

1	Vectors	2
	Interpretations of Vectors	2
	Vector Addition, Subtraction, and Multiplication	2

1 Vectors

Interpretations of Vectors

- ▷ **Vector**: an ordered list of numbers.
- ▷ Possible notations: $\vec{v} = \mathbf{v}$ are most common.
- ▷ **Dimensionality**: the number of the elements in a vector.
- ▷ **Geometric vector**: an object with a magnitude and direction.
- ▷ *Standard position*: when the vector begins at the origin.

Vector Addition, Subtraction, and Multiplication

- ▷ Vectors must have same dimensionality for addition and subtraction.
- ▷ Geometric and algebraic have same results.
- ▷ **Scalar**: scales each element in a vector, does not change direction. Generally represented with greek letters.
- ▷ **Dot product**: a single number that provides information about the relationship between two vectors. Must have same dimensionality.
- ▷ Notation for dot product: $a \cdot b = a^T b = \langle ab \rangle = \sum a_i b_i$
- ▷ *Algebraic* dot product properties:
 - **Associative: False**, $a^T (b^T c) \neq (a^T b)^T c$
 - **Distributive: True**, $a^T (b + c) = a^T b + a^T c$
 - **Commutative**:
 - Vector magnitude/length: $\|v\| = \sqrt{v^T v}$
- ▷ *Geometric* dot product properties:
 - Magnitudes of vectors scaled by angle between them.
 - $\vec{a} = |a||b| \cos(\theta_{ab})$
 - Geometric and algebraic are really the same. The above equation can be rewritten as the algebraic vector length, i.e. $a^T b = \cos(\theta_{ab})|a||b|$