

Performing Operations on Vectors (2.2 Honors)

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Addition & Subtraction of Vectors

Two vectors can be added or subtracted to get a resultant vector. This can be done with any of the following methods. (For subtraction, just add the opposite vector).

1) Head-to-Tail Method:

2) Parallelogram Rule: Align the initial points of \vec{u} and \vec{v} , then the diagonal of the parallelogram defined by them represents $\vec{u} + \vec{v}$.

3) Component-Wise Addition:

Ex. 1: Find each of the following in three ways: (a) by placing them head-to-tail, (b) by using the Parallelogram Rule, and (c) by using component-wise addition, given that

$$\vec{u} = \langle -2, 6 \rangle \quad \text{and} \quad \vec{v} = \langle -3, -4 \rangle$$

(i) $\vec{u} + \vec{v}$

(ii) $\vec{u} - \vec{v}$

Scalar Multiplication

Multiplying a vector by a scalar does not change the direction of the vector, only the magnitude. Scalar multiplication can be done algebraically.

A unit vector is a vector of magnitude 1. To find a unit vector in the direction of vector \vec{v} , divide the vector by its magnitude $\left(\frac{\vec{v}}{\|\vec{v}\|} \right)$.

The magnitude of a scalar multiple of a vector can be found by. $\|c\mathbf{v}\| = |c| \cdot \|\mathbf{v}\|$.

Ex. 2: Given vector $\vec{v} = \langle -9, 3 \rangle$, find each of the following.

(a) $\frac{-2}{3} \vec{v}$

(b) vector \vec{w} in the direction of \vec{v} such that $\|\vec{w}\| = 10$