

Section 9.2 Vectors

A **vector** is a quantity that has both magnitude and direction.

Zero Vector

Something that has magnitude but NOT direction is called a **scalar**.

Label each of these as a scalar or vector

Quantity	Vector	Scalar
Speed		
Force		
Debt		
Velocity		
Acceleration		
Momentum		
Energy		
Temperature		
Work		
Friction		
Current		

Combining Vectors

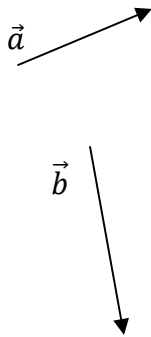
If we start with a vector that moves us from A to B , \overrightarrow{AB} and then from B to C , \overrightarrow{BC} , we end with a vector \overrightarrow{AC} that takes us from A to C .

We write $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$.

In general, the vector $\vec{u} + \vec{v}$ takes us from the initial point of \vec{u} to the terminal point of \vec{v} .

Example 1

Find the result when adding \vec{a} and \vec{b} .



Scalar Multiplication

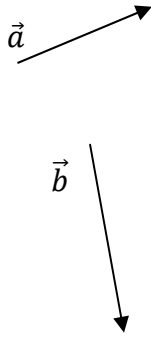
Parallel Vectors

Difference of two vectors

$$\vec{u} - \vec{v} = \vec{u} + (-\vec{v})$$

Example 2

Find $\vec{a} - \vec{b}$.



Components

We can treat a vector as having its initial point at the origin, then we only need to know its terminal point to identify the vector.

$$\vec{a} = \langle a_1, a_2 \rangle \text{ or } \vec{a} = \langle a_1, a_2, a_3 \rangle$$

Given the points $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$, the vector \overrightarrow{AB} is given by

Example 3

Find the vector with initial point $A(2, -1, 5)$ and terminal point $B(3, 2, 1)$.

Magnitude of a Vector

Manipulating Vectors Algebraically

Notation

We denote by V_n all n -dimensional vectors.

Properties of Vectors

Special vectors in V_3

Example 4

Write the vector $\langle 1, -2, 3 \rangle$ in terms of the standard basis vectors \vec{i} , \vec{j} , and \vec{k} .

Example 5

If $\vec{a} = 2\vec{i} + 3\vec{j} - 2\vec{k}$ and $\vec{b} = \vec{i} - 2\vec{j} + \vec{k}$, then find $\vec{a} - 2\vec{b}$.

Unit Vector

Example 6

Find the unit vector that lies in the same direction as $2\vec{i} - \vec{j} - 2\vec{k}$.

Example 7

A 50 lb weight hangs from two wires as shown below. Find the tension in each wire.

