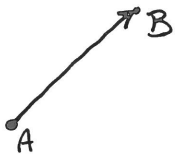


Section 12.2 - Vectors



\vec{u}

\vec{v}

Equivalent:

Addition:

Scalar Multiplication:

- Vector Components:

vectors in \mathbb{R}^2 :

$$\vec{v} =$$

vectors in \mathbb{R}^3 :

$$\vec{v} =$$

vectors in \mathbb{R}^n :

$$\vec{v} =$$

- Magnitude (length) of a vector:

$$V^2: |\vec{v}| =$$

$$V^3: |\vec{v}| =$$

- Position vector: $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$

- Operations of vectors:

$$\langle a, b \rangle + \langle c, d \rangle =$$

$$\langle a, b \rangle - \langle c, d \rangle =$$

$$c\langle a, b \rangle =$$

- Properties of vectors:

$$1. \vec{v} + \vec{u} =$$

Commutative

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

Associative

$$3. \vec{v} + \vec{0} =$$

additive identity

$$4. \vec{v} + (-\vec{v}) =$$

additive inverse

$$5. c(\vec{u} + \vec{v}) =$$

Distributive

$$6. (c+d)\vec{u} =$$

Laws

$$7. (cd)\vec{u} =$$

$$8. 1 \cdot \vec{v} =$$

Scalar Identity

Example

Sketch the vector between $A(2, 0)$ and $B(3, -2)$. Sketch the position vector. Add the vector $\langle 1, 2 \rangle$ to the vector \vec{AB} . Sketch it.

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Example 4 $\vec{a} = \langle 4, 0, 3 \rangle$ $\vec{b} = \langle -2, 1, 5 \rangle$ Find $|\vec{a}|$ and $2\vec{a} + 5\vec{b}$

• Standard Basis Vectors:

$\vec{i} =$

$\vec{j} =$

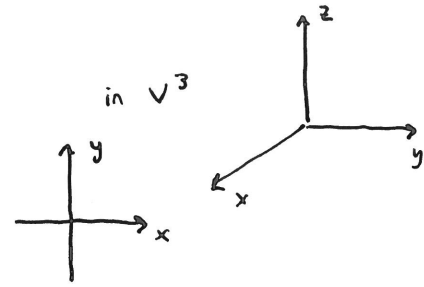
$\vec{k} =$

$\vec{i} =$

$\vec{j} =$

in V^2

in V^3



• Unit Vector:

Example

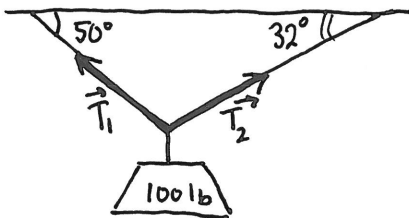
Express $\vec{v} = \langle 2, -1, -2 \rangle$ in terms of $\vec{i}, \vec{j}, \vec{k}$ and find a unit vector for \vec{v} .

- Applications: velocity and acceleration in space (3D), forces

Recall: Resultant Force is the sum of forces acting on an object.

Example 7

100 lb weight hangs from two wires. Find the tension forces \vec{T}_1 and \vec{T}_2 .



Section 12.2 - Vectors

MVC

• Extra Examples:

#26 Find a vector that has the same direction as $\langle -2, 4, 2 \rangle$ but length 6.

#28 What is the angle between $8\vec{i} + 6\vec{j}$ and the positive x-axis?

#39 A boatman wants to cross a river that is 3 km wide and land 2 km upstream. The current is 3.5 km/hr and the boat speed is 13 km/hr.

(a) In what direction should he steer?

(b) How long will the trip take?

#42 (a) Find the unit vectors that are parallel to the tangent line to $y = 2\sin x$ at $(\pi/6, 1)$.

(b) Find the unit vectors \perp to the tangent line.

(c) Sketch $y = \sin x$ and the vectors from (a), (b) at $(\pi/6, 1)$.