

Admin Notes / Agenda

- Math Major Schedule
- Lecture
- Board Problems

Summary of Key Terms and Operations

- **Vector (Position Form):** Represents a quantity with magnitude and direction, such as $\vec{v} = \langle 3, 2 \rangle$
- **Vector Addition:** $\vec{u} + \vec{v} = \langle u_1 + v_1, u_2 + v_2 \rangle$
- **Vector Subtraction:** $\vec{u} - \vec{v} = \langle u_1 - v_1, u_2 - v_2 \rangle$
- **Scalar Multiplication:** $c\vec{u} = \langle cu_1, cu_2 \rangle$
- **Displacement Vector:** From $A(x_1, y_1)$ to $B(x_2, y_2)$, $\overrightarrow{AB} = \langle x_2 - x_1, y_2 - y_1 \rangle$
- **Magnitude (Length):** $|\vec{v}| = \sqrt{v_1^2 + v_2^2}$
- **Unit Vector:** A vector with magnitude 1 in the same direction as \vec{v} :

$$\hat{v} = \frac{\vec{v}}{|\vec{v}|}$$

- **Dot Product (Algebraic):** For vectors $\vec{u} = \langle u_1, u_2 \rangle$ and $\vec{v} = \langle v_1, v_2 \rangle$:

$$\vec{u} \cdot \vec{v} = u_1v_1 + u_2v_2$$

- **Dot Product (Geometric):**

$$\vec{u} \cdot \vec{v} = |\vec{u}||\vec{v}| \cos(\theta)$$

where θ is the angle between the vectors.

- **Solving for Angle Between Vectors:**

$$\theta = \cos^{-1} \left(\frac{\vec{u} \cdot \vec{v}}{|\vec{u}||\vec{v}|} \right)$$

- **Vector Components:** The projection of \vec{v} onto the x and y axes:

$$\vec{v} = v_x \hat{i} + v_y \hat{j}$$

where $v_x = |\vec{v}| \cos(\theta)$ and $v_y = |\vec{v}| \sin(\theta)$

- **Standard Basis Vectors:**

$$\hat{i} = \langle 1, 0 \rangle, \quad \hat{j} = \langle 0, 1 \rangle$$

Any 2D vector can be written as a linear combination of \hat{i} and \hat{j} .