

Vector Formulas

Dot Product

$$v \cdot w = a_1 a_2 + b_1 b_2$$

Angle Between Vectors

$$\cos \theta = \frac{v \cdot w}{\|v\| \|w\|}$$

Orthogonality Test

$$v \cdot w = 0$$

Vector Projection

$$v_1 = \frac{v \cdot w}{\|w\|^2} w$$

Adding Vectors

$$v + w = (a_1 + a_2)\mathbf{i} + (b_1 + b_2)\mathbf{j}$$

$$v - w = (a_1 - a_2)\mathbf{i} + (b_1 - b_2)\mathbf{j}$$

Magnitude of Vectors

$$\|v\| = \sqrt{a^2 + b^2}$$

Polar Form

$$v = \|v\| (\cos \theta \mathbf{i} + \sin \theta \mathbf{j})$$

Decomposition of Vectors

$$v_1 = \frac{v \cdot w}{\|w\|^2} w \quad v_2 = v - v_1$$

Unit Vector in the Direction of v

$$u = \frac{v}{\|v\|}$$