

1 1.2: Dot Product

Definitions:

The dot product of the vectors \mathbf{a} and \mathbf{b} is given by

Dot Product computation formula

From the definition, it follows that the angle between two vectors is given by

\mathbf{a} and \mathbf{b} are orthogonal if and only if

Orthogonal complements

Scalar and Vector projections

Work

Examples:

If $\mathbf{a} = \langle 4, 2 \rangle$ and $\mathbf{b} = \mathbf{i} + \mathbf{j}$, find the scalar and vector projection of \mathbf{b} onto \mathbf{a} .

A 10 kg block slides down a ramp which is 3 m tall and 2 m horizontal. Find the work done by gravity if the block slides (friction-free) all the way down the ramp.

Find the distance from the point $(1, 5)$ to the line $2x - 3y = 12$.

On Your Own: Given $\mathbf{a} = \langle 1, -1 \rangle$ and $\mathbf{b} = \mathbf{i} + 2\mathbf{j}$, find $\mathbf{a} \cdot \mathbf{b}$ and the cosine of the angle between the vectors.

$$-1, \frac{-1}{\sqrt{10}}$$

Find x such that $\mathbf{a} = \langle 4x - 5, x \rangle$ is orthogonal to $\mathbf{b} = \mathbf{i} + x\mathbf{j}$.

$$x = -5, 1$$

Given $|\mathbf{a}| = 2$, \mathbf{b} is a unit vector orthogonal to \mathbf{a} , and $\mathbf{c} = \mathbf{a} + \mathbf{b}$, find $\mathbf{a} \cdot \mathbf{c}$ and $\mathbf{b} \cdot \mathbf{c}$.

$$4, 1$$