

Lesson 9.2: The Dot Product

Definition of the Dot Product

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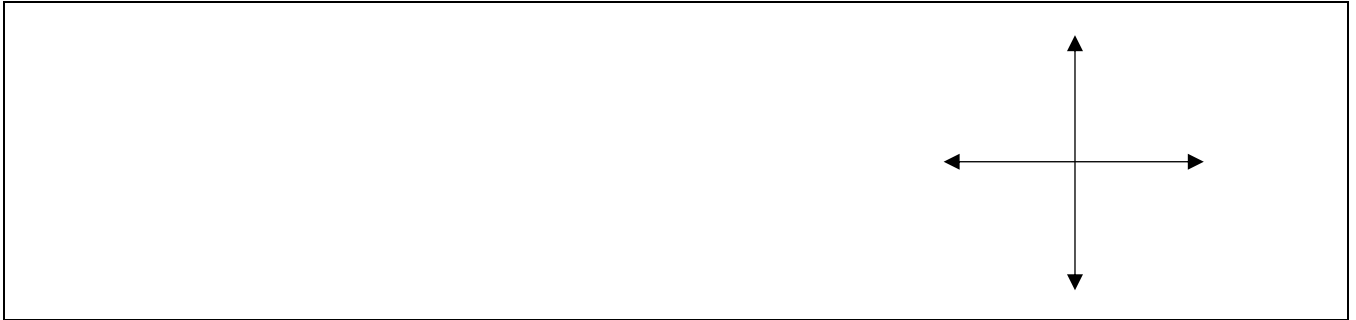
Examples:

1. If $\vec{u} = \langle 3, -2 \rangle$ and $\vec{v} = \langle 4, 5 \rangle$, then find $\vec{u} \cdot \vec{v}$.

2. If $\vec{u} = 2\vec{i} + \vec{j}$ and $\vec{v} = 5\vec{i} - 6\vec{j}$, then find $\vec{u} \cdot \vec{v}$.

Properties of the Dot Product

The Dot Product Theorem



Re-arranging the theorem above, we get:

We can use the above formula to solve for _____ between vectors.

Example: Find the angle between vectors $\vec{u} = \langle 2, 5 \rangle$ and $\vec{v} = \langle 4, -3 \rangle$.

Orthogonal Vectors

Two nonzero vectors \vec{u} and \vec{v} are _____ (or orthogonal) if the angle between them is $\frac{\pi}{2}$ or 90° .

The following theorem can be used to determine if two vectors are orthogonal:



Examples: Determine if the vectors in each pair are perpendicular.

1. $\vec{u} = \langle 3, 5 \rangle$ and $\vec{v} = \langle 2, -8 \rangle$

2. $\vec{u} = \langle 2, 1 \rangle$ and $\vec{v} = \langle -1, 2 \rangle$

Work

One use of the _____ occurs when calculating work.

In everyday use, the term “work” means the total amount of _____ required to perform a task.

In physics, we have a more technical definition that conforms to its intuitive definition.

Examples:

1. A force is given by the vector $\vec{F} = \langle 2,3 \rangle$ and moves an object from the point (1,3) to the point (5,9). Find the work done.

2. A man pulls a wagon horizontally by exerting a force of 20 lb. on the handle. If the handle makes an angle of 60° with the horizontal, find the work done in moving the wagon 100 ft.