MCV4U

The Dot Product

Today we will define a new operation between 2 vectors – called the dot product. Unlike previous operations with vectors this operation is used for vectors and does not have a similar operation with scalars.

The Dot Product

The *dot product* of two vectors $\vec{u}$ and $\vec{v}$ is given by:

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

where θ is the angle between the 2 vectors (tail-to-tail).

The dot product is sometimes called the ***scalar product*** or ***an inner product***.

Example Find $\vec{u} \cdot \vec{v}$ if:

a) $|\vec{u}| = 7$, $|\vec{v}| = 15$ and $\theta = 60°$.

b) $|\vec{u}| = 13$, $|\vec{v}| = 55$ and $\theta = 150°$.

So what does the dot product represent?

-"angular relationship"

-somewhat similar to multiplication

-properties very useful

Prove that two non-zero vectors $\vec{u}$ and $\vec{v}$ are perpendicular ***if and only if*** $\vec{u} \cdot \vec{v} = 0$.

What do you get if take the dot product of a vector with itself?

The Dot Product for Algebraic Vectors

Let $\vec{u} = (a_1, b_1, c_1)$ and $\vec{v} = (a_2, b_2, c_2)$.

$\vec{u} \cdot \vec{v} =$

Example: Find the dot product between the vectors $\vec{a} = (1, -3, 5)$ and $\vec{b} = (-2, 0, -4)$.

Find the angle between these 2 vectors.

Show that vectors $\vec{a} = (15, 0, -3)$ and $\vec{b} = (-1, 5, 5)$ are perpendicular.

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