7.3 The Dot Product: A Geometric View

Definition 7.3.1

Given vectors $\vec{a}$ and $\vec{b}$ with angle θ between them, then the Dot Product is given by:

$$\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}|\cos(\theta)$$

Note: $|\vec{a}|$, $|\vec{b}|$ and $\cos(\theta)$ are all just

Further note that the Dot Product depends on the cosine of an angle. Thus, the Dot Product will have a

Now, $\forall$ vectors $\vec{a}$ and $\vec{b}$, the angle θ between the vectors has the property that

Example 7.3.1

Given that two vectors $\vec{a} \& \vec{b}$ are perpendicular, determine $\vec{a} \cdot \vec{b}$

Note: Given that $\vec{a} \cdot \vec{b} = 0$

Example 7.3.2

a) Given $|\vec{a}| = 5$, $|\vec{b}| = 3$ and the angle between them is $\frac{\pi}{4}$, determine $\vec{a} \cdot \vec{b}$.

b) Given $|\vec{c}| = 7$, determine $\vec{c} \cdot \vec{c}$.

Algebraic Properties of the Dot Product

Given vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ and scalar k,

1) $\vec{a} \cdot \vec{b} =$

2) $\vec{a} \cdot \left(\vec{b} \cdot \vec{c}\right) =$

3) $\vec{a} \cdot \vec{a} =$

4) $k\left(\vec{a} \cdot \vec{b}\right) =$

Note: $\vec{a} \cdot \left(\vec{b} \cdot \vec{c}\right)$

Example 7.3.3

Given $|\vec{a}| = 3$, $|\vec{b}| = 2$ and that the vectors $\vec{u} = (2\vec{a} - 3\vec{b})$ and $\vec{v} = (\vec{a} + 2\vec{b})$ are **perpendicular**, determine the angle between $\vec{a}$ and $\vec{b}$.

Class/Homework for Section 7.3

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