Problems on Dot Product and Cross Product

SUBJECT : MATHEMATICS
CHAPTER NUMBER:10
CHAPTER NAME :VECTOR ALGEBRA

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Lagrange's Identity

Prove that for any two vectors $\vec{a}$ and $\vec{b}$, $\left(\vec{a} \times \vec{b}\right)^2 = |\vec{a}|^2 \left|\vec{b}\right|^2 - \left(\vec{a}.\vec{b}\right)^2$

EXAMPLE

If $|\vec{a}| = \sqrt{26}, |\vec{b}| = 7$ and $|\vec{a} \times \vec{b}| = 35$, then find the value of $\vec{a}.\vec{b}$.

EXAMPLE

If $\vec{a}$ and $\vec{b}$ are two unit vectors and θ is the angle between them then prove that

(i) $sin\frac{\theta}{2} = \frac{1}{2}\left|\vec{a} - \vec{b}\right|$

(ii) $cos\frac{\theta}{2} = \frac{1}{2}\left|\vec{a} + \vec{b}\right|$.

EXAMPLE

Given that $\vec{a}.\vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$. What can you conclude about vectors $\vec{a}$ and $\vec{b}$.

EXAMPLE

Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{p}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{p} \cdot \vec{c}$ = 18.

EXAMPLE

If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$

Prove that $\vec{a} - \vec{d}$ is parallel to $\vec{b} - \vec{c}$, where $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$.

EXAMPLE

If $\vec{a}, \vec{b}, \vec{c}$ are three mutually perpendicular vectors of equal magnitude, show that $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}$ and $\vec{c}$. Also find the angle.

EXAMPLE

If the sum of two unit vector is a unit vector prove that magnitude of their difference is $\sqrt{3}$.

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Assignments

1. Miscellaneous exercise chapter 10

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THANKING YOU

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