

Problem 1. If $\vec{p} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{q} = \hat{i} - 3\hat{j} + 2\hat{k}$.

1. Represent the two vectors in a three dimensional orthonormal coordinate system.
2. Find $\vec{p} + \vec{q}$. Then represent it on the same coordinate system.
3. Find $|\vec{p}|$, $|\vec{q}|$ and $|\vec{p} + \vec{q}|$.
4. Find $\vec{p} \cdot \vec{q}$, then find the angle between \vec{p} and \vec{q}

Problem 2. If $\vec{p} = 4\hat{i} + \hat{j} - 2\hat{k}$, $\vec{q} = 3\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{r} = \hat{i} - 2\hat{j}$

1. Represent the three vectors in a three dimensional orthonormal coordinate system.
2. Find $(\vec{p} - 2\vec{q}) \times \vec{r}$.
3. Find $\vec{p} \times (2\vec{r} \times 3\vec{q})$

Problem 3. For the vectors $\vec{a} = \hat{i} + 4\hat{j} - 2\hat{k}$ and $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$.

1. Represent the two vectors in a three dimensional orthonormal coordinate system.
2. Find $\vec{a} \times \vec{b}$. Then represent it on the same coordinate system.

Problem 4. Represent the two vectors $\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} - 3\hat{k}$ in a three-dimensional orthonormal coordinate system.

Find the angle between the two vectors. Then

Find $\vec{a} \times \vec{b}$. Then represent it on the same coordinate system.

Problem 5. For the vector $\vec{r} = 2\hat{i} + 5\hat{j} + 13\hat{k}$

- 1) Sketch the vector in a three-dimensional orthonormal coordinate system.
- 2) Find its length. Then
- 3) Find the direction cosines and the angles the vector makes with coordinate axes.