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

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 $\vec{p} = 4\hat{\imath} + \hat{\jmath} - 2\hat{k}$, $\vec{q} = 3\hat{\imath} - 2\hat{\jmath} + \hat{k}$ and $\vec{r} = \hat{\imath} - 2\hat{\jmath}$

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 $\vec{a} = \hat{\imath} + 4\hat{\jmath} - 2\hat{k}$ and $\vec{b} = 2\hat{\imath} - \hat{\jmath} + 3\hat{k}$.

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 $\vec{a} = 2\hat{\imath} - \hat{\jmath} + 3\hat{k}$ and $\vec{b} = -\hat{\imath} + \hat{\jmath} - 3\hat{k}$. 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 $\vec{r} = 2\hat{\imath} + 5\hat{\jmath} + 13\ \hat{k}$

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.

Problem 6. sketch the three vectors: $\vec{a} = 2\hat{\imath} + \hat{\jmath} - \hat{k}$, $\vec{b} = \hat{\imath} - 3\hat{\jmath} + 2\hat{k}$ and $\vec{c} = 2\hat{\imath} - \hat{\jmath} + 3\hat{k}$, then find the oriented volume (الحجم الموجه) of the parallelepiped (متوازي سطوح) defined by these vectors.