1. Find the magnitude of the following vectors:

(*i*) $\hat{i} + \hat{j} + \hat{k}$ (*ii*) $3\hat{i} - 2\hat{j} + 6\hat{k}$

(*iii*) $2\hat{i} - 7\hat{j} - 3\hat{k}$ (*iv*) $\frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} + \frac{1}{\sqrt{3}}\hat{k}$.

2. Find the position vector and magnitude of the following points:

(*i*) (0, 3, 4) (*ii*) (– 5, – 4, – 3).

3. (*i*) Show that the vectors $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = 4\hat{i} - 8\hat{j} + 4\hat{k}$ are parallel.

(*ii*) Show that the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $-4\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear.

(*iii*) Show that the vectors $\vec{a} = 3\hat{i} + 2\hat{j} - 4\hat{k}$ and $\vec{b} = -6\hat{i} - 4\hat{j} + 8\hat{k}$ are unlike vectors.

(*iv*) For what value of '*p*' the vectors $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} - 2p\hat{j} + 3\hat{k}$ are parallel.

(*v*) Find the values of *x*, *y* and *z* so that the vectors $\vec{a} = x\hat{i} + 2\hat{j} + z\hat{k}$ and $\vec{b} = 2\hat{i} + y\hat{j} + \hat{k}$ are equal.

4. Let $\vec{a} = \hat{i} + 2\hat{j}$ and $\vec{b} = 2\hat{i} + \hat{j}$. Is $|\vec{a}| = |\vec{b}|$? Are the vectors $\vec{a}$ and $\vec{b}$ equal?

5. If $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 6\hat{k}$, find the values of $|\vec{a} + 2\vec{b}|$ and $|3\vec{a} - \vec{b}|$.

6. If A is (a_1, a_2, a_3), $\overrightarrow{AB}$ is the vector $b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$, find the coordinates of B.

1. Find the scalar product of the vectors $\vec{a}$ and $\vec{b}$, where:

   (*i*) $\vec{a} = 3\hat{i} - \hat{j} + 2\hat{k}, \vec{b} = 2\hat{i} + 3\hat{j} + 3\hat{k}$

   (*ii*) $\vec{a} = -\hat{i} + \hat{j} - 2\hat{k}, \vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$.

2. Find the value of λ such that the vectors $\vec{a}$ and $\vec{b}$ are perpendicular, where:

   (*i*) $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}, \vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$

   (*ii*) $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}, \vec{b} = \hat{i} + \lambda\hat{j} - 3\hat{k}$

   (*iii*) $\vec{a} = 2\hat{i} + \lambda\hat{j} + 3\hat{k}, \vec{b} = 3\hat{i} + 2\hat{j} - 4\hat{k}$

   (*iv*) $\vec{a} = \hat{i} + 2\lambda\hat{j} + \hat{k}, \vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$. ...

3. Find the value of λ so that the vectors $2\hat{i} + 3\hat{j} - \hat{k}$ and $4\hat{i} + 6\hat{j} + \lambda\hat{k}$ are:
   (*i*) parallel (*ii*) perpendicular to each other.

4. Find $(\vec{a} + 3\vec{b}) \cdot (2\vec{a} - \vec{b})$ if $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}, \vec{b} = 3\hat{i} + 2\hat{j} - \hat{k}$.

5. (*i*) Find the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$.

   (*ii*) Find the projection of the vector $\hat{i} + \hat{j} + \hat{k}$ on the vector $\hat{j}$.

   (*iii*) Find the projection of the vector $2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $2\hat{i} + 2\hat{j} + \hat{k}$.

1. Find the vector $\vec{a} \times \vec{b}$ where: $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 3\hat{i} - 4\hat{j} + 4\hat{k}$.

2. Verify that $\vec{b} \times \vec{a} = -(\vec{a} \times \vec{b})$ where: $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = 3\hat{i} - \hat{j} + \hat{k}$.

3. (*i*) Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $|\vec{a} \times \vec{b}| = \sqrt{3}$.

(*ii*) Find the value of p if $(2\hat{i} + 6\hat{j} + 27\hat{k}) \times (\hat{i} + 3\hat{j} + p\hat{k}) = \vec{0}$.

(*iii*) Write the value of p for which $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are parallel vectors.

(*iv*) Find λ and μ if $(2\hat{i} + 6\hat{j} + 27\hat{k}) \times (\hat{i} + \lambda\hat{j} + \mu\hat{k}) = \vec{0}$.

(*v*) Write the value of $\hat{i} \times (\hat{j} + \hat{k}) + \hat{j} \times (\hat{k} + \hat{i}) + \hat{k} \times (\hat{i} + \hat{j})$.

(*vi*) Write the value of $\hat{i} \cdot (\hat{j} \times \hat{k}) + \hat{j} \cdot (\hat{k} \times \hat{i}) + \hat{k} \cdot (\hat{j} \times \hat{i})$.

(*vii*) Show that $(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) = 2(\vec{a} \times \vec{b})$.

(*viii*) Find the value of $(\hat{i} \times \hat{j}) \cdot \hat{k} + \hat{i} \cdot \hat{j}$.

(*ix*) Find the value of $(\hat{k} \times \hat{j}) \cdot \hat{i} + \hat{j} \cdot \hat{k}$.

4. Find the magnitude of the vector $\vec{a} \times \vec{b}$, where:

(*i*) $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$

(*ii*) $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} + 5\hat{j} - 2\hat{k}$.

5. If $\vec{a} = 4\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{k}$, find $|2\vec{b} \times \vec{a}|$.

6. If $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$, find $(2\vec{a} - \vec{b}) \times (\vec{a} + 2\vec{b})$.

7. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ if $|\vec{a} \times \vec{b}| = \vec{a} \cdot \vec{b}$.

8. (*i*) If either $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$, then $\vec{a} \times \vec{b} = \vec{0}$. Is the converse true ? Justify your answer with an example.

(*ii*) What inference can you draw about the vectors $\vec{a}$ and $\vec{b}$ if $\vec{a} \times \vec{b} = \vec{0}$ and $\vec{a} \cdot \vec{b} = 0$?