

THE O.P. GUPTA

ADVANCED MATH CLASSES

Class XII - Mathematics (041)

Topics - Vector Algebra

Alpha Test Series-10

(For Academic session 2025-26)

Max. Marks - 30

Time - 60 Minutes

For Video Solutions
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Followings are of 2 Marks each (Q01-05).

Q01. If $\vec{PO} + \vec{OQ} = \vec{QO} + \vec{OR}$, then show that the points P, Q and R are collinear.

Q02. If a unit vector $\vec{r}$ makes the angle $\frac{\pi}{4}$ with $\hat{i}$, $\frac{\pi}{3}$ with $\hat{k}$ and ω , $\left(0 < \omega < \frac{\pi}{2}\right)$ with $\hat{j}$, then find the value of angle ω . Hence, find vector $\vec{p}$, such that $\vec{p} = 2\vec{r}$.

Q03. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then show that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$.

Q04. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$, then prove that $\vec{a} = \pm 2(\vec{b} \times \vec{c})$.

Q05. Find $|\vec{a}|$ and $|\vec{b}|$, if $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = 8$ and $|\vec{a}| = 8|\vec{b}|$. [2×5=10]

Followings are of 3 Marks each (Q06-07).

Q06. The position vectors of P, Q, R and S are $\hat{i} - 3\hat{j} + \hat{k}$, $2\hat{i} + \hat{j}$, $3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$ respectively. Prove that the lines PQ and RS are parallel and the ratio of their lengths is 1 : 2.

Q07. Find the value of m such that the scalar product of vector $\hat{i} + \hat{j} + \hat{k}$ with the unit vector parallel to the sum of the vectors $m\hat{i} + 2\hat{j} + 3\hat{k}$ and $2\hat{i} - m\hat{j} - 5\hat{k}$ is equal to $\frac{1}{2}$.

OR

Given $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} - \hat{k}$ and $\vec{c} = 2\hat{i} + \hat{j} - 2\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 3$. [3×2=6]

Following is of 4 Marks (Q08).

Q08. CASE STUDY : The municipal council of a metro city has developed a triangular park for the public living around the society.

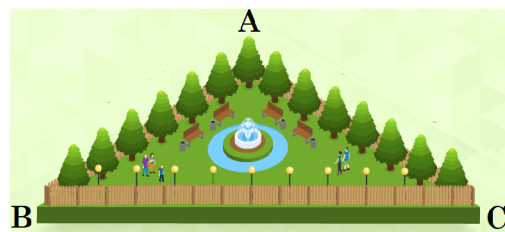
The sides of triangular park are denoted by $\vec{AB} = -\hat{i} - 2\hat{j} - 6\hat{k}$, $\vec{BC} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{CA} = -\hat{i} + 3\hat{j} + 5\hat{k}$.

Using the information given above, answer the following.

(i) Write the value of $\angle BCA$ in $\triangle ABC$.

Is $\triangle ABC$ a right angled triangle? Justify.

(ii) Show that the area of $\triangle ABC$ is $\frac{\sqrt{210}}{2}$ Sq. units? Use vector method. [2×2=4]



Followings are of 5 Marks each (Q09-10).

Q09. If A, B and C are non-collinear points with position vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively.

Show that the length of perpendicular drawn from A on BC is $\frac{|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|}{|\vec{c} - \vec{b}|}$.

OR

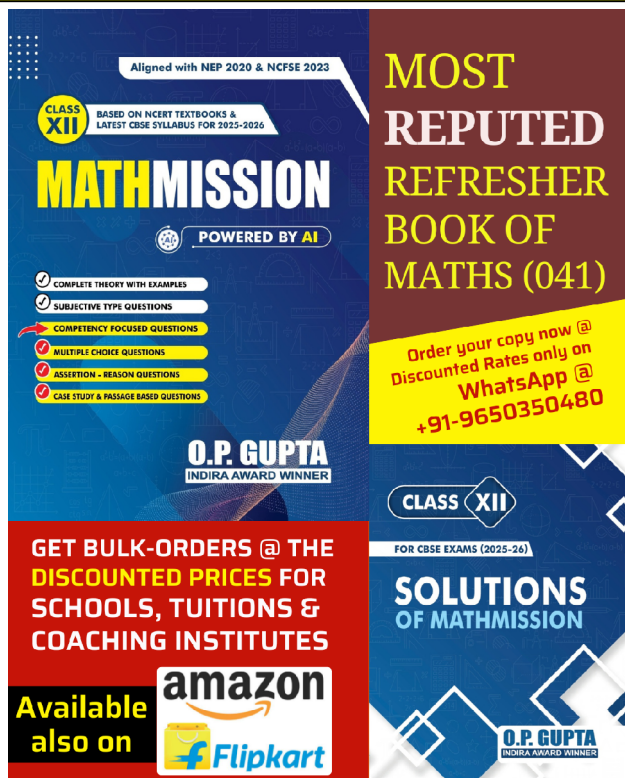
If $\hat{i} + \hat{j} + \hat{k}$, $2\hat{i} + 5\hat{j}$, $3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$ are the position vectors of A, B, C and D respectively, then find the angle between $\overrightarrow{AB}$ and $\overrightarrow{CD}$. Deduce that the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are collinear.

- Q10.** For three vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ if $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{a} \times \vec{c} = \vec{b}$, then prove that $\vec{a}$, $\vec{b}$ and $\vec{c}$ are mutually perpendicular vectors, $|\vec{b}| = |\vec{c}|$ and $|\vec{a}| = 1$. [5 × 2 = 10]

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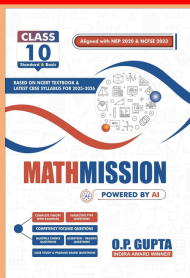
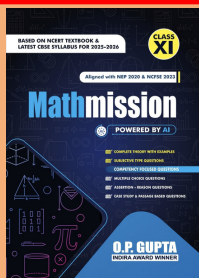
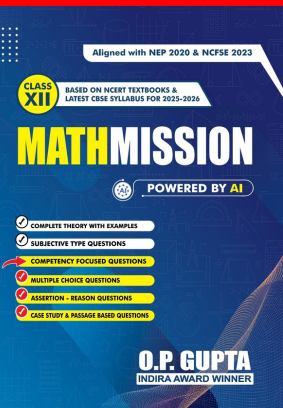
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