

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  $\vec{p}$  makes the angle  $\frac{\pi}{4}$  with  $\hat{i}$ ,  $\frac{\pi}{3}$  with  $\hat{k}$  and  $\omega$ ,  $\left(0 < \omega < \frac{\pi}{2}\right)$  with  $\hat{j}$ , then find the value of angle  $\omega$ . Hence, find vector  $\vec{p}$ .

Q03. If  $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ , 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

If  $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$ ,  $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$  and  $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$  then, find a vector  $\vec{d}$  which is perpendicular to both  $\vec{a}$  and  $\vec{b}$  satisfying the condition  $\vec{c} \cdot \vec{d} = 15$ . [3×2=6]

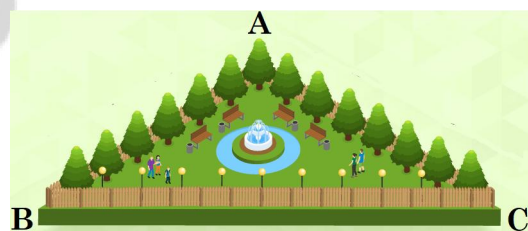
Following is of 4 Marks (Q08).

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

The sides of triangular park are denoted by  $\vec{AB} = 3\hat{i} + \hat{j} + 5\hat{k}$ ,  $\vec{BC} = -\hat{i} + 2\hat{j} - \hat{k}$  and  $\vec{CA} = -2\hat{i} - 3\hat{j} - 4\hat{k}$ .

Using the information given above, answer the following :

- Write the value of  $\angle BCA$  in  $\triangle ABC$ .
- Is  $\triangle ABC$  a right angled triangle?  
Is it scalene triangle? Justify your answer.
- What is the area of  $\triangle ABC$ ? Use vector method.
- Let a perpendicular is drawn from C on the side AB, such that it meets AB at D.  
Then find the length of this perpendicular CD.



[1×4=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  $\overline{AB}$  and  $\overline{CD}$ . Deduce that the vectors  $\overline{AB}$  and  $\overline{CD}$  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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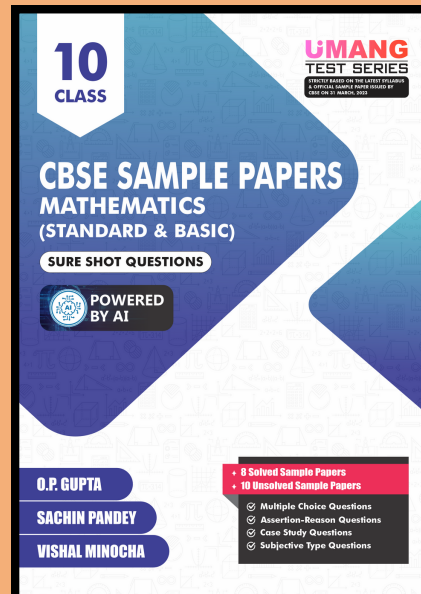
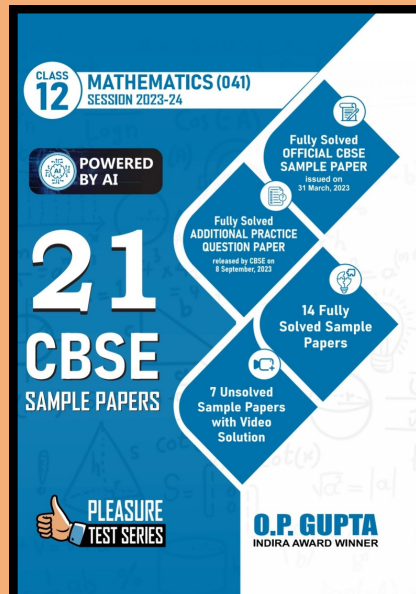
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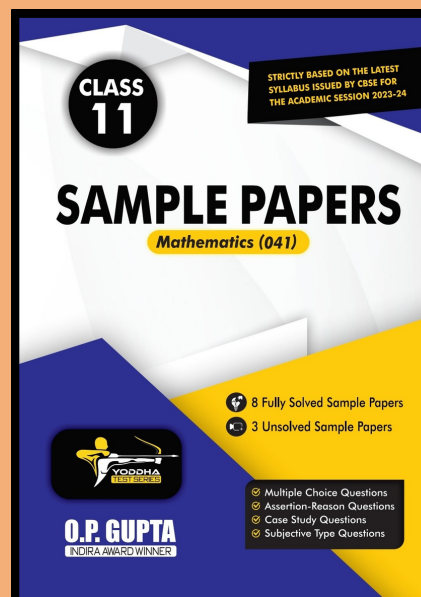
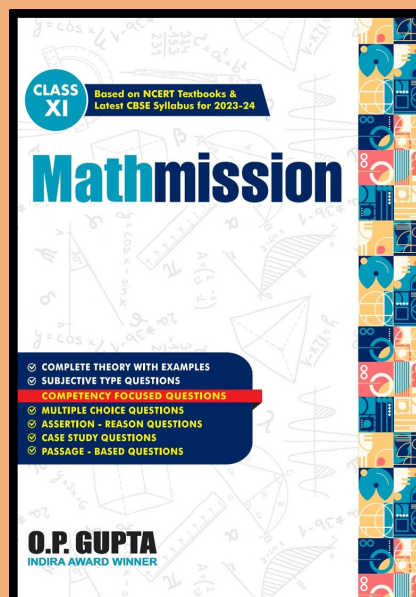
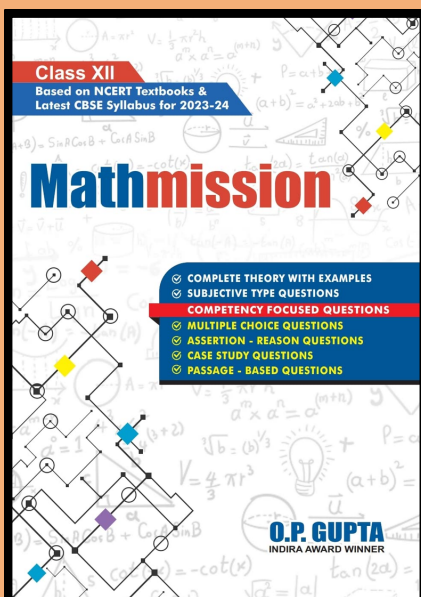
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