

Topics : Application of Derivatives, Solution of Triangle, Vector

Type of Questions

M.M. Min.

Single choice Objective (no negative marking) Q.1,2,3,4	(3 marks, 3 min.)	[12, 12]
Assertion and Reason (no negative marking) Q.5	(3 marks, 3 min.)	[3, 3]
Subjective Questions (no negative marking) Q.6,7	(4 marks, 5 min.)	[8, 10]
Match the Following (no negative marking) Q.8	(8 marks, 8 min.)	[8, 8]

1. Let  $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$  and  $\vec{b} = \hat{i} + \hat{j}$ . If  $\vec{c}$  is a vector such that  $\vec{a} \cdot \vec{c} = |\vec{c}|$ ,  $|\vec{c} - \vec{a}| = 2\sqrt{2}$  and the angle between  $\vec{a} \times \vec{b}$  and  $\vec{c}$  is  $30^\circ$  then  $|(\vec{a} \times \vec{b}) \times \vec{c}|$  is equal to:

- (A)  $\frac{2}{3}$  (B)  $\frac{3}{2}$  (C) 2 (D) 3

2. Let the centre of the parallelopiped formed by  $\vec{PA} = \hat{i} + 2\hat{j} + 2\hat{k}$ ;  $\vec{PB} = 4\hat{i} - 3\hat{j} + \hat{k}$ ;  $\vec{PC} = 3\hat{i} + 5\hat{j} - \hat{k}$  is given by the position vector (7, 6, 2). Then the position vector of the point P is:

- (A) (3, 4, 1) (B) (6, 8, 2) (C) (1, 3, 4) (D) (2, 6, 8)

3. If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are coplanar vectors and  $\vec{a}$  is not parallel to  $\vec{b}$  then,

$\{(\vec{c} \times \vec{b}) \cdot (\vec{a} \times \vec{b})\} \vec{a} + \{(\vec{a} \times \vec{c}) \cdot (\vec{a} \times \vec{b})\} \vec{b}$  is equal to :

- (A)  $\{(\vec{a} \times \vec{b}) \cdot (\vec{a} + \vec{b})\} \vec{c}$  (B)  $\{(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{b})\} \vec{c}$  (C)  $\{(\vec{a} \times \vec{b}) \cdot (\vec{a} - \vec{b})\} \vec{c}$  (D) none of these

4. If  $g(x) = 2f(2x^3 - 3x^2) + f(6x^2 - 4x^3 - 3) \forall x \in \mathbb{R}$  and  $f''(x) > 0, \forall x \in \mathbb{R}$ , then  $g(x)$  is increasing in the interval

- (A)  $\left(-\infty, -\frac{1}{2}\right) \cup (0, 1)$  (B)  $\left(-\frac{1}{2}, 0\right) \cup (1, \infty)$  (C)  $(0, \infty)$  (D) none of these

5. **Statement-1** : In any  $\triangle ABC$ , the minimum value of  $\frac{r_1 + r_2 + r_3}{r}$  is equal to 9.

**Statement-2** : In a  $\triangle ABC$  if  $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ , then  $\frac{r_1 + r_2 + r_3}{r} = 9$ .

- (A) Statement-1 is correct and statement-2 is correct and statement-2 is correct explanation of statement-1  
(B) Statement-1 and statement-2 both are correct but statement-2 is not correct explanation of statement-1  
(C) Statement-1 is false but statement-2 is true  
(D) Statement-1 is true but statement-2 is false  
(E) Statement-1 and Statement-2 both are False.

6. A spherical iron ball 8 inch. in diameter is coated with a layer of ice of uniform thickness. If the ice melts at the rate of  $10 \text{ inch}^3/\text{minute}$ , how fast is the thickness of the ice decreasing when it is 2 inch. thick?
7. A circle with centre in the first quadrant is tangent to  $y = x + 10$ ,  $y = x - 6$ , and the y-axis. Let  $(h, k)$  be the centre of the circle. If the value of  $(h + k) = a + b\sqrt{a}$  (where  $a, b \in \mathbb{Q}$ ), find the value of  $a + b$ .

8. Match the column

Column - I

Column - II

(A) If  $\vec{a}, \vec{b}, \vec{c}$  are three mutually perpendicular vectors where

(p)  $-\frac{3}{4}$

$|\vec{a}| = |\vec{b}| = 2$  and  $|\vec{c}| = 1$ , then  $\frac{1}{12}[\vec{a} \times \vec{b} \quad \vec{b} \times \vec{c} \quad \vec{c} \times \vec{a}]$  is

(B) If  $\vec{a}, \vec{b}$  are two unit vectors inclined at  $\frac{\pi}{3}$ , then

(q) 0

$[\vec{a} \quad \vec{b} + \vec{a} \times \vec{b} \quad \vec{b}]$  is

(C) If  $\vec{b}, \vec{c}$  are orthogonal unit vectors and  $\vec{b} \times \vec{c} = \vec{a}$ , then

(r)  $\frac{4}{3}$

$[\vec{a} + \vec{b} + \vec{c} \quad \vec{a} + \vec{b} \quad \vec{b} + \vec{c}]$  is

(D) If  $[\vec{x} \vec{y} \vec{a}] = [\vec{x} \vec{y} \vec{b}] = [\vec{a} \vec{b} \vec{c}] = 0$  each vector being a

(s) 1

non-zero vector, and no two vectors are collinear then  $[\vec{x} \vec{y} \vec{c}] =$

## Answers Key

1. (B)      2. (A)      3. (B)      4. (B)

5. (B)      6.  $\frac{5}{72\pi}$  inch/minute

7. 10

8. (A)  $\rightarrow$  (r) ; (B)  $\rightarrow$  (p) ; (C)  $\rightarrow$  (s) ; (D)  $\rightarrow$  (q)