

## VECTOR LEVEL-I

1.  $\vec{OA}$  and  $\vec{OB}$  are two vectors such that  $|\vec{OA} + \vec{OB}| = |\vec{OA} + 2\vec{OB}|$ . Then  
 (A)  $\angle BOA = 90^\circ$  (B)  $\angle BOA > 90^\circ$   
 (C)  $\angle BOA < 90^\circ$  (D)  $60^\circ \leq \angle BOA \leq 90^\circ$
2. If  $\vec{b}$  and  $\vec{c}$  are two non-collinear vectors such that  $\vec{a} \cdot (\vec{b} + \vec{c}) = 4$  and  $\vec{a} \times (\vec{b} \times \vec{c}) = (x^2 - 2x + 6)\vec{b} + (\sin y)\vec{c}$ , then the point  $(x, y)$  lies on  
 (A)  $x = 1$  (B)  $y = 1$   
 (C)  $y = \pi$  (D)  $x + y = 0$
3. The scalar  $\vec{a} \cdot \{(\vec{b} + \vec{c}) \times (\vec{a} + \vec{b} + \vec{c})\}$  equals  
 (A) 0 (B)  $2[\vec{a} \vec{b} \vec{c}]$  (C)  $[\vec{a} \vec{b} \vec{c}]$  (D) None of these
4. If  $\hat{a}, \hat{b}, \hat{c}$  are three unit vectors, such that  $\hat{a} + \hat{b} + \hat{c}$  is also a unit vector, and  $\theta_1, \theta_2, \theta_3$  are angle between the vectors,  $\hat{a}, \hat{b}; \hat{b}, \hat{c}$  and  $\hat{c}, \hat{a}$  respectively then  $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$  equals  
 (A) 3 (B) -3 (C) 1 (D) -1
5. If angle between  $\vec{a}$  and  $\vec{b}$  is  $\frac{\pi}{3}$ , then angle between  $2\vec{a}$  and  $-3\vec{b}$  is  
 (A)  $\pi/3$  (B)  $-\pi/3$  (C)  $2\pi/3$  (D)  $-2\pi/3$
6. The vectors  $2\hat{i} - m\hat{j} + 3m\hat{k}$  and  $(1+m)\hat{i} - 2m\hat{j} + \hat{k}$  include an acute angle for  
 (A) all real  $m$  (B)  $m < -2$  or  $m > -1/2$   
 (C)  $m = -1/2$  (D)  $m \in [-2, -1/2]$
7.  $|\vec{a}| = 3, |\vec{b}| = 4, |\vec{c}| = 5$  such that each is perpendicular to sum of the other two, then  $|\vec{a} + \vec{b} + \vec{c}| =$   
 (A)  $5\sqrt{2}$  (B)  $\frac{5}{\sqrt{2}}$  (C)  $10\sqrt{2}$  (D)  $5\sqrt{3}$
8. If  $\vec{x}$  and  $\vec{y}$  are two vectors and  $\phi$  is the angle between them, then  $\frac{1}{2}|\vec{x} - \vec{y}|$  is equal to  
 (A) 0 (B)  $\frac{\pi}{2}$  (C)  $\left|\sin \frac{\phi}{2}\right|$  (D)  $\left|\cos \frac{\phi}{2}\right|$
9. If  $\vec{u} = \hat{i} \times (\vec{a} \times \hat{i}) + \hat{j} \times (\vec{a} \times \hat{j}) + \hat{k} \times (\vec{a} \times \hat{k})$ , then  
 (A)  $u$  is unit vector (B)  $u = a + i + j + k$   
 (C)  $u = 2a$  (D) none of these
10. Let  $\hat{a}$  and  $\hat{b}$  be two unit vectors such that  $\hat{a} + \hat{b}$  is also a unit vector. Then the angle between  $\hat{a}$  and  $\hat{b}$  is  
 (A)  $30^\circ$  (B)  $60^\circ$   
 (C)  $90^\circ$  (D)  $120^\circ$

11. If  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ ,  $\vec{b} = 4\hat{i} + 3\hat{j} + 4\hat{k}$  and  $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$  are linearly dependent vectors and  $|\vec{c}| = \sqrt{3}$ .  
 (A)  $\alpha = 1, \beta = -1$  (B)  $\alpha = 1, \beta \neq 1$   
 (C)  $\alpha = -1, \beta \neq 1$  (D)  $\alpha = \pm 1, \beta = 1$
12. 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  $|(\vec{a} \times \vec{b}) \times \vec{c}| =$   
 (A)  $\frac{2}{3}$  (B)  $\frac{3}{2}$   
 (C) 2 (D) 3
13. Let  $\vec{a} = x\hat{i} - \hat{k}$ ,  $\vec{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}$  and  $\vec{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}$ . Then  $[\vec{a} \ \vec{b} \ \vec{c}]$  depends on  
 (A) only x (B) only y  
 (C) NEITHER x NOR y (D) both x and y
14. If  $|\vec{a} + \vec{b}| = |\vec{a}|$ , then  $\vec{b} \cdot (2\vec{a} + \vec{b})$  equals  
 (A) 0 (B) 1  
 (C)  $2\vec{a} \cdot \vec{b}$  (D) none of these
15. If  $|\vec{a}| = 3$ ,  $|\vec{b}| = 5$ ,  $|\vec{c}| = 7$  and  $\vec{a} + \vec{b} + \vec{c} = 0$ , then angle between  $\vec{a}$  and  $\vec{b}$  is  
 (A)  $\frac{\pi}{4}$  (B)  $\frac{\pi}{3}$   
 (C)  $\frac{\pi}{2}$  (D) none of these
16. Given that angle between the vectors  $\vec{a} = \lambda\hat{i} - 3\hat{j} - \hat{k}$  and  $\vec{b} = 2\lambda\hat{i} + \lambda\hat{j} - \hat{k}$  is acute, whereas the vector  $\vec{b}$  makes with the co-ordinate axes an obtuse angle then  $\lambda$  belongs to  
 (A)  $(-\infty, 0)$  (B)  $(0, \infty)$   
 (C)  $\mathbb{R}$  (D) none of these
17. If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are unit coplanar vectors then the scalar triple product  $[2\vec{a} - \vec{b}, 2\vec{b} - \vec{c}, 2\vec{c} - \vec{a}] =$   
 (A) 0 (B) 1  
 (C)  $-\sqrt{3}$  (D)  $\sqrt{3}$
18. If  $|\vec{a} + \vec{b}| > |\vec{a} - \vec{b}|$ , then the angle between  $\vec{a}$  and  $\vec{b}$  is  
 (A) acute (B) obtuse  
 (C)  $\pi/2$  (D) none of these
19. If the lines  $\vec{r} = x\left(\frac{\vec{b}}{|\vec{b}|} + \frac{\vec{c}}{|\vec{c}|}\right)$  and  $\vec{r} = 2\vec{b} + y(\vec{c} - \vec{b})$  intersect at a point with position vector  $z\left(\frac{\vec{b}}{|\vec{b}|} + \frac{\vec{c}}{|\vec{c}|}\right)$ , then  
 (A) z is the AM between  $|\vec{b}|$  and  $|\vec{c}|$  (B) z is the GM between  $|\vec{b}|$  &  $|\vec{c}|$

(C)  $z$  is the HM between  $|\vec{b}|$  and  $|\vec{c}|$  (D)  $z = |\vec{b}| + |\vec{c}|$

20. Let ABCDEF be a regular hexagon and  $\vec{AB} = \vec{a}$ ,  $\vec{BC} = \vec{b}$ ,  $\vec{CD} = \vec{c}$  then  $\vec{AE}$  is

- (A)  $\vec{a} + \vec{b} + \vec{c}$  (B)  $\vec{a} + \vec{b}$   
(C)  $\vec{b} + \vec{c}$  (D)  $\vec{c} + \vec{a}$

21. The number of unit vectors perpendicular to vectors  $\vec{a} = (1, 1, 0)$  and  $\vec{b} = (0, 1, 1)$  is

- (A) One (B) Two  
(C) Three (D) Infinite

22. If  $\hat{p}$  and  $\hat{d}$  are two unit vectors and  $\theta$  is the angle between them, then

- (A)  $\frac{1}{2}|\hat{p} - \hat{d}|^2 = \sin^2 \frac{\theta}{2}$  (B)  $\hat{p} \times \hat{d} = \sin \theta$   
(C)  $\frac{1}{2}(\hat{p} - \hat{d})^2 = 1 - \cos \theta$  (D)  $\frac{1}{2}(\hat{p} - \hat{d})^2 = 1 - \cos 2\theta$

23. The value of  $k$  for which the points  $A(1, 0, 3)$ ,  $B(-1, 3, 4)$ ,  $C(1, 2, 1)$  and  $D(k, 2, 5)$  are coplanar is

- (A) 1 (2) 2  
(C) 0 (D) -1

24. If  $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0$  and the vectors  $A = (1, a, a^2)$ ,  $B = (1, b, b^2)$ ,  $C = (1, c, c^2)$  are

non-coplanar, then the value of  $abc$  will be

- (A) -1 (B) 1  
(C) 0 (D) None of these

25. Let  $a, b, c$  be distinct non-negative numbers. If the vectors  $a\hat{i} + a\hat{j} + c\hat{k}$ ,  $\hat{i} + \hat{k}$ ,  $c\hat{i} + c\hat{j} + b\hat{k}$  lie in a plane, then  $c$  is

- (A) the arithmetic mean of  $a$  and  $b$  (B) the geometric mean of  $a$  and  $b$   
(C) the harmonic mean of  $a$  and  $b$  (D) equal to zero

26. The unit vector perpendicular to the plane determined by  $P(1, -1, 2)$ ,  $Q(2, 0, -1)$ ,  $R(0, 2, 1)$  is

- (A)  $\frac{i + 2j + k}{\sqrt{6}}$  (B)  $\frac{i - j + 2k}{\sqrt{6}}$   
(C)  $\frac{2i + j + k}{\sqrt{6}}$  (D) None of these

27. If  $\vec{A}, \vec{B}, \vec{C}$  are non-coplanar vectors then  $\frac{\vec{A} \cdot \vec{B} \times \vec{C}}{\vec{C} \times \vec{A} \cdot \vec{B}} + \frac{\vec{B} \cdot \vec{A} \times \vec{C}}{\vec{C} \cdot \vec{A} \times \vec{B}}$  is equal to

- (A) 3 (B) 0  
(B) 1 (D) None of these

28. If the vector  $a\hat{i} + \hat{j} + \hat{k}$ ,  $\hat{i} + b\hat{j} + \hat{k}$  and  $\hat{i} + \hat{j} + c\hat{k}$  ( $a \neq b \neq c \neq 1$ ) are coplanar, then the value of  $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$  is equal to
- (A) 1 (B) 0  
(C) 2 (D) None of these
29. If  $\vec{a}, \vec{b}, \vec{c}$  are vectors such that  $\vec{a} \cdot \vec{b} = 0$  and  $\vec{a} + \vec{b} = \vec{c}$ . Then
- (A)  $|\vec{a}|^2 + |\vec{b}|^2 = |\vec{c}|^2$  (B)  $|\vec{a}|^2 = |\vec{b}|^2 + |\vec{c}|^2$   
(C)  $|\vec{b}|^2 = |\vec{a}|^2 + |\vec{c}|^2$  (D) None of these
30. The points with position vector  $60\hat{i} + 3\hat{j}$ ,  $40\hat{i} - 8\hat{j}$  and  $a\hat{i} - 52\hat{j}$  are collinear if
- (A)  $a = -40$  (B)  $a = 40$  (C)  $a = 20$  (D) none of these.
31. Let  $\hat{a}$  and  $\hat{b}$  be two unit vectors such that  $\hat{a} + \hat{b}$  is also a unit vector. Then the angle between  $\hat{a}$  and  $\hat{b}$  is
- (A)  $30^\circ$  (B)  $60^\circ$  (C)  $90^\circ$  (D)  $120^\circ$
32. If vectors  $ax\hat{i} + 3\hat{j} - 5\hat{k}$  and  $x\hat{i} + 2\hat{j} + 2ax\hat{k}$  make an acute angle with each other, for all  $x \in \mathbb{R}$ , then  $a$  belongs to the interval
- (A)  $\left(-\frac{1}{4}, 0\right)$  (B)  $(0, 1)$  (C)  $\left(0, \frac{6}{25}\right)$  (D)  $\left(-\frac{3}{25}, 0\right)$
33. A vector of unit magnitude that is equally inclined to the vectors  $\hat{i} + \hat{j}$ ,  $\hat{j} + \hat{k}$  and  $\hat{i} + \hat{k}$  is;
- (A)  $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} - \hat{k})$  (B)  $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} - \hat{k})$   
(C)  $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k})$  (D) none of these
34. Let  $a, b, c$  be three distinct positive real numbers. If  $\vec{p}, \vec{q}, \vec{r}$  lie in plane, where  $\vec{p} = a\hat{i} - a\hat{j} + b\hat{k}$ ,  $\vec{q} = \hat{i} + \hat{k}$  and  $\vec{r} = c\hat{i} + c\hat{j} + b\hat{k}$  then  $b$  is
- (A) A.M of  $a, c$  (B) the G.M of  $a, c$   
(C) the H.M of  $a, c$  (D) equal to  $c$
85. The scalar  $\vec{A} \cdot \{(\vec{B} + \vec{C}) \times (\vec{A} + \vec{B} + \vec{C})\}$  is equal to \_\_\_\_\_
36. If  $\vec{a}, \vec{b}, \vec{c}$  are unit coplanar vectors, then the scalar triple product  $[2\vec{a} - \vec{b}, 2\vec{b} - \vec{c}, 2\vec{c} - \vec{a}]$  is equal to \_\_\_\_\_
37. The area of a parallelogram whose diagonals represent the vectors  $3\hat{i} + \hat{j} - 2\hat{k}$  and  $\hat{i} - 3\hat{j} + 4\hat{k}$  is
- (A)  $10\sqrt{3}$  (B)  $5\sqrt{3}$   
(C) 8 (D) 4

38. The value of  $\left| \vec{a} + \vec{b} \quad \vec{b} + \vec{c} \quad \vec{c} + \vec{a} \right|$  is equal to
- (A)  $2 \left| \vec{a} \vec{b} \vec{c} \right|$  (B)  $3 \left| \vec{a} \vec{b} \vec{c} \right|$   
 (C)  $\left| \vec{a} \vec{b} \vec{c} \right|$  (D) 0

### LEVEL-II

- If  $\vec{a}$  is any vector in the plane of unit vectors  $\hat{b}$  and  $\hat{c}$ , with  $\hat{b} \cdot \hat{c} = 0$ , then the magnitude of the vector  $\vec{a} \times (\hat{b} \times \hat{c})$  is  
 (A)  $|\vec{a}|$  (B) 2  
 (C) 0 (D) none of these.
- If  $\vec{a}$  and  $\vec{b}$  are two unit vectors and  $\theta$  is the angle between them, then the unit vector along the angular bisector of  $\vec{a}$  and  $\vec{b}$  will be given by  
 (A)  $\frac{\vec{a} - \vec{b}}{2 \cos \frac{\theta}{2}}$  (B)  $\frac{\vec{a} + \vec{b}}{2 \cos \frac{\theta}{2}}$   
 (C)  $\frac{\vec{a} + \vec{b}}{2 \sin \frac{\theta}{2}}$  (D) none of these.
- If  $\vec{a}$  is a unit vector and projection of  $\vec{x}$  along  $\vec{a}$  is 2 units and  $(\vec{a} \times \vec{x}) + \vec{b} = \vec{x}$ , then  $\vec{x}$  is given by  
 (A)  $\frac{1}{2} [\vec{a} - \vec{b} + (\vec{a} \times \vec{b})]$  (B)  $\frac{1}{2} [2\vec{a} + \vec{b} + (\vec{a} \times \vec{b})]$   
 (C)  $[\vec{a} + (\vec{a} \times \vec{b})]$  (D) none of these.
- If  $4\vec{a} + 5\vec{b} + 9\vec{c} = 0$ , then  $(\vec{a} \times \vec{b}) \times [(\vec{b} \times \vec{c}) \times (\vec{c} \times \vec{a})]$  is equal to  
 (A) A vector perpendicular to plane of  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  (B) A scalar quantity  
 (C)  $\vec{0}$  (D) None of these
- The shortest distance of the point (3, 2, 1) from the plane, which passes through a(1, 1, 1) and which is perpendicular to vector  $\vec{a} = 2\hat{i} + 3\hat{k}$ , is  
 (A)  $\frac{4}{\sqrt{3}}$  (B) 2 (C) 3 (D)  $\frac{1}{\sqrt{13}}$
- Let  $\vec{a} = 2\hat{i} + \hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$  and a unit vector  $\vec{c}$  be coplanar. If  $\vec{c}$  is perpendicular to  $\vec{a}$  then  $\vec{c} =$   
 (A)  $\frac{1}{\sqrt{2}}(-\hat{j} + \hat{k})$  (B)  $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} - \hat{k})$   
 (C)  $\frac{1}{\sqrt{5}}(\hat{i} + 2\hat{j})$  (D)  $\frac{1}{\sqrt{2}}(\hat{i} - \hat{j} - \hat{k})$
- Let  $\vec{a}$  and  $\vec{b}$  be the two non-collinear unit vector. If  $\vec{u} = \vec{a} - (\vec{a} \cdot \vec{b})\vec{b}$  and  $\vec{v} = \vec{a} \times \vec{b}$ , then  $|\vec{v}|$  is  
 (A)  $|\vec{u}|$  (B)  $|\vec{u}| + |\vec{u} \cdot \vec{a}|$   
 (C)  $|\vec{u}| + \vec{u} \cdot (\vec{a} + \vec{b})$  (D) none of these

8. If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are unit vectors, then  $|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2$  does NOT exceed  
 (A) 4 (B) 9  
 (C) 8 (D) 6
9. If  $\vec{a} \times \vec{r} = \vec{b} + t\vec{a}$  and  $\vec{a} \cdot \vec{r} = 3$ , where  $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$  and  $\vec{b} = -\hat{i} - 2\hat{j} + \hat{k}$  then  $\vec{r}$  equals  
 (A)  $\frac{7}{6}\hat{i} + \frac{2}{5}\hat{j}$  (B)  $\frac{7}{6}\hat{i} + \frac{1}{3}\hat{j}$   
 (C)  $\frac{7}{6}\hat{i} + \frac{2}{3}\hat{j} + \frac{1}{3}\hat{k}$  (D) none of these
10. If  $\alpha(\vec{a} \times \vec{b}) + \beta(\vec{b} \times \vec{c}) + \gamma(\vec{c} \times \vec{a}) = 0$  and at least one of the numbers  $\alpha$ ,  $\beta$  and  $\gamma$  is non-zero, then the vectors  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are  
 (A) perpendicular (B) parallel  
 (C) co-planar (D) none of these
11. The vectors  $\vec{a}$  and  $\vec{b}$  are non-zero and non-collinear. The value of  $x$  for which vector  $\vec{c} = (x - 2)\vec{a} + \vec{b}$  and  $\vec{d} = (2x + 1)\vec{a} - \vec{b}$  are collinear.  
 (A) 1 (B) 1/2  
 (C) 1/3 (D) 2
12.  $\vec{a} \times \vec{b} = \vec{c}$ ,  $\vec{b} \times \vec{c} = \vec{a}$ , then  
 (A)  $|\vec{a}| = 1$ ,  $|\vec{b}| = |\vec{c}|$  (B)  $|\vec{c}| = 1$ ,  $|\vec{a}| = 1$   
 (C)  $|\vec{b}| = 2$ ,  $|\vec{c}| = 2|\vec{a}|$  (D)  $|\vec{b}| = 1$ ,  $|\vec{c}| = |\vec{a}|$
13. If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are three non-coplanar vectors and  $\vec{p}$ ,  $\vec{q}$ ,  $\vec{r}$  are vectors defined by the relations  $\vec{p} = \frac{\vec{b} \times \vec{c}}{[\vec{a} \vec{b} \vec{c}]}$ ,  $\vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{a} \vec{b} \vec{c}]}$ ,  $\vec{r} = \frac{\vec{a} \times \vec{b}}{[\vec{a} \vec{b} \vec{c}]}$  then the value of expression  $(\vec{a} + \vec{b}) \cdot \vec{p} + (\vec{b} + \vec{c}) \cdot \vec{q} + (\vec{c} + \vec{a}) \cdot \vec{r}$  is equal to  
 (A) 0 (B) 1  
 (C) 2 (D) 3
14. The value of  $|\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2$  is  
 (A)  $a^2$  (B)  $2a^2$   
 (C)  $3a^2$  (D) None of these
15. If  $\vec{a} = \hat{i} + \hat{j}$ ,  $\vec{b} = 2\hat{j} - \hat{k}$  and  $\vec{r} \times \vec{a} = \vec{b} \times \vec{a}$ ,  $\vec{r} \times \vec{b} = \vec{a} \times \vec{b}$ , then a unit vector in the direction of  $\vec{r}$  is;  
 (A)  $\frac{1}{\sqrt{11}}(\hat{i} + 3\hat{j} - \hat{k})$  (B)  $\frac{1}{\sqrt{11}}(\hat{i} - 3\hat{j} + \hat{k})$   
 (C)  $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} - \hat{k})$  (D) none of these
16.  $(\vec{a} \cdot \hat{i})(\vec{a} \times \hat{i}) + (\vec{a} \cdot \hat{j})(\vec{a} \times \hat{j}) + (\vec{a} \cdot \hat{k})(\vec{a} \times \hat{k})$  is equal to;  
 (A)  $3\vec{a}$  (B)  $\vec{r}$   
 (C)  $2\vec{r}$  (D) none of these

17. If the vertices of a tetrahedron have the position vectors  $\vec{0}$ ,  $\hat{i} + \hat{j}$ ,  $2\hat{j} - \hat{k}$  and  $\hat{i} + \hat{k}$  then the volume of the tetrahedron is  
 (A)  $1/6$  (B) 1  
 (C) 2 (D) none of these
18.  $\vec{A} = (1, -1, 1)$ ,  $\vec{C} = (-1, -1, 0)$  are given vectors; then the vector  $\vec{B}$  which satisfies  $\vec{A} \times \vec{B} = \vec{C}$  and  $\vec{A} \cdot \vec{B} = 1$  is \_\_\_\_\_
19. If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are given non-coplanar unit vectors such that  $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{\vec{b} + \vec{c}}{2}$ , then the angle between  $\vec{a}$  and  $\vec{c}$  is \_\_\_\_\_
20. Vertices of a triangle are (1, 2, 4) (3, 1, -2) and (4, 3, 1) then its area is \_\_\_\_\_
21. A unit vector coplanar with  $\hat{i} + \hat{j} + 2\vec{k}$  and  $\hat{i} + 2\hat{j} + \vec{k}$  and perpendicular to  $\hat{i} + \hat{j} + \vec{k}$  is \_\_\_\_\_

### LEVEL-III

- 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
- The projection of  $\hat{i} + \hat{j} + \hat{k}$  on the line whose equation is  $\vec{r} = (3 + \lambda)\hat{i} + (2\lambda - 1)\hat{j} + 3\lambda\hat{k}$ ,  $\lambda$  being the scalar parameter is;  
 (A)  $\frac{1}{\sqrt{14}}$  (B) 6  
 (C)  $\frac{6}{\sqrt{14}}$  (D) none of these
- If  $\vec{p}, \vec{q}$  are two non-collinear and non-zero vectors such that  $(b - c)\vec{p} \times \vec{q} + (c - a)\vec{p} + (a - b)\vec{q} = 0$  where  $a, b, c$  are the lengths of the sides of a triangle, then the triangle is  
 (A) right angled (B) obtuse angled (C) equilateral (D) isosceles

#### L-I

- |       |       |
|-------|-------|
| 1. B  | 2. A  |
| 3. A  | 4. D  |
| 5. C  | 6. B  |
| 7. A  | 8.    |
| 9. C  | 10. D |
| 11. B | 12. B |
| 13. C | 14. A |
| 15. B | 16. A |
| 17. A | 18. A |
| 19. C | 20. C |
| 21. B | 22. C |
| 23. D | 24. A |
| 25. B | 26. C |
| 27. B | 28. A |
| 29. A | 30. A |
| 31. D | 32. C |
| 33. C | 34. C |
| 35. O | 36. O |
| 37. B | 38. A |

#### L-II

- |                      |                   |
|----------------------|-------------------|
| 1. A                 | 2. B              |
| 3. B                 | 4. C              |
| 5. A                 | 6. A              |
| 7. A                 | 8. B              |
| 9. D                 | 10. C             |
| 11. C                | 12. D             |
| 13. D                | 14. B             |
| 15. A                | 16. D             |
| 17. A                | 18. K             |
| 19. $\theta = \pi/3$ | 20. $5\sqrt{5/2}$ |



$$21. \quad -\frac{\hat{J}+\hat{K}}{\sqrt{2}} \text{ ON } \frac{\hat{J}-\hat{K}}{\sqrt{2}}$$

L-III

1.

3. C

2. C