101. The projection of the vector $\mathbf{i}+\mathbf{j}+\mathbf{k}$ along the vector $\mathbf{j}$ is **[Kerala (Engg.) 2002]**

(a) 1 (b) 0
(c) 2 (d) –1

102. If the position vectors of A and B be $6\mathbf{i}+\mathbf{j}-3\mathbf{k}$ and $4\mathbf{i}-3\mathbf{j}-2\mathbf{k}$, then the work done by the force $\vec{F}=\mathbf{i}-3\mathbf{j}+5\mathbf{k}$ in displacing a particle from A to B is **[MP PET 1987]**

(a) 15 *unit* (b) 17 *unit*
(c) – 15 *unit* (d) None of these

103. If the force $\vec{F}=\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ moves from $\mathbf{i}+\mathbf{j}-\mathbf{k}$ to $2\mathbf{i}-\mathbf{j}+\mathbf{k}$, then work done will be represented by **[BIT Ranchi 1992]**

(a) 3 (b) 4
(c) 5 (d) 6

104. The work done by the force $F=2\mathbf{i}-3\mathbf{j}+2\mathbf{k}$ in displacing a particle from the point (3, 4, 5) to the point (1, 2, 3) is **[MP PET 1994; Kurukshetra CEE 2002]**

(a) 2 *unit* (b) 3 *unit*
(c) 4 *unit* (d) 5 *unit*

105. Force $3\mathbf{i}+2\mathbf{j}+5\mathbf{k}$ and $2\mathbf{i}+\mathbf{j}-3\mathbf{k}$ are acting on a particle and displace it from the point $2\mathbf{i}-\mathbf{j}-3\mathbf{k}$ to the point $4\mathbf{i}-3\mathbf{j}+7\mathbf{k}$, then work done by the force is **[MP PET 1995]**

(a) 30 *unit* (b) 36 *unit*
(c) 24 *unit* (d) 18 *unit*

106. A particle acted on by two forces $3\mathbf{i}+2\mathbf{j}-3\mathbf{k}$ and $2\mathbf{i}+4\mathbf{j}+2\mathbf{k}$ is displaced from the point $\mathbf{i}+2\mathbf{j}+\mathbf{k}$ to $5\mathbf{i}+4\mathbf{j}+2\mathbf{k}$. The total work done by the forces is equal to

(a) 63 *unit* (b) 39 *unit*
(c) 33 *unit* (d) 31 *unit*

107. The work done in moving an object along the vector $3\mathbf{i}+2\mathbf{j}-5\mathbf{k}$, if the applied force is $\vec{F}=2\mathbf{i}-\mathbf{j}-\mathbf{k}$, is **[MP PET 1997, 2001]**

(a) 7 (b) 8
(c) 9 (d) 10

108. A force of magnitude 5 units acting along the vector $2\mathbf{i}-2\mathbf{j}+\mathbf{k}$ displaces the point of application from $(1,2,3)$ to $(5,3,7)$, then the work done is

(a) 50/7 (b) 50/3
(c) 25/3 (d) 25/4

109. A particle acted on by constant forces $4\mathbf{i}+\mathbf{j}-3\mathbf{k}$ and $3\mathbf{i}+\mathbf{j}-\mathbf{k}$ is displaced from the point $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ to the point $5\mathbf{i}+4\mathbf{j}+\mathbf{k}$. The total work done by the force is **[AIEEE 2003, 04]**

(a) 20 *unit* (b) 30 *unit*
(c) 40 *unit* (d) 50 *unit*

110. If the scalar projection of the vectors $x\mathbf{i}-\mathbf{j}+\mathbf{k}$ on the vector $2\mathbf{i}-\mathbf{j}+5\mathbf{k}$ is $\frac{1}{\sqrt{30}}$ then value of x is equal to **[J & K 2005]**

(a) $\frac{-5}{2}$ (b) 6
(c) –6 (d) 3

111. If $\mathbf{x}+\mathbf{y}+\mathbf{z}=0, |\mathbf{x}|=|\mathbf{y}|=|\mathbf{z}|=2$ and θ is angle between $\mathbf{y}$ and $\mathbf{z}$, then the value of $\operatorname{cosec}^2\theta+\cot^2\theta$ is equal to **[J & K 2005]**

(a) 4/3 (b) 5/3
(c) 1/3 (d) 1

112. The projection of the vector $2\mathbf{i}+\mathbf{j}-3\mathbf{k}$ on the vector $\mathbf{i}-2\mathbf{j}+\mathbf{k}$ is..... **[Karnataka CET 2005]**

(a) $-\frac{3}{\sqrt{14}}$ (b) $\frac{3}{\sqrt{14}}$
(c) $-\sqrt{\frac{3}{2}}$ (d) $\frac{3}{\sqrt{2}}$

113. If $|\mathbf{a}|=|\mathbf{b}|=1$ and $|\mathbf{a}+\mathbf{b}|=\sqrt{3}$, then the value of $(3\mathbf{a}-4\mathbf{b}).(2\mathbf{a}+5\mathbf{b})$ is **[Kerala (Engg.) 2005]**

(a) – 21 (b) –21/2
(c) 21 (d) 21/2
(e) 59/2

114. A unit vector in the plane of $\mathbf{i}+2\mathbf{j}+\mathbf{k}$ and $\mathbf{i}+\mathbf{j}+2\mathbf{k}$ are perpendicular to $2\mathbf{i}+\mathbf{j}+\mathbf{k}$ is

(a) $\mathbf{j}-\mathbf{k}$ (b) $\frac{\mathbf{i}+\mathbf{j}}{\sqrt{2}}$
(c) $\frac{\mathbf{j}+\mathbf{k}}{\sqrt{2}}$ (d) $\frac{\mathbf{j}-\mathbf{k}}{\sqrt{2}}$
(e) $5(\mathbf{j}-\mathbf{k})$

115. If $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ are perpendicular to $\mathbf{b}+\mathbf{c}, \mathbf{c}+\mathbf{a}$ and $\mathbf{a}+\mathbf{b}$ respectively and if $|\mathbf{a}+\mathbf{b}|=6, |\mathbf{b}+\mathbf{c}|=8$ and $|\mathbf{c}+\mathbf{a}|=10$ then $|\mathbf{a}+\mathbf{b}+\mathbf{c}|=$

(a) $5\sqrt{2}$ (b) 50
(c) $10\sqrt{2}$ (d) 10
(e) 20

Vector or Cross product of two vectors and its applications

1. If **a**, **b**, **c** are any vectors, then the true statement is **[RPET 1988]**

(a) $\mathbf{a}\times(\mathbf{b}\times\mathbf{c})=(\mathbf{a}\times\mathbf{b})\times\mathbf{c}$ (b) $\mathbf{a}\times\mathbf{b}=\mathbf{b}\times\mathbf{a}$
(c) $\mathbf{a}.(\mathbf{b}\times\mathbf{c})=\mathbf{a}.\mathbf{b}\times\mathbf{a}.\mathbf{c}$ (d) $\mathbf{a}.(\mathbf{b}-\mathbf{c})=\mathbf{a}.\mathbf{b}-\mathbf{a}.\mathbf{c}$

2. If **a** and **b** are unit vectors such that $\mathbf{a}\times\mathbf{b}$ is also a unit vector, then the angle between **a** and **b** is

(a) 0 (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{2}$ (d) π

3. The points $A(\mathbf{a}), B(\mathbf{b}), C(\mathbf{c})$ will be collinear if

(a) $\mathbf{a}+\mathbf{b}+\mathbf{c}=\mathbf{0}$ (b) $\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a}=\mathbf{0}$

(c) $\mathbf{a}.\mathbf{b}+\mathbf{b}.\mathbf{c}+\mathbf{c}.\mathbf{a}=0$ (d) None of these

4. $(\mathbf{a}-\mathbf{b})\times(\mathbf{a}+\mathbf{b})=$ **[MP PET 1987]**

(a) $2(\mathbf{a}\times\mathbf{b})$ (b) $\mathbf{a}\times\mathbf{b}$

(c) a^2-b^2 (d) None of these

5. If $\mathbf{a}+\mathbf{b}+\mathbf{c}=\mathbf{0}$, then which relation is correct **[RPET 1985; Roorkee 1981; AIEEE 2002]**

(a) $\mathbf{a}=\mathbf{b}=\mathbf{c}=\mathbf{0}$ (b) $\mathbf{a}.\mathbf{b}=\mathbf{b}.\mathbf{c}=\mathbf{c}.\mathbf{a}$

(c) $\mathbf{a}\times\mathbf{b}=\mathbf{b}\times\mathbf{c}=\mathbf{c}\times\mathbf{a}$ (d) None of these

6. If be the angle between the vectors **a** and **b** and $|\mathbf{a}\times\mathbf{b}|=\mathbf{a}.\mathbf{b}$, then $\theta=$ **[RPET 1990; MP PET 1990; UPSEAT 2003]**

(a) π (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{4}$ (d) 0

7. $(2\mathbf{a}+3\mathbf{b})\times(5\mathbf{a}+7\mathbf{b})=$ **[MP PET 1988]**

(a) $\mathbf{a}\times\mathbf{b}$ (b) $\mathbf{b}\times\mathbf{a}$

(c) $\mathbf{a}+\mathbf{b}$ (d) $7\mathbf{a}+10\mathbf{b}$

8. If **a** and **b** are two vectors such that **a** . **b** = 0 and $\mathbf{a}\times\mathbf{b}=\mathbf{0}$, then **[IIT Screening 1989; MNR 1988; UPSEAT 2000, 01]**

(a) **a** is parallel to **b**

(b) **a** is perpendicular to **b**

(c) Either **a** or **b** is a null vector

(d) None of these

9. The components of a vector **a** along and perpendicular to the non-zero vector **b** are respectively **[IIT 1988]**

(a) $\frac{\mathbf{a}.\mathbf{b}}{|\mathbf{a}|}, \frac{|\mathbf{a}\times\mathbf{b}|}{|\mathbf{a}|}$ (b) $\frac{\mathbf{a}.\mathbf{b}}{|\mathbf{b}|}, \frac{|\mathbf{a}\times\mathbf{b}|}{|\mathbf{b}|}$

(c) $\frac{\mathbf{a}.\mathbf{b}}{|\mathbf{a}|}, \frac{\mathbf{a}.\mathbf{b}}{|\mathbf{a}|}$ (d) $\frac{|\mathbf{a}\times\mathbf{b}|}{|\mathbf{a}|}, \frac{|\mathbf{a}\times\mathbf{b}|}{|\mathbf{b}|}$

10. $|(\mathbf{a}\times\mathbf{b}).\mathbf{c}|=|\mathbf{a}||\mathbf{b}||\mathbf{c}|$, if **[MP PET 1994; BIT Ranchi 1990; IIT 1982; AMU 2002]**

(a) $\mathbf{a}.\mathbf{b}=\mathbf{b}.\mathbf{c}=0$ (b) $\mathbf{b}.\mathbf{c}=\mathbf{c}.\mathbf{a}=0$

(c) $\mathbf{c}.\mathbf{a}=\mathbf{a}.\mathbf{b}=0$ (d) $\mathbf{a}.\mathbf{b}=\mathbf{b}.\mathbf{c}=\mathbf{c}.\mathbf{a}=0$

11. Which of the following is not a property of vectors **[MP PET 1987]**

(a) $\mathbf{u}\times\mathbf{v}=\mathbf{v}\times\mathbf{u}$

(b) $\mathbf{u}.\mathbf{v}=\mathbf{v}.\mathbf{u}$

(c) $(\mathbf{u}\times\mathbf{v})^2=\mathbf{u}^2.\mathbf{v}^2-(\mathbf{u}.\mathbf{v})^2$

(d) $\mathbf{u}^2=|\mathbf{u}|^2$

12. The number of vectors of unit length perpendicular to vectors $\mathbf{a}=(1,1,0)$ and $\mathbf{b}=(0,1,1)$ is **[BIT Ranchi 1991; IIT 1987; Kurukshetra CEE 1998; DCE 2000; MP PET 2002]**

(a) Three (b) One

(c) Two (d) Infinite

13. If $\mathbf{a}=(1,-1,1)$ and $\mathbf{c}=(-1,-1,0)$, then the vector **b** satisfying $\mathbf{a}\times\mathbf{b}=\mathbf{c}$ and $\mathbf{a}.\mathbf{b}=1$ is **[MP PET 1989]**

(a) (1, 0, 0) (b) (0, 0, 1)

(c) (0, –1, 0) (d) None of these

14. If $\mathbf{a}\times\mathbf{b}=\mathbf{b}\times\mathbf{c}\neq 0$, where **a, b** and **c** are coplanar vectors, then for some scalar k **[Roorkee 1985; RPET 199**

(a) $\mathbf{a}+\mathbf{c}=k\mathbf{b}$ (b) $\mathbf{a}+\mathbf{b}=k\mathbf{c}$

(c) $\mathbf{b}+\mathbf{c}=k\mathbf{a}$ (d) None of these

15. If $\mathbf{a}\neq\mathbf{0}, \mathbf{b}\neq\mathbf{0}, \mathbf{c}\neq\mathbf{0}$, then true statement is **[MP PET 1991]**

(a) $\mathbf{a}\times(\mathbf{b}+\mathbf{c})=(\mathbf{c}+\mathbf{b})\times\mathbf{a}$ (b) $\mathbf{a}.(\mathbf{b}+\mathbf{c})=-(\mathbf{b}+\mathbf{c}).\mathbf{a}$

(c) $\mathbf{a}\times(\mathbf{b}-\mathbf{c})=(\mathbf{c}-\mathbf{b})\times\mathbf{a}$ (d) $\mathbf{a}.(\mathbf{b}-\mathbf{c})=(\mathbf{c}-\mathbf{b}).\mathbf{a}$

16. Let **a** and **b** be two non-collinear unit vectors. If $\mathbf{u}=\mathbf{a}-(\mathbf{a}.\mathbf{b})\mathbf{b}$ and $\mathbf{v}=\mathbf{a}\times\mathbf{b}$, then $|\mathbf{v}|$ is **[IIT 1999]**

(a) $|\mathbf{u}|$ (b) $|\mathbf{u}|+|\mathbf{u}.\mathbf{a}|$

(c) $|\mathbf{u}|+|\mathbf{u}.\mathbf{b}|$ (d) $|\mathbf{u}|+\mathbf{u}.(\mathbf{a}+\mathbf{b})$

17. If $\mathbf{a}\times\mathbf{b}=\mathbf{b}\times\mathbf{c}\neq 0$ and $\mathbf{a}+\mathbf{c}\neq 0$, then **[RPET 1999]**

(a) $(\mathbf{a}+\mathbf{c})\perp\mathbf{b}$ (b) $(\mathbf{a}+\mathbf{c})||\mathbf{b}$

(c) $\mathbf{a}+\mathbf{c}=\mathbf{b}$ (d) None of these

18. A unit vector perpendicular to the plane determined by the points (1, – 1, 2), (2, 0, – 1) and (0, 2, 1) is **[IIT 1983; MNR 1984]**

(a) $\pm\frac{1}{\sqrt{6}}(2\mathbf{i}+\mathbf{j}+\mathbf{k})$ (b) $\frac{1}{\sqrt{6}}(\mathbf{i}+2\mathbf{j}+\mathbf{k})$

(c) $\frac{1}{\sqrt{6}}(\mathbf{i}+\mathbf{j}+\mathbf{k})$ (d) $\frac{1}{\sqrt{6}}(2\mathbf{i}-\mathbf{j}-\mathbf{k})$

19. If $\mathbf{a}=2\mathbf{i}+3\mathbf{j}-5\mathbf{k}, \mathbf{b}=m\mathbf{i}+n\mathbf{j}+12\mathbf{k}$ and $\mathbf{a}\times\mathbf{b}=0$, then $(m,n)=$

(a) $\left(-\frac{24}{5},\frac{36}{5}\right)$ (b) $\left(\frac{24}{5},-\frac{36}{5}\right)$

(c) $\left(-\frac{24}{5},-\frac{36}{5}\right)$ (d) $\left(\frac{24}{5},\frac{36}{5}\right)$

20. A unit vector which is perpendicular to $\mathbf{i}+2\mathbf{j}-2\mathbf{k}$ and $-\mathbf{i}+2\mathbf{j}+2\mathbf{k}$ is **[MP PET 1992]**

(a) $\frac{1}{\sqrt{5}}(2\mathbf{i}-\mathbf{k})$ (b) $\frac{1}{\sqrt{5}}(-2\mathbf{i}+\mathbf{k})$

(c) $\frac{1}{\sqrt{5}}(2\mathbf{i}+\mathbf{j}+\mathbf{k})$ (d) $\frac{1}{\sqrt{5}}(2\mathbf{i}+\mathbf{k})$

21. If $A(-1,2,3), B(1,1,1)$ and $C(2,-1,3)$ are points on a plane. A unit normal vector to the plane ABC is **[BIT Ranchi 1988]**

(a) $\pm\left(\frac{2\mathbf{i}+2\mathbf{j}+\mathbf{k}}{3}\right)$ (b) $\pm\left(\frac{2\mathbf{i}-2\mathbf{j}+\mathbf{k}}{3}\right)$

(c) $\pm\left(\frac{2\mathbf{i}-2\mathbf{j}-\mathbf{k}}{3}\right)$ (d) $-\left(\frac{2\mathbf{i}+2\mathbf{j}+\mathbf{k}}{3}\right)$

22. The unit vector perpendicular to the vectors $6\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ and $3\mathbf{i}-6\mathbf{j}-2\mathbf{k}$, is

(a) $\frac{2\mathbf{i}-3\mathbf{j}+6\mathbf{k}}{7}$ (b) $\frac{2\mathbf{i}-3\mathbf{j}-6\mathbf{k}}{7}$

(c) $\frac{2\mathbf{i}+3\mathbf{j}-6\mathbf{k}}{7}$ (d) $\frac{2\mathbf{i}+3\mathbf{j}+6\mathbf{k}}{7}$

23. For any two vectors **a** and **b**, $(\mathbf{a}\times\mathbf{b})^2$ is equal to **[Roorkee 1975, 79, 81, 85]**

(a) a^2-b^2 (b) a^2+b^2

(c) $a^2b^2-(\mathbf{a}.\mathbf{b})^2$ (d) None of these

24. The unit vector perpendicular to $3\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $12\mathbf{i}+5\mathbf{j}-5\mathbf{k}$, is **[Roorkee 1979; RPET 1989, 91]**

(a) $\frac{5\mathbf{i}-3\mathbf{j}+9\mathbf{k}}{\sqrt{115}}$ (b) $\frac{5\mathbf{i}+3\mathbf{j}-9\mathbf{k}}{\sqrt{115}}$

(c) $\frac{-5\mathbf{i}+3\mathbf{j}-9\mathbf{k}}{\sqrt{115}}$ (d) $\frac{5\mathbf{i}+3\mathbf{j}+9\mathbf{k}}{\sqrt{115}}$

25. The sine of the angle between the two vectors $3\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $12\mathbf{i}+5\mathbf{j}-5\mathbf{k}$ will be

(a) $\frac{\sqrt{115}}{\sqrt{14}\sqrt{194}}$ (b) $\frac{51}{\sqrt{14}\sqrt{144}}$

(c) $\frac{\sqrt{64}}{\sqrt{14}\sqrt{194}}$ (d) None of these

26. For any two vectors **a** and **b**, if $\mathbf{a}\times\mathbf{b}=\mathbf{0}$, then **[Roorkee 1984]**

(a) $\mathbf{a}=\mathbf{0}$ (b) $\mathbf{b}=\mathbf{0}$

(c) Not parallel (d) None of these

27. If **a** and **b** are two vectors, then $(\mathbf{a}\times\mathbf{b})^2$ equals **[Roorkee 1975, 79, 81, 85]**

(a) $\begin{vmatrix}\mathbf{a}.\mathbf{b} & \mathbf{a}.\mathbf{a}\\ \mathbf{b}.\mathbf{b} & \mathbf{b}.\mathbf{a}\end{vmatrix}$ (b) $\begin{vmatrix}\mathbf{a}.\mathbf{a} & \mathbf{a}.\mathbf{b}\\ \mathbf{b}.\mathbf{a} & \mathbf{b}.\mathbf{b}\end{vmatrix}$

(c) $\begin{vmatrix}\mathbf{a}.\mathbf{b}\\ \mathbf{b}.\mathbf{a}\end{vmatrix}$ (d) None of these

28. For any vectors **a, b, c**
$\mathbf{a}\times(\mathbf{b}+\mathbf{c})+\mathbf{b}\times(\mathbf{c}+\mathbf{a})+\mathbf{c}\times(\mathbf{a}+\mathbf{b})=$ **[Roorkee 1981; Kerala (Engg.) 2002]**

(a) $\mathbf{0}$ (b) $\mathbf{a}+\mathbf{b}+\mathbf{c}$

(c) $[\mathbf{a}\,\mathbf{b}\,\mathbf{c}]$ (d) $\mathbf{a}\times\mathbf{b}\times\mathbf{c}$

29. If $\mathbf{a}.\mathbf{b}=\mathbf{a}.\mathbf{c}$, $\mathbf{a}\times\mathbf{b}=\mathbf{a}\times\mathbf{c}$ and $\mathbf{a}\neq\mathbf{0}$, then **[RPET 1990]**

(a) $\mathbf{b}=\mathbf{0}$ (b) $\mathbf{b}\neq\mathbf{c}$

(c) $\mathbf{b}=\mathbf{c}$ (d) None of these

30. If $|\mathbf{a}|=2, |\mathbf{b}|=5$ and $|\mathbf{a}\times\mathbf{b}|=8$, then **a . b** is equal to **[AI CBSE 1984; RPET 1991]**

(a) 0 (b) 2

(c) 4 (d) 6

31. If $|\mathbf{a}.\mathbf{b}|=3$ and $|\mathbf{a}\times\mathbf{b}|=4$, then the angle between **a** and **b** is

(a) $\cos^{-1}\frac{3}{4}$ (b) $\cos^{-1}\frac{3}{5}$

(c) $\cos^{-1}\frac{4}{5}$ (d) $\frac{\pi}{4}$

32. If $\mathbf{a}=2\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $\mathbf{b}=6\mathbf{i}-3\mathbf{j}+2\mathbf{k}$, then the value of $\mathbf{a}\times\mathbf{b}$ is **[MNR 1978; RPET 2001]**

(a) $2\mathbf{i}+2\mathbf{j}-\mathbf{k}$ (b) $6\mathbf{i}-3\mathbf{j}+2\mathbf{k}$

(c) $\mathbf{i}-10\mathbf{j}-18\mathbf{k}$ (d) $\mathbf{i}+\mathbf{j}+\mathbf{k}$

33. The scalars l and m such that $l\mathbf{a}+m\mathbf{b}=\mathbf{c}$, where **a, b** and **c** are given vectors, are equal to

(a) $l=\frac{(\mathbf{c}\times\mathbf{b}).(\mathbf{a}\times\mathbf{b})}{(\mathbf{a}\times\mathbf{b})^2}$, $m=\frac{(\mathbf{c}\times\mathbf{a}).(\mathbf{b}\times\mathbf{a})}{(\mathbf{b}\times\mathbf{a})^2}$

(b) $l=\frac{(\mathbf{c}\times\mathbf{b}).(\mathbf{a}\times\mathbf{b})}{(\mathbf{a}\times\mathbf{b})}$, $m=\frac{(\mathbf{c}\times\mathbf{a}).(\mathbf{b}\times\mathbf{a})}{(\mathbf{b}\times\mathbf{a})}$

(c) $l=\frac{(\mathbf{c}\times\mathbf{b})\times(\mathbf{a}\times\mathbf{b})}{(\mathbf{a}\times\mathbf{b})^2}$, $m=\frac{(\mathbf{c}\times\mathbf{a})\times(\mathbf{b}\times\mathbf{a})}{(\mathbf{b}\times\mathbf{a})}$

(d) None of these

34. $|\mathbf{a}\times\mathbf{i}|^2+|\mathbf{a}\times\mathbf{j}|^2+|\mathbf{a}\times\mathbf{k}|^2=$ **[EAMCET 1988; MP PET 1994, 2004; RPET 2000; Pb. CET 2001; Orissa JEE 2003; AIEEE 2005]**

(a) $|\mathbf{a}|^2$ (b) $2|\mathbf{a}|^2$

(c) $3|\mathbf{a}|^2$ (d) $4|\mathbf{a}|^2$

35. A unit vector perpendicular to the plane determined by the points $P(1,-1,2)$, $Q(2,0,-1)$ and $R(0,2,1)$ is **[IIT 1994]**

(a) $\frac{2\mathbf{i}-\mathbf{j}+\mathbf{k}}{\sqrt{6}}$ (b) $\frac{2\mathbf{i}+\mathbf{j}+\mathbf{k}}{\sqrt{6}}$

(c) $\frac{-2\mathbf{i}+\mathbf{j}+\mathbf{k}}{\sqrt{6}}$ (d) $\frac{2\mathbf{i}+\mathbf{j}-\mathbf{k}}{\sqrt{6}}$

36. A unit vector perpendicular to the vector $4\mathbf{i}-\mathbf{j}+3\mathbf{k}$ and $-2\mathbf{i}+\mathbf{j}-2\mathbf{k}$ is

(a) $\frac{1}{3}(\mathbf{i}-2\mathbf{j}+2\mathbf{k})$ (b) $\frac{1}{3}(-\mathbf{i}+2\mathbf{j}+2\mathbf{k})$

(c) $\frac{1}{3}(2\mathbf{i}+\mathbf{j}+2\mathbf{k})$ (d) $\frac{1}{3}(2\mathbf{i}-2\mathbf{j}+2\mathbf{k})$

37. Given $\mathbf{a}=\mathbf{i}+\mathbf{j}-\mathbf{k}$, $\mathbf{b}=-\mathbf{i}+2\mathbf{j}+\mathbf{k}$ and $\mathbf{c}=-\mathbf{i}+2\mathbf{j}-\mathbf{k}$. A unit vector perpendicular to both $\mathbf{a}+\mathbf{b}$ and $\mathbf{b}+\mathbf{c}$ is **[Karnataka CET 1993]**

(a) **i** (b) **j**

(c) **k** (d) $\frac{\mathbf{i}+\mathbf{j}+\mathbf{k}}{\sqrt{3}}$

38. The vectors **c**, $\mathbf{a}=x\mathbf{i}+y\mathbf{j}+z\mathbf{k}$ and $\mathbf{b}=\mathbf{j}$ are such that **a, c, b** form a right handed system, then **c** is **[DCE 1999]**

(a) $z\mathbf{i}-x\mathbf{k}$ (b) 0

(c) $y\mathbf{j}$ (d) $-z\mathbf{i}+x\mathbf{k}$

39. If *A, B, C, D* are any four points in space, then $|\overrightarrow{AB}\times\overrightarrow{CD}+\overrightarrow{BC}\times\overrightarrow{AD}+\overrightarrow{CA}\times\overrightarrow{BD}|$ is equal to

(a) 2Δ (b) 4Δ

(c) 3Δ (d) 5Δ

(where denotes the area of ΔABC)

40. If $(\mathbf{a}\times\mathbf{b})^2+(\mathbf{a}.\mathbf{b})^2=144$ and $|\mathbf{a}|=4$, then $|\mathbf{b}|=$ **[EAMCET 1994]**

(a) 16 (b) 8

(c) 3 (d) 12

41. $\mathbf{r}\times\mathbf{a}=\mathbf{b}\times\mathbf{a}$; $\mathbf{r}\times\mathbf{b}=\mathbf{a}\times\mathbf{b}$; $\mathbf{a}\neq 0$; $\mathbf{b}\neq 0$; $\mathbf{a}\neq\lambda\mathbf{b}$, **a** is not perpendicular to **b**, then $\mathbf{r}=$

(a) $\mathbf{a}-\mathbf{b}$ (b) $\mathbf{a}+\mathbf{b}$

(c) $\mathbf{a}\times\mathbf{b}+\mathbf{a}$ (d) $\mathbf{a}\times\mathbf{b}+\mathbf{b}$

42. If $\mathbf{i}, \mathbf{j}, \mathbf{k}$ are unit orthonormal vectors and $\mathbf{a}$ is a vector, if $\mathbf{a}\times\mathbf{r}=\mathbf{j}$, then $\mathbf{a}\,.\,\mathbf{r}$ is

(a) 0 (b) 1

(c) – 1 (d) Arbitrary scalar

43. A unit vector perpendicular to each of the vector $2\mathbf{i}-\mathbf{j}+\mathbf{k}$ and $3\mathbf{i}+4\mathbf{j}-\mathbf{k}$ is equal to

(a) $\frac{(-3\mathbf{i}+5\mathbf{j}+11\mathbf{k})}{\sqrt{155}}$ (b) $\frac{(3\mathbf{i}-5\mathbf{j}+11\mathbf{k})}{\sqrt{155}}$

(c) $\frac{(6\mathbf{i}-4\mathbf{j}-\mathbf{k})}{\sqrt{53}}$ (d) $\frac{(5\mathbf{i}+3\mathbf{j})}{\sqrt{34}}$

44. If $\vec{A}=3\mathbf{i}+\mathbf{j}+2\mathbf{k}$ and $\vec{B}=2\mathbf{i}-2\mathbf{j}+4\mathbf{k}$ and is the angle between $\vec{A}$ and $\vec{B}$, then the value of $\sin\theta$ is

(a) $\frac{2}{\sqrt{7}}$ (b) $\sqrt{\frac{2}{7}}$

(c) $\frac{4}{\sqrt{7}}$ (d) $\frac{3}{\sqrt{7}}$

45. A unit vector perpendicular to vector $\mathbf{c}$ and coplanar with vectors $\mathbf{a}$ and $\mathbf{b}$ is

(a) $\frac{\mathbf{a}\times(\mathbf{b}\times\mathbf{c})}{|\mathbf{a}\times(\mathbf{b}\times\mathbf{c})|}$ (b) $\frac{\mathbf{b}\times(\mathbf{c}\times\mathbf{a})}{|\mathbf{b}\times(\mathbf{c}\times\mathbf{a})|}$

(c) $\frac{\mathbf{c}\times(\mathbf{a}\times\mathbf{b})}{|\mathbf{c}\times(\mathbf{a}\times\mathbf{b})|}$ (d) None of these

46. $|\mathbf{a}\times\mathbf{b}|^2+(\mathbf{a}.\mathbf{b})^2=$ **[MP PET 1989, 97, 2004]**

(a) $(\mathbf{a}\times\mathbf{a}).(\mathbf{b}\times\mathbf{b})$ (b) $(\mathbf{a}.\mathbf{a})(\mathbf{b}.\mathbf{b})$

(c) $|(\mathbf{a}\times\mathbf{b})|\,(\mathbf{a}.\mathbf{b})$ (d) $2(\mathbf{a}.\mathbf{b})(\mathbf{a}.\mathbf{b})$

47. If the position vectors of three points A, B and C are respectively $\mathbf{i}+\mathbf{j}+\mathbf{k}$, $2\mathbf{i}+3\mathbf{j}-4\mathbf{k}$ and $7\mathbf{i}+4\mathbf{j}+9\mathbf{k}$, then the unit vector to the plane containing the triangle ABC is **[DCE 1999]**

(a) $31\mathbf{i}-18\mathbf{j}-9\mathbf{k}$ (b) $\frac{31\mathbf{i}-38\mathbf{j}-9\mathbf{k}}{\sqrt{2486}}$

(c) $\frac{31\mathbf{i}+18\mathbf{j}+9\mathbf{k}}{\sqrt{2486}}$ (d) None of these

48. If **a, b, c** are position vector of vertices of a triangle ABC, then unit vector perpendicular to its plane is **[RPET 1999]**

(a) $\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a}$ (b) $\frac{\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a}}{|\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a}|}$

(c) $\frac{\mathbf{a}\times\mathbf{b}}{|\mathbf{a}\times\mathbf{b}|}$ (d) None of these

49. If θ is the angle between the vectors $\mathbf{a}$ and $\mathbf{b}$, then $\frac{|\mathbf{a}\times\mathbf{b}|}{|\mathbf{a}.\mathbf{b}|}$ equal to **[Karnataka CET 1999]**

(a) $\tan\theta$ (b) $-\tan\theta$

(c) $\cot\theta$ (d) $-\cot\theta$

50. If the vectors $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ are represented by the sides BC, CA and AB respectively of the ΔABC, then **[IIT Screening 2000]**

(a) $\mathbf{a}.\mathbf{b}+\mathbf{b}.\mathbf{c}+\mathbf{c}.\mathbf{a}=0$ (b) $\mathbf{a}\times\mathbf{b}=\mathbf{b}\times\mathbf{c}=\mathbf{c}\times\mathbf{a}$

(c) $\mathbf{a}.\mathbf{b}=\mathbf{b}.\mathbf{c}=\mathbf{c}.\mathbf{a}$ (d) $\mathbf{a}\times\mathbf{b}=\mathbf{b}\times\mathbf{c}=\mathbf{c}\times\mathbf{a}=0$

51. A vector perpendicular to both of the vectors $\mathbf{i}+\mathbf{j}+\mathbf{k}$ and $\mathbf{i}+\mathbf{j}$ is **[RPET 2000]**

(a) $\mathbf{i}+\mathbf{j}$ (b) $\mathbf{i}-\mathbf{j}$

(c) $c(\mathbf{i}-\mathbf{j})$, c is a scalar (d) None of these

52. A unit vector perpendicular to the plane of $\mathbf{a}=2\mathbf{i}-6\mathbf{j}-3\mathbf{k}$, $\mathbf{b}=4\mathbf{i}+3\mathbf{j}-\mathbf{k}$ is

(a) $\frac{4\mathbf{i}+3\mathbf{j}-\mathbf{k}}{\sqrt{26}}$ (b) $\frac{2\mathbf{i}-6\mathbf{j}-3\mathbf{k}}{7}$

(c) $\frac{3\mathbf{i}-2\mathbf{j}+6\mathbf{k}}{7}$ (d) $\frac{2\mathbf{i}-3\mathbf{j}-6\mathbf{k}}{7}$

53. The unit vector perpendicular to both the vectors $\mathbf{i}-2\mathbf{j}+3\mathbf{k}$ and $\mathbf{i}+2\mathbf{j}-\mathbf{k}$ is

(a) $\frac{1}{\sqrt{3}}(-\mathbf{i}+\mathbf{j}+\mathbf{k})$ (b) $(-\mathbf{i}+\mathbf{j}+\mathbf{k})$

(c) $\frac{(\mathbf{i}+\mathbf{j}-\mathbf{k})}{\sqrt{3}}$ (d) None of these

54. The unit vector perpendicular to the vectors $\mathbf{i}-\mathbf{j}+\mathbf{k}$ and $2\mathbf{i}+3\mathbf{j}-\mathbf{k}$ is **[Karnataka CET 2001]**

(a) $\frac{-2\mathbf{i}+3\mathbf{j}+5\mathbf{k}}{\sqrt{30}}$ (b) $\frac{-2\mathbf{i}+5\mathbf{j}+6\mathbf{k}}{\sqrt{38}}$

(c) $\frac{-2\mathbf{i}+3\mathbf{j}+5\mathbf{k}}{\sqrt{38}}$ (d) $\frac{-2\mathbf{i}+4\mathbf{j}+5\mathbf{k}}{\sqrt{38}}$

55. If $\mathbf{a}=2\mathbf{i}-3\mathbf{j}-\mathbf{k}$ and $\mathbf{b}=\mathbf{i}+4\mathbf{j}-2\mathbf{k}$, then $\mathbf{a}\times\mathbf{b}$ is **[MP PET 2001]**

(a) $10\mathbf{i}+2\mathbf{j}+11\mathbf{k}$ (b) $10\mathbf{i}+3\mathbf{j}+11\mathbf{k}$

(c) $10\mathbf{i}-3\mathbf{j}+11\mathbf{k}$ (d) $10\mathbf{i}-3\mathbf{j}-10\mathbf{k}$

56. If $|\mathbf{a}|=4, |\mathbf{b}|=2$ and the angle between $\mathbf{a}$ and $\mathbf{b}$ is $\frac{\pi}{6}$, then $(\mathbf{a}\times\mathbf{b})^2$ is equal to

(a) 48 (b) 16

(c) 8 (d) None of these

57. If $\mathbf{a}=2\mathbf{i}+4\mathbf{j}-5\mathbf{k}$ and $\mathbf{b}=\mathbf{i}+2\mathbf{j}+3\mathbf{k}$, then $|\mathbf{a}\times\mathbf{b}|$ is **[UPSEAT 2002]**

(a) $11\sqrt{5}$ (b) $11\sqrt{3}$

(c) $11\sqrt{7}$ (d) $11\sqrt{2}$

58. The unit vector perpendicular to both $\mathbf{i}+\mathbf{j}$ and $\mathbf{j}+\mathbf{k}$ is **[Kerala (Engg.) 2002]**

(a) $\mathbf{i}-\mathbf{j}+\mathbf{k}$ (b) $\mathbf{i}+\mathbf{j}+\mathbf{k}$

(c) $\frac{\mathbf{i}+\mathbf{j}-\mathbf{k}}{\sqrt{3}}$ (d) $\frac{\mathbf{i}-\mathbf{j}+\mathbf{k}}{\sqrt{3}}$

59. A unit vector in the plane of the vectors $2\mathbf{i}+\mathbf{j}+\mathbf{k}$, $\mathbf{i}-\mathbf{j}+\mathbf{k}$ and orthogonal to $5\mathbf{i}+2\mathbf{j}+6\mathbf{k}$ is **[IIT Screening 2004]**

(a) $\frac{6\mathbf{i}-5\mathbf{k}}{\sqrt{61}}$ (b) $\frac{3\mathbf{j}-\mathbf{k}}{\sqrt{10}}$

(c) $\frac{2\mathbf{i}-5\mathbf{j}}{\sqrt{29}}$ (d) $\frac{2\mathbf{i}+\mathbf{j}-2\mathbf{k}}{3}$

60. Let $\mathbf{a}, \mathbf{b}, \mathbf{c}$ be three vectors such that $\mathbf{a} \neq 0$, and $\mathbf{a}\times\mathbf{b} = 2\mathbf{a}\times\mathbf{c}$, $|\mathbf{a}| = |\mathbf{c}| = 1$, $|\mathbf{b}| = 4$ and $|\mathbf{b}\times\mathbf{c}| = 15$. If $\mathbf{b}-2\mathbf{c} = \lambda\mathbf{a}$, then equals to

(a) 1 (b) ± 4

(c) 3 (d) – 2

61. The area of a triangle whose vertices are $A(1,-1,2)$, $B(2,1,-1)$ and $C(3,-1,2)$ is

(a) 13 (b) $\sqrt{13}$

(c) 6 (d) $\sqrt{6}$

62. If vertices of a triangle are $A(1,-1,2), B(2,0,-1)$ and $C(0,2,1)$, then the area of a triangle is **[RPET 2000]**

(a) $\sqrt{6}$ (b) $2\sqrt{6}$

(c) $3\sqrt{6}$ (d) $4\sqrt{6}$

63. The area of triangle whose vertices are $(1,2,3),(2,5,-1)$ and $(-1,1,2)$ is

(a) 150 *sq. unit* (b) 145 *sq. unit*

(c) $\frac{\sqrt{155}}{2}$ *sq. unit* (d) $\frac{155}{2}$ *sq. unit*

64. The area of a parallelogram whose two adjacent sides are represented by the vector $3\mathbf{i}-\mathbf{k}$ and $\mathbf{i}+2\mathbf{j}$ is **[MNR 1981]**

(a) $\frac{1}{2}\sqrt{17}$ (b) $\frac{1}{2}\sqrt{14}$

(c) $\sqrt{41}$ (d) $\frac{1}{2}\sqrt{7}$

65. The area of the parallelogram whose diagonals are $\mathbf{a} = 3\mathbf{i}+\mathbf{j}-2\mathbf{k}$ and $\mathbf{b} = \mathbf{i}-3\mathbf{j}+4\mathbf{k}$ is

[MP PET 1988, 93; MNR 1985]

(a) $10\sqrt{3}$ (b) $5\sqrt{3}$

(c) 8 (d) 4

66. The position vectors of the points *A, B* and *C* are $\mathbf{i}+\mathbf{j}$, $\mathbf{j}+\mathbf{k}$ and $\mathbf{k}+\mathbf{i}$ respectively. The vector area of the $\Delta ABC = \pm\frac{1}{2}\vec{\alpha}$ where $\vec{\alpha} =$

(a) $-\mathbf{i}+\mathbf{j}+\mathbf{k}$ (b) $\mathbf{i}-\mathbf{j}+\mathbf{k}$

(c) $\mathbf{i}+\mathbf{j}-\mathbf{k}$ (d) $\mathbf{i}+\mathbf{j}+\mathbf{k}$

67. If $\overrightarrow{OA} = 3\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $\overrightarrow{OB} = \mathbf{i}+3\mathbf{j}+\mathbf{k}$, then the area of the triangle *OAB* is

(a) $\sqrt{15}$ (b) $3\sqrt{5}$

(c) $\frac{3}{2}\sqrt{10}$ (d) $\frac{5\sqrt{5}}{3}$

68. Let **a, b, c** be the position vectors of the vertices of a triangle *ABC*. The vector area of triangle *ABC* is

[MP PET 1990; EAMCET 2003]

(a) $\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a}$ (b) $\frac{1}{4}(\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a})$

(c) $\frac{1}{2}(\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a})$ (d) $\mathbf{b}\times\mathbf{a}+\mathbf{c}\times\mathbf{b}+\mathbf{a}\times\mathbf{c}$

69. If $|\mathbf{a}| = 2, |\mathbf{b}| = 3$ and **a, b** are mutually perpendicular, then the area of the triangle whose vertices are $\mathbf{0}$, $\mathbf{a}+\mathbf{b}$, $\mathbf{a}-\mathbf{b}$ is

(a) 5 (b) 1

(c) 6 (d) 8

70. If $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ and $3\mathbf{i}-2\mathbf{j}+\mathbf{k}$ represents the adjacent sides of a parallelogram, then the area of this parallelogram is

[Roorkee 1978, 79; MP PET 1990; RPET 1988, 89, 91]

(a) $4\sqrt{3}$ (b) $6\sqrt{3}$

(c) $8\sqrt{3}$ (d) $16\sqrt{3}$

71. If $3\mathbf{i}+4\mathbf{j}$ and $-5\mathbf{i}+7\mathbf{j}$ are the vector sides of any triangle, then its area is given by

(a) 41 (b) 47

(c) $\frac{41}{2}$ (d) $\frac{47}{2}$

72. If the vectors $\mathbf{i}-3\mathbf{j}+2\mathbf{k}$, $-\mathbf{i}+2\mathbf{j}$ represents the diagonals of a parallelogram, then its area will be **[Roork**

(a) $\sqrt{21}$ (b) $\frac{\sqrt{21}}{2}$

(c) $2\sqrt{21}$ (d) $\frac{\sqrt{21}}{4}$

73. The area of the parallelogram whose diagonals are the vectors $2\mathbf{a}-\mathbf{b}$ and $4\mathbf{a}-5\mathbf{b}$, where **a** and **b** are the unit vectors forming an angle of 45^o, is

(a) $3\sqrt{2}$ (b) $\frac{3}{\sqrt{2}}$

(c) $\sqrt{2}$ (d) None of these

74. The area of a parallelogram whose adjacent sides are $\mathbf{i}-2\mathbf{j}+3\mathbf{k}$ and $2\mathbf{i}+\mathbf{j}-4\mathbf{k}$, is

(a) $5\sqrt{3}$ (b) $10\sqrt{3}$

(c) $5\sqrt{6}$ (d) $10\sqrt{6}$

75. If the diagonals of a parallelogram are represented by the vectors $3\mathbf{i}+\mathbf{j}-2\mathbf{k}$ and $\mathbf{i}+3\mathbf{j}-4\mathbf{k}$, then its area in *square unit* is

(a) $5\sqrt{3}$ (b) $6\sqrt{3}$

(c) $\sqrt{26}$ (d) $\sqrt{42}$

76. The area of a parallelogram whose adjacent sides are given by the vectors $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ and $-3\mathbf{i}-2\mathbf{j}+\mathbf{k}$ (in *square unit*) is

[Karnataka CET 2001; Pb. CET 2004]

(a) $\sqrt{180}$ (b) $\sqrt{140}$

(c) $\sqrt{80}$ (d) $\sqrt{40}$

77. If $\mathbf{a} = \mathbf{i}+\mathbf{j}+\mathbf{k}, \mathbf{b} = \mathbf{i}+3\mathbf{j}+5\mathbf{k}$ and $\mathbf{c} = 7\mathbf{i}+9\mathbf{j}+11\mathbf{k}$, then the area of the parallelogram having diagonals **a**

+ **b** and **b** + **c** is **[Kurukshetra CEE 2002]**

(a) $4\sqrt{6}$ (b) $\frac{1}{2}\sqrt{21}$

(c) $\frac{\sqrt{6}}{2}$ (d) $\sqrt{6}$

78. The area of the parallelogram whose diagonals are $\frac{3}{2}\mathbf{i}+\frac{1}{2}\mathbf{j}-\mathbf{k}$ and $2\mathbf{i}-6\mathbf{j}+8\mathbf{k}$ is

(a) $5\sqrt{3}$ (b) $5\sqrt{2}$

(c) $25\sqrt{3}$ (d) $25\sqrt{2}$

79. The area of the triangle having vertices as $\mathbf{i}-2\mathbf{j}+3\mathbf{k}$, $-2\mathbf{i}+3\mathbf{j}+\mathbf{k}$, $4\mathbf{i}-7\mathbf{j}+7\mathbf{k}$ is

(a) 26 (b) 11

(c) 36 (d) 0

80. The area of the parallelogram whose adjacent sides are $\mathbf{i}-\mathbf{k}$ and $2\mathbf{j}+3\mathbf{k}$ is

(a) 2 (b) 4

(c) $\sqrt{17}$ (d) $2\sqrt{13}$

81. The moment of the force $\vec{F}$ acting at a point *P*, about the point *C* is **[MP PET 1987]**

(a) $\vec{F}\times\overrightarrow{CP}$

(b) $\overrightarrow{CP}.\vec{F}$

(c) A vector having the same direction as $\vec{F}$

(d) $\overrightarrow{CP}\times\vec{F}$

82. Three forces $\mathbf{i}+2\mathbf{j}-3\mathbf{k}$, $2\mathbf{i}+3\mathbf{j}+4\mathbf{k}$ and $\mathbf{i}-\mathbf{j}+\mathbf{k}$ are acting on a particle at the point (0, 1, 2). The magnitude of the moment of the forces about the point $(1,-2,0)$ is

[MNR 1983]

(a) $2\sqrt{35}$ (b) $6\sqrt{10}$

(c) $4\sqrt{17}$ (d) None of these

83. Let the points *A, B* and *P* be (– 2, 2, 4), (2, 6, 3) and (1,2,1) respectively. The magnitude of the moment of the force represented by $\overrightarrow{AB}$ and acting at *A* about *P* is

[MP PET 1987]

(a) 15 (b) $3\sqrt{41}$

(c) $3\sqrt{57}$ (d) None of these

84. The moment of a force represented by $\vec{F}=\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ about the point $2\mathbf{i}-\mathbf{j}+\mathbf{k}=$

(a) $5\mathbf{i}-5\mathbf{j}+5\mathbf{k}$ (b) $5\mathbf{i}+5\mathbf{j}-5\mathbf{k}$

(c) $-5\mathbf{i}+5\mathbf{j}+5\mathbf{k}$ (d) $-5\mathbf{i}-5\mathbf{j}+5\mathbf{k}$

85. A force of magnitude 6 acts along the vector $(9,6,-2)$ and passes through a point *A* (4, – 1, –7). The moment of the force about the point *O* (1, – 3, 2) is

(a) $\frac{150}{11}(2\mathbf{i}-3\mathbf{j})$ (b) $\frac{6}{11}(50\mathbf{i}-75\mathbf{j}+36\mathbf{k})$

(c) $150(2\mathbf{i}-3\mathbf{j})$ (d) $6(50\mathbf{i}-75\mathbf{j}+36\mathbf{k})$

86. A force $\mathbf{F}=2\mathbf{i}+\mathbf{j}-\mathbf{k}$ acts at a point *A,* whose position vector is $2\mathbf{i}-\mathbf{j}$. The moment of **F** about the origin is

[Karnataka CET 2000]

(a) $\mathbf{i}+2\mathbf{j}-4\mathbf{k}$ (b) $\mathbf{i}-2\mathbf{j}-4\mathbf{k}$

(c) $\mathbf{i}+2\mathbf{j}+4\mathbf{k}$ (d) $\mathbf{i}-2\mathbf{j}+4\mathbf{k}$

87. If $\mathbf{a}=\mathbf{i}-\mathbf{j}, \mathbf{b}=\mathbf{i}+\mathbf{j}$, $\mathbf{c}=\mathbf{i}+3\mathbf{j}+5\mathbf{k}$ and $\mathbf{n}$ is a unit vector such that $\mathbf{b}.\mathbf{n}=0, \mathbf{a}.\mathbf{n}=0$ then the value of $|\mathbf{c}.\mathbf{n}|$ is equal to

[DCE 2005]

(a) 1 (b) 3

(c) 5 (d) 2

88. A unit vector perpendicular to the plane containing the vectors $\mathbf{i}-\mathbf{j}+\mathbf{k}$ and $-\mathbf{i}+\mathbf{j}+\mathbf{k}$ is **[Karnataka CET 2005]**

(a) $\frac{\mathbf{i}-\mathbf{j}}{\sqrt{2}}$ (b) $\frac{\mathbf{i}+\mathbf{k}}{\sqrt{2}}$

(c) $\frac{\mathbf{j}-\mathbf{k}}{\sqrt{2}}$ (d) $\frac{\mathbf{i}+\mathbf{j}}{\sqrt{2}}$

Scalar triple product and their applications

1. If **a**, **b**, **c** are three non-coplanar vector, then $\frac{\mathbf{a}.\mathbf{b}\times\mathbf{c}}{\mathbf{c}\times\mathbf{a}.\mathbf{b}}+\frac{\mathbf{b}.\mathbf{a}\times\mathbf{c}}{\mathbf{c}.\mathbf{a}\times\mathbf{b}}=$ **[IIT 1985, 86; UPSEAT 2003]**

(a) 0 (b) 2

(c) – 2 (d) None of these

2. If **a, b, c** be any three non-coplanar vectors, then $[\mathbf{a}+\mathbf{b}\ \ \mathbf{b}+\mathbf{c}\ \ \mathbf{c}+\mathbf{a}]=$ **[RPET 1988; MP PET 1990, 02; Kerala (Engg.) 2002]**

(a) $|\mathbf{a}\,\mathbf{b}\,\mathbf{c}|$ (b) $2[\mathbf{a}\,\mathbf{b}\,\mathbf{c}]$

(c) $[\mathbf{a}\,\mathbf{b}\,\mathbf{c}]^2$ (d) $2[\mathbf{a}\,\mathbf{b}\,\mathbf{c}]^2$

3. If the vectors $2\mathbf{i}-3\mathbf{j}$, $\mathbf{i}+\mathbf{j}-\mathbf{k}$ and $3\mathbf{i}-\mathbf{k}$ form three concurrent edges of a parallelopiped, then the volume of the parallelopiped is **[IIT 1983; RPET 1995; DCI Kurukshetra CEE 1998; MP PET 2001]**

(a) 8 (b) 10

(c) 4 (d) 14

4. If **a, b, c** are any three coplanar unit vectors, then

(a) $\mathbf{a}.(\mathbf{b}\times\mathbf{c})=1$ (b) $\mathbf{a}.(\mathbf{b}\times\mathbf{c})=3$

(c) $(\mathbf{a}\times\mathbf{b}).\mathbf{c}=0$ (d) $(\mathbf{c}\times\mathbf{a}).\mathbf{b}=1$

5. If **a** and **b** be parallel vectors, then [**a c b**] =

(a) 0 (b) 1

(c) 2 (d) None of these

6. If the vectors $2\mathbf{i}-\mathbf{j}+\mathbf{k}$, $\mathbf{i}+2\mathbf{j}-3\mathbf{k}$ and $3\mathbf{i}+\lambda\mathbf{j}+5\mathbf{k}$ be coplanar, then $\lambda=$

[Roorkee 1986; RPET 1999, 02; Kurukshetra CEE 2002]

(a) – 1 (b) – 2

(c) – 3 (d) – 4

7. If **a, b, c** are the three non-coplanar vectors and **p, q, r** are defined by the relations

$\mathbf{p}=\frac{\mathbf{b}\times\mathbf{c}}{[\mathbf{abc}]}, \mathbf{q}=\frac{\mathbf{c}\times\mathbf{a}}{[\mathbf{abc}]}, \mathbf{r}=\frac{\mathbf{a}\times\mathbf{b}}{[\mathbf{abc}]}$ then $(\mathbf{a}+\mathbf{b}).\mathbf{p}+(\mathbf{b}+\mathbf{c}).\mathbf{q}+(\mathbf{c}+\mathbf{a}).\mathbf{r}=$ **[IIT 1988; BIT Mesra 1996; AMU 2002]**

(a) 0 (b) 1
(c) 2 (d) 3

8. If the points whose position, vectors are $3\mathbf{i}-2\mathbf{j}-\mathbf{k}$, $2\mathbf{i}+3\mathbf{j}-4\mathbf{k}$, $-\mathbf{i}+\mathbf{j}+2\mathbf{k}$ and $4\mathbf{i}+5\mathbf{j}+\lambda\mathbf{k}$ lie on a plane, then $\lambda=$ **[IIT 1986; Pb. CET 2003**

(a) $-\frac{146}{17}$ (b) $\frac{146}{17}$
(c) $-\frac{17}{146}$ (d) $\frac{17}{146}$

9. If $\mathbf{p}=\frac{\mathbf{b}\times\mathbf{c}}{[\mathbf{abc}]}, \mathbf{q}=\frac{\mathbf{c}\times\mathbf{a}}{[\mathbf{abc}]}, \mathbf{r}=\frac{\mathbf{a}\times\mathbf{b}}{[\mathbf{abc}]}$, where **a**, **b**, **c** are three non-coplanar vectors, then the value of $(\mathbf{a}+\mathbf{b}+\mathbf{c}).(\mathbf{p}+\mathbf{q}+\mathbf{r})$ is given by **[MNR 1992; UPSEAT 2000]**

(a) 3 (b) 2
(c) 1 (d) 0

10. The volume of the parallelopiped whose edges are represented by $-12\mathbf{i}+\alpha\mathbf{k}$, $3\mathbf{j}-\mathbf{k}$ and $2\mathbf{i}+\mathbf{j}-15\mathbf{k}$ is 546. Then $\alpha=$ **[IIT Screening 1989; MNR 1987]**

(a) 3 (b) 2
(c) – 3 (d) – 2

11. Let *a, b, c* be distinct non-negative numbers. If the vectors $a\mathbf{i}+a\mathbf{j}+c\mathbf{k}$, $\mathbf{i}+\mathbf{k}$ and $c\mathbf{i}+c\mathbf{j}+b\mathbf{k}$ lie in a plane, then c is **[IIT 1993; AIEEE 2005]**

(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

12. If **a, b, c** are any three vectors and their inverse are $\mathbf{a}^{-1},\mathbf{b}^{-1},\mathbf{c}^{-1}$ and $[\mathbf{abc}]\neq 0$, then $[\mathbf{a}^{-1}\,\mathbf{b}^{-1}\,\mathbf{c}^{-1}]$ will be **[Roorkee 1989]**

(a) Zero (b) One
(c) Non-zero (d) [**a b c**]

13. If $\mathbf{a}=\mathbf{i}-\mathbf{j}+\mathbf{k}$, $\mathbf{b}=\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $\mathbf{c}=3\mathbf{i}+p\mathbf{j}+5\mathbf{k}$ are coplanar then the value of p will be **[RPET 1985, 86, 8**

(a) – 6 (b) – 2
(c) 2 (d) 6

14. If $\mathbf{i},\mathbf{j},\mathbf{k}$ are the unit vectors and mutually perpendicular, then $[\mathbf{i}\,\mathbf{k}\,\mathbf{j}]$ is equal to

(a) 0 (b) – 1
(c) 1 (d) None of these

15. If three vectors $\mathbf{a}=12\mathbf{i}+4\mathbf{j}+3\mathbf{k}$, $\mathbf{b}=8\mathbf{i}-12\mathbf{j}-9\mathbf{k}$ and $\mathbf{c}=33\mathbf{i}-4\mathbf{j}-24\mathbf{k}$ represents a cube, then its volume will be

(a) 616 (b) 308
(c) 154 (d) None of these

16. If $\mathbf{a}=2\mathbf{i}+\mathbf{j}-\mathbf{k}$, $\mathbf{b}=\mathbf{i}+2\mathbf{j}+\mathbf{k}$ and $\mathbf{c}=\mathbf{i}-\mathbf{j}+2\mathbf{k}$, then $\mathbf{a}.(\mathbf{b}\times\mathbf{c})=$ **[RPET 1989, 2001]**

(a) 6 (b) 10
(c) 12 (d) 24

17. Three concurrent edges *OA, OB, OC* of a parallelopiped are represented by three vectors $2\mathbf{i}+\mathbf{j}-\mathbf{k}$, $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ and $-3\mathbf{i}-\mathbf{j}+\mathbf{k}$, the volume of the solid so formed in cubic unit is

(a) 5 (b) 6
(c) 7 (d) 8

18. If $\mathbf{x}.\mathbf{a}=0$, $\mathbf{x}.\mathbf{b}=0$ and $\mathbf{x}.\mathbf{c}=0$ for some non-zero vector **x**, then the ture statement is **[IIT 1983; Karnataka CET 2002]**

(a) $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]=0$ (b) $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]\neq 0$
(c) $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]=1$ (d) None of these

19. If the given vectors $(-bc, b^2+bc, c^2+bc)$, $(a^2+ac, -ac, c^2+ac)$ and $(a^2+ab, b^2+ab, -ab)$ are coplanar, where none of *a*, *b* and *c* is zero, then

(a) $a^2+b^2+c^2=1$
(b) $bc+ca+ab=0$
(c) $a+b+c=0$
(d) $a^2+b^2+c^2=bc+ca+ab$

20. If **a**,**b**,**c** are three coplanar vectors, then $[\mathbf{a}+\mathbf{b}\ \ \mathbf{b}+\mathbf{c}\ \ \mathbf{c}+\mathbf{a}]=$ **[MP PET 1995]**

(a) [**a b c**] (b) 2 [**a b c**]
(c) 3 [**a b c**] (d) 0

21. $[\mathbf{a}\ \mathbf{b}\ \mathbf{a}\times\mathbf{b}]$ is equal to

(a) $|\mathbf{a}\times\mathbf{b}|$ (b) $|\mathbf{a}\times\mathbf{b}|^2$
(c) **0** (d) None of these

22. If $\mathbf{a}.\mathbf{i}=4$, then $(\mathbf{a}\times\mathbf{j}).(2\mathbf{j}-3\mathbf{k})=$

(a) 12 (b) 2
(c) 0 (d) – 12

23. If the vectors $2\mathbf{i}-3\mathbf{j}+4\mathbf{k}$, $\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $x\mathbf{i}-\mathbf{j}+2\mathbf{k}$ are coplanar, then $x=$ **[EAMCET 1994]**

(a) $\frac{8}{5}$ (b) $\frac{5}{8}$
(c) 0 (d) 1

24. Volume of the parallelopiped whose coterminous edges are $2\mathbf{i}-3\mathbf{j}+4\mathbf{k}$, $\mathbf{i}+2\mathbf{j}-2\mathbf{k}$, $3\mathbf{i}-\mathbf{j}+\mathbf{k}$, is **[EAMCET 199**

(a) 5 *cubic unit* (b) 6 *cubic unit*
(c) 7 *cubic unit* (d) 8 *cubic unit*

25. If $\mathbf{a}=3\mathbf{i}-\mathbf{j}+2\mathbf{k}$, $\mathbf{b}=2\mathbf{i}+\mathbf{j}-\mathbf{k}$, then $\mathbf{a}\times(\mathbf{a}.\mathbf{b})=$ **[Karnataka CET 1994]**

(a) 3**a** (b) $3\sqrt{14}$
(c) 0 (d) None of these

26. $\mathbf{i}.(\mathbf{j}\times\mathbf{k})+\mathbf{j}.(\mathbf{k}\times\mathbf{i})+\mathbf{k}.(\mathbf{i}\times\mathbf{j})=$ **[Karnataka CET 1994]**

(a) 1 (b) 3
(c) – 3 (d) 0

27. If $\mathbf{a}=\mathbf{i}-2\mathbf{j}+3\mathbf{k}$ and $\mathbf{b}=3\mathbf{i}+\mathbf{j}+2\mathbf{k}$, then the unit vector perpendicular to **a** and **b** is

(a) $\frac{\mathbf{i}+\mathbf{j}+\mathbf{k}}{\sqrt{3}}$ (b) $\frac{\mathbf{i}-\mathbf{j}+\mathbf{k}}{\sqrt{3}}$

(c) $\frac{-\mathbf{i}+\mathbf{j}+\mathbf{k}}{\sqrt{3}}$ (d) $\frac{\mathbf{i}-\mathbf{j}-\mathbf{k}}{\sqrt{3}}$

28. If $\mathbf{a}=-3\mathbf{i}+7\mathbf{j}+5\mathbf{k}$, $\mathbf{b}=-3\mathbf{i}+7\mathbf{j}-3\mathbf{k}$, $\mathbf{c}=7\mathbf{i}-5\mathbf{j}-3\mathbf{k}$ are the three coterminous edges of a parallelopiped, then its volume is
(a) 108 (b) 210
(c) 272 (d) 308

29. $\mathbf{a}.(\mathbf{a}\times\mathbf{b})=$ **[MP PET 1996]**
(a) **b . b** (b) a^2b
(c) 0 (d) a^2+ab

30. If three conterminous edges of a parallelopiped are represented by $\mathbf{a}-\mathbf{b}, \mathbf{b}-\mathbf{c}$ and $\mathbf{c}-\mathbf{a}$, then its volume is
[MP PET 1999; Pb. CET 2003]
(a) [**a b c**] (b) 2 [**a b c**]
(c) $[\mathbf{a\ b\ c}]^2$ (d) 0

31. For three vectors **u, v, w** which of the following expressions is not equal to any of the remaining three **[IIT 1998]**
(a) $\mathbf{u}.(\mathbf{v}\times\mathbf{w})$ (b) $(\mathbf{v}\times\mathbf{w}).\mathbf{u}$
(c) $\mathbf{v}.(\mathbf{u}\times\mathbf{w})$ (d) $(\mathbf{u}\times\mathbf{v}).\mathbf{w}$

32. Which of the following expressions are meaningful
[IIT 1998; RPET 2001]
(a) $\mathbf{u}.(\mathbf{v}\times\mathbf{w})$ (b) $(\mathbf{u}.\mathbf{v}).\mathbf{w}$
(c) $(\mathbf{u}.\mathbf{v})\mathbf{w}$ (d) $\mathbf{u}\times(\mathbf{v}.\mathbf{w})$

33. If **a,b,c** are non-coplanar vectors and $\mathbf{d}=\lambda\mathbf{a}+\mu\mathbf{b}+\nu\mathbf{c}$, then λ is equal to
(a) $\frac{[\mathbf{dbc}]}{[\mathbf{bac}]}$ (b) $\frac{[\mathbf{bcd}]}{[\mathbf{bca}]}$
(c) $\frac{[\mathbf{bdc}]}{[\mathbf{abc}]}$ (d) $\frac{[\mathbf{cbd}]}{[\mathbf{abc}]}$

34. If vectors $\vec{A}=2\mathbf{i}+3\mathbf{j}+4\mathbf{k}$, $\vec{B}=\mathbf{i}+\mathbf{j}+5\mathbf{k}$, and $\vec{C}$ form a left handed system, then $\vec{C}$ is
(a) 11**i** – 6**j** – **k** (b) – 11**i** + 6**j** + **k**
(c) 11**i** – 6**j** + **k** (d) – 11**i** + 6**j** – **k**

35. What will be the volume of that parallelopiped whose sides are **a** = **i** – **j** + **k**, **b** = **i** – 3**j** + 4**k** and **c** = 2**i** – 5**j** + 3**k**
[UPSEAT 1999]
(a) 5 *unit* (b) 6 *unit*
(c) 7 *unit* (d) 8 *unit*

36. Given vectors **a**, **b**, **c** such that $\mathbf{a}.(\mathbf{b}\times\mathbf{c})=\lambda\neq 0$, the value of $(\mathbf{b}\times\mathbf{c}).(\mathbf{a}+\mathbf{b}+\mathbf{c})/\lambda$ is
(a) 3 (b) 1
(c) -3λ (d) $3/\lambda$

37. If **a,b** and **c** are unit coplanar vectors then the scalar triple product $[2\mathbf{a}-\mathbf{b}\ 2\mathbf{b}-\mathbf{c}\ 2\mathbf{c}-\mathbf{a}]$ is equal to
[IIT Screening 2000; Kerala (Engg.) 2005]
(a) 0 (b) 1
(c) $-\sqrt{3}$ (d) $\sqrt{3}$

38. If the vectors $\mathbf{i}+3\mathbf{j}-2\mathbf{k}$, $2\mathbf{i}-\mathbf{j}+4\mathbf{k}$ and $3\mathbf{i}+2\mathbf{j}+x\mathbf{k}$ are coplanar, then the value of *x* is
(a) – 2 (b) 2
(c) 1 (d) 3

39. The value of [**a** – **b** **b** – **c** **c** – **a**], where $|\mathbf{a}|=1$, $|\mathbf{b}|=5$ and $|\mathbf{c}|=3$ is **[RPET 2000]**
(a) 0 (b) 1
(c) 2 (d) 4

40. $\mathbf{a}=\mathbf{i}+\mathbf{j}+\mathbf{k}, \mathbf{b}=2\mathbf{i}-4\mathbf{k}, \mathbf{c}=\mathbf{i}+\lambda\mathbf{j}+3\mathbf{k}$ are coplanar, then the value of λ is **[MP PET 2000]**
(a) 5/2 (b) 3/5
(c) 7/3 (d) None of these

41. Let $\vec{A}=\mathbf{i}+\mathbf{j}+\mathbf{k}$, $\vec{B}=\mathbf{i}, \vec{C}=C_1\mathbf{i}+C_2\mathbf{j}+C_3\mathbf{k}$. If $C_2=-1$, and $C_3=1$, then to make three vectors coplanar **[AMU 2000]**
(a) $C_1=0$
(b) $C_1=1$
(c) $C_1=2$
(d) No value of C_1 can be found

42. Let $\mathbf{a}=\mathbf{i}-\mathbf{k}$, $\mathbf{b}=x\mathbf{i}+\mathbf{j}+(1-x)\mathbf{k}$, $\mathbf{c}=y\mathbf{i}+x\mathbf{j}+(1+x-y)\mathbf{k}$. Then [**a b c**] depends on
[IIT Screening 2001; AIEEE 2005]
(a) Only *x* (b) Only *y*
(c) Neither *x* nor *y* (d) Both *x* and *y*

43. If $\mathbf{a}=3\mathbf{i}-2\mathbf{j}+2\mathbf{k}$, $\mathbf{b}=6\mathbf{i}+4\mathbf{j}-2\mathbf{k}$ and $\mathbf{c}=3\mathbf{i}-2\mathbf{j}-4\mathbf{k}$, then $\mathbf{a}.(\mathbf{b}\times\mathbf{c})$ is **[Karnataka CET 2001]**
(a) 122 (b) – 144
(c) 120 (d) – 120

44. $(\mathbf{a}+\mathbf{b}).(\mathbf{b}+\mathbf{c})\times(\mathbf{a}+\mathbf{b}+\mathbf{c})=$ **[EAMCET 2002]**
(a) – [**a b c**] (b) [**a b c**]
(c) 0 (d) 2[**a b c**]

45. **a**.(**b** × **c**) is equal to **[RPET 2001]**
(a) **b**.(**a** × **c**) (b) **c**.(**b** × **a**)
(c) **b**.(**c** × **a**) (d) None of these

46. If **a,b,c** are vectors such that $[\mathbf{abc}]=4$, then $[\mathbf{a}\times\mathbf{b}\ \mathbf{b}\times\mathbf{c}\ \mathbf{c}\times\mathbf{a}]=$ **[AIEEE 2002]**
(a) 16 (b) 64
(c) 4 (d) 8

47. The volume of the parallelopiped whose conterminous edges are $\mathbf{i}-\mathbf{j}+\mathbf{k}$, $2\mathbf{i}-4\mathbf{j}+5\mathbf{k}$ and $3\mathbf{i}-5\mathbf{j}+2\mathbf{k}$ is
[Kerala (Engg.) 2002]
(a) 4 (b) 3
(c) 2 (d) 8

48. $[\mathbf{i\ k\ j}]+[\mathbf{k\ j\ i}]+[\mathbf{j\ k\ i}]$ **[UPSEAT 2002]**
(a) 1 (b) 3
(c) – 3 (d) – 1

49. If **u**, **v** and **w** are three non-coplanar vectors, then $(\mathbf{u}+\mathbf{v}-\mathbf{w}).[(\mathbf{u}-\mathbf{v})\times(\mathbf{v}-\mathbf{w})]$ equals

[AIEEE 2003; DCE 2005]

(a) 0 (b) $\mathbf{u}.(\mathbf{v}\times\mathbf{w})$

(c) $\mathbf{u}.(\mathbf{w}\times\mathbf{v})$ (d) $3\mathbf{u}.(\mathbf{v}\times\mathbf{w})$

50. $\mathbf{a}.[(\mathbf{b}+\mathbf{c})\times(\mathbf{a}+\mathbf{b}+\mathbf{c})]$ is equal to

[IIT 1981; UPSEAT 2003; RPET 1988, 2002; MP PET 2004]

(a) [**a b c**] (b) 2[**a b c**]

(c) 3[**a b c**] (d) 0

51. If the vectors $4\mathbf{i}+11\mathbf{j}+m\mathbf{k}, 7\mathbf{i}+2\mathbf{j}+6\mathbf{k}$ and $\mathbf{i}+5\mathbf{j}+4\mathbf{k}$ are coplanar, then m is

(a) 38 (b) 0

(c) 10 (d) – 10

52. Vector coplanar with vectors **i** + **j** and **j** + **k** and parallel to the vector 2**i** – 2**j** – 4**k**, is

(a) **i** – **k** (b) **i** – **j** – 2**k**

(c) **i** + **j** – **k** (d) 3**i** + 3**j** – 6**k**

53. The value of for which the four points $2\mathbf{i}+3\mathbf{j}-\mathbf{k}$, $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$, $3\mathbf{i}+4\mathbf{j}-2\mathbf{k}$, $\mathbf{i}-\lambda\mathbf{j}+6\mathbf{k}$ are coplanar

[MP PET 2004]

(a) 8 (b) 0

(c) – 2 (d) 6

54. If **a**, **b**, **c** are non-coplanar vectors and is a real number, then the vectors $\mathbf{a}+2\mathbf{b}+3\mathbf{c}, \lambda\mathbf{b}+4\mathbf{c}$ and $(2\lambda-1)\mathbf{c}$ are non-coplanar for

(a) No value of (b) All except one value of

(c) All except two values of (d)

55. Let **a**, **b** and **c** be three vectors. Then scalar triple product [**a b c**] is equal to

(a) [**b a c**] (b) [**a c b**]

(c) [**c b a**] (d) [**b c a**]

56. If $\mathbf{a}.\mathbf{b}=\mathbf{b}.\mathbf{c}=\mathbf{c}.\mathbf{a}=0$ then the value of [**a b c**] is equal to

(a) 1 (b) – 1

(c) $|\mathbf{a}||\mathbf{b}||\mathbf{c}|$ (d) 0

57. If $\mathbf{a}=\mathbf{i}+\mathbf{j}-\mathbf{k}, \mathbf{b}=2\mathbf{i}+3\mathbf{j}+\mathbf{k}$ and $\mathbf{c}=\mathbf{i}+\alpha\mathbf{j}$ are coplanar vectors, the value of α is

(a) $-\frac{4}{3}$ (b) $\frac{3}{4}$

(c) $\frac{4}{3}$ (d) 2