10. If the position vectors of the vertices of a triangle be $6\mathbf{i}+4\mathbf{j}+5\mathbf{k}$, $4\mathbf{i}+5\mathbf{j}+6\mathbf{k}$ and $5\mathbf{i}+6\mathbf{j}+4\mathbf{k}$, then the triangle is

(a) Right angled (b) Isosceles
(c) Equilateral (d) None of these

11. The perimeter of the triangle whose vertices have the position vectors $(\mathbf{i}+\mathbf{j}+\mathbf{k}), (5\mathbf{i}+3\mathbf{j}-3\mathbf{k})$ and $(2\mathbf{i}+5\mathbf{j}+9\mathbf{k})$, is given by **[MP PET 1993]**

(a) $15+\sqrt{157}$ (b) $15-\sqrt{157}$
(c) $\sqrt{15}-\sqrt{157}$ (d) $\sqrt{15}+\sqrt{157}$

12. The position vectors of two points A and B are $\mathbf{i}+\mathbf{j}-\mathbf{k}$ and $2\mathbf{i}-\mathbf{j}+\mathbf{k}$ respectively. Then $|\overrightarrow{AB}|=$ **[BIT**

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

13. The magnitudes of mutually perpendicular forces **a, b** and **c** are 2, 10 and 11 respectively. Then the magnitude of its resultant is

(a) 12 (b) 15
(c) 9 (d) None

14. The system of vectors $\mathbf{i}, \mathbf{j}, \mathbf{k}$ is

(a) Orthogonal (b) Coplanar
(c) Collinear (d) None of these

15. The direction cosines of the resultant of the vectors $(\mathbf{i}+\mathbf{j}+\mathbf{k})$, $(-\mathbf{i}+\mathbf{j}+\mathbf{k})$, $(\mathbf{i}-\mathbf{j}+\mathbf{k})$ and $(\mathbf{i}+\mathbf{j}-\mathbf{k})$, are

(a) $\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{6}}\right)$ (b) $\left(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right)$
(c) $\left(-\frac{1}{\sqrt{6}}, -\frac{1}{\sqrt{6}}, -\frac{1}{\sqrt{6}}\right)$ (d) $\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

16. The position vectors of P and Q are $5\mathbf{i}+4\mathbf{j}+a\mathbf{k}$ and $-\mathbf{i}+2\mathbf{j}-2\mathbf{k}$ respectively. If the distance between them is 7, then the value of a will be

(a) – 5, 1 (b) 5, 1
(c) 0, 5 (d) 1, 0

17. A zero vector has

(a) Any direction (b) No direction
(c) Many directions (d) None of these

18. A unit vector **a** makes an angle $\frac{\pi}{4}$ with z-axis. If $\mathbf{a}+\mathbf{i}+\mathbf{j}$ is a unit vector, then **a** is equal to

(a) $\frac{\mathbf{i}}{2}+\frac{\mathbf{j}}{2}+\frac{\mathbf{k}}{\sqrt{2}}$ (b) $\frac{\mathbf{i}}{2}+\frac{\mathbf{j}}{2}-\frac{\mathbf{k}}{\sqrt{2}}$
(c) $-\frac{\mathbf{i}}{2}-\frac{\mathbf{j}}{2}+\frac{\mathbf{k}}{\sqrt{2}}$ (d) None of these

19. A force is a

(a) Unit vector (b) Localised vector
(c) Zero vector (d) Free vector

20. If **a**, **b**, **c**, **d** be the position vectors of the points A, B, C and D respectively referred to same origin O such that no three of these points are collinear and $\mathbf{a}+\mathbf{c}=\mathbf{b}+\mathbf{d}$, then quadrilateral $ABCD$ is a

(a) Square (b) Rhombus
(c) Rectangle (d) Parallelogram

21. If the position vectors of A and B are $\mathbf{i}+3\mathbf{j}-7\mathbf{k}$ and $5\mathbf{i}-2\mathbf{j}+4\mathbf{k}$, then the direction cosine of $\overrightarrow{AB}$ along y-axis is **[MNR 1989]**

(a) $\frac{4}{\sqrt{162}}$ (b) $-\frac{5}{\sqrt{162}}$
(c) – 5 (d) 11

22. If the resultant of two forces is of magnitude P and equal to one of them and perpendicular to it, then the other force is **[MNR 1986]**

(a) $P\sqrt{2}$ (b) P
(c) $P\sqrt{3}$ (d) None of these

23. The direction cosines of vector $\mathbf{a}=3\mathbf{i}+4\mathbf{j}+5\mathbf{k}$ in the direction of positive axis of x, is

(a) $\pm\frac{3}{\sqrt{50}}$ (b) $\frac{4}{\sqrt{50}}$
(c) $\frac{3}{\sqrt{50}}$ (d) $-\frac{4}{\sqrt{50}}$

24. The point having position vectors $2\mathbf{i}+3\mathbf{j}+4\mathbf{k}$, $3\mathbf{i}+4\mathbf{j}+2\mathbf{k}$, $4\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ are the vertices of **[EAMCET 1988]**

(a) Right angled triangle (b) Isosceles triangle
(c) Equilateral triangle (d) Collinear

25. Let α, β, γ be distinct real numbers. The points with position vectors $\alpha\mathbf{i}+\beta\mathbf{j}+\gamma\mathbf{k}, \beta\mathbf{i}+\gamma\mathbf{j}+\alpha\mathbf{k}, \gamma\mathbf{i}+\alpha\mathbf{j}+\beta\mathbf{k}$ **[IIT Screening 1994]**

(a) Are collinear
(b) Form an equilateral triangle
(c) Form a scalene triangle
(d) Form a right angled triangle

26. If $|\mathbf{a}|=3, |\mathbf{b}|=4$ and $|\mathbf{a}+\mathbf{b}|=5$, then $|\mathbf{a}-\mathbf{b}|=$ **[EAMCET 1994]**

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

27. If $OP=8$ and $\overrightarrow{OP}$ makes angles 45^o and 60^o with OX-axis and OY-axis respectively, then $\overrightarrow{OP}=$

(a) $8(\sqrt{2}\mathbf{i}+\mathbf{j}\pm\mathbf{k})$ (b) $4(\sqrt{2}\mathbf{i}+\mathbf{j}\pm\mathbf{k})$
(c) $\frac{1}{4}(\sqrt{2}\mathbf{i}+\mathbf{j}\pm\mathbf{k})$ (d) $\frac{1}{8}(\sqrt{2}\mathbf{i}+\mathbf{j}\pm\mathbf{k})$

28. If **a** and **b** are two non-zero and non-collinear vectors, then **a** + **b** and **a** – **b** are

(a) Linearly dependent vectors
(b) Linearly independent vectors
(c) Linearly dependent and independent vectors
(d) None of these

29. If the vectors $6\mathbf{i}-2\mathbf{j}+3\mathbf{k}$, $2\mathbf{i}+3\mathbf{j}-6\mathbf{k}$ and $3\mathbf{i}+6\mathbf{j}-2\mathbf{k}$ form a triangle, then it is

(a) Right angled (b) Obtuse angled
(c) Equilteral (d) Isosceles

30. If the resultant of two forces of magnitudes P and Q acting at a point at an angle of 60^o is $\sqrt{7}Q$, then P/Q is **[Roorkee 1999]**

(a) 1 (b) $\frac{3}{2}$

(c) 2 (d) 4

31. The direction cosines of the vector $3\mathbf{i}-4\mathbf{j}+5\mathbf{k}$ are **[Karnataka CET 2000]**

(a) $\frac{3}{5},\frac{-4}{5},\frac{1}{5}$ (b) $\frac{3}{5\sqrt{2}},\frac{-4}{5\sqrt{2}},\frac{1}{\sqrt{2}}$

(c) $\frac{3}{\sqrt{2}},\frac{-4}{\sqrt{2}},\frac{1}{\sqrt{2}}$ (d) $\frac{3}{5\sqrt{2}},\frac{4}{5\sqrt{2}},\frac{1}{\sqrt{2}}$

32. The position vectors of A and B are $2\mathbf{i}-9\mathbf{j}-4\mathbf{k}$ and $6\mathbf{i}-3\mathbf{j}+8\mathbf{k}$ respectively, then the magnitude of $\overrightarrow{AB}$ is **[MP PET 2000]**

(a) 11 (b) 12

(c) 13 (d) 14

33. If the position vectors of P and Q are $(\mathbf{i}+3\mathbf{j}-7\mathbf{k})$ and $(5\mathbf{i}-2\mathbf{j}+4\mathbf{k})$, then $|\overrightarrow{PQ}|$ is

(a) $\sqrt{158}$ (b) $\sqrt{160}$

(c) $\sqrt{161}$ (d) $\sqrt{162}$

34. If $\mathbf{a}$ is non zero vector of modulus a and m is a non-zero scalar, then $m\mathbf{a}$ is a unit vector if

(a) $m=\pm1$ (b) $m=|\mathbf{a}|$

(c) $m=\frac{1}{|\mathbf{a}|}$ (d) $m=\pm2$

35. The position vectors of the points A, B, C are $(2\mathbf{i}+\mathbf{j}-\mathbf{k})$, $(3\mathbf{i}-2\mathbf{j}+\mathbf{k})$ and $(\mathbf{i}+4\mathbf{j}-3\mathbf{k})$ respectively. These points **[Kurukshetra CEE 2002]**

(a) Form an isosceles triangle
(b) Form a right-angled triangle
(c) Are collinear
(d) Form a scalene triangle

36. The vectors $\overrightarrow{AB}=3\mathbf{i}+4\mathbf{k}$, and $\overrightarrow{AC}=5\mathbf{i}-2\mathbf{j}+4\mathbf{k}$ are the sides of a triangle ABC. The length of the median through A is

(a) $\sqrt{18}$ (b) $\sqrt{72}$

(c) $\sqrt{33}$ (d) $\sqrt{288}$

37. If the position vectors of the vertices A, B, C of a triangle ABC are $7\mathbf{j}+10\mathbf{k}$, $-\mathbf{i}+6\mathbf{j}+6\mathbf{k}$ and $-4\mathbf{i}+9\mathbf{j}+6\mathbf{k}$ respectively, the triangle is

(a) Equilateral
(b) Isosceles
(c) Scalene
(d) Right angled and isosceles also

38. The figure formed by the four points $\mathbf{i}+\mathbf{j}-\mathbf{k}$, $2\mathbf{i}+3\mathbf{j}$, $3\mathbf{i}+5\mathbf{j}-2\mathbf{k}$ and $\mathbf{k}-\mathbf{j}$ is

(a) Rectangle (b) Parallelogram

(c) Trapezium (d) None of these

39. ABC is an isosceles triangle right angled at A. Forces of magnitude $2\sqrt{2}, 5$ and 6 act along $\overrightarrow{BC}, \overrightarrow{CA}$ and $\overrightarrow{AB}$ respectively. The magnitude of their resultant force is **[Roorkee 1999]**

(a) 4 (b) 5

(c) $11+2\sqrt{2}$ (d) 30

40. If $ABCDEF$ is a regular hexagon and $\overrightarrow{AB}+\overrightarrow{AC}+\overrightarrow{AD}+\overrightarrow{AE}+\overrightarrow{AF}=\lambda\overrightarrow{AD}$, then $\lambda=$ **[RPET 1985]**

(a) 2 (b) 3

(c) 4 (d) 6

41. If P and Q be the middle points of the sides BC and CD of the parallelogram $ABCD$, then $\overrightarrow{AP}+\overrightarrow{AQ}=$

(a) $\overrightarrow{AC}$ (b) $\frac{1}{2}\overrightarrow{AC}$

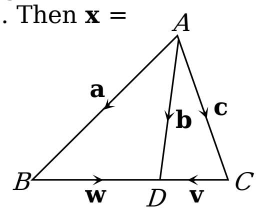
(c) $\frac{2}{3}\overrightarrow{AC}$ (d) $\frac{3}{2}\overrightarrow{AC}$

42. P is a point on the side BC of the ΔABC and Q is a point such that $\overrightarrow{PQ}$ is the resultant of $\overrightarrow{AP}, \overrightarrow{PB}, \overrightarrow{PC}$. Then $ABQC$ is a

(a) Square (b) Rectangle

(c) Parallelogram (d) Trapezium

43. In the figure, a vector $\mathbf{x}$ satisfies the equation $\mathbf{x}-\mathbf{w}=\mathbf{v}$. Then $\mathbf{x}=$



(a) $2\mathbf{a}+\mathbf{b}+\mathbf{c}$ (b) $\mathbf{a}+2\mathbf{b}+\mathbf{c}$

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

44. A vector coplanar with the non-collinear vectors $\mathbf{a}$ and $\mathbf{b}$ is

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

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

45. If $ABCD$ is a parallelogram, $\overrightarrow{AB}=2\mathbf{i}+4\mathbf{j}-5\mathbf{k}$ and $\overrightarrow{AD}=\mathbf{i}+2\mathbf{j}+3\mathbf{k}$, then the unit vector in the direction of BD is **[Roorkee 1976]**

(a) $\frac{1}{\sqrt{69}}(\mathbf{i}+2\mathbf{j}-8\mathbf{k})$ (b) $\frac{1}{69}(\mathbf{i}+2\mathbf{j}-8\mathbf{k})$

(c) $\frac{1}{\sqrt{69}}(-\mathbf{i}-2\mathbf{j}+8\mathbf{k})$ (d) $\frac{1}{69}(-\mathbf{i}-2\mathbf{j}+8\mathbf{k})$

46. If $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ be three non-zero vectors, no two of which are collinear. If the vector $\mathbf{a}+2\mathbf{b}$ is collinear with $\mathbf{c}$ and $\mathbf{b}+3\mathbf{c}$ is collinear with $\mathbf{a}$, then (λ being some non-zero scalar) $\mathbf{a}+2\mathbf{b}+6\mathbf{c}$ is equal to **[AIEEE 2004]**

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

(c) $\lambda\mathbf{c}$ (d) $\mathbf{0}$

47. If $\mathbf{a} = 2\mathbf{i} + 5\mathbf{j}$ and $\mathbf{b} = 2\mathbf{i} - \mathbf{j}$, then the unit vector along $\mathbf{a} + \mathbf{b}$ will be **[RPET 1985, 95]**

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

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

48. What should be added in vector $\mathbf{a} = 3\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$ to get its resultant a unit vector **i**

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

(c) $2\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$ (d) None of these

49. If $\mathbf{a} = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$, $\mathbf{b} = -\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and $\mathbf{c} = 3\mathbf{i} + \mathbf{j}$, then the unit vector along its resultant is

(a) $3\mathbf{i} + 5\mathbf{j} + 4\mathbf{k}$ (b) $\frac{3\mathbf{i} + 5\mathbf{j} + 4\mathbf{k}}{50}$

(c) $\frac{3\mathbf{i} + 5\mathbf{j} + 4\mathbf{k}}{5\sqrt{2}}$ (d) None of these

50. In a regular hexagon *ABCDEF*, $\overrightarrow{AE} =$ **[MNR 1984]**

(a) $\overrightarrow{AC} + \overrightarrow{AF} + \overrightarrow{AB}$ (b) $\overrightarrow{AC} + \overrightarrow{AF} - \overrightarrow{AB}$

(c) $\overrightarrow{AC} + \overrightarrow{AB} - \overrightarrow{AF}$ (d) None of these

51. $3\overrightarrow{OD} + \overrightarrow{DA} + \overrightarrow{DB} + \overrightarrow{DC} =$ **[IIT 1988]**

(a) $\overrightarrow{OA} + \overrightarrow{OB} - \overrightarrow{OC}$ (b) $\overrightarrow{OA} + \overrightarrow{OB} - \overrightarrow{BD}$

(c) $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC}$ (d) None of these

52. $\mathbf{p} = 2\mathbf{a} - 3\mathbf{b}$, $\mathbf{q} = \mathbf{a} - 2\mathbf{b} + \mathbf{c}$, $\mathbf{r} = -3\mathbf{a} + \mathbf{b} + 2\mathbf{c}$; where **a**, **b** and **c** being non-zero, non-coplanar vectors, then the vector $-2\mathbf{a} + 3\mathbf{b} - \mathbf{c}$ is equal to

(a) $\mathbf{p} - 4\mathbf{q}$ (b) $\frac{-7\mathbf{q} + \mathbf{r}}{5}$

(c) $2\mathbf{p} - 3\mathbf{q} + \mathbf{r}$ (d) $4\mathbf{p} - 2\mathbf{r}$

53. In a trapezium, the vector $\overrightarrow{BC} = \lambda\overrightarrow{AD}$. We will then find that $\mathbf{p} = \overrightarrow{AC} + \overrightarrow{BD}$ is collinear with $\overrightarrow{AD}$. If $\mathbf{p} = \mu\overrightarrow{AD}$, then

(a) $\mu = \lambda + 1$ (b) $\lambda = \mu + 1$

(c) $\lambda + \mu = 1$ (d) $\mu = 2 + \lambda$

54. If $\mathbf{a} = 2\mathbf{i} + \mathbf{j} - 8\mathbf{k}$ and $\mathbf{b} = \mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$, then the magnitude of $\mathbf{a} + \mathbf{b} =$ **[MP PET 1996]**

(a) 13 (b) $\frac{13}{3}$

(c) $\frac{3}{13}$ (d) $\frac{4}{13}$

55. *A, B, C, D, E* are five coplanar points, then $\overrightarrow{DA} + \overrightarrow{DB} + \overrightarrow{DC} + \overrightarrow{AE} + \overrightarrow{BE} + \overrightarrow{CE}$ is equal to **[RPET 1999]**

(a) $\overrightarrow{DE}$ (b) $3\overrightarrow{DE}$

(c) $2\overrightarrow{DE}$ (d) $4\overrightarrow{ED}$

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

(a) $3\mathbf{i} - 4\mathbf{j}$ (b) $3\mathbf{i} + 4\mathbf{j}$

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

57. Five points given by *A, B, C, D, E* are in a plane. Three forces $\overrightarrow{AC}, \overrightarrow{AD}$ and $\overrightarrow{AE}$ act at *A* and three forces $\overrightarrow{CB}, \overrightarrow{DB}, \overrightarrow{EB}$ act at *B*. Then their resultant is **[AMU 2**

(a) $2\overrightarrow{AC}$ (b) $3\overrightarrow{AB}$

(c) $3\overrightarrow{DB}$ (d) $2\overrightarrow{BC}$

58. The sum of two forces is 18 *N* and resultant whose direction is at right angles to the smaller force is 12*N*. The magnitude of the two forces are

(a) 13, 5 (b) 12, 6

(c) 14, 4 (d) 11, 7

59. The unit vector parallel to the resultant vector of $2\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ and $\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$ is **[MP PET 2003]**

(a) $\frac{1}{7}(3\mathbf{i} + 6\mathbf{j} - 2\mathbf{k})$ (b) $\frac{\mathbf{i} + \mathbf{j} + \mathbf{k}}{\sqrt{3}}$

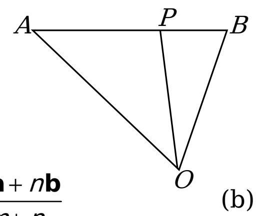
(c) $\frac{\mathbf{i} + \mathbf{j} + 2\mathbf{k}}{\sqrt{6}}$ (d) $\frac{1}{\sqrt{69}}(-\mathbf{i} - \mathbf{j} + 8\mathbf{k})$

60. If **a, b, c** are the position vectors of the vertices *A, B, C* of the triangle *ABC*, then the centroid of ΔABC is **[MP PET 1987]**

(a) $\frac{\mathbf{a} + \mathbf{b} + \mathbf{c}}{3}$ (b) $\frac{1}{2}\left(\mathbf{a} + \frac{\mathbf{b} + \mathbf{c}}{2}\right)$

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

61. If in the given figure $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $AP : PB = m : n$, then $\overrightarrow{OP} =$ **[RPET 1981; MP PET 1988]**



(a) $\frac{m\mathbf{a} + n\mathbf{b}}{m + n}$ (b) $\frac{n\mathbf{a} + m\mathbf{b}}{m + n}$

(c) $m\mathbf{a} - n\mathbf{b}$ (d) $\frac{m\mathbf{a} - n\mathbf{b}}{m - n}$

62. If *D, E, F* be the middle points of the sides *BC, CA* and *AB* of the triangle *ABC*, then $\overrightarrow{AD} + \overrightarrow{BE} + \overrightarrow{CF}$ is

(a) A zero vector (b) A unit vector

(c) 0 (d) None of these

63. If **a** and **b** are the position vectors of *A* and *B* respectively, then the position vector of a point *C* on *AB* produced such that $\overrightarrow{AC} = 3\overrightarrow{AB}$ is **[MNR 1980; MP PET 1995, 99]**

(a) $3\mathbf{a} - \mathbf{b}$ (b) $3\mathbf{b} - \mathbf{a}$

(c) $3\mathbf{a} - 2\mathbf{b}$ (d) $3\mathbf{b} - 2\mathbf{a}$

64. The position vectors of *A* and *B* are $\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ and $3\mathbf{i} - \mathbf{j} + 3\mathbf{k}$. The position vector of the middle point of the line *AB* is **[MP PET 1988]**

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

(c) $\frac{3}{2}\mathbf{i}-\frac{1}{2}\mathbf{j}+\frac{3}{2}\mathbf{k}$ (d) None of these

65. If *ABCD* is a parallelogram and the position vectors of *A, B, C* are $\mathbf{i}+3\mathbf{j}+5\mathbf{k}$, $\mathbf{i}+\mathbf{j}+\mathbf{k}$ and $7\mathbf{i}+7\mathbf{j}+7\mathbf{k}$, then the position vector of *D* will be

(a) $7\mathbf{i}+5\mathbf{j}+3\mathbf{k}$ (b) $7\mathbf{i}+9\mathbf{j}+11\mathbf{k}$

(c) $9\mathbf{i}+11\mathbf{j}+13\mathbf{k}$ (d) $8\mathbf{i}+8\mathbf{j}+8\mathbf{k}$

66. *P* is the point of intersection of the diagonals of the parallelogram *ABCD*. If *O* is any point, then $\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}+\overrightarrow{OD}=$ **[RPET 1989; J & K 2005]**

(a) $\overrightarrow{OP}$ (b) $2\,\overrightarrow{OP}$

(c) $3\,\overrightarrow{OP}$ (d) $4\,\overrightarrow{OP}$

67. If the position vectors of the point *A, B, C* be **i, j, k** respectively and *P* be a point such that $\overrightarrow{AB}=\overrightarrow{CP}$, then the position vector of *P* is

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

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

68. If the position vectors of the points *A, B, C, D* be $2\mathbf{i}+3\mathbf{j}+5\mathbf{k}$, $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$, $-5\mathbf{i}+4\mathbf{j}-2\mathbf{k}$ and $\mathbf{i}+10\mathbf{j}+10\mathbf{k}$ respectively, then **[MNR 1982]**

(a) $\overrightarrow{AB}=\overrightarrow{CD}$ (b) $\overrightarrow{AB}\,||\,\overrightarrow{CD}$

(c) $\overrightarrow{AB}\perp\overrightarrow{CD}$ (d) None of these

69. If the position vector of one end of the line segment *AB* be $2\mathbf{i}+3\mathbf{j}-\mathbf{k}$ and the position vector of its middle point be $3(\mathbf{i}+\mathbf{j}+\mathbf{k})$, then the position vector of the other end is

(a) $4\mathbf{i}+3\mathbf{j}+5\mathbf{k}$ (b) $4\mathbf{i}-3\mathbf{j}+7\mathbf{k}$

(c) $4\mathbf{i}+3\mathbf{j}+7\mathbf{k}$ (d) $4\mathbf{i}+3\mathbf{j}-7\mathbf{k}$

70. If *G* and *G'* be the centroids of the triangles *ABC* and $A'B'C'$ respectively, then $\overrightarrow{AA'}+\overrightarrow{BB'}+\overrightarrow{CC'}=$

(a) $\frac{2}{3}\overrightarrow{GG'}$ (b) $\overrightarrow{GG'}$

(c) $2\overrightarrow{GG'}$ (d) $3\overrightarrow{GG'}$

71. If *O* be the circumcentre and *O'* be the orthocentre of the triangle *ABC*, then $\overrightarrow{O'A}+\overrightarrow{O'B}+\overrightarrow{O'C}=$

(a) $\overrightarrow{OO'}$ (b) $2\overrightarrow{O'O}$

(c) $2\overrightarrow{OO'}$ (d) $\mathbf{0}$

72. If the vectors represented by the sides *AB* and *BC* of the regular hexagon *ABCDEF* be **a** and **b**, then the vector represented by $\overrightarrow{AE}$ will be

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

(c) $2\mathbf{a}-\mathbf{b}$ (d) $\mathbf{a}+\mathbf{b}$

73. The position vector of a point *C* with respect to *B* is $\mathbf{i}+\mathbf{j}$ and that of *B* with respect to *A* is $\mathbf{i}-\mathbf{j}$. The position vector of *C* with respect to *A* is

(a) $2\,\mathbf{i}$ (b) $2\,\mathbf{j}$

(c) $-2\,\mathbf{j}$ (d) $-2\,\mathbf{i}$

74. *A* and *B* are two points. The position vector of *A* is $6\mathbf{b}-2\mathbf{a}$. A point *P* divides the line *AB* in the ratio 1 : 2. If $\mathbf{a}-\mathbf{b}$ is the position vector of *P*, then the position vector of *B* is given by

(a) $7\mathbf{a}-15\mathbf{b}$ (b) $7\mathbf{a}+15\mathbf{b}$

(c) $15\mathbf{a}-7\mathbf{b}$ (d) $15\mathbf{a}+7\mathbf{b}$

75. If the position vectors of the points *A* and *B* are $\mathbf{i}+3\mathbf{j}-\mathbf{k}$ and $3\mathbf{i}-\mathbf{j}-3\mathbf{k}$, then what will be the position vector of the mid point of *AB*

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

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

76. If *C* is the middle point of *AB* and *P* is any point outside *AB*, then

(a) $\overrightarrow{PA}+\overrightarrow{PB}=\overrightarrow{PC}$ (b) $\overrightarrow{PA}+\overrightarrow{PB}=2\overrightarrow{PC}$

(c) $\overrightarrow{PA}+\overrightarrow{PB}+\overrightarrow{PC}=0$ (d) $\overrightarrow{PA}+\overrightarrow{PB}+2\overrightarrow{PC}=0$

77. If in a triangle $\overrightarrow{AB}=\mathbf{a}$, $\overrightarrow{AC}=\mathbf{b}$ and *D, E* are the mid-points of *AB* and *AC* respectively, then $\overrightarrow{DE}$ is equal to **[RPET 1986]**

(a) $\frac{\mathbf{a}}{4}-\frac{\mathbf{b}}{4}$ (b) $\frac{\mathbf{a}}{2}-\frac{\mathbf{b}}{2}$

(c) $\frac{\mathbf{b}}{4}-\frac{\mathbf{a}}{4}$ (d) $\frac{\mathbf{b}}{2}-\frac{\mathbf{a}}{2}$

78. In the triangle *ABC*, $\overrightarrow{AB}=\mathbf{a}$, $\overrightarrow{AC}=\mathbf{c}$, $\overrightarrow{BC}=\mathbf{b}$, then **[RPET 1984]**

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

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

79. *ABCDE* is a pentagon. Forces $\overrightarrow{AB},\overrightarrow{AE},\overrightarrow{DC},\overrightarrow{ED}$ act at a point. Which force should be added to this system to make the resultant $2\overrightarrow{AC}$

(a) $\overrightarrow{AC}$ (b) $\overrightarrow{AD}$

(c) $\overrightarrow{BC}$ (d) $\overrightarrow{BD}$

80. Let *A* and *B* be points with position vectors **a** and **b** with respect to the origin *O*. If the point *C* on *OA* is such that $2AC=CO$, *CD* is parallel to *OB* and $|\overrightarrow{CD}|=3|\overrightarrow{OB}|$, then $\overrightarrow{AD}$ is equal to

(a) $3\mathbf{b}-\frac{\mathbf{a}}{2}$ (b) $3\mathbf{b}+\frac{\mathbf{a}}{2}$

(c) $3\mathbf{b}-\frac{\mathbf{a}}{3}$ (d) $3\mathbf{b}+\frac{\mathbf{a}}{3}$

81. In a triangle *ABC*, if $2\overrightarrow{AC}=3\overrightarrow{CB}$, then $2\overrightarrow{OA}+3\overrightarrow{OB}$ equals **[IIT 1988; Pb. CET 2003]**

(a) $5\overrightarrow{OC}$ (b) $-\overrightarrow{OC}$

(c) $\overrightarrow{OC}$ (d) None of these

82. If $\overrightarrow{AO}+\overrightarrow{OB}=\overrightarrow{BO}+\overrightarrow{OC}$, then *A, B, C* form **[IIT 1983]**

(a) Equilateral triangle (b) Right angled triangle
(c) Isosceles triangle (d) Line

83. The sum of the three vectors determined by the medians of a triangle directed from the vertices is **[MP PET 1997]**
(a) 0 (b) 1
(c) – 1 (d) $\frac{1}{3}$

84. The position vector of the points which divides internally in the ratio 2 : 3 the join of the points $2\mathbf{a}-3\mathbf{b}$ and $3\mathbf{a}-2\mathbf{b}$, is
(a) $\frac{12}{5}\mathbf{a}+\frac{13}{5}\mathbf{b}$ (b) $\frac{12}{5}\mathbf{a}-\frac{13}{5}\mathbf{b}$
(c) $\frac{3}{5}\mathbf{a}-\frac{2}{5}\mathbf{b}$ (d) None of these

85. If position vector of points *A, B, C* are respectively **i, j, k** and $AB = CX$, then position vector of point *X* is
[MP PET 1994]
(a) $-\mathbf{i}+\mathbf{j}+\mathbf{k}$ (b) $\mathbf{i}-\mathbf{j}+\mathbf{k}$
(c) $\mathbf{i}+\mathbf{j}-\mathbf{k}$ (d) $\mathbf{i}+\mathbf{j}+\mathbf{k}$

86. If **a** and **b** are *P.V.* of two points *A* and *B* and *C* divides *AB* in ratio 2 : 1, then *P.V.* of *C* is
(a) $\frac{\mathbf{a}+2\mathbf{b}}{3}$ (b) $\frac{2\mathbf{a}+\mathbf{b}}{3}$
(c) $\frac{\mathbf{a}+2}{3}$ (d) $\frac{\mathbf{a}+\mathbf{b}}{2}$

87. If A, B, C are the vertices of a triangle whose position vectors are **a**, **b**, **c** and *G* is the centroid of the ΔABC, then $\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}$ is
(a) **0** (b) $\vec{A}+\vec{B}+\vec{C}$
(c) $\frac{\mathbf{a}+\mathbf{b}+\mathbf{c}}{3}$ (d) $\frac{\mathbf{a}+\mathbf{b}-\mathbf{c}}{3}$

88. If *O* is origin and *C* is the mid point of $A(2,-1)$ and $B(-4,3)$. Then value of $\overrightarrow{OC}$ is
(a) **i** + **j** (b) **i** – **j**
(c) – **i** + **j** (d) – **i** – **j**

89. If $ABCDEF$ is regular hexagon, then $\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}=$
[Karnataka CET 2002]
(a) 0 (b) $2\overrightarrow{AB}$
(c) $3\overrightarrow{AB}$ (d) $4\overrightarrow{AB}$

90. If position vectors of a point *A* is **a** + 2**b** and **a** divides *AB* in the ratio $2:3$, then the position vector of *B* is **[MP PET 2002]**
(a) 2**a** – **b** (b) **b** – 2**a**
(c) **a** – 3**b** (d) **b**

91. If D, E, F are respectively the mid points of AB, AC and BC in ΔABC, then $\overrightarrow{BE}+\overrightarrow{AF}=$
(a) $\overrightarrow{DC}$ (b) $\frac{1}{2}\overrightarrow{BF}$
(c) $2\overrightarrow{BF}$ (d) $\frac{3}{2}\overrightarrow{BF}$

92. If $4\mathbf{i}+7\mathbf{j}+8\mathbf{k}$, $2\mathbf{i}+3\mathbf{j}+4\mathbf{k}$ and $2\mathbf{i}+5\mathbf{j}+7\mathbf{k}$ are the position vectors of the vertices *A, B* and *C* respectively of triangle *ABC*. The position vector of the point where the bisector of angle *A* meets *BC* is
[Pb. CET 2004]
(a) $\frac{1}{3}(6\mathbf{i}+13\mathbf{j}+18\mathbf{k})$ (b) $\frac{2}{3}(6\mathbf{i}+12\mathbf{j}-8\mathbf{k})$
(c) $\frac{1}{3}(-6\mathbf{i}-8\mathbf{j}-9\mathbf{k})$ (d) $\frac{2}{3}(-6\mathbf{i}-12\mathbf{j}+8\mathbf{k})$

93. If $\mathbf{a}=\mathbf{i}-\mathbf{j}$ and $\mathbf{b}=\mathbf{i}+\mathbf{k}$, then a unit vector coplanar with **a** and **b** and perpendicular to **a** is
(a) **i** (b) **j**
(c) **k** (d) None of these

94. If the position vectors of the points *A, B, C* be $\mathbf{i}+\mathbf{j}$, $\mathbf{i}-\mathbf{j}$ and $a\mathbf{i}+b\mathbf{j}+c\mathbf{k}$ respectively, then the points *A, B, C* are collinear if
(a) $a=b=c=1$
(b) $a=1$, b and c are arbitrary scalars
(c) $a=b=c=0$
(d) $c=0$, $a=1$ and b is arbitrary scalars

95. If the points $\mathbf{a}+\mathbf{b}$, $\mathbf{a}-\mathbf{b}$ and $\mathbf{a}+k\mathbf{b}$ be collinear, then $k=$
(a) 0 (b) 2
(c) – 2 (d) Any real number

96. If the position vectors of the points *A, B, C* be $\mathbf{a}$, $\mathbf{b}$, $3\mathbf{a}-2\mathbf{b}$ respectively, then the points *A, B, C* are
[MP PET 1989]
(a) Collinear (b) Non-collinear
(c) Form a right angled triangle (d) None of these

97. If **a, b, c** are non-collinear vectors such that for some scalars *x, y, z*, $x\mathbf{a}+y\mathbf{b}+z\mathbf{c}=\mathbf{0}$, then
(a) $x=0, y=0, z=0$ (b) $x\neq 0, y\neq 0, z=0$
(c) $x=0, y\neq 0, z\neq 0$ (d) $x\neq 0, y\neq 0, z\neq 0$

98. The vectors $3\mathbf{i}+\mathbf{j}-5\mathbf{k}$ and $a\mathbf{i}+b\mathbf{j}-15\mathbf{k}$ are collinear, if
[RPET 1986; MP PET 1988]
(a) $a=3, b=1$ (b) $a=9, b=1$
(c) $a=3, b=3$ (d) $a=9, b=3$

99. The points with position vectors $60\mathbf{i}+3\mathbf{j}$, $40\mathbf{i}-8\mathbf{j}$, $a\mathbf{i}-52\mathbf{j}$ are collinear, if $a=$
[RPET 1991; IIT 1983; MP PET 2002]
(a) – 40 (b) 40
(c) 20 (d) None of these

100. If *O* be the origin and the position vector of *A* be $4\mathbf{i}+5\mathbf{j}$, then a unit vector parallel to $\overrightarrow{OA}$ is
(a) $\frac{4}{\sqrt{41}}\mathbf{i}$ (b) $\frac{5}{\sqrt{41}}\mathbf{i}$

(c) $\frac{1}{\sqrt{41}}(4\mathbf{i}+5\mathbf{j})$ (d) $\frac{1}{\sqrt{41}}(4\mathbf{i}-5\mathbf{j})$

101. If the position vectors of the points A and B be $2\mathbf{i}+3\mathbf{j}-\mathbf{k}$ and $-2\mathbf{i}+3\mathbf{j}+4\mathbf{k}$, then the line AB is parallel to

(a) xy-plane (b) yz-plane
(c) zx-plane (d) None of these

102. The points with position vectors $10\mathbf{i}+3\mathbf{j}, 12\mathbf{i}-5\mathbf{j}$ and $a\mathbf{i}+11\mathbf{j}$ are collinear, if $a=$ **[MNR 1992; Kurukshetra CEE 2002]**

(a) – 8 (b) 4
(c) 8 (d) 12

103. Three points whose position vectors are $\mathbf{a}+\mathbf{b}, \mathbf{a}-\mathbf{b}$ and $\mathbf{a}+k\mathbf{b}$ will be collinear, if the value of k is **[IIT 1984]**

(a) Zero
(b) Only negative real number
(c) Only positive real number
(d) Every real number

104. If the position vectors of A, B, C, D are $2\mathbf{i}+\mathbf{j}$, $\mathbf{i}-3\mathbf{j}$, $3\mathbf{i}+2\mathbf{j}$ and $\mathbf{i}+\lambda\mathbf{j}$ respectively and $\overrightarrow{AB} \| \overrightarrow{CD}$, then λ will be

(a) – 8 (b) – 6
(c) 8 (d) 6

105. If the vectors $3\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $6\mathbf{i}-4x\mathbf{j}+y\mathbf{k}$ are parallel, then the value of x and y will be

(a) – 1, – 2 (b) 1, – 2
(c) – 1, 2 (d) 1, 2

106. If $(x, y, z) \ne (0, 0, 0)$ and $(\mathbf{i}+\mathbf{j}+3\mathbf{k})x+(3\mathbf{i}-3\mathbf{j}+\mathbf{k})y+(-4\mathbf{i}+5\mathbf{j})z=\lambda(x\mathbf{i}+y\mathbf{j}+z\mathbf{k})$, then the value of will be

(a) – 2, 0 (b) 0, – 2
(c) – 1, 0 (d) 0, – 1

107. The vectors **a, b** and **a** + **b** are

(a) Collinear (b) Coplanar
(c) Non-coplanar (d) None of these

108. If **a, b, c** are the position vectors of three collinear points, then the existence of x, y, z is such that

(a) $x\mathbf{a}+y\mathbf{b}+z\mathbf{c}=0,\ x+y+z\ne 0$
(b) $x\mathbf{a}+y\mathbf{b}+z\mathbf{c}\ne 0,\ x+y+z=0$
(c) $x\mathbf{a}+y\mathbf{b}+z\mathbf{c}\ne 0,\ x+y+z\ne 0$
(d) $x\mathbf{a}+y\mathbf{b}+z\mathbf{c}=0,\ x+y+z=0$

109. If $\mathbf{a}=(2, 5)$ and $\mathbf{b}=(1, 4)$, then the vector parallel to $(\mathbf{a}+\mathbf{b})$ is

(a) (3, 5) (b) (1, 1)
(c) (1, 3) (d) (8, 5)

110. The vectors **a** and **b** are non-collinear. The value of x for which the vectors $\mathbf{c}=(x-2)\mathbf{a}+\mathbf{b}$ and $\mathbf{d}=(2x+1)\mathbf{a}-\mathbf{b}$ are collinear, is

(a) 1 (b) $\frac{1}{2}$
(c) $\frac{1}{3}$ (d) None of these

111. The vectors $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$, $\lambda\mathbf{i}+4\mathbf{j}+7\mathbf{k}$, $-3\mathbf{i}-2\mathbf{j}-5\mathbf{k}$ are collinear, if equals **[Kurukshetra CEE 1996]**

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

112. The position vectors of four points P, Q, R, S are $2\mathbf{a}+4\mathbf{c}$, $5\mathbf{a}+3\sqrt{3}\,\mathbf{b}+4\mathbf{c}$, $-2\sqrt{3}\mathbf{b}+\mathbf{c}$ and $2\mathbf{a}+\mathbf{c}$ respectively, then

(a) $\overrightarrow{PQ}$ is parallel to $\overrightarrow{RS}$
(b) $\overrightarrow{PQ}$ is not parallel to $\overrightarrow{RS}$
(c) $\overrightarrow{PQ}$ is equal to $\overrightarrow{RS}$
(d) $\overrightarrow{PQ}$ is parallel and equal to $\overrightarrow{RS}$

113. If $\mathbf{a}=(1,-1)$ and $\mathbf{b}=(-2, m)$ are two collinear vectors, then $m=$ **[MP PET 1998]**

(a) 4 (b) 3
(c) 2 (d) 0

114. If three points A, B, C are collinear, whose position vectors are $\mathbf{i}-2\mathbf{j}-8\mathbf{k}, 5\mathbf{i}-2\mathbf{k}$ and $11\mathbf{i}+3\mathbf{j}+7\mathbf{k}$ respectively, then the ratio in which B divides AC is **[RPET 1999]**

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

115. If **a** and **b** are two non-collinear vectors and $x\mathbf{a}+y\mathbf{b}=0$ **[RPET 2001]**

(a) $x=0$, but y is not necessarily zero
(b) $y=0$, but x is not necessarily zero
(c) $x=0,\ y=0$
(d) None of these

116. If three points A, B and C have position vectors $(1, x, 3), (3, 4, 7)$ and $(y, -2, -5)$ respectively and if they are collinear, then $(x, y)=$

(a) (2, – 3) (b) (– 2, 3)
(c) (2, 3) (d) (– 2, – 3)

117. **a** and **b** are two non-collinear vectors, then $x\mathbf{a}+y\mathbf{b}$ (where x and y are scalars) represents a vector which is **[MP PET 2003]**

(a) Parallel to **b** (b) Parallel to **a**
(c) Coplanar with **a** and **b** (d) None of these

118. If **a, b, c** are three non-coplanar vectors such that $\mathbf{a}+\mathbf{b}+\mathbf{c}=\alpha\mathbf{d}$ and $\mathbf{b}+\mathbf{c}+\mathbf{d}=\beta\mathbf{a}$, then $\mathbf{a}+\mathbf{b}+\mathbf{c}+\mathbf{d}$ is equal to

(a) 0 (b) $\alpha\,\mathbf{a}$
(c) $\beta\,\mathbf{b}$ (d) $(\alpha+\beta)\mathbf{c}$

119. The value of k for which the vectors $\mathbf{a}=\mathbf{i}-\mathbf{j}$ and $\mathbf{b}=-2\mathbf{i}+k\mathbf{j}$ are collinear is

(a) 2 (b) $\frac{1}{2}$
(c) $\frac{1}{3}$ (d) 3

Scalar or Dot product of two vectors and its applications

1. $(\mathbf{a}.\mathbf{i})\mathbf{i}+(\mathbf{a}.\mathbf{j})\mathbf{j}+(\mathbf{a}.\mathbf{k})\mathbf{k}=$ **[Karnataka CET 2004]**

(a) **a** (b) 2 **a**
(c) 0 (d) None of these

2. If $\mathbf{r}.\mathbf{i}=\mathbf{r}.\mathbf{j}=\mathbf{r}.\mathbf{k}$ and $|\mathbf{r}|=3$, then $\mathbf{r}=$

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

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

3. If **a**, **b**, **c** are non-zero vectors such that $\mathbf{a}\,.\,\mathbf{b}=\mathbf{a}\,.\,\mathbf{c}$, then which statement is true

(a) **b = c** (b) $\mathbf{a}\perp(\mathbf{b}-\mathbf{c})$

(c) $\mathbf{b}=\mathbf{c}$ or $\mathbf{a}\perp(\mathbf{b}-\mathbf{c})$ (d) None of these

4. If **a** and **b** be unlike vectors, then **a . b =**

(a) | **a** | | **b** | (b) – | **a** | | **b** |
(c) 0 (d) None of these

5. If **a, b, c** are unit vectors such that $\mathbf{a}+\mathbf{b}+\mathbf{c}=\mathbf{0}$, then $\mathbf{a}\,.\,\mathbf{b}+\mathbf{b}\,.\,\mathbf{c}+\mathbf{c}\,.\,\mathbf{a}=$

[MP PET 1988; Karnataka CET 2000; UPSEAT 2003, 04]

(a) 1 (b) 3
(c) – 3/2 (d) 3/2

6. If **a**, **b**, **c** are mutually perpendicular vectors of equal magnitudes, then the angle between the vectors **a** and $\mathbf{a}+\mathbf{b}+\mathbf{c}$ is

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$

(c) $\cos^{-1}\frac{1}{\sqrt{3}}$ (d) $\frac{\pi}{2}$

7. If **a**, **b**, **c** are mutually perpendicular unit vectors, then $|\mathbf{a}+\mathbf{b}+\mathbf{c}|=$ **[Karnataka CET 2002, 05; J & K 2005]**

(a) $\sqrt{3}$ (b) 3
(c) 1 (d) 0

8. If $|\mathbf{a}|+|\mathbf{b}|=|\mathbf{c}|$ and $\mathbf{a}+\mathbf{b}=\mathbf{c}$, then the angle between **a** and **b** is

(a) $\frac{\pi}{2}$ (b) π

(c) 0 (d) None of these

9. If **a** has magnitude 5 and points north-east and vector **b** has magnitude 5 and points north-west, then $|\mathbf{a}-\mathbf{b}|=$

[MNR 1984]

(a) 25 (b) 5

(c) $7\sqrt{3}$ (d) $5\sqrt{2}$

10. If be the angle between the unit vectors **a** and **b,** then $\cos\frac{\theta}{2}=$ **[MP PET 1998; Pb. CET 2002]**

(a) $\frac{1}{2}|\mathbf{a}-\mathbf{b}|$ (b) $\frac{1}{2}|\mathbf{a}+\mathbf{b}|$

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

11. If $|\mathbf{a}|=3, |\mathbf{b}|=4, |\mathbf{c}|=5$ and $\mathbf{a}+\mathbf{b}+\mathbf{c}=0$, then the angle between **a** and **b** is **[MP PET 1989; Bihar CEE 1994]**

(a) 0 (b) $\frac{\pi}{6}$

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

12. If $|\mathbf{a}+\mathbf{b}|>|\mathbf{a}-\mathbf{b}|$, then the angle between **a** and **b** is

(a) Acute (b) Obtuse

(c) $\frac{\pi}{2}$ (d) π

13. If **a**, **b**, **c** are three vectors such that $\mathbf{a}=\mathbf{b}+\mathbf{c}$ and the angle between **b** and **c** is $\pi/2$, then

[EAMCET 2003]

(a) $a^2=b^2+c^2$ (b) $b^2=c^2+a^2$

(c) $c^2=a^2+b^2$ (d) $2a^2-b^2=c^2$

(**Note :** Here $a=|\mathbf{a}|,\ b=|\mathbf{b}|,\ c=|\mathbf{c}|$)

14. If the angle between the vectors **a** and **b** be and $\mathbf{a}.\mathbf{b}=\cos\theta$, then the true statement is

(a) **a** and **b** are equal vectors
(b) **a** and **b** are like vectors
(c) **a** and **b** are unlike vectors
(d) **a** and **b** are unit vectors

15. If the vector $\mathbf{i}+\mathbf{j}+\mathbf{k}$ makes angles α,β,γ with vectors $\mathbf{i},\mathbf{j},\mathbf{k}$ respectively, then

(a) $\alpha=\beta\neq\gamma$ (b) $\alpha=\gamma\neq\beta$

(c) $\beta=\gamma\neq\alpha$ (d) $\alpha=\beta=\gamma$

16. $(\mathbf{r}.\mathbf{i})^2+(\mathbf{r}.\mathbf{j})^2+(\mathbf{r}.\mathbf{k})^2=$

(a) $3r^2$ (b) r^2
(c) 0 (d) None of these

17. The value of b such that scalar product of the vectors $(\mathbf{i}+\mathbf{j}+\mathbf{k})$ with the unit vector parallel to the sum of the vectors $(2\mathbf{i}+4\mathbf{j}-5\mathbf{k})$ and $(b\mathbf{i}+2\mathbf{j}+3\mathbf{k})$ is 1, is

[MNR 1992; Roorkee 1985, 95; Kurukshetra CEE 1998; UPSEAT 2000]

(a) – 2 (b) – 1
(c) 0 (d) 1

18. If a unit vector lies in *yz*–plane and makes angles of 30^o and 60^o with the positive *y*-axis and *z*-axis respectively, then its components along the co-ordinate axes will be

(a) $\frac{\sqrt{3}}{2},\frac{1}{2},0$ (b) $0,\frac{\sqrt{3}}{2},\frac{1}{2}$

(c) $\frac{\sqrt{3}}{2},0,\frac{1}{2}$ (d) $0,\frac{1}{2},\frac{\sqrt{3}}{2}$

19. If $\vec{F_1} = \mathbf{i} - \mathbf{j} + \mathbf{k}$, $\vec{F_2} = -\mathbf{i} + 2\mathbf{j} - \mathbf{k}$, $\vec{F_3} = \mathbf{j} - \mathbf{k}$, $\vec{A} = 4\mathbf{i} - 3\mathbf{j} - 2\mathbf{k}$ and $\vec{B} = 6\mathbf{i} + \mathbf{j} - 3\mathbf{k}$, then the scalar product of $\vec{F_1} + \vec{F_2} + \vec{F_3}$ and $\overrightarrow{AB}$ will be **[Roorkee 1980]**

(a) 3 (b) 6
(c) 9 (d) 12

20. If the moduli of **a** and **b** are equal and angle between them is 120^o and $\mathbf{a}.\mathbf{b} = -8$, then $|\mathbf{a}|$ is equal to **[RPET 1986]**

(a) – 5 (b) – 4
(c) 4 (d) 5

21. If $|\mathbf{a}| = 3$, $|\mathbf{b}| = 4$ and the angle between **a** and **b** be 120^o, then $|4\mathbf{a} + 3\mathbf{b}| =$

(a) 25 (b) 12
(c) 13 (d) 7

22. A vector whose modulus is $\sqrt{51}$ and makes the same angle with $\mathbf{a} = \dfrac{\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}}{3}$, $\mathbf{b} = \dfrac{-4\mathbf{i} - 3\mathbf{k}}{5}$ and $\mathbf{c} = \mathbf{j}$, will be

[Roorkee 1987]

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

23. If **a**, **b**, **c** are coplanar vectors, then **[IIT 1989]**

(a) $\begin{vmatrix} \mathbf{a} & \mathbf{b} & \mathbf{c} \\ \mathbf{b} & \mathbf{c} & \mathbf{a} \\ \mathbf{c} & \mathbf{a} & \mathbf{b} \end{vmatrix} = \mathbf{0}$ (b) $\begin{vmatrix} \mathbf{a} & \mathbf{b} & \mathbf{c} \\ \mathbf{a}.\mathbf{a} & \mathbf{a}.\mathbf{b} & \mathbf{a}.\mathbf{c} \\ \mathbf{b}.\mathbf{a} & \mathbf{b}.\mathbf{b} & \mathbf{b}.\mathbf{c} \end{vmatrix} = \mathbf{0}$

(c) $\begin{vmatrix} \mathbf{a} & \mathbf{b} & \mathbf{c} \\ \mathbf{c}.\mathbf{a} & \mathbf{c}.\mathbf{b} & \mathbf{c}.\mathbf{c} \\ \mathbf{b}.\mathbf{a} & \mathbf{b}.\mathbf{c} & \mathbf{b}.\mathbf{b} \end{vmatrix} = \mathbf{0}$ (d) $\begin{vmatrix} \mathbf{a} & \mathbf{b} & \mathbf{c} \\ \mathbf{a}.\mathbf{b} & \mathbf{a}.\mathbf{a} & \mathbf{a}.\mathbf{c} \\ \mathbf{c}.\mathbf{a} & \mathbf{c}.\mathbf{c} & \mathbf{c}.\mathbf{b} \end{vmatrix} = \mathbf{0}$

24. If $\vec{\lambda}$ is a unit vector perpendicular to plane of vector **a** and **b** and angle between them is , then **a . b** will be

[RPET 1985]

(a) $|\mathbf{a}||\mathbf{b}|\sin\theta\,\vec{\lambda}$ (b) $|\mathbf{a}||\mathbf{b}|\cos\theta\,\vec{\lambda}$
(c) $|\mathbf{a}||\mathbf{b}|\cos\theta$ (d) $|\mathbf{a}||\mathbf{b}|\sin\theta$

25. If $\mathbf{p} = \mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ and $\mathbf{q} = 3\mathbf{i} + \mathbf{j} + 2\mathbf{k}$, then a vector along **r** which is linear combination of **p** and **q** and also perpendicular to **q** is

(a) $\mathbf{i} + 5\mathbf{j} - 4\mathbf{k}$ (b) $\mathbf{i} - 5\mathbf{j} + 4\mathbf{k}$
(c) $-\dfrac{1}{2}(\mathbf{i} + 5\mathbf{j} - 4\mathbf{k})$ (d) None of these

26. If $\mathbf{d} = \lambda(\mathbf{a} \times \mathbf{b}) + \mu(\mathbf{b} \times \mathbf{c}) + \nu(\mathbf{c} \times \mathbf{a})$ and $[\mathbf{a}\mathbf{b}\mathbf{c}] = \dfrac{1}{8}$, then $\lambda + \mu + \nu$ is equal to

(a) $8\mathbf{d}.(\mathbf{a} + \mathbf{b} + \mathbf{c})$ (b) $8\mathbf{d} \times (\mathbf{a} + \mathbf{b} + \mathbf{c})$
(c) $\dfrac{\mathbf{d}}{8}.(\mathbf{a} + \mathbf{b} + \mathbf{c})$ (d) $\dfrac{\mathbf{d}}{8} \times (\mathbf{a} + \mathbf{b} + \mathbf{c})$

27. The horizontal force and the force inclined at an angle 60^o with the vertical, whose resultant is in vertical direction of *P kg,* are

(a) $P, 2P$ (b) $P, P\sqrt{3}$
(c) $2P, P\sqrt{3}$ (d) None of these

28. If **a** and **b** are mutually perpendicular vectors, then $(\mathbf{a} + \mathbf{b})^2 =$ **[MP PET 1994; Pb. CET 2002]**

(a) $\mathbf{a} + \mathbf{b}$ (b) $\mathbf{a} - \mathbf{b}$
(c) $a^2 - b^2$ (d) $(\mathbf{a} - \mathbf{b})^2$

29. $\mathbf{a}.\mathbf{b} = 0$, then **[RPET 1995]**

(a) $\mathbf{a} \perp \mathbf{b}$
(b) $\mathbf{a} \,||\, \mathbf{b}$
(c) Angle between **a** and **b** is 60^o
(d) None of these

30. If $|\mathbf{a}| = 3, |\mathbf{b}| = 1, |\mathbf{c}| = 4$ and $\mathbf{a} + \mathbf{b} + \mathbf{c} = \mathbf{0}$, then $\mathbf{a}.\mathbf{b} + \mathbf{b}.\mathbf{c} + \mathbf{c}.\mathbf{a} =$ **[MP PET 1995; RPET 2000]**

(a) – 13 (b) – 10
(c) 13 (d) 10

31. If *ABCDEF* is regular hexagon, the length of whose side is *a,* then $\overrightarrow{AB}.\overrightarrow{AF} + \dfrac{1}{2}\overrightarrow{BC}^2 =$

(a) a (b) a^2
(c) $2a^2$ (d) 0

32. If in a right angled triangle *ABC*, the hypotenuse $AB = p$, then $\overrightarrow{AB}.\overrightarrow{AC} + \overrightarrow{BC}.\overrightarrow{BA} + \overrightarrow{CA}.\overrightarrow{CB}$ is equal to

(a) $2p^2$ (b) $\dfrac{p^2}{2}$
(c) p^2 (d) None of these

33. *A, B, C, D* are any four points, then $\overrightarrow{AB}.\overrightarrow{CD} + \overrightarrow{BC}.\overrightarrow{AD} + \overrightarrow{CA}.\overrightarrow{BD} =$ **[MNR 1986]**

(a) $2\,\overrightarrow{AB}.\overrightarrow{BC}.\overrightarrow{CD}$ (b) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD}$
(c) $5\sqrt{3}$ (d) 0

34. The vector **a** coplanar with the vectors **i** and **j**, perpendicular to the vector $\mathbf{b} = 4\mathbf{i} - 3\mathbf{j} + 5\mathbf{k}$ such that $|\mathbf{a}| = |\mathbf{b}|$ is

(a) $\sqrt{2}(3\mathbf{i} + 4\mathbf{j})$ or $-\sqrt{2}(3\mathbf{i} + 4\mathbf{j})$
(b) $\sqrt{2}(4\mathbf{i} + 3\mathbf{j})$ or $-\sqrt{2}(4\mathbf{i} + 3\mathbf{j})$
(c) $\sqrt{3}(4\mathbf{i} + 5\mathbf{j})$ or $-\sqrt{3}(4\mathbf{i} + 5\mathbf{j})$
(d) $\sqrt{3}(5\mathbf{i} + 4\mathbf{j})$ or $-\sqrt{3}(5\mathbf{i} + 4\mathbf{j})$

35. If **a** is any vector in space, then

(a) $\mathbf{a} = (\mathbf{a}.\mathbf{i})\mathbf{i} + (\mathbf{a}.\mathbf{j})\mathbf{j} + (\mathbf{a}.\mathbf{k})\mathbf{k}$
(b) $\mathbf{a} = (\mathbf{a} \times \mathbf{i}) + (\mathbf{a} \times \mathbf{j}) + (\mathbf{a} \times \mathbf{k})$
(c) $\mathbf{a} = \mathbf{j}(\mathbf{a}.\mathbf{i}) + \mathbf{k}(\mathbf{a}.\mathbf{j}) + \mathbf{i}(\mathbf{a}.\mathbf{k})$
(d) $\mathbf{a} = (\mathbf{a} \times \mathbf{i}) \times \mathbf{i} + (\mathbf{a} \times \mathbf{j}) \times \mathbf{j} + (\mathbf{a} \times \mathbf{k}) \times \mathbf{k}$

36. If vectors $\mathbf{a}, \mathbf{b}, \mathbf{c}$ satisfy the condition $|\mathbf{a} - \mathbf{c}| = |\mathbf{b} - \mathbf{c}|$, then $(\mathbf{b} - \mathbf{a}).\left(\mathbf{c} - \dfrac{\mathbf{a} + \mathbf{b}}{\mathbf{2}}\right)$ is equal to

(a) 0 (b) –1

(c) 1 (d) 2

37. $(\mathbf{a}.\mathbf{b})\,\mathbf{c}$ and $(\mathbf{a}.\mathbf{c})\,\mathbf{b}$ are **[RPET 2000]**

(a) Two like vectors
(b) Two equal vectors
(c) Two vectors in direction of **a**
(d) None of these

38. If $\mathbf{a}=(1,-1,2),\mathbf{b}=(-2,3,5)$, $\mathbf{c}=(2,-2,4)$ and **i** is the unit vector in the *x*-direction, then $(\mathbf{a}-2\mathbf{b}+3\mathbf{c}).\mathbf{i}=$ **[Karnataka CET 2001]**

(a) 11 (b) 15
(c) 18 (d) 36

39. For any three non-zero vectors $\mathbf{r}_1,\mathbf{r}_2$ and $\mathbf{r}_3$, $\begin{vmatrix}\mathbf{r}_1.\mathbf{r}_1 & \mathbf{r}_1.\mathbf{r}_2 & \mathbf{r}_1.\mathbf{r}_3\\ \mathbf{r}_2.\mathbf{r}_1 & \mathbf{r}_2.\mathbf{r}_2 & \mathbf{r}_2.\mathbf{r}_3\\ \mathbf{r}_3.\mathbf{r}_1 & \mathbf{r}_3.\mathbf{r}_2 & \mathbf{r}_3.\mathbf{r}_3\end{vmatrix}=0$. Then which of the following is false **[AMU 2000]**

(a) All the three vectors are parallel to one and the same plane
(b) All the three vectors are linearly dependent
(c) This system of equation has a non-trivial solution
(d) All the three vectors are perpendicular to each other

40. Let **a**, **b** and **c** be vectors with magnitudes 3, 4 and 5 respectively and **a** + **b** + **c** = 0, then the values of **a.b + b.c + c.a** is
[IIT 1995; DCE 2001; AIEEE 2002; UPSEAT 2002; Kerala (Engg.) 2005]

(a) 47 (b) 25
(c) 50 (d) – 25

41. If **a** and **b** are adjacent sides of a rhombus, then **[RPET**

(a) **a.b = 0** (b) **a × b = 0**
(c) **a.a = b.b** (d) None of these

42. If **x** and **y** are two unit vectors and π is the angle between them, then $\frac{1}{2}|\mathbf{x}-\mathbf{y}|$ is equal to

(a) 0 (b) $\pi/2$
(c) 1 (d) $\pi/4$

43. If $\mathbf{a}.\mathbf{i}=\mathbf{a}.(\mathbf{i}+\mathbf{j})=\mathbf{a}.(\mathbf{i}+\mathbf{j}+\mathbf{k})$, then **a** = **[EAMCET 2002]**

(a) **i** (b) **k**
(c) **j** (d) **i + j + k**

44. If **i**, **j**, **k** are unit vectors, then

(a) $\mathbf{i}\,.\,\mathbf{j}=1$ (b) $\mathbf{i}\,.\,\mathbf{i}=1$
(c) $\mathbf{i}\times\mathbf{j}=1$ (d) $\mathbf{i}\times(\mathbf{j}\times\mathbf{k})=1$

45. If $|\mathbf{a}|=|\mathbf{b}|$, then $(\mathbf{a}+\mathbf{b}).(\mathbf{a}-\mathbf{b})$ is **[MP PET 2002]**

(a) Positive (b) Negative
(c) Zero (d) None of these

46. **a,b,c** are three vectors, such that $\mathbf{a}+\mathbf{b}+\mathbf{c}=0$, $|\mathbf{a}|=1,|\mathbf{b}|=2,|\mathbf{c}|=3$, then **a.b**+ **b.c**+ **c.a** is equal to **[AIEEE 2003]**

(a) 0 (b) – 7
(c) 7 (d) 1

47. A unit vector which is coplanar to vector $\mathbf{i}+\mathbf{j}+2\mathbf{k}$ and $\mathbf{i}+2\mathbf{j}+\mathbf{k}$ and perpendicular to $\mathbf{i}+\mathbf{j}+\mathbf{k}$, is
[IIT 1992; Kurukshetra CEE 2002]

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

48. If $|\mathbf{a}|=3,|\mathbf{b}|=4$ then a value of for which $\mathbf{a}+\lambda\mathbf{b}$ is perpendicular to $\mathbf{a}-\lambda\mathbf{b}$ is

(a) $\frac{9}{16}$ (b) $\frac{3}{4}$
(c) $\frac{3}{2}$ (d) $\frac{4}{3}$

49. $\mathbf{a},\mathbf{b}$ and **c** are three vectors with magnitude $|\mathbf{a}|=4$, $|\mathbf{b}|=4$, $|\mathbf{c}|=2$ and such that **a** is perpendicular to $(\mathbf{b}+\mathbf{c}),\mathbf{b}$ is perpendicular to $(\mathbf{c}+\mathbf{a})$ and **c** is perpendicular to $(\mathbf{a}+\mathbf{b})$. It follows that $|\mathbf{a}+\mathbf{b}+\mathbf{c}|$ is equal to

(a) 9 (b) 6
(c) 5 (d) 4

50. The angle between the vectors $3\mathbf{i}+\mathbf{j}+2\mathbf{k}$ and $2\mathbf{i}-2\mathbf{j}+4\mathbf{k}$ is **[MP PET 1990]**

(a) $\cos^{-1}\frac{2}{\sqrt{7}}$ (b) $\sin^{-1}\frac{2}{\sqrt{7}}$
(c) $\cos^{-1}\frac{2}{\sqrt{5}}$ (d) $\sin^{-1}\frac{2}{\sqrt{5}}$

51. If the position vectors of the points *A, B, C, D* be $\mathbf{i}+\mathbf{j}+\mathbf{k}$, $2\mathbf{i}+5\mathbf{j}$, $3\mathbf{i}+2\mathbf{j}-3\mathbf{k}$ and $\mathbf{i}-6\mathbf{j}-\mathbf{k}$, then the angle between the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{2}$ (d) π

52. If be the angle between the unit vectors **a** and **b**, then $\mathbf{a}-\sqrt{2}\,\mathbf{b}$ will be a unit vector if $\theta=$

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{3}$ (d) $\frac{2\pi}{3}$

53. If the angle between **a** and **b** be 30^o, then the angle between 3 **a** and – 4 **b** will be

(a) 150^o (b) 90^o
(c) 120^o (d) 30^o

54. The angle between the vectors $\mathbf{i}-\mathbf{j}+\mathbf{k}$ and $\mathbf{i}+2\mathbf{j}+\mathbf{k}$ is
[BIT Ranchi 1991]

(a) $\cos^{-1}\left(\frac{1}{\sqrt{15}}\right)$ (b) $\cos^{-1}\left(\frac{4}{\sqrt{15}}\right)$
(c) $\cos^{-1}\left(\frac{4}{15}\right)$ (d) $\frac{\pi}{2}$

55. The position vector of vertices of a triangle ABC are $4\mathbf{i}-2\mathbf{j}, \mathbf{i}+4\mathbf{j}-3\mathbf{k}$ and $-\mathbf{i}+5\mathbf{j}+\mathbf{k}$ respectively, then $\angle ABC =$ **[RPET 1988, 97]**

(a) $\pi/6$ (b) $\pi/4$
(c) $\pi/3$ (d) $\pi/2$

56. The value of x for which the angle between the vectors $\mathbf{a}=x\mathbf{i}-3\mathbf{j}-\mathbf{k}$, $\mathbf{b}=2x\mathbf{i}+x\mathbf{j}-\mathbf{k}$ is acute and the angle between the vectors $\mathbf{b}$ and the axis of ordinate is obtuse, are

(a) 1, 2 (b) – 2, – 3
(c) $x > 0$ (d) None of these

57. If $\mathbf{a}$ and $\mathbf{b}$ are unit vectors and $\mathbf{a}-\mathbf{b}$ is also a unit vector, then the angle between $\mathbf{a}$ and $\mathbf{b}$ is **[RPET 1991; MP PET 1995; Pb. CET 2001]**

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

58. If be the angle between two vectors $\mathbf{a}$ and $\mathbf{b}$, then $\mathbf{a}.\mathbf{b} \geq 0$ if

(a) $0 \leq \theta \leq \pi$ (b) $\frac{\pi}{2} \leq \theta \leq \pi$
(c) $0 \leq \theta \leq \frac{\pi}{2}$ (d) None of these

59. If $\mathbf{a}=\mathbf{i}+2\mathbf{j}-3\mathbf{k}$ and $\mathbf{b}=3\mathbf{i}-\mathbf{j}+2\mathbf{k}$, then the angle between the vectors $\mathbf{a}+\mathbf{b}$ and $\mathbf{a}-\mathbf{b}$ is **[Karnataka CET 1994; Orissa JEE 2005]**

(a) 30^o (b) 60^o
(c) 90^o (d) 0^o

60. The value of x for which the angle between the vectors $\mathbf{a}=-3\mathbf{i}+x\mathbf{j}+\mathbf{k}$ and $\mathbf{b}=x\mathbf{i}+2x\mathbf{j}+\mathbf{k}$ is acute and the angle between $\mathbf{b}$ and x-axis lies between $\pi/2$ and π satisfy **[Kurukshetra CEE 1996]**

(a) $x > 0$ (b) $x < 0$
(c) $x > 1$ only (d) $x < -1$ only

61. The angle between the vectors $(2\mathbf{i}+6\mathbf{j}+3\mathbf{k})$ and $(12\mathbf{i}-4\mathbf{j}+3\mathbf{k})$ is **[MP PET 1996]**

(a) $\cos^{-1}\left(\frac{1}{10}\right)$ (b) $\cos^{-1}\left(\frac{9}{11}\right)$
(c) $\cos^{-1}\left(\frac{9}{91}\right)$ (d) $\cos^{-1}\left(\frac{1}{9}\right)$

62. If the angle between two vectors $\mathbf{i}+\mathbf{k}$ and $\mathbf{i}-\mathbf{j}+a\mathbf{k}$ is $\pi/3$, then the value of $a =$

(a) 2 (b) 4
(c) – 2 (d) 0

63. If three vectors $\mathbf{a}$, $\mathbf{b}$, $\mathbf{c}$ satisfy $\mathbf{a}+\mathbf{b}+\mathbf{c}=\mathbf{0}$ and $|\mathbf{a}|=3$, $|\mathbf{b}|=5$, $|\mathbf{c}|=7$, then the angle between $\mathbf{a}$ and $\mathbf{b}$ is **[Kurukshetra CEE 1998; UPSEAT 2001; AIEEE 2002; MP PET 2002]**

(a) 30^o (b) 45^o
(c) 60^o (d) 90^o

64. If $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are unit vectors such that $\mathbf{a}+\mathbf{b}-\mathbf{c}=0$, then the angle between $\mathbf{a}$ and $\mathbf{b}$ is **[Roorkee Qualifying 1998; MP PET 1999; UPSEAT 2000; RPET 2002]**

(a) $\pi/6$ (b) $\pi/3$
(c) $\pi/2$ (d) $2\pi/3$

65. If the sum of two unit vectors is a unit vector, then the magnitude of their difference is **[Kurukshetra CEE 1996; RPET 1996]**

(a) $\sqrt{2}$ (b) $\sqrt{3}$
(c) $\frac{1}{\sqrt{3}}$ (d) 1

66. The angle between the vector $2\mathbf{i}+3\mathbf{j}+\mathbf{k}$ and $2\mathbf{i}-\mathbf{j}-\mathbf{k}$ is **[MNR 1990; UPSEAT 2000]**

(a) $\pi/2$ (b) $\pi/4$
(c) $\pi/3$ (d) 0

67. If θ be the angle between the vectors $\mathbf{a}=2\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $\mathbf{b}=6\mathbf{i}-3\mathbf{j}+2\mathbf{k}$, then

(a) $\cos\theta=\frac{4}{21}$ (b) $\cos\theta=\frac{3}{19}$
(c) $\cos\theta=\frac{2}{19}$ (d) $\cos\theta=\frac{5}{21}$

68. If $\mathbf{a}$ and $\mathbf{b}$ are two unit vectors such that $\mathbf{a}+2\mathbf{b}$ and $5\mathbf{a}-4\mathbf{b}$ are perpendicular to each other, then the angle between $\mathbf{a}$ and $\mathbf{b}$ is

(a) 45^o (b) 60^o
(c) $\cos^{-1}\left(\frac{1}{3}\right)$ (d) $\cos^{-1}\left(\frac{2}{7}\right)$

69. Let $\mathbf{a}$ and $\mathbf{b}$ be two unit vectors inclined at an angle θ, then $\sin(\theta/2)$ is equal to **[BIT Ranchi 1991; Karnataka CET 2000, 01; UPSEAT 2002]**

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

70. The angle between the vectors $\mathbf{a}+\mathbf{b}$ and $\mathbf{a}-\mathbf{b}$, when $\mathbf{a}=(1,1,4)$ and $\mathbf{b}=(1,-1,4)$ is

(a) 90^o (b) 45^o
(c) 30^o (d) 15^o

71. A vector of length 3 perpendicular to each of the vectors $3\mathbf{i}+\mathbf{j}-4\mathbf{k}$ and $6\mathbf{i}+5\mathbf{j}-2\mathbf{k}$ is

(a) $2\mathbf{i}-2\mathbf{j}+\mathbf{k}$ (b) $-2\mathbf{i}+2\mathbf{j}+\mathbf{k}$
(c) $2\mathbf{i}+2\mathbf{j}-\mathbf{k}$ (d) None of these

72. If $\mathbf{a}\neq\mathbf{0}$, $\mathbf{b}\neq\mathbf{0}$ and $|\mathbf{a}+\mathbf{b}|=|\mathbf{a}-\mathbf{b}|$, then the vectors $\mathbf{a}$ and $\mathbf{b}$ are **[Roorkee 1986; MNR 1988; IIT Screening 1989; MP PET 1990, 97; RPET 1984, 90, 96, 99; KCET 1999]**

(a) Parallel to each other

(b) Perpendicular to each other

(c) Inclined at an angle of 60^o

(d) Neither perpendicular nor parallel

73. The vector $2\mathbf{i}+a\mathbf{j}+\mathbf{k}$ is perpendicular to the vector $2\mathbf{i}-\mathbf{j}-\mathbf{k}$, if $a=$ **[MP PET 1987]**

(a) 5 (b) – 5

(c) – 3 (d) 3

74. If $\mathbf{a}=2\mathbf{i}+2\mathbf{j}+3\mathbf{k}$, $\mathbf{b}=-\mathbf{i}+2\mathbf{j}+\mathbf{k}$ and $\mathbf{c}=3\mathbf{i}+\mathbf{j}$, then $\mathbf{a}+t\mathbf{b}$ is perpendicular to **c** if $t=$

[MNR 1979; MP PET 2002]

(a) 2 (b) 4

(c) 6 (d) 8

75. The vector $2\mathbf{i}+\mathbf{j}-\mathbf{k}$ is perpendicular to $\mathbf{i}-4\mathbf{j}+\lambda\mathbf{k}$, if $\lambda=$

(a) 0 (b) – 1

(c) – 2 (d) – 3

76. The vectors $2\mathbf{i}+3\mathbf{j}-4\mathbf{k}$ and $a\mathbf{i}+b\mathbf{j}+c\mathbf{k}$ are perpendicular, when

[MNR 1982; MP PET 1988; MP PET 2002]

(a) $a=2, b=3, c=-4$ (b) $a=4, b=4, c=5$

(c) $a=4, b=4, c=-5$ (d) None of these

77. A unit vector in the $xy-$ plane which is perpendicular to $4\mathbf{i}-3\mathbf{j}+\mathbf{k}$ is

(a) $\frac{\mathbf{i}+\mathbf{j}}{\sqrt{2}}$ (b) $\frac{1}{5}(3\mathbf{i}+4\mathbf{j})$

(c) $\frac{1}{5}(3\mathbf{i}-4\mathbf{j})$ (d) None of these

78. If $l\mathbf{a}+m\mathbf{b}+n\mathbf{c}=\mathbf{0}$, where l, m, n are scalars and **a, b, c** are mutually perpendicular vectors, then

(a) $l=m=n=1$ (b) $l+m+n=1$

(c) $l=m=n=0$ (d) $l\neq 0, m\neq 0, n\neq 0$

79. The unit normal vector to the line joining $\mathbf{i}-\mathbf{j}$ and $2\mathbf{i}+3\mathbf{j}$ and pointing towards the origin is

(a) $\frac{4\mathbf{i}-\mathbf{j}}{\sqrt{17}}$ (b) $\frac{-4\mathbf{i}+\mathbf{j}}{\sqrt{17}}$

(c) $\frac{2\mathbf{i}-3\mathbf{j}}{\sqrt{13}}$ (d) $\frac{-2\mathbf{i}+3\mathbf{j}}{\sqrt{13}}$

80. If the vectors $a\mathbf{i}-2\mathbf{j}+3\mathbf{k}$ and $3\mathbf{i}+6\mathbf{j}-5\mathbf{k}$ are perpendicular to each other, then a is given by **[MP PET 1993]**

(a) 9 (b) 16

(c) 25 (d) 36

81. The value of λ for which the vectors $2\lambda\mathbf{i}+\mathbf{j}-\mathbf{k}$ and $2\mathbf{j}+\mathbf{k}$ are perpendicular, is

(a) None (b) – 1

(c) 1 (d) Any value

82. If the vectors $a\mathbf{i}+b\mathbf{j}+c\mathbf{k}$ and $p\mathbf{i}+q\mathbf{j}+r\mathbf{k}$ are perpendicular, then **[RPET 1989]**

(a) $(a+b+c)(p+q+r)=0$ (b) $(a+b+c)(p+q+r)=1$

(c) $ap+bq+cr=0$ (d) $ap+bq+cr=1$

83. If $\mathbf{a}=2\mathbf{i}+4\mathbf{j}+2\mathbf{k}$ and $\mathbf{b}=8\mathbf{i}-3\mathbf{j}+\lambda\mathbf{k}$ and $\mathbf{a}\perp\mathbf{b}$, then value of λ will be **[RPET 1995]**

(a) 2 (b) – 1

(c) – 2 (d) 1

84. The vector $\frac{1}{3}(2\mathbf{i}-2\mathbf{j}+\mathbf{k})$ is

(a) A unit vector

(b) Makes an angle $\frac{\pi}{3}$ with the vector $2\mathbf{i}-4\mathbf{j}+3\mathbf{k}$

(c) Parallel to the vector $-\mathbf{i}+\mathbf{j}-\frac{1}{2}\mathbf{k}$

(d) Perpendicular to the vector $3\mathbf{i}+2\mathbf{j}-2\mathbf{k}$

85. If the vectors $a\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ and $-\mathbf{i}+5\mathbf{j}+a\mathbf{k}$ are perpendicular to each other, then $a=$ **[MP PET 1996]**

(a) 6 (b) – 6

(c) 5 (d) – 5

86. Which of the following is a true statement **[Kurukshetra CEE 1996]**

(a) $(\mathbf{a}\times\mathbf{b})\times\mathbf{c}$ is coplanar with **c**

(b) $(\mathbf{a}\times\mathbf{b})\times\mathbf{c}$ is perpendicular to **a**

(c) $(\mathbf{a}\times\mathbf{b})\times\mathbf{c}$ is perpendicular to **b**

(d) $(\mathbf{a}\times\mathbf{b})\times\mathbf{c}$ is perpendicular to **c**

87. If $\mathbf{a}=\mathbf{i}-2\mathbf{j}$ and $\mathbf{b}=2\mathbf{i}+\lambda\mathbf{j}$ are parallel, then λ is **[RPET 1996]**

(a) 4 (b) 2

(c) – 2 (d) – 4

88. If $a\mathbf{i}+6\mathbf{j}-\mathbf{k}$ and $7\mathbf{i}-3\mathbf{j}+17\mathbf{k}$ are perpendicular vectors, then the value of a is

(a) 5 (b) – 5

(c) 7 (d) $\frac{1}{7}$

89. If $4\mathbf{i}+\mathbf{j}-\mathbf{k}$ and $3\mathbf{i}+m\mathbf{j}+2\mathbf{k}$ are at right angle, then $m=$

[Karnataka CET 2002]

(a) – 6 (b) – 8

(c) – 10 (d) – 12

90. If the vectors $3\mathbf{i}+\lambda\mathbf{j}+\mathbf{k}$ and $2\mathbf{i}-\mathbf{j}+8\mathbf{k}$ are perpendicular, then λ is

(a) – 14 (b) 7

(c) 14 (d) 1/7

91. If **a** and **b** are two non-zero vectors, then the component of **b** along **a** is

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

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

92. A vector of magnitude 14 lies in the *xy*-plane and makes an angle of 60^o with *x*-axis. The components of the vector in the direction of *x*-axis and *y*-axis are

(a) $7, 7\sqrt{3}$ (b) $7\sqrt{3}, 7$

(c) $14\sqrt{3}, 14/\sqrt{3}$ (d) $14/\sqrt{3}, 14\sqrt{3}$

93. If $\mathbf{a} = 4\mathbf{i} + 6\mathbf{j}$ and $\mathbf{b} = 3\mathbf{j} + 4\mathbf{k}$, then the component of **a** along **b** is **[IIT Screening 1989; MNR 1983, 87; UPSEAT 2000]**

(a) $\frac{18}{10\sqrt{3}}(3\mathbf{j} + 4\mathbf{k})$ (b) $\frac{18}{25}(3\mathbf{j} + 4\mathbf{k})$

(c) $\frac{18}{\sqrt{3}}(3\mathbf{j} + 4\mathbf{k})$ (d) $(3\mathbf{j} + 4\mathbf{k})$

94. Let $\mathbf{b} = 3\mathbf{j} + 4\mathbf{k}$, $\mathbf{a} = \mathbf{i} + \mathbf{j}$ and let $\mathbf{b}_1$ and $\mathbf{b}_2$ be component vectors of **b** parallel and perpendicular to **a**. If $\mathbf{b}_1 = \frac{3}{2}\mathbf{i} + \frac{3}{2}\mathbf{j}$, then $\mathbf{b}_2 =$

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

(c) $-\frac{3}{2}\mathbf{i} + \frac{3}{2}\mathbf{j}$ (d) None of these

95. The component of $\mathbf{i} + \mathbf{j}$ along $\mathbf{j} + \mathbf{k}$ will be

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

(c) $\frac{\mathbf{k} + \mathbf{i}}{2}$ (d) None of these

96. The projection of vector $2\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$ on the vector $\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$ will be

[RPET 1984, 90, 97, 99; Karnataka CET 2004]

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

(c) $\frac{3}{\sqrt{14}}$ (d) $\sqrt{14}$

97. If vector $\mathbf{a} = 2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}$ and vector $\mathbf{b} = -2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$, then $\frac{\text{Projection of vector } \mathbf{a} \text{ on vector } \mathbf{b}}{\text{Projection of vector } \mathbf{b} \text{ on vector } \mathbf{a}} =$

[MP PET 1994, 99; Pb. CET 2000]

(a) $\frac{3}{7}$ (b) $\frac{7}{3}$

(c) 3 (d) 7

98. The projection of **a** along **b** is

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

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

99. If $\mathbf{a} = 2\mathbf{i} + \mathbf{j} + 2\mathbf{k}$ and $\mathbf{b} = 5\mathbf{i} - 3\mathbf{j} + \mathbf{k}$, then the projection of **b** on **a** is **[Karnataka CET 2002]**

(a) 3 (b) 4

(c) 5 (d) 6

100. The projection of the vector $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ on the vector $4\mathbf{i} - 4\mathbf{j} + 7\mathbf{k}$ is **[RPET 1990; MNR 1980; MP PET 2002; UPSEAT 2002; Pb. CET 2004]**

(a) $\frac{5\sqrt{6}}{10}$ (b) $\frac{19}{9}$

(c) $\frac{9}{19}$ (d) $\frac{\sqrt{6}}{19}$