Practice Problems

Problems based on fundamentals of vector

1. How many minimum number of coplanar vectors having different magnitudes can be added to give zero resultant

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

2. A hall has the dimensions $10\,m \times 12\,m \times 14\,m$. A fly starting at one corner ends up at a diametrically opposite corner. What is the magnitude of its displacement

(a) 17 *m* (b) 26 *m* (c) 36 *m* (d) 21 *m*

3. $0.4\hat{i} + 0.8\hat{j} + c\hat{k}$ represents a unit vector when *c* is

(a) – 0.2 (b) $\sqrt{0.2}$ (c) $\sqrt{0.8}$ (d) 0

4. 100 coplanar forces each equal to 10 N act on a body. Each force makes angle $\pi/50$ with the preceding force. What is the resultant of the forces

(a) 1000 *N* (b) 500 *N* (c) 250 *N* (d) Zero

5. The magnitude of a given vector with end points (4, – 4, 0) and (– 2, – 2, 0) must be

(a) 6 (b) $5\sqrt{2}$ (c) 4 (d) $2\sqrt{10}$

6. The angles which a vector $\hat{i} + \hat{j} + \sqrt{2}\,\hat{k}$ makes with *X*, *Y* and *Z* axes respectively are

(a) 60°, 60°, 60° (b) 45°, 45°, 45° (c) 60°, 60°, 45° (d) 45°, 45°, 60°

7. The expression $\left(\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}\right)$ is a

(a) Unit vector (b) Null vector (c) Vector of magnitude $\sqrt{2}$ (d) Scalar

8. Given vector $\vec{A} = 2\hat{i} + 3\hat{j}$, the angle between $\vec{A}$ and *y*-axis is **[CPMT 1993]**

(a) $\tan^{-1} 3/2$ (b) $\tan^{-1} 2/3$ (c) $\sin^{-1} 2/3$ (d) $\cos^{-1} 2/3$

9. The unit vector along $\hat{i} + \hat{j}$ is

(a) $\hat{k}$ (b) $\hat{i} + \hat{j}$ (c) $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$ (d) $\frac{\hat{i} + \hat{j}}{2}$

10. A vector is represented by $3\hat{i} + \hat{j} + 2\hat{k}$. Its length in *XY* plane is **[EAMCET (Engg.) 1994]**

(a) 2 (b) $\sqrt{14}$ (c) $\sqrt{10}$ (d) $\sqrt{5}$

11. Five equal forces of 10 *N* each are applied at one point and all are lying in one plane. If the angles between them are equal, the resultant force will be **[CBSE PMT 1995]**

(a) Zero (b) 10 *N* (c) 20 *N* (d) $10\sqrt{2}N$

12. The angle made by the vector $A = \hat{i} + \hat{j}$ with *x*- axis is **[EAMCET (Engg.) 1999]**

(a) 90° (b) 45° (c) 22.5° (d) 30°

13. The value of a unit vector in the direction of vector $A = 5\hat{i} - 12\hat{j}$, is

(a) $\hat{i}$ (b) $\hat{j}$ (c) $(\hat{i}+\hat{j})/13$ (d) $(5\hat{i}-12\hat{j})/13$

14. Any vector in an arbitrary direction can always be replaced by two (or three)

(a) Parallel vectors which have the original vector as their resultant

(b) Mutually perpendicular vectors which have the original vector as their resultant

(c) Arbitrary vectors which have the original vector as their resultant

(d) It is not possible to resolve a vector

15. Angular momentum is **[MNR 1986]**

(a) A scalar (b) A polar vector (c) An axial vector (d) None of these

16. If a vector $\vec{P}$ making angles α, β, and γ respectively with the *X*, *Y* and *Z* axes respectively. Then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=$

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

Problems based on addition of vectors

17. Two forces, each of magnitude *F* have a resultant of the same magnitude *F*. The angle between the two forces is **[CBSE PMT 1990]**

(a) 45° (b) 120° (c) 150° (d) 60°

18. For the resultant of the two vectors to be maximum, what must be the angle between them

(a) 0° (b) 60° (c) 90° (d) 180°

19. A particle is simultaneously acted by two forces equal to 4 *N* and 3 *N*. The net force on the particle is **[CPMT 1979]**

(a) 7 *N* (b) 5 *N* (c) 1 *N* (d) Between 1 *N* and 7 *N*

20. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors *i.e.*, $\vec{A}+\vec{B}+\vec{C}$

(a) Can be zero (b) Cannot be zero

(c) Lies in the plane containing $\vec{A}+\vec{B}$ (d) Lies in the plane containing $\vec{A}-\vec{B}$

21. If the resultant of the two forces has a magnitude smaller than the magnitude of larger force, the two forces must be

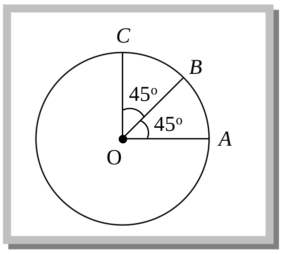
(a) Different both in magnitude and direction (b) Mutually perpendicular to one another

(c) Possess extremely small magnitude (d) Point in opposite directions

22. Forces F_1 and F_2 act on a point mass in two mutually perpendicular directions. The resultant force on the point mass will be **[CPMT 1991]**

(a) F_1+F_2 (b) F_1-F_2 (c) $\sqrt{F_1^2+F_2^2}$ (d) $F_1^2+F_2^2$

23. Find the resultant of three vectors $\overrightarrow{OA}, \overrightarrow{OB}$ and $\overrightarrow{OC}$ shown in the following figure. Radius of the circle is *R*.



(a) $2R$

(b) $R(1+\sqrt{2})$

(c) $R\sqrt{2}$

(d) $R(\sqrt{2}-1)$

24. If $|\vec{A}-\vec{B}|=|\vec{A}|=|\vec{B}|,$ the angle between $\vec{A}$ and $\vec{B}$ is

(a) 60° (b) 0° (c) 120° (d) 90°

25. At what angle must the two forces $(x + y)$ and $(x - y)$ act so that the resultant may be $\sqrt{(x^2 + y^2)}$

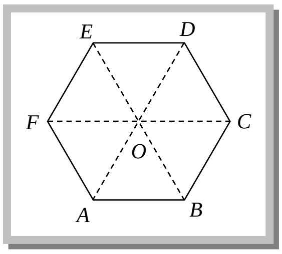
(a) $\cos^{-1}\left(-\frac{x^2+y^2}{2(x^2-y^2)}\right)$ (b) $\cos^{-1}\left(-\frac{2(x^2-y^2)}{x^2+y^2}\right)$ (c) $\cos^{-1}\left(-\frac{x^2+y^2}{x^2-y^2}\right)$ (d) $\cos^{-1}\left(-\frac{x^2-y^2}{x^2+y^2}\right)$

26. Let the angle between two nonzero vectors $\vec{A}$ and $\vec{B}$ be 120° and resultant be $\vec{C}$

(a) $\vec{C}$ must be equal to $|\vec{A}-\vec{B}|$ (b) $\vec{C}$ must be less than $|\vec{A}-\vec{B}|$

(c) $\vec{C}$ must be greater than $|\vec{A}-\vec{B}|$ (d) $\vec{C}$ may be equal to $|\vec{A}-\vec{B}|$

27. Fig. shows *ABCDEF* as a regular hexagon. What is the value of $\overrightarrow{AB}+\overrightarrow{AC}+\overrightarrow{AD}+\overrightarrow{AE}+\overrightarrow{AF}$



(a) $\overrightarrow{AO}$

(b) $2\overrightarrow{AO}$

(c) $4\overrightarrow{AO}$

(d) $6\overrightarrow{AO}$

28. The magnitude of vector $\vec{A}, \vec{B}$ and $\vec{C}$ are respectively 12, 5 and 13 units and $\vec{A}+\vec{B}=\vec{C}$ then the angle between $\vec{A}$ and $\vec{B}$ is **[CPMT 1997]**

(a) 0 (b) π (c) $\pi/2$ (d) $\pi/4$

29. Magnitude of vector which comes on addition of two vectors, $6\hat{i}+7\hat{j}$ and $3\hat{i}+4\hat{j}$ is **[BHU 2000]**

(a) $\sqrt{136}$ (b) $\sqrt{13.2}$ (c) $\sqrt{202}$ (d) $\sqrt{160}$

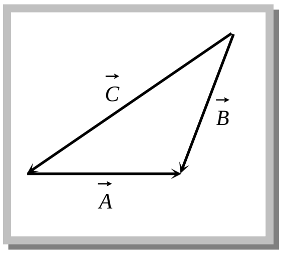
30. A particle has displacement of 12 *m* towards east and 5 *m* towards north then 6 *m* vertically upward. The sum of these displacements is

(a) 12 (b) 10.04 *m* (c) 14.31 *m* (d) None of these

31. The three vectors $\vec{A}=3\hat{i}-2\hat{j}+\hat{k}$, $\vec{B}=\hat{i}-3\hat{j}+5\hat{k}$ and $\vec{C}=2\hat{i}+\hat{j}-4\hat{k}$ form

(a) An equilateral triangle (b) Isosceles triangle (c) A right angled triangle (d) No triangle

32. For the fig.



(a) $\vec{A}+\vec{B}=\vec{C}$

(b) $\vec{B}+\vec{C}=\vec{A}$

(c) $\vec{C}+\vec{A}=\vec{B}$

(d) $\vec{A}+\vec{B}+\vec{C}=0$

33. Let $\vec{C}=\vec{A}+\vec{B}$ then

(a) $|\overrightarrow{C}|$ is always greater then $|\vec{A}|$ (b) It is possible to have $|\vec{C}| < |\vec{A}|$ and $|\vec{C}| < |\vec{B}|$

(c) C is always equal to $A + B$ (d) C is never equal to $A + B$

34. The value of the sum of two vectors $\vec{A}$ and $\vec{B}$ with θ as the angle between them is **[BHU 1996]**

(a) $\sqrt{A^2+B^2+2AB\cos\theta}$ (b) $\sqrt{A^2-B^2+2AB\cos\theta}$ (c) $\sqrt{A^2+B^2-2AB\sin\theta}$ (d) $\sqrt{A^2+B^2+2AB\sin\theta}$

35. Following forces start acting on a particle at rest at the origin of the co-ordinate system simultaneously

$\vec{F}_1 = -4\hat{i} - 5\hat{j} + 5\hat{k}$, $\vec{F}_2 = 5\hat{i} + 8\hat{j} + 6\hat{k}$, $\vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{F}_4 = 2\hat{i} - 3\hat{j} - 2\hat{k}$ then the particle will move

(a) In $x-y$ plane (b) In $y-z$ plane (c) In $x-z$ plane (d) Along x -axis

36. Following sets of three forces act on a body. Whose resultant cannot be zero **[CPMT 1985]**

(a) 10, 10, 10 (b) 10, 10, 20 (c) 10, 20, 20 (d) 10, 20, 40

37. When three forces of 50 N, 30 N and 15 N act on a body, then the body is

(a) At rest (b) Moving with a uniform velocity (c) In equilibrium (d) Moving with an acceleration

38. The sum of two forces acting at a point is 16 N. If the resultant force is 8 N and its direction is perpendicular to minimum force then the forces are **[CPMT 1997]**

(a) 6 N and 10 N (b) 8 N and 8 N (c) 4 N and 12 N (d) 2 N and 14 N

39. If vectors P, Q and R have magnitude 5, 12 and 13 units and $\vec{P} + \vec{Q} = \vec{R}$, the angle between Q and R is **[CEET 1998]**

(a) $\cos^{-1}\frac{5}{12}$ (b) $\cos^{-1}\frac{5}{13}$ (c) $\cos^{-1}\frac{12}{13}$ (d) $\cos^{-1}\frac{7}{13}$

40. The resultant of two vectors A and B is perpendicular to the vector A and its magnitude is equal to half the magnitude of vector B. The angle between A and B is

(a) 120° (b) 150° (c) 135° (d) None of these

41. What vector must be added to the two vectors $\hat{i} - 2\hat{j} + 2\hat{k}$ and $2\hat{i} + \hat{j} - \hat{k}$, so that the resultant may be a unit vector along x-axis **[BHU 1990]**

(a) $2\hat{i} + \hat{j} - \hat{k}$ (b) $-2\hat{i} + \hat{j} - \hat{k}$ (c) $2\hat{i} - \hat{j} + \hat{k}$ (d) $-2\hat{i} - \hat{j} - \hat{k}$

42. What is the angle between $\vec{P}$ and the resultant of $(\vec{P} + \vec{Q})$ and $(\vec{P} - \vec{Q})$

(a) Zero (b) $\tan^{-1} P/Q$ (c) $\tan^{-1} Q/P$ (d) $\tan^{-1}(P-Q)/(P+Q)$

43. The resultant of $\vec{P}$ and $\vec{Q}$ is perpendicular to $\vec{P}$. What is the angle between $\vec{P}$ and $\vec{Q}$

(a) $\cos^{-1}(P/Q)$ (b) $\cos^{-1}(-P/Q)$ (c) $\sin^{-1}(P/Q)$ (d) $\sin^{-1}(-P/Q)$

44. Maximum and minimum magnitudes of the resultant of two vectors of magnitudes P and Q are in the ratio $3:1$. Which of the following relations is true

(a) $P = 2Q$ (b) $P = Q$ (c) $PQ = 1$ (d) None of these

45. The resultant of $\vec{A} + \vec{B}$ is $\vec{R}_1$. On reversing the vector $\vec{B}$, the resultant becomes $\vec{R}_2$. What is the value of $R_1^2 + R_2^2$

(a) $A^2 + B^2$ (b) $A^2 - B^2$ (c) $2(A^2 + B^2)$ (d) $2(A^2 - B^2)$

46. The resultant of two vectors $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If Q is doubled, the new resultant is perpendicular to P. Then R equals

(a) P (b) $(P+Q)$ (c) Q (d) $(P-Q)$

47. Two forces, F_1 and F_2 are acting on a body. One force is double that of the other force and the resultant is equal to the greater force. Then the angle between the two forces is

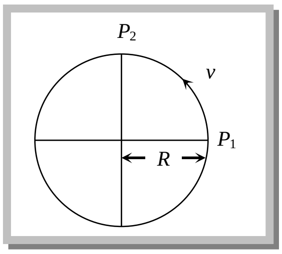
(a) $\cos^{-1}(1/2)$ (b) $\cos^{-1}(-1/2)$ (c) $\cos^{-1}(-1/4)$ (d) $\cos^{-1}(1/4)$

48. Given that $\vec{A} + \vec{B} = \vec{C}$ and that $\vec{C}$ is $\perp$ to $\vec{A}$. Further if $|\vec{A}| = |\vec{C}|$, then what is the angle between $\vec{A}$ and $\vec{B}$

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

Problems based on subtraction of vectors

49. Figure below shows a body of mass M moving with the uniform speed on a circular path of radius, R. What is the change in acceleration in going from P_1 to P_2



(a) Zero

(b) $v^2 / 2R$

(c) $2v^2 / R$

(d) $\frac{v^2}{R} \times \sqrt{2}$

50. A body is at rest under the action of three forces, two of which are $\vec{F}_1 = 4\hat{i}, \vec{F}_2 = 6\hat{j}$, the third force is **[AMU 1996]**

(a) $4\hat{i} + 6\hat{j}$ (b) $4\hat{i} - 6\hat{j}$ (c) $-4\hat{i} + 6\hat{j}$ (d) $-4\hat{i} - 6\hat{j}$

51. A plane is revolving around the earth with a speed of 100 *km/hr* at a constant height from the surface of earth. The change in the velocity as it travels half circle is **[RPET 1998; KCET 2000]**

(a) 200 *km/hr* (b) 150 *km/hr* (c) $100\sqrt{2}\, km/hr$ (d) 0

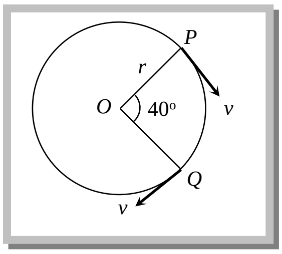
52. What displacement must be added to the displacement $25\hat{i} - 6\hat{j}\ m$ to give a displacement of 7.0 *m* pointing in the *x*- direction

(a) $18\hat{i} - 6\hat{j}$ (b) $32\hat{i} - 13\hat{j}$ (c) $-18\hat{i} + 6\hat{j}$ (d) $-25\hat{i} + 13\hat{j}$

53. A body moves due East with velocity 20 *km/hour* and then due North with velocity 15 *km/hour*. The resultant velocity **[AFMC 1995]**

(a) 5 *km/hour* (b) 15 *km/hour* (c) 20 *km/hour* (d) 25 *km/hour*

54. A particle is moving on a circular path of radius r with uniform velocity v. The change in velocity when the particle moves from P to Q is $(\angle POQ = 40°)$



(a) $2v \cos 40°$

(b) $2v \sin 40°$

(c) $2v \sin 20°$

(d) $2v \cos 20°$

55. The length of second's hand in watch is 1 *cm*. The change in velocity of its tip in 15 seconds is **[MP PMT 1987]**

(a) Zero (b) $\frac{\pi}{30\sqrt{2}}\ cm/\sec$ (c) $\frac{\pi}{30}\ cm/\sec$ (d) $\frac{\pi\sqrt{2}}{30}\ cm/\sec$

56. A particle moves towards east with velocity 5 *m/s*. After 10 seconds its direction changes towards north with same velocity. The average acceleration of the particle is **[CPMT 1997; IIT-JEE 1982]**

(a) Zero (b) $\frac{1}{\sqrt{2}} m/s^2\ N-W$ (c) $\frac{1}{\sqrt{2}} m/s^2\ N-E$ (d) $\frac{1}{\sqrt{2}} m/s^2\ S-W$

Problems based on scalar product of vectors

57. Consider two vectors $\vec{F}_1 = 2\hat{i} + 5\hat{k}$ and $\vec{F}_2 = 3\hat{j} + 4\hat{k}$. The magnitude of the scalar product of these vectors is **[MP PMT 1987]**

(a) 20 (b) 23 (c) $5\sqrt{33}$ (d) 26

58. Consider a vector $\vec{F} = 4\hat{i} - 3\hat{j}$. Another vector that is perpendicular to $\vec{F}$ is

(a) $4\hat{i}+3\hat{j}$ (b) $6\hat{i}$ (c) $7\hat{k}$ (d) $3\hat{i}-4\hat{j}$

59. Two vectors $\vec{A}$ and $\vec{B}$ are at right angles to each other, when **[AIIMS 1987]**

(a) $\vec{A}+\vec{B}=0$ (b) $\vec{A}-\vec{B}=0$ (c) $\vec{A}\times\vec{B}=0$ (d) $\vec{A}.\vec{B}=0$

60. If $|\vec{V}_1+\vec{V}_2|=|\vec{V}_1-\vec{V}_2|$ and V_2 is finite, then **[CPMT 1989]**

(a) V_1 is parallel to V_2 (b) $\vec{V}_1=\vec{V}_2$

(c) V_1 and V_2 are mutually perpendicular (d) $|\vec{V}_1|=|\vec{V}_2|$

61. A force $\vec{F}=(5\hat{i}+3\hat{j})$Newton is applied over a particle which displaces it from its origin to the point $\vec{r}=(2\hat{i}-1\hat{j})$ *metres*. The work done on the particle is **[MP PMT 1995]**

(a) – 7 *joules* (b) +13 *joules* (c) +7 *joules* (d) +11 *joules*

62. The angle between two vectors $-2\hat{i}+3\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}-4\hat{k}$ is **[EAMCET 1990]**

(a) 0° (b) 90° (c) 180° (d) None of the above

63. The angle between the vectors $(\hat{i}+\hat{j})$ and $(\hat{j}+\hat{k})$ is **[EAMCET 1995]**

(a) 30° (b) 45° (c) 60° (d) 90°

64. A particle moves with a velocity $6\hat{i}-4\hat{j}+3\hat{k}\,m/s$ under the influence of a constant force $\vec{F}=20\hat{i}+15\hat{j}-5\hat{k}\,N$. The instantaneous power applied to the particle is **[CBSE PMT 2000]**

(a) 35 *J/s* (b) 45 *J/s* (c) 25 *J/s* (d) 195 *J/s*

65. If $\vec{P}.\vec{Q}=PQ$, then angle between $\vec{P}$ and $\vec{Q}$ is **[AIIMS 1999]**

(a) 0° (b) 30° (c) 45° (d) 60°

66. Two constant forces $F_1=2\hat{i}-3\hat{j}+3\hat{k}$ (*N*) and $F_2=\hat{i}+\hat{j}-2\hat{k}$ (*N*) act on a body and displace it from the position $r_1=\hat{i}+2\hat{j}-2\hat{k}$ (m) to the position $r_2=7\hat{i}+10\hat{j}+5\hat{k}$ (m). What is the work done

(a) 9 *J* (b) 41 *J* (c) – 3 *J* (d) None of these

67. A force $\vec{F}=5\hat{i}+6\hat{j}+4\hat{k}$ acting on a body, produces a displacement $\vec{S}=6\hat{i}-5\hat{k}$. Work done by the force is **[KCET 1999]**

(a) 10 units (b) 18 units (c) 11 units (d) 5 units

68. The angle between the two vector $\vec{A}=5\hat{i}+5\hat{j}$ and $\vec{B}=5\hat{i}-5\hat{j}$ will be **[CPMT 2000]**

(a) Zero (b) 45° (c) 90° (d) 180°

69. The vector $\vec{P}=a\hat{i}+a\hat{j}+3\hat{k}$ and $\vec{Q}=a\hat{i}-2\hat{j}-\hat{k}$ are perpendicular to each other. The positive value of *a* is **[AFMC 2000]**

(a) 3 (b) 4 (c) 9 (d) 13

70. A body, constrained to move in the *Y*-direction is subjected to a force given by $\vec{F}=(-2\hat{i}+15\hat{j}+6\hat{k})N$. What is the work done by this force in moving the body a distance 10 *m* along the *Y*-axis **[CBSE PMT 1994]**

(a) 20 *J* (b) 150 *J* (c) 160 *J* (d) 190 *J*

71. A particle moves in the *x*-*y* plane under the action of a force $\vec{F}$ such that the value of its liner momentum $(\vec{P})$ at anytime *t* is $P_x=2\cos t, p_y=2\sin t$. The angle θ between $\vec{F}$ and $\vec{P}$ at a given time *t*. will be **[UPSEAT 2000]**

(a) $\theta=0°$ (b) $\theta=30°$ (c) $\theta=90°$ (d) $\theta=180°$

Problems based on cross product of vectors

72. The area of the parallelogram represented by the vectors $\vec{A}=2\hat{i}+3\hat{j}$ and $\vec{B}=\hat{i}+4\hat{j}$ is

(a) 14 units (b) 7.5 units (c) 10 units (d) 5 units

73. For any two vectors $\vec{A}$ and $\vec{B}$ if $\vec{A}.\vec{B}=|\vec{A}\times\vec{B}|$, the magnitude of $\vec{C}=\vec{A}+\vec{B}$ is equal to

(a) $\sqrt{A^2+B^2}$ (b) $A+B$ (c) $\sqrt{A^2+B^2+\frac{AB}{\sqrt{2}}}$ (d) $\sqrt{A^2+B^2+\sqrt{2}\times AB}$

74. A vector $\vec{F}_1$ is along the positive *X*-axis. If its vector product with another vector $\vec{F}_2$ is zero then $\vec{F}_2$ could be **[MP PMT 1987]**

(a) $4\hat{j}$ (b) $-(\hat{i}+\hat{j})$ (c) $(\hat{j}+\hat{k})$ (d) $(-4\hat{i})$

75. If for two vectors $\vec{A}$ and $\vec{B}, \vec{A}\times\vec{B}=0$, the vectors

(a) Are perpendicular to each other (b) Are parallel to each other

(c) Act at an angle of 60° (d) Act at an angle of 30°

76. The angle between vectors $(\vec{A}\times\vec{B})$ and $(\vec{B}\times\vec{A})$ is

(a) Zero (b) π (c) $\pi/4$ (d) $\pi/2$

77. What is the angle between $(\vec{P}+\vec{Q})$ and $(\vec{P}\times\vec{Q})$

(a) 0 (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) π

78. The resultant of the two vectors having magnitude 2 and 3 is 1. What is their cross product

(a) 6 (b) 3 (c) 1 (d) 0

79. Which of the following is the unit vector perpendicular to $\vec{A}$ and $\vec{B}$

(a) $\frac{\hat{A}\times\hat{B}}{AB\sin\theta}$ (b) $\frac{\hat{A}\times\hat{B}}{AB\cos\theta}$ (c) $\frac{\vec{A}\times\vec{B}}{AB\sin\theta}$ (d) $\frac{\vec{A}\times\vec{B}}{AB\cos\theta}$

80. Let $\vec{A}=\hat{i}A\cos\theta+\hat{j}A\sin\theta$ be any vector. Another vector $\vec{B}$ which is normal to *A* is **[BHU 1997]**

(a) $\hat{i}B\cos\theta+jB\sin\theta$ (b) $\hat{i}B\sin\theta+jB\cos\theta$ (c) $\hat{i}B\sin\theta-jB\cos\theta$ (d) $\hat{i}B\cos\theta-jB\sin\theta$

81. The angle between two vectors given by $6\bar{i}+6\bar{j}-3\bar{k}$ and $7\bar{i}+4\bar{j}+4\bar{k}$ is **[EAMCET (Engg.) 1999]**

(a) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\cos^{-1}\left(\frac{5}{\sqrt{3}}\right)$ (c) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (d) $\sin^{-1}\left(\frac{\sqrt{5}}{3}\right)$

82. A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards north. The vector product $\vec{A}\times\vec{B}$ is **[UPSEAT 2000]**

(a) Zero (b) Along west (c) Along east (d) Vertically downward

83. Angle between the vectors $(\hat{i}+\hat{j})$ and $(\hat{j}-\hat{k})$ is

(a) 90° (b) 0° (c) 180° (d) 60°

84. Two vectors $P=2\hat{i}+b\hat{j}+2\hat{k}$ and $Q=\hat{i}+\hat{j}+\hat{k}$ will be parallel if

(a) $b=0$ (b) $b=1$ (c) $b=2$ (d) $b=-4$

85. The position vectors of points *A, B, C* and *D* are $A=3\hat{i}+4\hat{j}+5\hat{k}$, $B=4\hat{i}+5\hat{j}+6\hat{k}$, $C=7\hat{i}+9\hat{j}+3\hat{k}$ and $D=4\hat{i}+6\hat{j}$ then the displacement vectors *AB* and *CD* are

(a) Perpendicular (b) Parallel (c) Antiparallel (d) Inclined at an angle of 60°

86. Which of the following is not true ? If $\vec{A}=3\hat{i}+4\hat{j}$ and $\vec{B}=6\hat{i}+8\hat{j}$ where *A* and *B* are the magnitudes of $\vec{A}$ and $\vec{B}$

(a) $\vec{A}\times\vec{B}=0$ (b) $\frac{A}{B}=\frac{1}{2}$ (c) $\vec{A}.\vec{B}=48$ (d) A = 5

87. If force $(\vec{F})=4\hat{i}+5\hat{j}$ and displacement $(\vec{s})=3\hat{i}+6\hat{k}$ then the work done is **[Manipal 1995]**

(a) 4×3 (b) 5×6 (c) 6×3 (d) 4×6

88. If $|\vec{A}\times\vec{B}|=|\vec{A}.\vec{B}|$, then angle between $\vec{A}$ and $\vec{B}$ will be **[AIIMS 2000; Manipal 2000]**

(a) 30° (b) 45° (c) 60° (d) 90°

89. In an clockwise system **[CPMT 1990]**

(a) $\hat{j}\times\hat{k}=\hat{i}$ (b) $\hat{i}.\hat{i}=0$ (c) $\hat{j}\times\hat{j}=1$ (d) $\hat{k}.\hat{j}=1$

90. The linear velocity of a rotating body is given by $\vec{v}=\vec{\omega}\times\vec{r}$, where $\vec{\omega}$ is the angular velocity and $\vec{r}$ is the radius vector. The angular velocity of a body is $\vec{\omega}=\hat{i}-2\hat{j}+2\hat{k}$ and the radius vector $\vec{r}=4\hat{j}-3\hat{k}$, then $|\vec{v}|$ is

(a) $\sqrt{29}$ units (b) $\sqrt{31}$ units (c) $\sqrt{37}$ units (d) $\sqrt{41}$ units

91. Three vectors $\vec{a},\vec{b}$ and $\vec{c}$ satisfy the relation $\vec{a}.\vec{b}=0$ and $\vec{a}.\vec{c}=0$. The vector $\vec{a}$ is parallel to **[AIIMS 1996]**

(a) $\vec{b}$ (b) $\vec{c}$ (c) $\vec{b}.\vec{c}$ (d) $\vec{b}\times\vec{c}$

92. The diagonals of a parallelogram are $2\hat{i}$ and $2\hat{j}$. What is the area of the parallelogram

(a) 0.5 units (b) 1 unit (c) 2 units (d) 4 units

93. What is the unit vector perpendicular to the following vectors $2\hat{i}+2\hat{j}-\hat{k}$ and $6\hat{i}-3\hat{j}+2\hat{k}$

(a) $\frac{\hat{i}+10\hat{j}-18\hat{k}}{5\sqrt{17}}$ (b) $\frac{\hat{i}-10\hat{j}+18\hat{k}}{5\sqrt{17}}$ (c) $\frac{\hat{i}-10\hat{j}-18\hat{k}}{5\sqrt{17}}$ (d) $\frac{\hat{i}+10\hat{j}+18\hat{k}}{5\sqrt{17}}$

94. The area of the parallelogram whose sides are represented by the vectors $\hat{j}+3\hat{k}$ and $\hat{i}+2\hat{j}-\hat{k}$ is

(a) $\sqrt{61}$ sq.unit (b) $\sqrt{59}$ sq.unit (c) $\sqrt{49}$ sq.unit (d) $\sqrt{52}$ sq.unit

95. The area of the triangle formed by $2\hat{i}+\hat{j}-\hat{k}$ and $\hat{i}+\hat{j}+\hat{k}$ is

(a) 3 sq.unit (b) $2\sqrt{3}$ sq. unit (c) $2\sqrt{14}$ sq. unit (d) $\frac{\sqrt{14}}{2}$ sq. unit

96. The position of a particle is given by $\vec{r}=(\vec{i}+2\vec{j}-\vec{k})$ momentum $\vec{P}=(3\vec{i}+4\vec{j}-2\vec{k})$. The angular momentum is perpendicular to **[EAMCET (Engg.) 1998]**

(a) x-axis (b) y-axis

(c) z-axis (d) Line at equal angles to all the three axes

97. Two vector A and B have equal magnitudes. Then the vector $A+B$ is perpendicular to

(a) $A\times B$ (b) $A-B$ (c) $3A-3B$ (d) All of these

98. Find the torque of a force $\vec{F}=-3\hat{i}+\hat{j}+5\hat{k}$ acting at the point $\vec{r}=7\hat{i}+3\hat{j}+\hat{k}$ **[CPMT 1997]**

(a) $14\hat{i}-38\hat{j}+16\hat{k}$ (b) $4\hat{i}+4\hat{j}+6\hat{k}$ (c) $21\hat{i}+4\hat{j}+4\hat{k}$ (d) $-14\hat{i}+34\hat{j}-16\hat{k}$

99. The value of $(\vec{A}+\vec{B})\times(\vec{A}-\vec{B})$ is **[RPET 1991]**

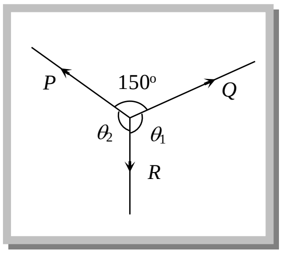
(a) 0 (b) A^2-B^2 (c) $\vec{B}\times\vec{A}$ (d) $2(\vec{B}\times\vec{A})$

100. A particle of mass $m = 5$ is moving with a uniform speed $v=3\sqrt{2}$ in the XOY plane along the line $Y=X+4$. The magnitude of the angular momentum of the particle about the origin is **[CBSE PMT 1990]**

(a) 60 units (b) $40\sqrt{2}$ units (c) Zero (d) 7.5 units

Problems based on Lami's theorem

101. P, Q and R are three coplanar forces acting at a point and are in equilibrium. Given P = 1.9318 *kg wt,* $\sin\theta_1=0.9659$, the value of R is (in *kg wt*) **[CET 1998]**



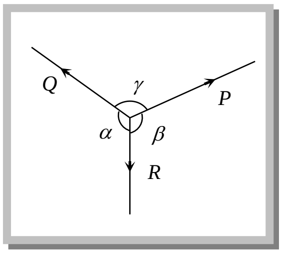
(a) 0.9659

(b) 2

(c) 1

(d) $\frac{1}{2}$

102. A body is in equilibrium under the action the action of three coplanar forces *P*, *Q* and *R* as shown in the figure. Select the correct statement



(a) $\frac{P}{\sin\alpha}=\frac{Q}{\sin\beta}=\frac{R}{\sin\gamma}$

(b) $\frac{P}{\cos\alpha}=\frac{Q}{\cos\beta}=\frac{R}{\cos\gamma}$

(c) $\frac{P}{\tan\alpha}=\frac{Q}{\tan\beta}=\frac{R}{\tan\gamma}$

(d) $\frac{P}{\sin\beta}=\frac{Q}{\sin\gamma}=\frac{R}{\sin\alpha}$

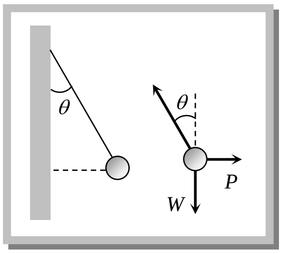
103. If a body is in equilibrium under a set of non-collinear forces, then the minimum number of forces has to be **[AIIMS 2000]**

(a) Four (b) Three (c) Two (d) Five

104. How many minimum number of non-zero vectors in different planes can be added to give zero resultant

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

105. A metal sphere is hung by a string fixed to a wall. The sphere is pushed away from the wall by a stick. The forces acting on the sphere are shown in the second diagram. Which of the following statements is wrong



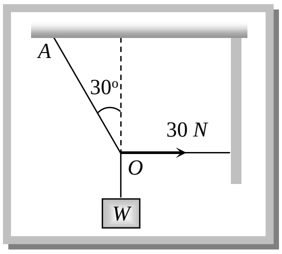
(a) $P=W\tan\theta$

(b) $\vec{T}+\vec{P}+\vec{W}=0$

(c) $T^2=P^2+W^2$

(d) $T=P+W$

106. As shown in figure the tension in the horizontal cord is 30 *N*. The weight *W* and tension in the string *OA* in Newton are **[DPMT 1992]**



(a) $30\sqrt{3}, 30$

(b) $30\sqrt{3}, 60$

(c) $60\sqrt{3}, 30$

(d) None of these

Problems based on relative velocity

107. A 150 m long train is moving to north at a speed of 10 m/s. A parrot flying towards south with a speed of 5 m/s crosses the train. The time taken by the parrot the cross to train would be: **[CBSE PMT 1992]**

(a) 30 s (b) 15 s (c) 8 s (d) 10 s

108. A swimmer can swim in still water with speed υ and the river is flowing with velocity *v*/2. To cross the river in shortest time, he should swim making angle θ with the upstream. What is the ratio of the time taken to swim across the shortest time to that is swimming across over shortest distance

(a) $\cos\theta$ (b) $\sin\theta$ (c) $\tan\theta$ (d) $\cot\theta$

109. The speed of a boat is 5 *km*/*h* in still water. It crosses a river of width 1 *km* along the shortest possible path in 15 minutes. The velocity of the river water is **[CBSE PMT 1998]**

(a) 1 *km*/*h* (b) 3 *km*/*h* (c) 4 km/h (d) 5 *km*/*h*

110. A river is flowing from east to west at a speed of 5 m/min. A man on south bank of river, capable of swimming 10m/min in still water, wants to swim across the river in shortest time. He should swim **[BHU 1998]**

(a) Due north

(b) Due north-east

(c) Due north-east with double the speed of river

(d) None of these

111. A person aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of 0.5 *m*/*s* at an angle of 120^0 with the direction of flow of water. The speed of water in the stream is **[CBSE PMT 1999]**

(a) 1 *m*/*s* (b) 0.5 *m*/*s* (c) 0.25 *m*/*s* (d) 0.433 *m*/*s*

112. A moves with 65 *km*/*h* while *B* is coming back of *A* with 80 *km*/*h*. The relative velocity of *B* with respect to *A* is **[AFMC 2000]**

(a) 80 *km*/*h* (b) 60 *km*/*h* (c) 15 *km*/*h* (d) 145 *km*/*h*

113. A man crosses a 320 *m* wide river perpendicular to the current in 4 minutes. If in still water he can swim with a speed 5/3 times that of the current, then the speed of the current, in *m*/*min* is **[Roorkee 1998]**

(a) 30 (b) 40 (c) 50 (d) 60.

114. A thief is running away on a straight road on a jeep moving with a speed of 9 *m*/*s*. A police man chases him on a motor cycle moving at a speed of 10 *m*/*s*. If the instantaneous separation of jeep from the motor cycle is 100 *m*, how long will it take for the policemen to catch the thief

(a) 1 second (b) 19 second (c) 90 second (d) 100 second

115. A bus is moving with a velocity 10 m/s on a straight road. A scooterist wishes to overtake the bus in 100 *s*. If the bus is at a distance of 1 *km* from the scooterist, with what velocity should the scooterist chase the bus

(a) 50 *m*/*s* (b) 40 *m*/*s* (c) 30 *m*/*s* (d) 20 *m*/*s*

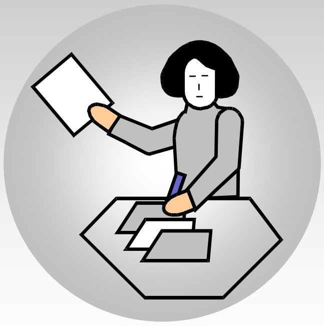
116. A man can swim with velocity *v* relative to water. He has to cross a river of width d flowing with a velocity *u* ($u > v$). The distance through which he is carried down stream by the river is *x*. Which of the following statement is correct

(a) If he crosses the river in minimum time $x = \frac{du}{v}$

(b) x can not be less than $\frac{du}{v}$

(c) For x to be minimum he has to swim in a direction making an angle of $\frac{\pi}{2} + \sin^{-1}\left(\frac{v}{u}\right)$ with the direction of the flow of water

(d) x will be max. if he swims in a direction making an angle of $\frac{\pi}{2} + \sin^{-1}\frac{v}{u}$ with direction of the flow of water



Answer Sheet (Practice problems)

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
b	d	b	d	d	c	a	b	c	c
11.	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
a	b	d	c	c	c	b	a	d	b
21.	**22.**	**23.**	**24.**	**25.**	**26.**	**27.**	**28.**	**29.**	**30.**
d	c	b	a	a	c	d	c	c	c
31.	**32.**	**33.**	**34.**	**35.**	**36.**	**37.**	**38.**	**39.**	**40.**
c	c	b	a	b	d	d	a	c	b
41.	**42.**	**43.**	**44.**	**45.**	**46.**	**47.**	**48.**	**49.**	**50.**
b	a	b	a	c	c	c	c	d	d
51.	**52.**	**53.**	**54.**	**55.**	**56.**	**57.**	**58.**	**59.**	**60.**
a	c	d	b	d	b	a	c	d	c
61.	**62.**	**63.**	**64.**	**65.**	**66.**	**67.**	**68.**	**69.**	**70.**
c	b	c	b	a	a	a	c	a	b
71.	**72.**	**73.**	**74.**	**75.**	**76.**	**77.**	**78.**	**79.**	**80.**
c	b	d	d	b	b	b	d	c	c
81.	**82.**	**83.**	**84.**	**85.**	**86.**	**87.**	**88.**	**89.**	**90.**
d	b	d	c	c	c	a	b	a	a
91.	**92.**	**93.**	**94.**	**95.**	**96.**	**97.**	**98.**	**99.**	**100.**
d	c	c	b	d	a	a	a	d	a
101.	**102.**	**103.**	**104.**	**105.**	**106.**	**107.**	**108.**	**109.**	**110.**
c	a	b	c	d	b	d	b	b	a
111.	**112.**	**113.**	**114.**	**115.**	**116.**				
c	c	a	d	d	a, c				