1. The ratio in which the line $3x + y - 9 = 0$ divides the segment joining the points $(1,3)$ and $(2,7)$, is
(a) $1:2$
(b) $4:3$
(c) $3:4$
(d) None of these

2. The points $(k, 2-2k), (-k+1, 2k)$ and $(-4-k, 6-2k)$ are collinear for
(a) all values of k
(b) $k = -1$ or $\frac{1}{2}$
(c) $k = -1$
(d) no values of k

3. If the coordinates of two opposite vertices of a square are $(6,-3)$ and $(-2,3)$, then area of square is
(a) 50 sq units
(b) 25 sq units
(c) 35 sq units
(d) None of these

4. Two vertices of a triangle are $(3,-5)$ and $(-7,4)$. If its centroid is $(2,-1)$. Then, the third vertex is
(a) $(10,2)$
(b) $(10,-2)$
(c) $(2,2)$
(d) None of these

5. If a vertex of a triangle is $(1,1)$ and the mid-points of two sides through this vertex are $(-1,2)$ and $(3,2)$, then the centroid of the triangle is
(a) $\left(\frac{1}{3}, \frac{7}{3}\right)$
(b) $\left(1, \frac{7}{3}\right)$
(c) $\left(-\frac{1}{3}, \frac{7}{3}\right)$
(d) $\left(-1, \frac{7}{3}\right)$

6. If the line $2x + y = k$ passes through the point which divides the line segment joining the points $(1,1)$ and $(2,4)$ in the ratio $3:2$, then k equals
(a) $\frac{29}{5}$
(b) 5
(c) 6
(d) $\frac{11}{5}$

7. A triangle with vertices $(4,0), (-1,-1)$ and $(3,5)$ is
(a) isosceles and right angled
(b) isosceles but not right angled
(c) right angled but not isosceles
(d) neither right angled nor isosceles

8. The incentre of the triangle with vertices $(1,\sqrt{3}), (0,0)$ and $(2,0)$ is
(a) $\left(1, \frac{\sqrt{3}}{2}\right)$
(b) $\left(\frac{2}{3}, \frac{1}{\sqrt{3}}\right)$
(c) $\left(\frac{2}{3}, \frac{\sqrt{3}}{2}\right)$
(d) $\left(1, \frac{1}{\sqrt{3}}\right)$

9. The vertices of a triangle are $A(0,0), B(0,2)$ and $C(2,0)$, then find the distance between its orthocentre and circumcentre.
(a) 0
(b) $\sqrt{2}$
(c) $\frac{1}{\sqrt{2}}$
(d) None of these

10. Orthocentre of the triangle formed by the lines $x - y = 0, x + y = 0$ and $x = 3$ is
(a) $(0,0)$
(b) $(3,0)$
(c) $(0,3)$
(d) Cannot be determined

11. If the distance between $(2,3)$ and $(-5,2)$ is equal to the distance between $(x,2)$ and $(1,3)$, then the values of x are
(a) $-6,8$
(b) $6,8$
(c) $-8,6$
(d) $-7,7$

12. Find the value of k for which the line $(k-3)x - (4-k^2)y + k^2 - 7k + 6 = 0$ is parallel to X-axis.

(a) 3
(b) 2
(c) 1
(d) None of these

13. A square is constructed on the portion of the line $x + y = 5$, which is intercepted between the axes on the side of the line away from origin. The equations to the diagonals of the square are
(a) $x - 5, y = -5$
(b) $x = 5, y = 5$
(c) $x = -5, y = 5$
(d) $x - y = 5, x - y = -5$

14. If $A(1,1), B(\sqrt{3}+1, 2)$ and $C(\sqrt{3}, \sqrt{3}+2)$ are three vertices of a square, then the diagonal through B is
(a) $y = (\sqrt{3}-2)x + (3-\sqrt{3})$
(b) $y = 0$

(c) $y = x$
(d) None of the above

15. The number of integer values of m for which the x-coordinate of the point of intersection of the lines $3x + 4y = 9$ and $y = mx + 1$ is also an integer, is
(a) 2
(b) 0
(c) 4
(d) 1

16. The perpendicular bisector of the line segment joining $P(1,4)$ and $Q(k, 3)$ has y-intercept -4 . Then, a possible value of k is
(a) -4
(b) 1
(c) 2
(d) -2

17. A straight line through the point $A(3,4)$ is such that its intercept between the axes is bisected at A. Its equation is
(a) $3x - 4y + 7 = 0$
(b) $4x + 3y = 24$
(c) $3x + 4y = 25$
(d) $x + y = 7$

18. If non-zero numbers a, b and c are in HP, then the straight line $\frac{x}{a} + \frac{y}{b} + \frac{1}{c} = 0$ always passes through a fixed point. That point is
(a) $\left(1, -\frac{1}{2}\right)$
(b) $(1, -2)$
(c) $(-1, -2)$
(d) $(-1,2)$

19. A straight line passes through the points $(5,0)$ and $(0,3)$. The length of perpendicular from the point $(4,4)$ on the line is
(a) $\frac{15}{\sqrt{34}}$
(b) $\frac{\sqrt{17}}{2}$
(c) $\frac{17}{2}$
(d) $\sqrt{\frac{17}{2}}$

20. If p is the length of the perpendicular from the origin to the line, whose intercepts with the coordinate axes are $\frac{1}{3}$ and $\frac{1}{4}$, then the value of p is
(a) $\frac{3}{4}$
(b) $\frac{1}{12}$
(c) 5
(d) 12
(e) $\frac{1}{5}$

21. A plane is parallel to XZ-plane, so it is perpendicular to
(a) X-axis
(b) Y-axis
(c) Z-axis
(d) None of the above

22. A point R with x-coordinate 4 lies on the line segment joining the points $P(2, -3,4)$ and $Q(8,0,10)$. Find the coordinates of the point R.
(a) $(4, -2, -6)$
(b) $(4,2,6)$
(c) $(4, -2,6)$
(d) None of these

23. Statement I The coordinates of the point which divides the line segment joining the points $(1, -2,3)$ and $(3,4, -5)$ in the ratio $2: 3$ internally, are $\left(\frac{9}{5}, \frac{2}{5}, -\frac{1}{5}\right)$.

Statement II The coordinates of the point which divides the line segment joining the points $(1, -2,3)$ and $(3,4, -5)$ in the ratio $2: 3$ externally, are $\left(\frac{19}{2}, \frac{5}{2}, \frac{-1}{2}\right)$.

24. The distance of the point $(1,0,2)$ from the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x - y + z = 16$ is
(a) $2\sqrt{14}$
(b) 8
(c) $3\sqrt{21}$
(d) 13

Directions (Q. Nos. 25-27) Consider the lines

$$L_1: \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+1}{2}; L_2: \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$$

25. The unit vector perpendicular to both L_1 and L_2 is
(a) $\frac{-\hat{\mathbf{i}}+7\hat{\mathbf{j}}+7\hat{\mathbf{k}}}{\sqrt{99}}$
(b) $\frac{-\hat{\mathbf{i}}-7\hat{\mathbf{j}}+5\hat{\mathbf{k}}}{5\sqrt{3}}$
(c) $\frac{-\hat{\mathbf{i}}+7\hat{\mathbf{j}}+5\hat{\mathbf{k}}}{5\sqrt{3}}$
(d) $\frac{7\hat{\mathbf{i}}-7\hat{\mathbf{j}}-\hat{\mathbf{k}}}{\sqrt{99}}$

26. The shortest distance between L_1 and L_2 is
(a) 0 unit

(b) $\frac{17}{\sqrt{3}}$ units
(c) $\frac{41}{5\sqrt{3}}$ units
(d) $\frac{17}{5\sqrt{3}}$ units

27. The distance of the point $(1,1,1)$ from the plane passing through the point $(-1,-2,-1)$ and whose normal is perpendicular to both the lines L_1 and L_2, is
(a) $\frac{2}{\sqrt{75}}$ unit
(b) $\frac{7}{\sqrt{75}}$ unit
(c) $\frac{13}{\sqrt{75}}$ units
(d) $\frac{23}{\sqrt{75}}$ units

28. The angle between the lines whose direction cosines satisfy the equations $l+m+n=0$ and $l^2=m^2+n^2$, is
(a) $\frac{\pi}{3}$
(b) $\frac{\pi}{4}$
(c) $\frac{\pi}{6}$
(d) $\frac{\pi}{2}$

29. The image of the line $\frac{x-1}{3}=\frac{y-3}{1}=\frac{z-4}{-5}$ in the plane $2x-y+z+3=0$ is the line
(a) $\frac{x+3}{3}=\frac{y-5}{1}=\frac{z-2}{-5}$
(b) $\frac{x+3}{-3}=\frac{y-5}{-1}=\frac{z+2}{5}$
(c) $\frac{x-3}{3}=\frac{y+5}{1}=\frac{z-2}{-5}$
(d) $\frac{x-3}{-3}=\frac{y+5}{-1}=\frac{z-2}{5}$

30. If the lines $\frac{x+1}{2}=\frac{y-1}{1}=\frac{z+1}{3}$ and $\frac{x+2}{2}=\frac{y-k}{3}=\frac{z}{4}$ are coplanar, then the value of k is
(a) $\frac{11}{2}$
(b) $-\frac{11}{2}$
(c) $\frac{9}{2}$
(d) $-\frac{9}{2}$

31. If the angle between the line $x=\frac{y-1}{2}=\frac{z-3}{\lambda}$ and the plane $x+2y+3z=4$ is $\cos^{-1}\left(\sqrt{\frac{5}{14}}\right)$, then λ is equal to
(a) $\frac{3}{2}$
(b) $\frac{2}{5}$
(c) $\frac{5}{3}$
(d) $\frac{2}{3}$

32. If $(2,3,5)$ is one end of a diameter of the sphere $x^2+y^2+z^2-6x-12y-2z+20=0$, then the coordinates of the other end of the diameter are
(a) $(4,9,-3)$
(b) $(4,-3,3)$
(c) $(4,3,5)$
(d) $(4,3,-3)$

33. The angle between the lines $2x=3y=-z$ and $6x=-y=-4z$ is
(a) 30°
(b) 45°
(c) 90°
(d) 0°

34. The plane $x+2y-z=4$ cuts the sphere $x^2+y^2+z^2-x+z-2=0$ in a circle of radius
(a) $\sqrt{2}$
(b) 2
(c) 1
(d) 3

35. The equation of the plane containing the line $\frac{x-x_1}{l}=\frac{y-y_1}{m}=\frac{z-z_1}{n}$ is $a(x-x_1)+b(y-y_1)+c(z-z_1)=0$, where
(a) $ax_1+by_1+cz_1=0$
(b) $al+bm+cn=0$
(c) $\frac{a}{l}=\frac{b}{m}=\frac{c}{n}$
(d) $lx_1+my_1+nz_1=0$

36. If $\mathbf{a}=\hat{\mathbf{i}}-2\hat{\mathbf{j}}+3\hat{\mathbf{k}}$ and $\mathbf{b}$ is a vector such that $\mathbf{a}\cdot\mathbf{b}=|\mathbf{b}|^2$ and $|\mathbf{a}-\mathbf{b}|=\sqrt{7}$, then $|\mathbf{b}|$ is equal to
(a) $\sqrt{7}$
(b) $\sqrt{3}$
(c) 7
(d) 3
(e) $7\sqrt{3}$

37. If $|\mathbf{a}|=1, |\mathbf{b}|=4, \mathbf{a}\cdot\mathbf{b}=2$ and $\mathbf{c}=2\mathbf{a}\times\mathbf{b}-3\mathbf{b}$, then the angle between $\mathbf{b}$ and $\mathbf{c}$ is
(a) $\frac{\pi}{6}$
(b) $\frac{5\pi}{6}$
(c) $\frac{\pi}{3}$
(d) $\frac{2\pi}{3}$

38. Let $\hat{\mathbf{a}}$ and $\hat{\mathbf{b}}$ be two unit vectors. If the vectors $\mathbf{c}=\hat{\mathbf{a}}+2\hat{\mathbf{b}}$ and $\mathbf{d}=5\hat{\mathbf{a}}-4\hat{\mathbf{b}}$ are perpendicular to each other, then the angle between $\hat{\mathbf{a}}$ and $\hat{\mathbf{b}}$ is

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

39. If $\mathbf{a} = \frac{1}{\sqrt{10}}(3\hat{\mathbf{i}} + \hat{\mathbf{k}})$ and $\mathbf{b} = \frac{1}{7}(2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} - 6\hat{\mathbf{k}})$, then the value of $(2\mathbf{a} - \mathbf{b}) \cdot \{(\mathbf{a} \times \mathbf{b}) \times (\mathbf{a} + 2\mathbf{b})\}$ is
(a) -3
(b) 5
(c) 3
(d) -5

40. If $|\mathbf{a}| = 1, |\mathbf{b}| = 4, \mathbf{a} \cdot \mathbf{b} = 2$ and $\mathbf{c} = 2\mathbf{a} \times \mathbf{b} - 3\mathbf{b}$, then the angle between $\mathbf{b}$ and $\mathbf{c}$ is
(a) $\frac{\pi}{6}$
(b) $\frac{5\pi}{6}$
(c) $\frac{\pi}{3}$
(d) $\frac{2\pi}{3}$

41. The area of the parallelogram whose adjacent sides are $\hat{\mathbf{i}} + \hat{\mathbf{k}}$ and $2\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$, is
(a) 3
(b) $\sqrt{2}$
(c) 4
(d) $\sqrt{3}$

42. The angle between the vectors $\mathbf{a} = \hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ and $\mathbf{b} = \hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ is
(a) $\sin^{-1}\left(\frac{1}{9}\right)$
(b) $\cos^{-1}\left(\frac{8}{9}\right)$
(c) $\sin^{-1}\left(\frac{8}{9}\right)$
(d) $\cos^{-1}\left(\frac{1}{9}\right)$

43. A unit vector perpendicular to both $\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$ and $2\hat{\mathbf{i}} + \hat{\mathbf{j}} + 3\hat{\mathbf{k}}$ is
(a) $(2\hat{\mathbf{i}} - \hat{\mathbf{j}} - \hat{\mathbf{k}})\sqrt{6}$
(b) $\frac{(2\hat{\mathbf{i}} - \hat{\mathbf{j}} - \hat{\mathbf{k}})}{\sqrt{6}}$
(c) $2\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$
(d) $\frac{3\hat{\mathbf{i}} + \hat{\mathbf{j}} - 2\hat{\mathbf{k}}}{\sqrt{6}}$

44. If $|\mathbf{a}| = 5, |\mathbf{b}| = 6$ and $\mathbf{a} \cdot \mathbf{b} = -25$, then $|\mathbf{a} \times \mathbf{b}|$ is equal to
(a) 25
(b) $6\sqrt{11}$
(c) $11\sqrt{5}$
(d) $11\sqrt{6}$
(e) $5\sqrt{11}$

45. If the vectors $\mathbf{a} = 2\hat{\mathbf{i}} + \hat{\mathbf{j}} + 4\hat{\mathbf{k}}, \mathbf{b} = 4\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$ and $\mathbf{c} = 2\hat{\mathbf{i}} - 3\hat{\mathbf{j}} - \lambda\hat{\mathbf{k}}$ are coplanar, then the value of λ is
(a) 2
(b) 1
(c) 3
(d) -1
(e) 0

46. If $\mathbf{a} = \hat{\mathbf{j}} - \hat{\mathbf{k}}$ and $\mathbf{c} = \hat{\mathbf{i}} - \hat{\mathbf{j}} - \hat{\mathbf{k}}$. Then, the vector $\mathbf{b}$ satisfying $\mathbf{a} \times \mathbf{b} + \mathbf{c} = 0$ and $\mathbf{a} \cdot \mathbf{b} = 3$, is
(a) $-\hat{\mathbf{i}} + \hat{\mathbf{j}} - 2\hat{\mathbf{k}}$
(b) $2\hat{\mathbf{i}} - \hat{\mathbf{j}} + 2\hat{\mathbf{k}}$
(c) $\hat{\mathbf{i}} - \hat{\mathbf{j}} - 2\hat{\mathbf{k}}$
(d) $\hat{\mathbf{i}} + \hat{\mathbf{j}} - 2\hat{\mathbf{k}}$

47. If $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are three vectors, such that $\mathbf{a} + \mathbf{b} + \mathbf{c} = 0, |\mathbf{a}| = 1, |\mathbf{b}| = 2, |\mathbf{c}| = 3$, then $\mathbf{a} \cdot \mathbf{b} + \mathbf{b} \cdot \mathbf{c} + \mathbf{c} \cdot \mathbf{a}$ is equal to
(a) 0
(b) -7
(c) 7
(d) 1

48. Consider points A, B, C and D with position vectors $7\hat{\mathbf{i}} - 4\hat{\mathbf{j}} + 7\hat{\mathbf{k}}, \hat{\mathbf{i}} - 6\hat{\mathbf{j}} + 10\hat{\mathbf{k}}, -\hat{\mathbf{i}} - 3\hat{\mathbf{j}} + 4\hat{\mathbf{k}}$ and $5\hat{\mathbf{i}} - \hat{\mathbf{j}} + 5\hat{\mathbf{k}}$, respectively. Then, $ABCD$ is a
(a) square
(b) rhombus
(c) rectangle
(d) None of the above

49. If $|\mathbf{a}| = 7, |\mathbf{b}| = 11, |\mathbf{a} + \mathbf{b}| = 10\sqrt{3}$, then $|\mathbf{a} - \mathbf{b}|$ equals
(a) 10
(b) $\sqrt{10}$
(c) $2\sqrt{10}$
(d) 20

50. The vector $\mathbf{c}$, directed along the internal bisector of the angle between the vectors $\mathbf{a} = 7\hat{\mathbf{i}} - 4\hat{\mathbf{j}} - 4\hat{\mathbf{k}}$ and $\mathbf{b} = -2\hat{\mathbf{i}} - \hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ with $|\mathbf{c}| = 5\sqrt{6}$, is
(a) $\frac{5}{3}(\hat{\mathbf{i}} - 7\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$
(b) $\frac{5}{3}(5\hat{\mathbf{i}} + 5\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$
(c) $\frac{5}{3}(\hat{\mathbf{i}} + 7\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$
(d) $\frac{5}{3}(-5\hat{\mathbf{i}} + 5\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$