3D ASSIGNMENT

1. The angle between two diagonals of a cube will be

(a) $\sin^{-1}\frac{1}{3}$ (b) $\cos^{-1}\frac{1}{3}$ (c) Constant (d) Variable

2. If a line makes angles $\alpha, \beta, \gamma, \delta$ with the four diagonals of a cube, then the value of $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta=$

(a) 1 (b) $\frac{4}{3}$ (c) Constant (d) Variable

3. The angle between the lines whose direction cosines satisfy the equations $l+m+n=0, l^2+m^2-n^2=0$ is given by

(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{5\pi}{6}$ (d) $\frac{\pi}{3}$

4. If three mutually perpendicular lines have direction cosines $(l_1, m_1, n_1), (l_2, m_2, n_2)$, and (l_3, m_3, n_3), then the line having direction cosines $l_1+l_2+l_3, m_1+m_2+m_3$ and $n_1+n_2+n_3$ make an angle of ……….with each other

(a) 0° (b) 30° (c) 60° (d) 90°

5. The straight lines whose direction cosines are given by $al+bm+cn=0,\ fmn+gnl+hlm=0$ are perpendicular, if

(a) $\frac{f}{a}+\frac{g}{b}+\frac{h}{c}=0$ (b) $\sqrt{\frac{a}{f}}+\sqrt{\frac{b}{g}}+\sqrt{\frac{c}{h}}=0$ (c) $\sqrt{af}=\sqrt{bg}=\sqrt{ch}$ (d) $\sqrt{\frac{a}{f}}=\sqrt{\frac{b}{g}}=\sqrt{\frac{c}{h}}$

6. The angle between the lines whose direction cosines are connected by the relations $l+m+n=0$ and $2lm+2nl-mn=0$, is

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

7. $A(3, 2, 0), B(5, 3, 2), C(-9, 6, -3)$ are three points forming a triangle and *AD* is the bisector of the $\angle BAC$, then coordinates of *D* are

(a) $\left(\frac{17}{16}, \frac{57}{16}, \frac{28}{16}\right)$ (b) $\left(\frac{38}{16}, \frac{57}{16}, \frac{17}{16}\right)$ (c) $\left(\frac{38}{16}, \frac{17}{16}, \frac{57}{16}\right)$ (d) $\left(\frac{57}{16}, \frac{38}{16}, \frac{17}{16}\right)$

8. The direction cosines of two lines at right angles are $<l_1, m_1, n_1>$ and $<l_2, m_2, n_2>$. Then the d.c. of a line $\perp$ to both the given lines are

(a) $<m_1n_2-m_2n_1, n_1l_2-n_2l_1, l_1m_2-l_2m_1>$ (b) $<l_1+l_2, m_1+m_2, n_1+n_2>$

(c) $<l_1-l_2, m_1-m_2, n_1-n_2>$ (d) None of these

9. Three lines drawn from origin with direction cosines $l_1, m_1, n_1; l_2, m_2, n_2; l_3, m_3, n_3$ are coplanar iff $\begin{vmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{vmatrix}=0$, since

(a) All lines pass through origin (b) It is possible to find a line perpendicular to all these lines

(c) Intersecting lines are coplanar (d) None of these

10. The direction cosines of a variable line in two adjacent positions are l, m, n and $l+\delta l, m+\delta m, n+\delta n$. If angle between these two positions is $\delta\theta$, where $\delta\theta$ is a small angle, then $\delta\theta^2$ is equal to

(a) $\delta l^2+\delta m^2+\delta n^2$ (b) $\delta l+\delta m+\delta n$ (c) $\delta l\,.\,\delta m+\delta m\,.\,\delta n+\delta n\,.\,\delta l$ (d) None of these

11. If direction cosines of two lines *OA* and *OB* are respectively proportional to 1, –2, –1 and 3, –2, 3 then direction cosine of line perpendicular to given both lines are

(a) $\pm 4/\sqrt{29}, \pm 3/\sqrt{29}, \pm 2/\sqrt{29}$, (b) $\pm 4/\sqrt{29}, \pm 3/\sqrt{29}, \mp 2/\sqrt{29}$

(c) $\pm 4/\sqrt{29}, \pm 2/\sqrt{29}, \pm 3/\sqrt{29}$, (d) None of these

12. A mirror and a source of light are situated at the origin *O* and at a point on *OX* respectively. A ray of light from the source strikes the mirror and is reflected. If the d.r'.s of the normal to the plane are 1, –1, 1, then d.c'.s of the reflected ray are

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

13. The equation of the line passing through the point (1, 2, –4) and perpendicular to the two lines $\frac{x-8}{2}=\frac{y+19}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{-2}=\frac{y-29}{8}=\frac{z-5}{-5}$, will be

(a) $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z+4}{6}$ (b) $\frac{x-1}{-2}=\frac{y-2}{3}=\frac{z+4}{8}$ (c) $\frac{x-1}{3}=\frac{y-2}{2}=\frac{z+4}{8}$ (d) None of these

14. The equation of straight line $3x+2y-z-4=0$; $4x+y-2z+3=0$ in the symmetrical form is

(a) $\frac{x-2}{3}=\frac{y-5}{2}=\frac{z}{5}$ (b) $\frac{x+2}{3}=\frac{y-5}{-2}=\frac{z}{5}$ (c) $\frac{x+2}{3}=\frac{y-5}{2}=\frac{z}{5}$ (d) None of these

15. The point of intersection of lines $\frac{x-4}{5}=\frac{y-1}{2}=\frac{z}{1}$ and $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ is

(a) $(-1, -1, -1)$ (b) $(-1, -1, 1)$ (c) $(1, -1, -1)$ (d) $(-1, 1, -1)$

16. The length and foot of the perpendicular from the point $(2, -1, 5)$ to the line $\frac{x-11}{10}=\frac{y+2}{-4}=\frac{z+8}{-11}$ are

(a) $\sqrt{14}, (1, 2, -3)$ (b) $\sqrt{14}, (1, -2, 3)$ (c) $\sqrt{14}, (1, 2, 3)$ (d) None of these

17. The perpendicular distance of the point (2, 4, –1) from the line $\frac{x+5}{1}=\frac{y+3}{4}=\frac{z-6}{-9}$ is

(a) 3 (b) 5 (c) 7 (d) 9

18. Distance of the point (x_1, y_1, z_1) from the line $\frac{x-x_2}{l}=\frac{y-y_2}{m}=\frac{z-z_2}{n}$, where *l, m* and *n* are the direction cosines of line is

(a) $\sqrt{(x_1-x_2)^2+(y_1-y_2)^2+(z_1-z_2)^2-[l(x_1-x_2)+m(y_1-y_2)+n(z_1-z_2)]^2}$

(b) $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2}$

(c) $\sqrt{(x_2-x_1)l+(y_2-y_1)m+(z_2-z_1)n}$

(d) None of these

19. The length of the perpendicular from point (1, 2, 3) to the line $\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$ is

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

20. The foot of the perpendicular from (0, 2, 3) to the line $\frac{x+3}{5}=\frac{y-1}{2}=\frac{z+4}{3}$ is

(a) (–2, 3, 4) (b) (2, –1, 3) (c) (2, 3, –1) (d) (3, 2, –1)

21. The foot of the perpendicular from (1, 2, 3) to the line joining the points (6, 7, 7) and (9, 9, 5) is

(a) (5, 3, 9) (b) (3, 5, 9) (c) (3, 9, 5) (d) (3, 9, 9)

22. If the equation of a line through a point **a** and parallel to vector **b** is $\mathbf{r}=\mathbf{a}+t\mathbf{b}$, where *t* is a parameter, then its perpendicular distance from the point **c** is

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

23. The distance of the point $B(\mathbf{i}+2\mathbf{j}+3\mathbf{k})$ from the line which is passing through $A(4\mathbf{i}+2\mathbf{j}+2\mathbf{k})$ and which is parallel to the vector $\vec{C}=2\mathbf{i}+3\mathbf{j}+6\mathbf{k}$ is

(a) 10 (b) $\sqrt{10}$ (c) 100 (d) None of these

24. A variable plane at a constant distance *p* from origin meets the coordinate axes in *A, B, C*. Through these points planes are drawn parallel to coordinate planes. Then locus of the point of intersection is

(a) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}$ (b) $x^2+y^2+z^2=p^2$ (c) $x+y+z=p$ (d) $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=p$

25. A variable plane is at a constant distance *p* from the origin and meets the axes in *A, B* and *C,* then the locus of the centroid of the triangle *ABC* is

(a) $x^{-2}+y^{-2}+z^{-2}=p^{-2}$ (b) $x^{-2}+y^{-2}+z^{-2}=9p^{-2}$ (c) $x^{-2}+y^{-2}+z^{-2}=p^2$ (d) None of these

26. The equation of the plane which bisects line joining (2, 3, 4) and (6, 7, 8) is

(a) $x+y+z-15=0$ (b) $x-y+z-15=0$ (c) $x-y-z-15=0$ (d) $x+y+z+15=0$

27. The equation of the plane which bisects the line joining the points (–1, 2, 3) and (3, –5, 6) at right angle, is

(a) $4x-7y-3z=8$ (b) $4x-7y-3z=28$ (c) $4x-7y+3z=28$ (d) $4x+2y-3z=28$

28. *P* is a fixed point (*a, a, a*) on a line through the origin equally inclined to the axes, then any plane through *P* perpendicular to *OP*, makes intercepts on the axes, the sum of whose reciprocals is equal to

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

29. If from a point *P* (*a, b, c*) perpendiculars *PA* and *PB* are drawn to *yz* and *zx* planes, then the equation of the plane *OAB* is

(a) $bcx + cay + abz = 0$ (b) $bcx + cay - abz = 0$ (c) $bcx - cay + abz = 0$ (d) $-bcx + cay + abz = 0$

30. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction ratios of two intersecting lines, then the direction ratios of lines through them and coplanar with them are given by

(a) $l_1 + km_1, l_2 + km_2, l_3 + km_3$ (b) $kl_1 l_2, km_1 m_2, kn_1 n_2$

(c) $l_1 + kl_2, m_1 + km_2, n_1 + kn_2$ (d) $\frac{kl_1}{l_2}, \frac{km_1}{m_2}, \frac{kn_1}{n_2}$, *k* being a number whatsoever

31. The four points (0, 4, 3), (–1, –5, –3), (–2, –2, 1) and (1, 1, –1) lie in the plane

(a) $4x + 3y + 2z - 9 = 0$ (b) $9x - 5y + 6z + 2 = 0$ (c) $3x + 4y + 7z - 5 = 0$ (d) None of these

32. A plane meets the coordinate axes at *A, B, C* such that the centre of the triangle is (3, 3, 3). The equation of the plane is

(a) $x + y + z = 3$ (b) $x + y + z = 9$ (c) $3x + 3y + 3z = 1$ (d) $9x + 9y + 9z = 1$

33. Two system of rectangular axes have the same origin. If a plane cuts them at distance *a, b,c* and *a', b', c'* from the origin, then

(a) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} + \frac{1}{a'^2} + \frac{1}{b'^2} + \frac{1}{c'^2} = 0$ (b) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} + \frac{1}{a'^2} + \frac{1}{b'^2} - \frac{1}{c'^2} = 0$

(c) $\frac{1}{a^2} - \frac{1}{b^2} - \frac{1}{c^2} + \frac{1}{a'^2} - \frac{1}{b'^2} - \frac{1}{c'^2} = 0$ (d) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} - \frac{1}{a'^2} - \frac{1}{b'^2} - \frac{1}{c'^2} = 0$

34. Which one of the following is the best condition for the plane $ax + by + cz + d = 0$ to intersect the *x* and *y* axes at equal angle

(a) $|a| = |b|$ (b) $a = -b$ (c) $a = b$ (d) $a^2 + b^2 = 1$

35. If the equation $2x^2 - 2y^2 + 4z^2 + 6xz + 2yz + 3xy = 0$ represents a pair of planes, then the angle between the pair of planes is

(a) $\cos^{-1}(4/9)$ (b) $\cos^{-1}(4/21)$ (c) $\cos^{-1}(4/17)$ (d) $\cos^{-1}(2/3)$

36. The points $A(-1, 3, 0), B(2, 2, 1)$ and $C(1, 1, 3)$ determine a plane. The distance from the plane to the point $D(5, 7, 8)$ is

(a) $\sqrt{66}$ (b) $\sqrt{71}$ (c) $\sqrt{73}$ (d) $\sqrt{76}$

37. The length and foot of the perpendicular from the point (7, 14, 5) to the plane $2x + 4y - z = 2$, are

(a) $\sqrt{21}, (1, 2, 8)$ (b) $3\sqrt{21}, (3, 2, 8)$ (c) $21\sqrt{3}, (1, 2, 8)$ (d) $3\sqrt{21}, (1, 2, 8)$

38. The distance of the point (1, 1, 1) from the plane passing through the points (2, 1, 1), (1, 2, 1) and (1, 1, 2) is

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

39. Perpendicular is drawn from the point (0, 3, 4) to the plane $2x - 2y + z = 10$. The coordinates of the foot of the perpendicular are

(a) $(-8/3, 1/3, 16/3)$ (b) $(8/3, 1/3, 16/3)$ (c) $(8/3, -1/3, 16/3)$ (d) $(8/3, 1/3, -16/3)$

40. The equation of the plane containing the lines $\mathbf{r} - \mathbf{a} = t\,\mathbf{b}$ and $\mathbf{r} - \mathbf{b} = s\,\mathbf{a}$ is

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

41. Let the points *P, Q* and *R* have position vectors $\mathbf{r}_1 = 3\mathbf{i} - 2\mathbf{j} - \mathbf{k}$; $\mathbf{r}_2 = \mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ and $\mathbf{r}_3 = 2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ relative to an origin *O*. The distance of *P* from the plane *OQR* is

(a) 2 (b) 3 (c) 1 (d) 5

42. The projection of the point (1, 3, 4) on the plane $\mathbf{r}.(2\mathbf{i} - \mathbf{j} + \mathbf{k}) + 3 = 0$ is

(a) (1, 3, 4) (b) (–3, 5, 2) (c) (–1, 4, 3) (d) None of these

43. If $\mathbf{r}.(2\mathbf{i} - \mathbf{j} + \mathbf{k}) + \frac{3}{2} = 0$ is the equation of plane and $\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ is a point, then a point equidistant from the plane on the opposite side is

(a) $\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$ (b) $3\mathbf{i} + \mathbf{j} + \mathbf{k}$ (c) $3\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$ (d) $3(\mathbf{i} + \mathbf{j} + \mathbf{k})$

44. If (p_1, q_1, r_1) be the image of (p, q, r) in the plane $ax + by + cz + d = 0$, then

(a) $\frac{p_1 - p}{a} = \frac{q_1 - q}{b} = \frac{r_1 - r}{c}$ (b) $a(p + p_1) + b(q + q_1) + c(r + r_1) + 2d = 0$

(c) Both (a) and (b) (d) None of these

45. A straight line passes through the point (2, –1, –1). It is parallel to the plane $4x + y + z + 2 = 0$ and is perpendicular to the line $x/1 = y/(-2) = (z-5)/1$. The equation of the straight line are

(a) $(x-2)/4 = (y+1)/1 = (z+1)/1$ (b) $(x+2)/4 = (y-1)/1 = (z-1)/3$

(c) $(x-2)/(-1) = (y+1)/1 = (z+1)/3$ (d) $(x+2)/(-1) = (y-1)/1 = (z-1)/3$

46. The equations of the projection of the line $\frac{x-1}{2}=\frac{y-2}{1}=\frac{z-3}{3}$ on the plane $x+y+z-1=0$ are

(a) $x+y+z-1=0=2x-y-z+3$

(b) $x+y-z-1=0=x+2y-z-3$

(c) $2x-y+3z-1=0=x+y+z+1$

(d) $x+2y-3z=0=x+y+z+1$

47. If a plane passes through the point (1, 1, 1) and is perpendicular to the line $\frac{x-1}{3}=\frac{y-1}{0}=\frac{z-1}{4}$, then its perpendicular distance from the origin is

(a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{7}{5}$ (d) 1

48. The line $\frac{x-2}{3}=\frac{y+1}{2}=\frac{z-1}{-1}$ intersects the curve $xy=c^2, z=0$ if $c=$

(a) ± 1 (b) $\pm 1/3$ (c) $\pm\sqrt{5}$ (d) None of these

49. The points on the line $\frac{x+1}{1}=\frac{y+3}{3}=\frac{z-2}{-2}$ distant $\sqrt{(14)}$ from the point in which the line meets the plane $3x+4y+5z-5=0$ are

(a) (0, 0, 0), (2, –4, 6) (b) (0, 0, 0), (3, –4, –5) (c) (0, 0, 0), (2, 6, –4) (d) (2, 6, –4), (3, –4, –5)

50. The angle between the line $\mathbf{r}=(\mathbf{i}+2\mathbf{j}-\mathbf{k})+\lambda(\mathbf{i}-\mathbf{j}+\mathbf{k})$ and the normal to the plane $\mathbf{r}.(2\mathbf{i}-\mathbf{j}+\mathbf{k})=4$ is

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