JEE MAIN + ADVANCED

MATHEMATICS

TOPIC NAME

3-D COORDINATE GEOMETRY

(PRACTICE SHEET)

LEVEL-1

Question based on: Distance between two points

Q.1 The points A(1, –1, – 5), B(3, 1, 3) and C(9, 1, –3) are the vertices of-
(A) an equilateral triangle
(B) an isosceles triangle
(C) a right angled triangle
(D) none of these

Q.2 Distance of the point (x, y, z) from y-axis is-
(A) y (B) $\sqrt{x^2+y^2}$
(C) $\sqrt{y^2+z^2}$ (D) $\sqrt{z^2+x^2}$

Q.3 The distance of a point P(x, y, z) from yz plane is-
(A) x (B) y
(C) z (D) x + y + z

Q.4 The co-ordinates of the point which are lie equally distance from the point (0, 0, 0); (a, 0, 0) ; (0, b, 0) and (0, 0, c)
(A) (a/2, b/2, c/2) (B) (–a/2, b/2, c/2)
(C) (–a/2, –b/2, c/2) (D) (a/2, –b/2, –c/2)

Q.5 Distance of the point (a, b, c) from z- axis is -
(A) $\sqrt{a^2+b^2}$ (B) $\sqrt{b^2+c^2}$
(C) $\sqrt{c^2+a^2}$ (D) c

Q.6 The point on xy-plane which is equidistant from the points (2, 0, 3), (0, 3, 2), (0, 0, 1) is-
(A) (2, 3, 0) (B) (3, 0, 2)
(C) (3, 2, 0) (D) (2, 3, 1)

Q.7 The point which lie on z -axis has the following condition-
(A) z - coordinate are zero
(B) both x and y coordinate are zero
(C) both y and z coordinate are zero
(D) both x and z coordinate are zero

Q.8 The distance of the point (1, 2, 3) from x-axis is
(A) $\sqrt{13}$ (B) $\sqrt{5}$
(C) $\sqrt{10}$ (D) None of these

Q.9 If P ≡ (0, 5, 6), Q ≡ (2, 1, 2), R ≡ (a, 3, 4) and PQ = QR then 'a' equal to-
(A) 1 (B) 2
(C) 3 (D) None of these

Q.10 Points (1, 2, 3); (3, 5, 7) and (–1, –1, –1) are-
(A) vertices of a equilateral triangle
(B) vertices of a right angle triangle
(C) vertices of a isosceles triangle
(D) collinear

Q.11 If the vertices of points A, B, C of a tetrahedron ABCD are respectively (1, 2, 3) ; (–1, 2, 3), (1, –2, 3) and his centroid is (0, 0, 3/2) then co-ordinate of point D are-
(A) (1, 2, –3) (B) (–1, –2, 3)
(C) (–1, –2, –3) (D) (0, 0, 0)

Q.12 The distance of point (1, 2, 3) from coordinate axis are-
(A) 1, 2 , 3 (B) $\sqrt{5}, \sqrt{10}, \sqrt{13}$
(C) $\sqrt{10}, \sqrt{13}, \sqrt{5}$ (D) $\sqrt{13}, \sqrt{10}, \sqrt{5}$

Q.13 The coordinates of the points A and B are (–2, 2, 3) and (13, –3, 13) respectively. A point P moves so that 3PA = 2 PB, then locus of P is-
(A) $x^2 + y^2 + z^2 + 28x – 12y + 10z – 247 = 0$
(B) $x^2 + y^2 + z^2 + 28x – 12y + 10z + 247 = 0$
(C) $x^2 + y^2 + z^2 – 28x + 12y – 10z – 247 = 0$
(D) None of these

Q.14 A point which lie in yz plane, the sum of co-ordinate is 3, if distance of point from xz plane is twice the distance of point from xy plane, then co-ordinates are-

(A) (1, 2, 0) (B) (0, 1, 2)
(C) (0, 2, 1) (D) (2, 0, 1)

Q.15 A point located in space is moves in such a way that sum of distance from xy and yz plane is equal to distance from zx plane the locus of the point are-

(A) $x - y + z = 2$ (B) $x + y - z = 0$
(C) $x + y - z = 2$ (D) $x - y + z = 0$

Q.16 A (1, 3, 5) and B (– 2, 3, – 4) are two points, A point P moves such that $PA^2 - PB^2 = 6c$, then locus of P is-

(A) $x + 3z + 1 - c = 0$
(B) $x + 3z - 1 + c = 0$
(C) $2x + 3z + 1 - c = 0$
(D) $2x + 3z - 1 + c = 0$

Q.17 The locus of the point which moves such that its distance from (1, –2, 2) is unity, is-

(A) $x^2 + y^2 + z^2 - 2x + 4y + 4z + 8 = 0$
(B) $x^2 + y^2 + z^2 - 2x - 4y - 4z + 8 = 0$
(C) $x^2 + y^2 + z^2 + 2x + 4y + 4z + 8 = 0$
(D) $x^2 + y^2 + z^2 - 2x + 4y - 4z + 8 = 0$

Q.18 If distance of any point from z - axis is thrice its distance from xy-plane, then its locus is-

(A) $x^2 + y^2 - 9z^2 = 0$ (B) $y^2 + z^2 - 9x^2 = 0$
(C) $x^2 - 9y^2 + z^2 = 0$ (D) $x^2 + y^2 + z^2 = 0$

Q.19 The points (1, 2, 3), (– 1, – 2, – 1), (2, 3, 2) and (4, 7, 6) form a-

(A) rectangle (B) square
(C) parallelogram (D) rhombus

Q.20 If BC, CA and AB are the sides of a triangle ABC whose midpoints are (p, 0, 0), (0, q, 0), (0, 0, r) then find $\dfrac{(AB)^2 + (BC)^2 + (CA)^2}{p^2 + q^2 + r^2}$ -

(A) 8 (B) 6 (C) 5 (D) 2

Question based on Coordinates of division point

Q.21 Find the ratio in which the segment joining the points (2, 4, 5), (3, 5, –4) is divided by the yz-plane.

(A) 3 : 1 (B) – 2 : 3
(C) – 1 : 3 (D) 1 : 2

Q.22 Find the ratio in which the segment joining (1, 2, –1) and (4, –5, 2) is divided by the plane $2x - 3y + z = 4$.

(A) 2 : 1 (B) 3 : 2
(C) 3 : 7 (D) 1 : 2

Q.23 If points A (3, 2, –4); B(5,4, –6) and C(9, 8,–10) are collinear then B divides AC in the ratio-

(A) 2 : 1 (B) 1 : 2
(C) 2 : 3 (D) 3 : 2

Q.24 If zx plane divides the line joining the points (1, –1, 5) and (2, 3, 4) in the ratio λ:1 then λ equals to-

(A) 1/3 (B) 3
(C) –3 (D) –1/3

Q.25 OABC is a tetrahedron whose vertices are O (0, 0, 0); A (a, 2, 3); B (1, b, 2) and C (2, 1, c) if its centroid is (1, 2, –1) then distance of point (a, b, c) from origin are-

(A) $\sqrt{14}$ (B) $\sqrt{107}$
(C) $\sqrt{107/14}$ (D) None of these

Q.26 If A(1, 2, –1) and B (–1, 0, 1) are two points then co-ordinate of points which divide AB externally in the ratio of 1 : 2

(A) (3, 4, –3) (B) $\frac{1}{3}$ (3, 4, –3)
(C) $\frac{1}{3}$ (1, 4, –1) (D) None of these

Q.27 The ratio in which the yz-plane divides the join of the points (–2, 4, 7) and (3, –5, 8) is-

(A) 2 : 3 (B) 3 : 2

(C) –2 : 3 (D) 4 : –3

Q.28 A (3, 2, 0), B (5, 3, 2) and C (–9, 6, –3) are vertices of a triangle ABC. If the bisector of $\angle$A meets BC at D, then its coordinates are-

(A) $\left(\frac{19}{8}, \frac{57}{16}, \frac{17}{16}\right)$ (B) $\left(-\frac{19}{8}, \frac{57}{16}, \frac{17}{16}\right)$

(C) $\left(\frac{19}{8}, \frac{57}{16}, -\frac{17}{16}\right)$ (D) $\left(-\frac{19}{8}, -\frac{57}{16}, \frac{17}{16}\right)$

Q.29 If origin is the centroid of the triangle ABC with vertices A(a, 1, 3), B(–2, b, –5) and C(4, 7, c) then values of a, b, c are respectively-

(A) 2, 8, 2 (B) 0, 2, 2

(C) –2, –8, 2 (D) None of these

Q.30 The line joining the points (2, –3, 1) and (3, –4, –5) and cuts the plane 2x + y + z =7 in those points, the point are-

(A) (1, 2, 7) (B) (–1, 2, 7)

(C) (1, –2, 7) (D) (1, –2, –7)

Q.31 The vertices of a triangle ABC are A (4, 3, –2), B(3, 0, 1) and C(2, –1 , 3), the length of the median drawn from point 'A' -

(A) $\frac{1}{2}\sqrt{122}$ (B) $\sqrt{122}$

(C) $\frac{1}{3}\sqrt{122}$ (D) None of these

Q.32 The orthocentre of the triangle with vertices (2, 3, 4), (3, 4, 2) and (4, 2, 3) is-

(A) (1, 1, 1) (B) (2, 2, 2)

(C) (3, 3, 3) (D) None of these

Q.33 The z-coordinates of a point R is 3, which is lie on a line meets the point P(2, 7, 1) & Q(3, 10, 11) then coordinates of R is-

(A) (2, 7, 3) (B) (3, 10, 3)

(C) (11/5, 38/5, 3) (D) (38/5, 11/5, 3)

Q.34 If three consecutive vertices of a parallelogram are A (1, 2, 3), B (– 1, – 2, – 1) and C (2, 3, 2). Its fourth vertex is-

(A) (– 4, 5, 3) (B) (4, 7, 6)

(C) (3, – 5, 2) (D) (4, 5, 3)

Q.35 The points trisecting the line segment joining the points (0, 0, 0) and (6, 9, 12) are-

(A) (2, 3, 4), (4, 6, 8) (B) (3, 4, 2), (6, 8, 4)

(C) (2, 3, 4), (4, 8, 6) (D) none of these

Q.36 The point which divides the line joining the points (2, 4, 5) and (3, 5, – 4) in the ratio – 2 : 3 lies on-

(A) XOY plane (B) YOZ plane

(C) ZOX plane (D) none of these

Q.37 The line joining the points (0,0,0) and (1,–2, – 5) is divided by plane x – y + z = 1 in the ratio-

(A) 1 : 1 (B) 1 : 2

(C) 1 : 3 (external) (D) 3 : 1 (external)

Question based on **Direction cosines and direction Ratio's of a line**

Q.38 Find the d.c's of a line whose direction ratios are 2, 3, –6

(A) $\frac{2}{7}, \frac{2}{5}, \frac{2}{7}$ (B) $\frac{2}{7}, \frac{3}{7}, -\frac{6}{7}$

(C) $\frac{2}{7}, \frac{3}{4}, -\frac{2}{7}$ (D) $\frac{3}{7}, \frac{4}{7}, \frac{6}{7}$

Q.39 The projections of a line segment on x, y and z axes are respectively 3, 4 and 5. Find the length and direction cosines of the line segment-

(A) $5\sqrt{3}$; $\frac{3}{5\sqrt{3}}, \frac{4}{5\sqrt{3}}, \frac{1}{\sqrt{3}}$

(B) $5\sqrt{2}$; $\frac{5}{5\sqrt{2}}, \frac{3}{5\sqrt{2}}, \frac{1}{\sqrt{2}}$

(C) $5\sqrt{2}$; $\frac{3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}, \frac{1}{\sqrt{2}}$

(D) $3\sqrt{2}$; $\frac{3}{3\sqrt{2}}, \frac{4}{3\sqrt{2}}, \frac{1}{\sqrt{2}}$

Q.40 The direction cosines of a line equally inclined with the coordinate axes are-

(A) (1, 1, 1) or (–1, –1, –1)

(B) $\left(\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}}\right)$ or $\left(-\frac{1}{\sqrt{3}},-\frac{1}{\sqrt{3}},-\frac{1}{\sqrt{3}}\right)$

(C) $\left(\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}}\right)$ or $\left(-\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}}\right)$

(D) none of these

Q.41 If the projection of a line on the co-ordinate axes are 6, –3, 2, then direction cosines of the line are-

(A) 6, –3, 2 (B) $\frac{6}{7},\frac{-3}{7},\frac{2}{7}$

(C) $\frac{7}{6},\frac{-7}{3},\frac{7}{2}$ (D) none of these

Q.42 If a line makes angle α, β, γ with the co-ordinate axis then cos2 α + cos2 β + cos 2γ equals to-

(A) –2 (B) –1 (C) 1 (D) 2

Q.43 If a line makes angle α, β, γ with the co-ordinate axis and cos α = 14/15] cos β =1/3 then cos γ is equal to ?

(A) 1/5 (B) ± 1/ 5

(C) ± 2/15 (D) None of these

Q.44 If a line makes angle 120º and 60º with x and y axis then angle makes with the z axis are-

(A) 60º or 120º (B) 45º or 135º

(C) 30º or 150º (D) 30º or 60º

Q.45 If α, β, γ be the angles which a line makes with the positive directions of the axes, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$ =

(A) 2 (B) 3

(C) 4 (D) None of these

Q.46 If the direction ratios of a line are 1, –3, 2, then the direction cosines of the line are-

(A) $\frac{1}{\sqrt{14}},\frac{-3}{\sqrt{14}},\frac{2}{\sqrt{14}}$

(B) $\frac{1}{\sqrt{14}},\frac{2}{\sqrt{14}},\frac{3}{\sqrt{14}}$

(C) $-\frac{1}{\sqrt{14}},\frac{3}{\sqrt{14}},\frac{-2}{\sqrt{14}}$

(D) $-\frac{1}{\sqrt{14}},\frac{-2}{\sqrt{14}},\frac{-3}{\sqrt{14}}$

Q.47 The direction cosine of a line which are perpendicular to the yz plane-

(A) 1, 0 , 0 (B) 0, 1, 0

(C) 0, 0 , 1 (D) 1, 1, 1

Q.48 The co-ordinates of a point P are (3, 12, 4) with respect to the origin O, then the direction cosines of OP are-

(A) 3, 12, 4 (B) $\frac{1}{4},\frac{1}{3},\frac{1}{2}$

(C) $\frac{3}{\sqrt{13}},\frac{1}{\sqrt{13}},\frac{2}{\sqrt{13}}$ (D) $\frac{3}{13},\frac{12}{13},\frac{4}{13}$

Q.49 A line makes angle α, β, γ with the co-ordinate axis if $\alpha + \beta = 90º$] then γ equal to-

(A) 0º (B) 90º

(C) 180º (D) None of these

Q.50 The length of line segment AB is 14 if its direction ratio are 2, 3, 6 then its direction cosines will be-

(A) ± 2/7 ± 3/7, ± 6/7

(B) ± 2/14, ± 3/14, ± 6/14

(C) ± 2/7 ∓ 3/7, ± 6/7

(D) None of these

Q.51 Which of the following triplets gives direction cosines of a line?

(A) 1, 1, 1 (B) 1, 1, –1

(C) 1, –1, 1 (D) $\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}}$

Question based on Angle between two lines

Q.52 If the line through the points (4, 1, 2) and (5, λ, 0) is parallel to the line through the points (2, 1, 1) and (3, 3, –1), find λ.

(A) 3 (B) –3
(C) 2 (D) 4

Q.53 If the line joining the points (1, 2, 3) and (4, 5, 7) is perpendicular to the line joining the points (–4, 3, –6) and (2, 9, λ).

(A) –15 (B) 20
(C) 5/3 (D) 10

Q.54 If the coordinates of the vertices of a triangle ABC be A(–1, 3, 2), B(2, 3, 5) and C(3, 5, –2), then $\angle$A is equal to-

(A) 45º (B) 60º (C) 90º (D) 30º

Q.55 If co-ordinates of points P, Q, R, S are respectively (1, 2, 3), (4, 5, 7); (–4, 3, –6) and (2, 0, 2) then-

(A) PQ $\parallel$ RS (B) PQ $\perp$ RS
(C) PQ = RS (D) None of these

Q.56 A line located in a space makes equal angle with the co-ordinate axis then the angle made by this line with any axis is-

(A) 60º (B) 45º
(C) $\cos^{-1} 1/3$ (D) $\cos^{-1} 1/\sqrt{3}$

Q.57 The angle between the pair of lines with direction ratios 1, 2, 2 and 2 , 3, 6 is-

(A) $\cos^{-1}\left(\frac{21}{20}\right)$ (B) $\cos^{-1}\left(\frac{19}{20}\right)$
(C) $\cos^{-1}\left(\frac{20}{21}\right)$ (D) $\cos^{-1}\left(\frac{20}{19}\right)$

Q.58 If O is origin and P(1, –2, 1) and Q(2, 3 , 4) are other two points then-

(A) OP = OQ (B) OP $\perp$ OQ
(C) OP $\parallel$ OQ (D) None of these

Q.59 The point in which the join of (–9, 4, 5) and (11, 0, –1) is met by the perpendicular from the origin is-

(A) (2, 1, 2) (B) (2, 2, 1)
(C) (1, 2, 2) (D) None of these

Q.60 If vertices of a ΔABC are respectively (a, 0, 0); (0, b, 0) and (0, 0, c) then $\angle$B is equal to-

(A) $\cos^{-1}\frac{b^2}{\sqrt{(a^2+b^2)(b^2+c^2)}}$

(B) $\cos^{-1}\frac{b^2}{\sqrt{(b^2+c^2)(c^2+a^2)}}$

(C) $\cos^{-1}\frac{b^2}{\sqrt{(a^2+b^2)(c^2+a^2)}}$

(D) None of these

Q.61 The co-ordinates of points A, B, C, D are respectively (4, 1, 2); (5, a, 0);(2,1, 1) and (3, 3, –1), if AB is perpendicular to CD then 'a' equal to-

(A) 1/2 (B) –1/2
(C) 3/2 (D) –3/2

Q.62 If points (2, 0, –1); (3, 2, –2) and (5, 6, λ) are collinear then λ equal to-

(A) 4 (B) –4
(C) 3 (D) 0

Q.63 The angle between the lines whose direction ratios are 3, 4, 5 and 4, –3, 5 is-

(A) 30º (B) 45º (C) 60º (D) 90º

Q.64 If the vertices of a right angle isosceles triangles are A(a, 7, 10); B(–1, 6, 6) and C(–4, 9, 6) which are right angle on B, then 'a' equal to-

(A) –1 (B) 0 (C) 2 (D) – 3

Q.65 If < a, b, c > and < a', b', c' > are the direction ratios of two perpendicular lines, then-

(A) a/a' = b/b' = c/c' (B) aa' + bb' + cc' = 0
(C) aa' + bb' + cc' = 1 (D) None of these

Q.66 If direction ratio of two lines are a_1, b_1, c_1 and a_2, b_2, c_2 then these lines are parallel if and only if-

(A) $a_1 = a_2, b_1 = b_2, c_1 = c_2$

(B) $a_1a_2 + b_1b_2 + c_1c_2 = 0$

(C) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(D) None of these

Q.67 If $A \equiv (k, 1, -1)$; $B \equiv (2k, 0, 2)$ & $C \equiv (2 + 2k, k, 1)$ if $AB \perp BC$, then value of k are-

(A) 0 (B) 1 (C) 2 (D) 3

Q.68 A point P(x, y, z) moves parallel to z-axis. Which of the three variables x, y, z remain fixed?

(A) x and y (B) y and z

(C) x and z (D) none of these

Q.69 A point P(x, y, z), moves parallel to yz-plane. Which of the three variables x, y, z remain fixed?

(A) x (B) y (C) z (D) y and z

Question based on Projection problems

Q.70 If P(6, 3, 2); Q(5,1,4); R(3, –4, 7) and S(0, 2, 5) are given points then the projection of PQ on RS is equal to-

(A) 13/7 (B) 13

(C) $\sqrt{13}$ /7 (D) $13/\sqrt{7}$

Q.71 $P \equiv (x_1, y_1, z_1)$ and $Q \equiv (x_2, y_2, z_2)$ are two points if direction cosines of a line AB are ℓ, m, n then projection of PQ on AB are-

(A) $\frac{1}{\ell}(x_2 - x_1) + \frac{1}{m}(y_2 - y_1) + \frac{1}{n}(z_2 - z_1)$

(B) $\ell(x_2 - x_1) + m(y_2 - y_1) + n(z_2 - z_1)$

(C) $\frac{1}{\ell mn}[\ell(x_2 - x_1) + m(y_2 - y_1) + n(z_2 - z_1)]$

(D) None of these

Q.72 A line makes angle 45º, 60 and 60º with the coordinate axis, the projection of line segments on line which joins point (–1, 2, 3) & (–1, 4, 0) are-

(A) 3/2 (B) 1/3

(C) 1/2 (D) 2/3

Q.73 The projection of point (a, b, c) in yz plane are-

(A) (0, b, c) (B) (a, 0, c)

(C) (a, b, 0) (D) (a, 0, 0)

Q.74 The direction cosine of a line are proportional to 1, 2, 3, the projection of line segment on line which joins point (5, 2, 3) and (–1, 0, 2)-

(A) 13 (B) 13/14

(C) $13/\sqrt{14}$ (D) None of these

Q.75 If the angle between the line AB and CD is θ then projection of line segment AB on CD are

(A) AB sin θ (B) AB cos θ

(C) AB tan θ (D) AB cot θ

Q.76 The projections of a line segment on x, y, z axes are 12, 4, 3. The length and the direction cosines of the line segments are-

(A) 13, < 12/13, 4/13, 3/13 >

(B) 19, < 12/19, 4/19, 3/19 >

(C) 11, < 12/11, 14/11, 3/11 >

(D) None of these

Question based on Equation of a line and angle between them

Q.77 If $\frac{x-1}{\ell} = \frac{y-2}{m} = \frac{z+1}{n}$ is the equation of the line through (1, 2, –1) & (–1, 0, 1), then (ℓ, m, n) is-

(A) (–1, 0, 1) (B) (1, 1, –1)

(C) (1, 2, –1) (D) (0, 1, 0)

Q.78 If the angle between the lines whose direction ratios are 2, –1, 2 and a, 3, 5 be 45º, then a =

(A) 1 (B) 2

(C) 3 (D) 4

Q.79 Direction ratios of the line represented by the equation x = ay + b, z = cy + d are-

(A) (a, 1, c) (B) (a, b – d, c)
(C) (c, 1, a) (D) (b, ac, d)

Q.80 The equation of a line passing through the point (–3, 2, –4) and equally inclined to the axes, are-

(A) x – 3 = y + 2 = z – 4
(B) x + 3 = y – 2 = z + 4
(C) $\frac{x+3}{1} = \frac{y-2}{2} = \frac{z+4}{3}$
(D) none of these

Q.81 The equation of the line passing through the points (3, 2, 4) and (4, 5, 2) is-

(A) $\frac{x+3}{1} = \frac{y+2}{3} = \frac{z+4}{-2}$
(B) $\frac{x-3}{1} = \frac{y-2}{3} = \frac{z-4}{-2}$
(C) $\frac{x+3}{7} = \frac{y+2}{7} = \frac{z+4}{6}$
(D) $\frac{x-3}{7} = \frac{y-2}{7} = \frac{z-4}{6}$

Q.82 If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-5}{1} = \frac{z-6}{-5}$ are at right angles, then the value of k will be-

(A) $-\frac{10}{7}$ (B) $-\frac{7}{10}$ (C) –10 (D) –7

Q.83 Angle between two lines $\frac{x+1}{2} = \frac{y+3}{2} = \frac{z-4}{-1}$ and $\frac{x-4}{1} = \frac{y+4}{2} = \frac{z+1}{2}$ is-

(A) $\cos^{-1}\left(\frac{1}{9}\right)$ (B) $\cos^{-1}\left(\frac{2}{9}\right)$
(C) $\cos^{-1}\left(\frac{3}{9}\right)$ (D) $\cos^{-1}\left(\frac{4}{9}\right)$

Q.84 A line passing through the point (– 5, 1, 3) and (1, 2, 0) is perpendicular to the line passing through the point (x, 2, 1) and (0, – 4, 6) then x equal to-

(A) 7/2 (B) –7/2 (C) 1 (D) – 1

Q.85 The angle between the lines whose direction ratios are 1, –2, 7 and 3, –2, –1 is -

(A) 0° (B) 30° (C) 45° (D) 90°

Q.86 Equation of x-axis is-

(A) $\frac{x}{1} = \frac{y}{1} = \frac{z}{1}$ (B) $\frac{x}{0} = \frac{y}{1} = \frac{z}{1}$
(C) $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$ (D) $\frac{x}{0} = \frac{y}{0} = \frac{z}{1}$

Question based on **Perpendicular distance of a point from a line, foot of the perpendicular**

Q.87 The co-ordinates of the foot of the perpendicular drawn from the point A (1, 0, 3) to the join of the point B (4, 7, 1) and C (3, 5, 3) are-

(A) $\left(\frac{5}{3}, \frac{7}{3}, \frac{17}{3}\right)$ (B) (5, 7, 17)
(C) $\left(\frac{5}{3}, -\frac{7}{3}, \frac{17}{3}\right)$ (D) $\left(-\frac{5}{3}, \frac{7}{3}, -\frac{17}{3}\right)$

Q.88 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

Q.89 The perpendicular distance of the point (2, 4, –1) from the line $\frac{x+5}{7} = \frac{y+3}{4} = \frac{z-6}{-9}$ is-

(A) 3 (B) 5
(C) 7 (D) none of these

Question based on **Distance between two lines and Intersection point**

Q.90 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)

Q.91 The shortest distance between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ is

(A) $\sqrt{30}$ (B) $2\sqrt{30}$

(C) $5\sqrt{30}$ (D) $3\sqrt{30}$

Q.92 The straight lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x-1}{2}=\frac{y-2}{2}=\frac{z-3}{-2}$ are-

(A) parallel lines

(B) intersecting at 60^{o}

(C) skew lines

(D) intersecting at right angle

Question based on Different forms of the plane

Q.93 The equation of the plane through the three points (1, 1, 1), (1, –1, 1) and (–7, –3, –5), is-

(A) 3x – 4z + 1 = 0

(B) 3x – 4y + 1 = 0

(C) 3x + 4y + 1 = 0

(D) None of these

Q.94 The co-ordinates of the foot of the perpendicular drawn from the origin to a plane is (2, 4, –3). The equation of the plane is-

(A) 2x – 4y – 3z = 29

(B) 2x – 4y + 3z = 29

(C) 2x + 4y – 3z = 29

(D) none of these

Q.95 The equation of a plane which passes through (2, – 3, 1) and is normal to the line joining the points (3, 4, –1) and (2, – 1, 5) is given by-

(A) x + 5y – 6z + 19 = 0

(B) x – 5y + 6z – 19 = 0

(C) x + 5y + 6z + 19 = 0

(D) x – 5y – 6z – 19 = 0

Q.96 If O is the origin and A is the point (a, b, c) then the equation of the plane through A and at right angles to OA is-

(A) a(x – a) – b (y – b) – c (z – c) = 0

(B) a(x + a) + b(y + b) + c (z + c) = 0

(C) a (x – a) + b (y – b) + c (z – c) = 0

(D) none of these

Q.97 If from a point P(a, b, c) perpendicular 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

Q.98 The equation of a plane which cuts equal intercepts of unit length on the axes, is-

(A) x + y + z = 0 (B) x + y + z = 1

(C) x + y – z = 1 (D) $\frac{x}{a}+\frac{y}{a}+\frac{z}{a}=1$

Q.99 The plane ax + by + cz = 1 meets the co-ordinate axes in A, B and C. The centroid of the triangle is-

(A) (3a, 3b, 3c) (B) $\left(\frac{a}{3},\frac{b}{3},\frac{c}{3}\right)$

(C) $\left(\frac{3}{a},\frac{3}{b},\frac{3}{c}\right)$ (D) $\left(\frac{1}{3a},\frac{1}{3b},\frac{1}{3c}\right)$

Q.100 The equation of yz-plane is-

(A) x = 0 (B) y = 0

(C) z = 0 (D) x + y + z = 0

Q.101 If the length of perpendicular drawn from origin on a plane is 7 units and its direction ratios are –3, 2, 6, then that plane is-

(A) –3x + 2y + 6z – 7 = 0

(B) –3x + 2y + 6z – 49 = 0

(C) 3x – 2y + 6z + 7 = 0

(D) –3x + 2y – 6z – 49 = 0

Q.102 A plane meets the coordinate axes at A, B and C such that the centroid 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

Q.103 The direction cosines of any normal to the xz-plane is-

(A) 1, 0, 0 (B) 0, 1, 0
(C) 1, 1, 0 (D) 0, 0, 1

Question based on Angle between two planes

Q.104 Find the angle between the planes $2x - y + z = 6$ and $x + y + 2z = 3$ is-

(A) $\pi / 3$ (B) $\pi / 6$
(C) $\pi / 2$ (D) 0

Q.105 The equation of the plane which is parallel to y-axis and cuts off intercepts of length 2 and 3 from x-axis and z-axis is-

(A) $3x + 2z = 1$ (B) $3x + 2z = 6$
(C) $2x + 3z = 6$ (D) $3x + 2z = 0$

Q.106 The value of k for which the planes $3x - 6y - 2z = 7$ and $2x + y - kz = 5$ are perpendicular to each other, is -

(A) 0 (B) 1 (C) 2 (D) 3

Q.107 The equation of the plane passing through the point (–1, 3, 2) and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 0$, is-

(A) $7x - 8y + 3z - 25 = 0$
(B) $7x - 8y + 3z + 25 = 0$
(C) $-7x + 8y - 3z + 5 = 0$
(D) $7x - 8y - 3z + 5 = 0$

Q.108 The equation of the plane through (1, 2, 3) and parallel to the plane $2x + 3y - 4z = 0$ is-

(A) $2x + 3y + 4z = 4$
(B) $2x + 3y + 4z + 4 = 0$
(C) $2x - 3y + 4z + 4 = 0$
(D) $2x + 3y - 4z + 4 = 0$

Q.109 The equation of the plane passing through (1, 1, 1) and (1, – 1, –1) and perpendicular to $2x - y + z + 5 = 0$ is-

(A) $2x + 5y + z - 8 = 0$
(B) $x + y - z - 1 = 0$
(C) $2x + 5y + z + 4 = 0$
(D) $x - y + z - 1 = 0$

Question based on Intersection of two planes

Q.110 The equation of the plane through intersection of planes $x + 2y + 3z = 4$ and $2x + y - z = -5$ & perpendicular to the plane $5x + 3y + 6z + 8 = 0$ is-

(A) $7x - 2y + 3z + 81 = 0$
(B) $23x + 14y - 9z + 48 = 0$
(C) $51x + 15y - 50z + 173 = 0$
(D) None of these

Q.111 The equation of the plane containing the line of intersection of the planes $2x - y = 0$ and $y - 3z = 0$ and perpendicular to the plane $4x + 5y - 3z - 8 = 0$ is-

(A) $28x - 17y + 9z = 0$
(B) $28x + 17y + 9z = 0$
(C) $28x - 17y - 9z = 0$
(D) $7x - 3y + z = 0$

Q.112 The equation of the plane passing through the line of intersection of the planes $x + y + z = 1$ and $2x + 3y - z + 4 = 0$ and parallel to x-axis is-

(A) $y - 3z - 6 = 0$ (B) $y - 3z + 6 = 0$
(C) $y - z - 1 = 0$ (D) $y - z + 1 = 0$

Q.113 The equation of the plane passing through the intersection of the planes $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$ and the point (1, 1, 1), is-

(A) $20x + 23y + 26z - 69 = 0$
(B) $20x + 23y + 26z + 69 = 0$
(C) $23x + 20y + 26z - 69 = 0$
(D) none of these

Question based on Length & foot of perpendicular & image of the point w.r.t.plane

Q.114 Distance of the point (2, 3, 4) from the plane $3x - 6y + 2z + 11 = 0$ is-

(A) 1 (B) 2 (C) 3 (D) 0

Q.115 The distance between the planes $x + 2y + 3z + 7 = 0$ and $2x + 4y + 6z + 7 = 0$ is

(A) $\frac{\sqrt{7}}{2\sqrt{2}}$ (B) $\frac{7}{2}$ (C) $\frac{\sqrt{7}}{2}$ (D) $\frac{7}{2\sqrt{2}}$

Q.116 If the product of distances of the point (1, 1, 1) from the origin and the plane $x - y + z + k = 0$ be 5, then k =

(A) –2 (B) –3 (C) 4 (D) 7

Q.117 The equation of the plane which is parallel to the plane $x - 2y + 2z = 5$ and whose distance from the point (1, 2, 3) is 1, is-

(A) $x - 2y + 2z = 3$ (B) $x - 2y + 2z + 3 = 0$
(C) $x - 2y + 2z = 6$ (D) $x - 2y + 2z + 6 = 0$

Q.118 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)

Q.119 Image point of (1, 3, 4) in the plane $2x - y + z + 3 = 0$ is -

(A) (–3, 5, 2) (B) (3, 5, – 2)
(C) (3, – 5, 3) (D) none of these

Q.120 If p_1, p_2, p_3 denote the distances of the plane $2x - 3y + 4z + 2 = 0$ from the planes $2x - 3y + 4z + 6 = 0$, $4x - 6y + 8z + 3 = 0$ and $2x - 3y + 4z - 6 = 0$ respectively then -

(A) $p_1 + 8p_2 - p_3 = 0$
(B) $p_3^2 = 16p_2$
(C) $8p_2^2 = p_1^2$
(D) $p_1 + 2p_2 + 3p_3 = \sqrt{29}$

Question based on **Line and Plane**

Q.121 Equations of the line through (1, 2, 3) and parallel to the plane $2x + 3y + z + 5 = 0$ are

(A) $\frac{x-1}{-1} = \frac{y-2}{1} = \frac{z-3}{-1}$
(B) $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{1}$
(C) $\frac{x-1}{3} = \frac{y-2}{2} = \frac{z-3}{1}$
(D) $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{1}$

Q.122 The co-ordinates of the point where the line joining the points (2, –3, 1), (3, –4, –5) cuts the plane $2x + y + z = 7$ are-

(A) (2, 1, 0) (B) (3, 2, 5)
(C) (1, –2, 7) (D) None of these

Q.123 Equations of the line through (1, 1, 1) and perpendicular to the plane $2x + 3y - z - 5 = 0$ are-

(A) $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-1}{1}$
(B) $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-1}{-1}$
(C) $\frac{x-1}{2} = \frac{y-1}{-1} = \frac{z-1}{1}$
(D) None of these

Q.124 The angle between the line $\frac{x+1}{3} = \frac{y-1}{4} = \frac{z-2}{2}$ and the plane $2x - 3y + z + 4 = 0$ is-

(A) $\cos^{-1}\left(\frac{-4}{\sqrt{406}}\right)$ (B) $\tan^{-1}\left(\frac{4}{\sqrt{406}}\right)$
(C) $\sin^{-1}\left(\frac{-4}{\sqrt{406}}\right)$ (D) None of these

Q.125 The point of intersection of the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z+2}{3}$ & the plane $2x + 3y + z = 0$ is-

(A) (0, 1, –2) (B) (1, 2, 3)
(C) (–1, 9, –25) (D) $\left(\frac{-1}{11}, \frac{9}{11}, \frac{-25}{11}\right)$

Q.126 The equation of the plane passing through the origin and perpendicular to the line $x = 2y = 3z$ is-

(A) $6x + 3y + 2z = 0$ (B) $x + 2y + 3z = 0$
(C) $3x + 2y + z = 0$ (D) none of these

Q.127 If the equation of a line and a plane be $\frac{x+3}{2} = \frac{y-4}{3} = \frac{z+5}{2}$ and $4x - 2y - z = 1$ respectively, then-

(A) line is parallel to the plane
(B) line is perpendicular to the plane
(C) line lies in the plane
(D) none of these

Q.128 The equation of the plane passing through the lines $\frac{x-4}{1}=\frac{y-3}{1}=\frac{z-2}{2}$ & $\frac{x-3}{1}=\frac{y-2}{-4}=\frac{z}{5}$ is-

(A) 11x – y – 3x = 35 (B) 11x + y – 3z = 35

(C) 11x – y + 3z = 35 (D) none of these

Q.129 The equation of the plane passing through the points (3, 2, 2) and (1, 0, –1) and parallel to the line $\frac{x-1}{2}=\frac{y-1}{-2}=\frac{z-2}{3}$, is-

(A) 4x – y – 2z + 6 = 0

(B) 4x – y + 2z + 6 = 0

(C) 4x – y – 2z – 6 = 0

(D) none of these

Q.130 The point where the line $\frac{x-1}{2}=\frac{y-2}{-3}=\frac{z+3}{4}$ meets the plane 2x + 4y – z = 1, is-

(A) (3, –1, 1) (B) (3, 1, 1)

(C) (1, 1, 3) (D) (1, 3, 1)

Q.131 The line drawn from (4, –1, 2) to the point (–3, 2, 3) meets a plane at right angles at the point (–10, 5, 4), then the equation of plane is-

(A) 7x – 3y – z + 89 = 0

(B) 7x + 3y + z + 89 = 0

(C) 7x – 3y + z + 89 = 0

(D) none of these

Q.132 The line $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ is parallel to the plane-

(A) 2x + 3y + 4z = 29 (B) 3x + 4y – 5z = 10

(C) 3x + 4y + 5z = 38 (D) x + y + z = 0

Q.133 The distance between the line $\frac{x-1}{3}=\frac{y+2}{-2}=\frac{z-1}{2}$ & the plane 2x + 2y – z = 6 is-

(A) 9 (B) 1

(C) 2 (D) 3

Q.134 The angle between the line $\frac{x-2}{a}=\frac{y-2}{b}=\frac{z-2}{c}$ and the plane ax + by + cz + 6 = 0 is-

(A) $\sin^{-1}\left(\frac{1}{\sqrt{a^2+b^2+c^2}}\right)$

(B) 45º

(C) 60º

(D) 90º

Q.135 The angle between the line $\frac{x-1}{2}=\frac{y-2}{1}=\frac{z+3}{-2}$ and the plane x + y + 4 = 0, is-

(A) 0º (B) 30º

(C) 45º (D) 90º

Q.136 The equation of the plane containing the line $\frac{x+1}{-3}=\frac{y-3}{2}=\frac{z+2}{1}$ and the point (0, 7, – 7) is-

(A) x + y + z = 1 (B) x + y + z = 2

(C) x + y + z = 0 (D) none of these

LEVEL- 2

Q.1 The cosines of the angle between any two diagonals of a cube is-

(A) 1/3 (B) 1/2

(C) 2/3 (D) $1/\sqrt{3}$

Q.2 A point moves in such a way that sum of square of its distances from the co-ordinate axis are 36, then distance of these given point from origin are-

(A) 6 (B) $2\sqrt{3}$

(C) $3\sqrt{2}$ (D) None of these

Q.3 If co-ordinates of points A and B are (3, 4, 5) and (–1, 3, –7) respectively, then the locus of P such that $PA^2 - PB^2 + 2k^2 = 0$ is-

(A) $8x + 2y + 24z = 2k^2 - 9$

(B) $8x + 2y + 24z = 2k^2$

(C) $8x + 2y - 24z = 2k^2$

(D) $8x + 2y - 24z + 9 = 2k^2$

Q.4 If A(3, 2, – 5), B(– 3, 8, – 5) and C(– 3, 2, 1) are vertices of a triangle, then its circumcentre is-

(A) (1, 4, 3) (B) (–1, 4, –3)

(C) (1, – 4, 3) (D) none of these

Q.5 A line passes through the points (6, –7, –1) and (2, –3, 1). The direction cosines of the line so directed that the angle made by it with positive direction of x-axis is acute, are -

(A) $\frac{2}{3}, \frac{-2}{3}, \frac{-1}{3}$ (B) $\frac{2}{3}, \frac{-2}{3}, \frac{1}{3}$

(C) $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$ (D) $-\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$

Q.6 The graph of the equation $x^2 + y^2 = 0$ in three dimensional space is-

(A) x-axis (B) y-axis

(C) z-axis (D) xy-plane

Q.7 Three lines with direction ratios 1, 1, 2; $\sqrt{3} - 1, -\sqrt{3} - 1, 4$; $-\sqrt{3} - 1, \sqrt{3} - 1, 4$, enclose-

(A) an equilateral triangle

(B) an isosceles triangle

(C) a right angled triangle

(D) a right angled isosceles triangle

Q.8 The distance of the point (–1,–5,–10) from the point of intersection of line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and plane $x - y + z = 5$ is-

(A) 13 (B) 10 (C) 8 (D) 21

Q.9 If the direction cosines of a line are $\left(\frac{1}{c}, \frac{1}{c}, \frac{1}{c}\right)$, then-

(A) $c > 0$ (B) $c = \pm\sqrt{3}$

(C) $0 < c < 1$ (D) $c > 2$

Q.10 The co-ordinates of points A, B, C, D are (a, 2, 1), (1, –1, 1), (2, –3, 4) and (a + 1, a + 2, a + 3) respectively. If AB = 5 and CD = 6, then a =

(A) 2 (B) 3 (C) – 2 (D) – 3

Q.11 The number of straight lines are equally inclined to the three dimensional co-ordinate axes, is-

(A) 2 (B) 4 (C) 6 (D) 8

Q.12 The acute angle between the line joining the point (2, 1, –3), (–3, 1, 7) and a line parallel to $\frac{x-1}{3} = \frac{y}{4} = \frac{z+3}{5}$ through the point (–1, 0, 4) is-

(A) $\cos^{-1}\left(\frac{7}{5\sqrt{10}}\right)$ (B) $\cos^{-1}\left(\frac{1}{\sqrt{10}}\right)$

(C) $\cos^{-1}\left(\frac{3}{5\sqrt{10}}\right)$ (D) $\cos^{-1}\left(\frac{1}{5\sqrt{10}}\right)$

Q.13 The point of intersection of the lines $\frac{x-5}{3}=\frac{y-7}{-1}=\frac{z+2}{1}, \frac{x+3}{-36}=\frac{y-3}{2}=\frac{z-6}{4}$ is

(A) $\left(21, \frac{5}{3}, \frac{10}{3}\right)$ (B) (2, 10, 4)

(C) (– 3, 3, 6) (D) (5, 7, –2)

Q.14 If A, B, C, D are the points (2, 3, –1), (3, 5, –3), (1, 2, 3), (3, 5, 7) respectively, then the angle between AB and CD is -

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$

(C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

Q.15 The angle between two lines whose direction cosines are given by $\ell + m + n = 0$, $\ell^2 + m^2 - n^2 = 0$ is-

(A) $\pi/3$ (B) $\pi/6$ (C) $5\pi/6$ (D) $2\pi/3$

Q.16 If the points (1, 1, k) and (–3, 0, 1) be equidistant from the plane $3x + 4y - 12z + 13 = 0$, then k =

(A) 0 (B) 1

(C) 2 (D) None of these

Q.17 The equation of the line passing through (1, 2, 3) and parallel to the planes $x - y + 2z = 5$ and $3x + y + z = 6$, is-

(A) $\frac{x-1}{-3}=\frac{y-2}{5}=\frac{z-3}{4}$

(B) $\frac{x-1}{-3}=\frac{y-2}{-5}=\frac{z-1}{4}$

(C) $\frac{x-1}{-3}=\frac{y-2}{-5}=\frac{z-1}{-4}$

(D) None of these

Q.18 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

Q.19 The equations of the line passing through the point (1, 2, –4) and perpendicular to the two lines $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$ 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

Q.20 Equation of the plane through (3, 4, –1) which is parallel to the plane $\vec{r}\cdot(2\hat{i}-3\hat{j}+5\hat{k})+7=0$ is-

(A) $\vec{r}\cdot(2\hat{i}-3\hat{j}+5\hat{k}) + 11 = 0$

(B) $\vec{r}\cdot(3\hat{i}+4\hat{j}-\hat{k}) + 11 = 0$

(C) $\vec{r}\cdot(3\hat{i}+4\hat{j}-\hat{k}) + 7 = 0$

(D) $\vec{r}\cdot(2\hat{i}-3\hat{j}+5\hat{k}) - 7 = 0$

Q.21 If $\vec{r}\cdot\vec{n} = q$ is the equation of a plane normal to the vector $\vec{n}$, the length of the perpendicular from the origin on the plane is

(A) q (B) $|\vec{n}|$

(C) $q|\vec{n}|$ (D) $q/|\vec{n}|$

Q.22 Equation of the plane through three points A, B, C with position vectors $-6\hat{i}+3\hat{j}+2\hat{k}$, $3\hat{i}-2\hat{j}+4\hat{k}$, $5\hat{i}+7\hat{j}+3\hat{k}$ is-

(A) $\vec{r}\cdot(\hat{i}-\hat{j}-7\hat{k}) + 23 = 0$

(B) $\vec{r}\cdot(\hat{i}+\hat{j}+7\hat{k}) = 23$

(C) $\vec{r}\cdot(\hat{i}+\hat{j}-7\hat{k}) + 23 = 0$

(D) $\vec{r}\cdot(\hat{i}-\hat{j}-7\hat{k}) = 23$

Q.23 The lines $\vec{r} = \hat{i} - \hat{j} + \lambda(2\hat{i} + \hat{k})$ &

$\vec{r} = 2\hat{i} - \hat{j} + \mu(\hat{i} + \hat{j} - \hat{k})$

(A) intersect each other

(B) do not intersect

(C) intersect at $\vec{r} = 3\hat{i} - \hat{j} + \hat{k}$

(D) are parallel

Q.24 Equation of the plane containing the lines.

$\vec{r} = \hat{i} + 2\hat{j} - \hat{k} + \lambda(\hat{i} + 2\hat{j} - \hat{k})$ and

$\vec{r} = \hat{i} + 2\hat{j} - \hat{k} + \mu(\hat{i} + \hat{j} + 3\hat{k})$ is-

(A) $\vec{r} \cdot (7\hat{i} - 4\hat{j} - \hat{k}) = 0$

(B) $7(x - 1) - 4(y - 1) - (z + 3) = 0$

(C) $\vec{r} \cdot (\hat{i} + 2\hat{j} - \hat{k}) = 0$

(D) $\vec{r} \cdot (\hat{i} + \hat{j} + 3\hat{k}) = 0$

Q.25 The Cartesian equation of the plane passing through the line of intersection of the planes $\vec{r} \cdot (2\hat{i} - 3\hat{j} + 4\hat{k}) = 1$ & $\vec{r} \cdot (\hat{i} - \hat{j}) + 4 = 0$ and perpendicular to the plane $\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) + 8 = 0$ is-

(A) $3x - 4y - 4z = 5$

(B) $x - 2y + 4z = 3$

(C) $5x - 2y - 12z + 47 = 0$

(D) $2x + 3y + 4 = 0$

Q.26 If the line $\frac{x-3}{2} = \frac{y+5}{k} = \frac{z+1}{2k}$ is parallel to the plane $6x + 8y + 2z - 4 = 0$, then k

(A) 1 (B) –1

(C) 2 (D) 3

Q.27 The equation of a line through (–2, 3, 4) and parallel to the planes $2x + 3y + 4z = 5$ and $3x + 4y + 5z = 6$ are-

(A) $\frac{x-2}{1} = \frac{y+3}{2} = \frac{z+4}{-1}$

(B) $\frac{x+2}{2} = \frac{y-3}{3} = \frac{z-4}{1}$

(C) $\frac{x+2}{1} = \frac{y-3}{-2} = \frac{z-4}{1}$

(D) $\frac{x+2}{-1} = \frac{y-3}{-2} = \frac{z-4}{1}$

LEVEL- 3

Q.1 A plane is such that the foot of perpendicular drawn from the origin to it is (2, –1, 1). The distance of (1, 2, 3) from the plane is-

(A) $\frac{3}{2}$ (B) $\sqrt{\frac{3}{2}}$

(C) 2 (D) None of these

Q.2 A line makes an angle θ both with x and y-axes. A possible value of θ is-

(A) $\left[0, \frac{\pi}{4}\right]$ (B) $\left[0, \frac{\pi}{2}\right]$

(C) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$ (D) $\left[\frac{\pi}{3}, \frac{\pi}{6}\right]$

Q.3 If the plane x + y + z = 1 is rotated through 90º about its line of intersection with the plane x – 2y + 3z = 0, the new position of the plane is-

(A) x – 5y + 4z = 1 (B) x – 5y + 4z = – 1

(C) x – 8y + 7z = 2 (D) x – 8y + 7z =– 2

Q.4 The shortest distance between the lines

$\vec{r} = -(\hat{i} + \hat{j} + \hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 4\hat{k})$ and

$\vec{r} = -\hat{i} + \mu(3\hat{i} + 4\hat{j} + 5\hat{k})$ is-

(A) 1 (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{1}{\sqrt{3}}$ (D) $\frac{1}{\sqrt{6}}$

Q.5 The angle between a diagonal of unit cube and an edge is-

(A) $\cos^{-1}\frac{1}{3}$ (B) $\cos^{-1}\frac{1}{\sqrt{3}}$

(C) $\sin^{-1}\frac{1}{\sqrt{3}}$ (D) $\tan^{-1}\frac{1}{3}$

Q.6 If A = (0, 1, –2), B = (2, –1, 0), C = (1, 2, 3), then a bisector of angle BAC has direction ratios-

(A) 1, 1, 1 (B) 1, 1, –1

(C) 0, –1, 1 (D) None of these

Q.7 If the foot of perpendicular from the point (1, –5, –10) to the plane x – y + z = 5 is (a, b, c) then a + b + c =

(A) 10 (B) –10

(C) 11 (D) –11

Q.8 The distance of the plane x + 2y – z = 2 from the point (2, –1, 3) measured in the direction with d.r.'s 2, 2, 1 is-

(A) 1 (B) 2

(C) 3 (D) $\frac{5}{\sqrt{6}}$

Q.9 A variable plane makes with coordinate planes a tetrahedron of unit volume. The locus of the centroid of the tetrahedron is-

(A) xyz = 6 (B) xyz = $\frac{3}{32}$

(C) x + y + z = 6 (D) $x^3 + y^3 + z^3 = 3$

Q.10 An equation of the plane passing through the origin and containing the lines whose direction cosines are proportional to 1, –2, 2 & 2, 3, –1 is-

(A) x – 2y + 2z = 0 (B) 2x + 3y – z = 0

(C) x + 5y – 3z = 0 (D) 4x – 5y – 7z = 0

Q.11 The lines $\vec{r} = \vec{a} + \lambda(\vec{b} \times \vec{c})$ and $\vec{r} = \vec{b} + \mu(\vec{c} \times \vec{a})$ will intersect if

(A) $\vec{a} \times \vec{c} = \vec{b} \times \vec{c}$ (B) $\vec{a} \cdot \vec{c} = \vec{b} \cdot \vec{c}$

(C) $\vec{b} \times \vec{a} = \vec{c} \times \vec{a}$ (D) None of these

Q.12 If θ denotes the acute angle between the line $\vec{r} = (\hat{i} + 2\hat{j} - \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k})$ and the plane $\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) = 4$, then $\sin\theta + \sqrt{2}\cos\theta$ =

(A) $1/\sqrt{2}$ (B) 1

(C) $\sqrt{2}$ (D) $1 + \sqrt{2}$

Q.13 Direction ratios of the line $x - y + z - 5 = 0 = x - 3y - 6$ are-

(A) 3, 1, –2 (B) 2, –4, 1

(C) $\frac{3}{\sqrt{14}}, \frac{1}{\sqrt{14}}, \frac{-2}{\sqrt{14}}$ (D) $\frac{2}{\sqrt{41}}, \frac{-4}{\sqrt{41}}, \frac{1}{\sqrt{41}}$

Q.14 The distance between the line $\vec{r} = (\hat{i} + \hat{j} + 2\hat{k}) + \lambda(2\hat{i} + 5\hat{j} + 3\hat{k})$ & the plane $\vec{r}.(2\hat{i} + \hat{j} - 3\hat{k}) = 5$ is

(A) $\frac{5}{\sqrt{14}}$ (B) $\frac{6}{\sqrt{14}}$

(C) $\frac{7}{\sqrt{14}}$ (D) $\frac{8}{\sqrt{14}}$

Q.15 Volume of the tetrahedron included between the plane $2x - 3y - z - 6 = 0$ and the coordinate planes is-

(A) 3 (B) 6 (C) 18 (D) 12

Q.16 If A(3, –4, 7), B(0, 2, 5), C(6, 3, 2) and D(5, 1, 4) are four given points (Projection of $\overrightarrow{AB}$ on $\overrightarrow{CD}$) : (projection of $\overrightarrow{CD}$ on $\overrightarrow{AB}$) is-

(A) 3 : 7 (B) 7 : 3

(C) 4 : 5 (D) 5 : 6

Q.17 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)

Q.18 Distance of the point (0, 1, 2) from the plane $2x - y + z = 3$ measured parallel to the line $\frac{x}{1} = \frac{y}{-1} = \frac{z}{-1}$ is equal to-

(A) 0 (B) $3\sqrt{3}$

(C) $\sqrt{3}$ (D) None of these

Q.19 A variable plane is at a constant distance p from the origin and meets the axes in A, B and C. The locus of the centroid of the tetrahedron OABC is-

(A) $x^{-2} + y^{-2} + z^{-2} = 16p^{-2}$

(B) $x^{-2} + y^{-2} + z^{-2} = 16p^{-1}$

(C) $x^{-2} + y^{-2} + z^{-2} = 16$

(D) None of these

Q.20 The planes $x = cy + bz$, $y = az + cx$, $z = bx + ay$ pass through one line, if

(A) $a + b + c = 0$

(B) $a + b + c = 1$

(C) $a^2 + b^2 + c^2 = 1$

(D) $a^2 + b^2 + c^2 + 2abc = 1$

Q.21 A variable plane at a constant distance p from origin meets the co-ordinates axes in A, B, C. Through these points planes are drawn parallel to co-ordinate 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) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = p$

Q.22 The equation of the planes passing through the line of intersection of the planes $3x - y - 4z = 0$ and $x + 3y + 6 = 0$ whose distance from the origin is 1, are-

(A) $x - 2y - 2z - 3 = 0$, $2x + y - 2z + 3 = 0$

(B) $x - 2y + 2z - 3 = 0$, $2x + y + 2z + 3 = 0$

(C) $x + 2y - 2z - 3 = 0$, $2x - y - 2z + 3 = 0$

(D) None of these

Q.23 The lines $\frac{x-a+d}{\alpha-\delta} = \frac{y-a}{\alpha} = \frac{z-a-d}{\alpha+\delta}$ and $\frac{x-b+c}{\beta-\gamma} = \frac{y-b}{\beta} = \frac{z-b-c}{\beta+\gamma}$ are coplanar and then equation to the plane in which they lie, is-

(A) $x + y + z = 0$ (B) $x - y + z = 0$

(C) $x - 2y + z = 0$ (D) $x + y - 2z = 0$

Q.24 If P_1 and P_2 are the lengths of the perpendiculars from the points (2, 3, 4) and (1, 1, 4) respectively from the plane $3x - 6y + 2z + 11 = 0$, then P_1 and P_2 are the roots of the equation-

(A) $P^2 - 23P + 7 = 0$ (B) $7P^2 - 23P + 16 = 0$

(C) $P^2 - 17P + 16 = 0$ (D) $P^2 - 16P + 7 = 0$

Q.25 I. The ratio in which the line segment joining (2, 4, 5) and (3, 5, –4) is divided by the yz-plane is 2 : 3.

II. The line joining (x_1, y_1, z_1) and (x_2, y_2, z_2) is divided by xy-plane in the ratio $-z_1 : z_2$.

Which of the statement is true?

(A) both I and II (B) only I

(C) only II (D) neither I nor II

Statement type questions

Each of the questions given below consists of Statement -I and Statement- II. Use the following key to choose the appropriate answer.

(A) If both Statement- I Statement- II are true, and Statement- II is the correct explanation of Statement- I.

(B) If Statement- I and Statement-II are true but Statement-II is not the correct explanation of Statement- I

(C) If Statement- I is true but Statement- II is false

(D) If Statement- I is false but Statement- II is true.

Q. 26 **Statement-1 (A) :** The angle between the rays of with d.r's (4, –3, 5) and (3, 4, 5) is $\pi/3$.

Statement-2 (R) The angle between the rays whose d.c's are ℓ_1, m_1, n_1 and ℓ_2, m_2, n_2 is given by θ, whose $\cos\theta = \ell_1\ell_2 + m_1m_2 + n_1n_2$

Q.27 **Statement 1 (A) :** A line makes 60º with x-axis and 30º with y-axis then it makes 90° with z-plane.

Statement 2 (R) :

If a ray makes angles α, β, γ with x-axis, y-axis and z-axis respectively then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 1$

Q.28 **Statement- 1 (A) :** If the lines $\vec{r} = \vec{a} + \lambda\vec{b}$ and $\vec{r} = \vec{c} + \mu\vec{d}$ intersects at a point then $(\vec{c} - \vec{a}).\{\vec{b} \times \vec{d}\} = 0$

Statement- 2 (R) : Two coplanar lines always intersects.

Q.29 **Statement- 1 (A) :** If lines $x = ay + b$, $z = 3y + 4$ and $x = 2y + 6$, $z = ay + d$ are perpendicular to each other then $a = 1/5$

Statement- 2 (R) : If two lines with d.rs a_1, b_1, c_1 and a_2, b_2, c_2 are perpendicular then $a_1a_2 + b_1b_2 + c_1c_2 = 0$

Q.30 **Statement- 1 (A) :** The line of intersection of the planes $2x + 3y + z = 10$ and $x + 3y + 2z = 5$ is parallel to vector $\hat{i} - \hat{j} + \hat{k}$

Statement- 2 (R) : The line of intersection of two non parallel planes $\vec{r}.\vec{n}_1 = \lambda_1$ and $\vec{r}.\vec{n}_2 = \lambda_2$ is always parallel to $\vec{n}_1 \times \vec{n}_2$

Q.31

List-I	**List-II**
(P) The points (–1, 0, 7) (3, 2, –k) and (5, 3, –2) are collinear then k =	(1) 22/7
(Q) The length of the projection of the line segment joining the points (–1, 0, 3) and (2, 5, 1) on the line whose d.r's are 6, 2, 3 is	(2) 1
(R) The distance of the point (1, –2, 8) from the plane $2x - 3y + 6z = 63$ is	(3) –1
(S) The distance between the parallel planes $2x - 2y + z + 3 = 0$, $4x - 4y + 2z + 5 = 0$	(4) 1/6

Correct match for **List-I** from **List-II** is

	P	Q	R	S
(A)	1	4	5	3
(B)	3	1	2	4
(C)	2	5	1	2
(D)	4	2	3	1

Passage based questions

Passage-1

Consider the line $\frac{x-1}{2}=\frac{y}{-1}=\frac{z+1}{2}$ and the point C(–1, 1, 2). Let the point D be the image of C in the line.

Q.32 The distance of C from the line is

(A) $\frac{\sqrt{5}}{3}$ (B) $\frac{2}{3}\sqrt{5}$

(C) $\frac{4}{3}\sqrt{5}$ (D) $\frac{5}{3}\sqrt{5}$

Q.33 The distance of the origin from the plane through C and the line is

(A) $\frac{1}{\sqrt{5}}$ (B) $\frac{2}{\sqrt{5}}$

(C) $\frac{3}{\sqrt{5}}$ (D) $\frac{4}{\sqrt{5}}$

Q.34 The distance of D from the origin is

(A) $\sqrt{15}$ (B) $\sqrt{21}$

(C) $\sqrt{26}$ (D) $\sqrt{30}$

LEVEL- 4

(Question asked in previous AIEEE and IIT-JEE)

SECTION –A

Q.1 If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-5}{1} = \frac{z-6}{-5}$ are perpendicular to each other then k = **[AIEEE 2002]**

(A) $\frac{5}{7}$ (B) $\frac{7}{5}$ (C) $\frac{-7}{10}$ (D) $\frac{-10}{7}$

Q.2 The angle between the lines, whose direction ratios are 1, 1, 2 and $\sqrt{3}-1, -\sqrt{3}-1, 4$, is- **[AIEEE 2002]**

(A) 45° (B) 30° (C) 60° (D) 90°

Q.3 The acute angle between the planes $2x - y + z = 6$ and $x + y + 2z = 3$ is- **[AIEEE 2002]**

(A) 30° (B) 45° (C) 60° (D) 75°

Q.4 The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if- **[AIEEE 2003]**

(A) k = 3 or – 3 (B) k = 0 or – 1

(C) k = 1 or – 1 (D) k = 0 or – 3

Q.5 A tetrahedron has vertices at O (0, 0, 0), A (1, 2, 1), B (2, 1, 3) and C (–1, 1, 2). Then the angle between the faces OAB and ABC will be- **[AIEEE 2003]**

(A) 90° (B) $\cos^{-1}\left(\frac{19}{35}\right)$

(C) $\cos^{-1}\left(\frac{17}{31}\right)$ (D) 30°

Q.6 Two systems of rectangular axes have the same origin. If a plane makes intercepts a, b, c and a′, b′, c′ on the two systems of axes respectively, then **[AIEEE-2003]**

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

(B) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c} = \frac{1}{a'}+\frac{1}{b'}+\frac{1}{c'}$

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

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

Q.7 A line makes the same angle θ, with each of the x and z axis. If the angle β, which it makes with y- axis, is such that $\sin^2\beta = 3\sin^2\theta$, then $\cos^2\theta$ equals- **[AIEEE 2004]**

(A) 2/3 (B) 1/5

(C) 3/5 (D) 2/5

Q.8 Distance between two parallel planes $2x + y + 2z = 8$ and $4x + 2y + 4z + 5 = 0$ is **[AIEEE 2004]**

(A) 3/2 (B) 5/2 (C) 7/2 (D) 9/2

Q.9 A line with direction cosines proportional to 2, 1, 2 meets each of the lines $x = y + a = z$ and $x + a = 2y = 2z$. The coordinates of each of the points of intersection are given by- **[AIEEE 2004]**

(A) (3a, 3a, 3a), (a, a, a)

(B) (3a, 2a, 3a), (a, a, a)

(C) (3a, 2a, 3a), (a, a, 2a)

(D) (2a, 3a, 3a), (2a, a, a)

Q.10 If the straight lines $x = 1 + s$, $y = -3 - \lambda s$, $z = 1 + \lambda s$ and $x = \frac{t}{2}$, $y = 1 + t$, $z = 2 - t$, with parameters s and t respectively are coplanar then λ equals- **[AIEEE 2004]**

(A) – 2 (B) – 1

(C) – 1/2 (D) 0

Q.11 If the angle θ between the line $\frac{x+1}{1} = \frac{y-1}{2} = \frac{z-2}{2}$ and the plane $2x - y + \sqrt{\lambda}\, z + 4 = 0$ is such that $\sin\theta = \frac{1}{3}$ the value of λ is – **[AIEEE-2005]**

(A) $\frac{5}{3}$ (B) $\frac{-3}{5}$

(C) $\frac{3}{4}$ (D) $\frac{-4}{3}$

Q.12 The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$ is- **[AIEEE-2005]**

(A) 0º (B) 90º (C) 45º (D) 30º

Q.13 The distance between the line $\vec{r} = 2\hat{i} - 2\hat{j} + 3\hat{k} + \lambda(\hat{i} - \hat{j} + 4\hat{k})$ and the plane $\vec{r}\cdot(\hat{i} + 5\hat{j} + \hat{k}) = 5$ is **[AIEEE-2005]**

(A) $\frac{10}{9}$ (B) $\frac{10}{3\sqrt{3}}$ (C) $\frac{3}{10}$ (D) $\frac{10}{3}$

Q.14 The two lines $x = ay + b$, $z = cy + d$; and $x = a'y + b'$, $z = c'y + d'$ are perpendicular to each other if – **[AIEEE-2006/AIEEE -2003]**

(A) $aa' + cc' = 1$ (B) $\frac{a}{a'} + \frac{c}{c'} = -1$

(C) $\frac{a}{a'} + \frac{c}{c'} = 1$ (D) $aa' + cc' = -1$

Q.15 The image of the point (–1, 3, 4) in the plane $x - 2y = 0$ is – **[AIEEE 2006]**

(A) (15, 11, 4) (B) $\left(-\frac{17}{3}, -\frac{19}{3}, 1\right)$

(C) (8, 4, 4) (D) None of these

Q.16 Let L be the line of intersection of the planes $2x + 3y + z = 1$ and $x + 3y + 2z = 2$. If L makes an angle α with the positive x-axis, then $\cos\alpha$ equals- **[AIEEE 2007]**

(A) $1/\sqrt{3}$ (B) 1/2

(C) 1 (D) $1/\sqrt{2}$

Q.17 If a line makes an angle of $\pi/4$ with the positive directions of each of x-axis and y-axis, then the angle that the line makes with the positive direction of the z-axis is- **[AIEEE-2007]**

(A) $\pi/6$ (B) $\pi/3$

(C) $\pi/4$ (D) $\pi/2$

Q.18 If the straight lines $\frac{x-1}{k} = \frac{y-2}{2} = \frac{z-3}{3}$ and $\frac{x-2}{3} = \frac{y-3}{k} = \frac{z-1}{2}$ intersect at a point, then the integer k is equal to- **[AIEEE-2008]**

(A) 5 (B) 2

(C) –2 (D) –5

Q.19 The line passing through the points (5, 1, a) and (3, b, 1) crosses the yz-plane at the point $\left(0, \frac{17}{2}, \frac{-13}{2}\right)$. Then **[AIEEE-2008]**

(A) a = 4, b = 6 (B) a = 6, b = 4

(C) a = 8, b = 2 (D) a = 2, b = 8

Q.20 Let the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lie in the plane $x + 3y - \alpha z + \beta = 0$, then (α, β) equals : **[AIEEE-2009]**

(A) (–6, 7) (B) (5, –15)

(C) (–5, 5) (D) (6, –17)

Q.21 The projections of a vector on the three coordinate axis are 6, –3, 2 respectively. The direction cosines of the vector are : **[AIEEE-2009]**

(A) $\frac{6}{5}, \frac{-3}{5}, \frac{2}{5}$ (B) $\frac{6}{7}, \frac{-3}{7}, \frac{2}{7}$

(C) $\frac{-6}{7}, \frac{-3}{7}, \frac{2}{7}$ (D) 6, –3, 2

Q.22 A line AB in three dimensional space makes angles 45° and 120° with the positive x – axis and the positive y – axis respectively. If AB makes an acute angle θ with the positive z – axis, then θ equals - **[AIEEE-2010]**

(A) 30° (B) 45°

(C) 60° (D) 75°

Q.23 **Statement – 1 :** The point A(3, 1, 6) is the mirror image of the point B(1, 3, 4) in the plane x – y + z = 5.

Statement – 2 : The plane x – y + z = 5 bisects the line segment joining A(3, 1, 6) and B(1, 3, 4).

[AIEEE-2010]

(A) Statement -1 is true, Statement -2 is true; Statement -2 is a correct explanation for Statement -1

(B) Statement -1 is true, Statement -2 is true; Statement -2 is ***not*** a correct explanation for Statement -1.

(C) Statement -1 is true, Statement -2 is false.

(D) Statement -1 is false, Statement -2 is ture.

Q.24 **Statement – 1 :**

The point A(1, 0, 7) is the mirror image of the point B (1, 6, 3) in the line :

$\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$.

Statement – 2 :

The line : $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ bisects the line segment joining A(1, 0, 7) and B(1, 6, 3).

[AIEEE-2011]

(A) Statement -1 is true, Statement -2 is true; Statement -2 is a correct explanation for Statement -1

(B) Statement -1 is true, Statement -2 is true; Statement -2 is ***not*** a correct explanation for Statement -1.

(C) Statement -1 is true, Statement -2 is false.

(D) Statement -1 is false, Statement -2 is true.

Q.25 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 equals - **[AIEEE-2011]**

(A) 2/3 (B) 3/2

(C) 2/5 (D) 5/2

Q.26 An equation of a plane parallel to the plane x – 2y + 2z – 5 = 0 and at a unit distance from the origin is : **[AIEEE-2012]**

(A) x – 2y + 2z + 1 = 0 (B) x – 2y + 2z – 1 = 0

(C) x – 2y + 2z + 5 = 0 (D) x – 2y + 2z – 3 = 0

Q.27 If the lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then k is equal to :

[AIEEE-2012]

(A) $\frac{2}{9}$ (B) $\frac{9}{2}$ (C) 0 (D) –1

Q.28 If the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar, then k can have – **[JEE Main - 2013]**

(A) exactly two values (B) exactly three values

(C) any value (D) exactly one value

Q.29 Distance between two parallel planes 2x + y + 2z = 8 and 4x + 2y + 4z + 5 = 0 is –

[JEE Main - 2013]

(A) $\frac{7}{2}$ (B) $\frac{9}{2}$ (C) $\frac{3}{2}$ (D) $\frac{5}{2}$

SECTION-B

Q.1 If line $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-k}{2}$ lies in the plane 2x – 4y + z = 7 then the value of k = ?

[IIT Scr.2003]

(A) k = –1 (B) k = 7

(C) k = –7 (D) no value of k

Q.2 Two lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect at a point then k is- **[IIT Scr.2004]**

(A) 3/2 (B) 9/2

(C) 2/9 (D) 2

Q.3 A plane at a unit distance from origins cuts at three axes at P, Q, R points. Δ PQR has centroid at (x, y, z) point & satisfy to $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}$ = k, then k = **[IIT Scr.2005]**

(A) 9 (B) 1 (C) 3 (D) 4

Q.4 A plane passes through (1, –2, 1) and is perpendicular to two planes 2x – 2y + z = 0 and x – y + 2z = 4. The distance of the plane from point (1, 2, 2) is- **[IIT-2006]**

(A) $2\sqrt{2}$ (B) 0

(C) 1 (D) $\sqrt{2}$

Q.5 A line perpendicular to x + 2y + 2z = 0 and passes through (0, 1, 0) then the perpendicular distance of this line from the origin is- **[IIT-2007]**

(A) $\frac{\sqrt{5}}{3}$ (B) $\frac{\sqrt{3}}{2}$

(C) $\frac{-\sqrt{3}}{2}$ (D) None of these

Q.6 Consider the planes 3x – 6y – 2z = 15 and 2x + y – 2z = 5

STATEMENT–1 : The parametric equations of the line of intersection of the given planes are x = 3 + 14t, y = 1 + 2t, z = 15t.

because

STATEMENT–2 : The vector $14\hat{i}+2\hat{j}+15\hat{k}$ is parallel to the line of intersection of given planes. **[IIT-2007]**

(A) Statement–1 is True, Statement–2 is True; Statement–2 is a correct explanation for Statement–1.

(B) Statement–1 is True, Statement–2 is True; Statement–2 is NOT a correct explanation for Statement–1

(C) Statement–1 is True, Statement–2 is False

(D) Statement–1 is False, Statement–2 is True

Passage :

Consider the lines

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

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

Q.7 The unit vector perpendicular to both L_1 and L_2 is- **[IIT 2008]**

(A) $\frac{-\hat{i}+7\hat{j}+7\hat{k}}{\sqrt{99}}$ (B) $\frac{-\hat{i}-7\hat{j}+5\hat{k}}{5\sqrt{3}}$

(C) $\frac{-\hat{i}+7\hat{j}+5\hat{k}}{5\sqrt{3}}$ (D) $\frac{7\hat{i}-7\hat{j}-\hat{k}}{\sqrt{99}}$

Q.8 The shortest distance between L_1 and L_2 is- **[IIT 2008]**

(A) 0 (B) $\frac{17}{\sqrt{3}}$ (C) $\frac{41}{5\sqrt{3}}$ (D) $\frac{17}{5\sqrt{3}}$

Q.9 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- **[IIT 2008]**

(A) $\frac{2}{\sqrt{75}}$ (B) $\frac{7}{\sqrt{75}}$ (C) $\frac{13}{\sqrt{75}}$ (D) $\frac{23}{\sqrt{75}}$

Q.10 Let P(3, 2, 6) be a point in space and Q be a point on the line - **[IIT 2009]**

$\vec{r}=(\hat{i}-\hat{j}+2\hat{k})+\mu(-3\hat{i}+\hat{j}+5\hat{k})$

Then the value of μ for which the vector $\overrightarrow{PQ}$ is parallel to the plane x – 4y + 3z = 1 is

(A) $\frac{1}{4}$ (B) $-\frac{1}{4}$ (C) $\frac{1}{8}$ (D) $-\frac{1}{8}$

Q.11 A line with positive direction cosines passes through the point P(2, –1, 2) and makes equal angles with the coordinate axes. The line meets the plane 2x + y + z = 9 at point Q. The length of the line segment PQ equals- **[IIT 2009]**

(A) 1 (B) $\sqrt{2}$ (C) $\sqrt{3}$ (D) 2

Q.12 If the distance between the plane x – 2y + z = d and the plane containing the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ is $\sqrt{6}$, then | d | is – **[IIT 2010]**

(A) $\sqrt{6}$ (B) 6 (C) $1/\sqrt{6}$ (D) 1/6

Q.13 Equation of the plane containing the straight line $\frac{x}{2}=\frac{y}{3}=\frac{z}{4}$ and perpendicular to the plane containing the straight lines $\frac{x}{3}=\frac{y}{4}=\frac{z}{2}$ and $\frac{x}{4}=\frac{y}{2}=\frac{z}{3}$ is - **[IIT 2010]**

(A) $x + 2y - 2z = 0$ (B) $3x + 2y - 2z = 0$
(C) $x - 2y + z = 0$ (D) $5x + 2y - 4z = 0$

Q.14 If the distance of the point P (1, –2, 1) from the plane $x + 2y - 2z = \alpha$, where $\alpha > 0$, is 5, then the foot of the perpendicular from P to the plane is - **[IIT 2010]**

(A) $\left(\frac{8}{3},\frac{4}{3},-\frac{7}{3}\right)$ (B) $\left(\frac{4}{3},-\frac{4}{3},\frac{1}{3}\right)$
(C) $\left(\frac{1}{3},\frac{2}{3},\frac{10}{3}\right)$ (D) $\left(\frac{2}{3},-\frac{1}{3},\frac{5}{2}\right)$

Q.15 The point P is the intersection of the straight line joining the points Q(2, 3,5) and R(1, –1, 4) with the plane $5x - 4y - z = 1$. If S is the foot of the perpendicular drawn from the point T(2, 1, 4) to QR, then the length of the line segment PS is **[IIT 2012]**

(A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$ (C) 2 (D) $2\sqrt{2}$

Q.16 The equation of a plane passing through the line of intersection of the planes $x + 2y + 3z = 2$ and $x - y + z = 3$ and at a distance $\frac{2}{\sqrt{3}}$ from the point (3, 1, – 1) is **[IIT 2012]**

(A) $5x - 11y + z = 17$ (B) $\sqrt{2}x + y = 3\sqrt{2} - 1$
(C) $x + y + z = \sqrt{3}$ (D) $x - \sqrt{2}y = 1 - \sqrt{2}$

Q.17 If the straight lines $\frac{x-1}{2}=\frac{y+1}{k}=\frac{z}{2}$ and $\frac{x+1}{5}=\frac{y+1}{2}=\frac{z}{k}$ are coplanar, then the plane(s) containing these two lines is (are) **[IIT 2012]**

(A) $y + 2z = -1$ (B) $y + z = -1$
(C) $y - z = -1$ (D) $y - 2z = -1$

Q.18 Perpendiculars are drawn from points on the line $\frac{x+2}{2}=\frac{y+1}{-1}=\frac{z}{3}$ to the plane $x + y + z = 3$. The feet of perpendiculars lie on the line – **[JEE - Advance 2013]**

(A) $\frac{x}{5}=\frac{y-1}{8}=\frac{z-2}{-13}$ (B) $\frac{x}{2}=\frac{y-1}{3}=\frac{z-2}{-5}$
(C) $\frac{x}{4}=\frac{y-1}{3}=\frac{z-2}{-7}$ (D) $\frac{x}{2}=\frac{y-1}{-7}=\frac{z-2}{5}$

Q.19 A line ℓ passing through the origin is perpendicular to the lines

$\ell_1 : (3 + t)\,\hat{i} + (-1 + 2t)\,\hat{j} + (4 + 2t)\,\hat{k}, -\infty < t < \infty$

$\ell_2 : (3 + 2s)\,\hat{i} + (3 + 2s)\,\hat{j} + (2 + s)\,\hat{k}, -\infty < s < \infty$

Then the coordinates(s) of the point(s) on ℓ_2 at a distance of $\sqrt{17}$ from the point of intersection of ℓ and ℓ_1 is(are) **[JEE - Advance 2013]**

(A) $\left(\frac{7}{3},\frac{7}{3},\frac{5}{3}\right)$ (B) (–1, –1, 0)
(C) (1, 1, 1) (D) $\left(\frac{7}{9},\frac{7}{9},\frac{8}{9}\right)$

Q.20 Two lines $L_1 : x = 5, \frac{y}{3-\alpha} = \frac{z}{-2}$ and $L_2 : x = \alpha, \frac{y}{-1} = \frac{z}{2-\alpha}$ are coplanar, Then α can take value(s) – **[JEE - Advance 2013]**

(A) 1 (B) 2 (C) 3 (D) 4

Q.21 Consider the lines $L_1 : \frac{x-1}{2} = \frac{y}{-1} = \frac{z+3}{1}$, $L_2 : \frac{x-4}{1} = \frac{y+3}{1} = \frac{z+3}{2}$ and the planes $P_1 : 7x + y + 2z = 3$, $P_2 : 3x + 5y - 6z = 4$. Let $ax + by + cz = d$ be the equation of the plane passing through the point of intersection of lines L_1 and L_2, and perpendicular to planes P_1 and P_2. Match List-I with List-II and select the correct answer using the code given below the lists : **[JEE - Advance 2013]**

List-I	**List-II**
(P) a =	(1) 13
(Q) b =	(2) –3
(R) c =	(3) 1
(S) d =	(4) –2

Codes :

	P	Q	R	S
(A)	3	2	4	1
(B)	1	3	4	2
(C)	3	2	1	4
(D)	2	4	1	3

ANSWER KEY

LEVEL- 1

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	A	D	A	A	A	C	B	A	D	D	C	D	A	C	D	B	D	A	C	A
Qus.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	B	C	B	A	B	A	A	A	C	C	A	C	C	B	A	B	C	B	C	B
Qus.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	B	B	C	B	A	A,C	A	D	B	A	D	A	A	C	D	D	C	B	C	A
Qus.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	D	B	C	B	B	C	D	A	A	A	B	C	A	C	B	A	B	D	A	B
Qus.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	B	A	D	B	D	C	A	C	D	A	D	D	A	C	A	C	B	B	D	A
Qus.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	B	B	B	A	B	A	B	D	B	C	A	B	A	A	A	C	C	D	A	A
Qus.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136				
Ans.	A	C	B	C	D	A	A	D	D	A	A	B	D	D	C	C				

LEVEL- 2

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	A	C	A	B	A	C	A	A	B	D	B	A	A	A	D	B	A	C	A	A
Qus.	21	22	23	24	25	26	27													
Ans.	D	A	B	A	C	B	C													

LEVEL- 3

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	B	C	D	D	B	D	D	C	B	D	B	C	A	D	B	B	C	C	A	D
Qus.	21	22	23	24	25	26	27	28	29	30	31	32	33	34						
Ans.	A	A	C	B	C	B	C	C	D	A	B	D	A	C						

LEVEL- 4

SECTION-A

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	D	C	C	D	B	C	C	C	B	A	A	B	B	D	D	A	D	D	B	A
Qus.	21	22	23	24	25	26	27	28	29											
Ans.	B	C	B	B	A	D	B	A	A											

SECTION-B

1.[B] equation of line $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-k}{2}$ ...(i)

equation of plane $2x - 4y + z = 7$ ...(ii)

line (i) lies in plane (ii)

$\therefore$ (4, 2, k) satisfies equation (ii)

$2(4) - 4(2) + k = 7$

$k = 7$

2.[B] lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and

$\frac{x-3}{1}=\frac{y-k}{2} = \frac{z}{1}$ intersect at a point

$\therefore$ lines are coplanar

$$\therefore \begin{vmatrix} 2 & k+1 & -1 \\ 2 & 3 & 4 \\ 1 & 2 & 1 \end{vmatrix} = 0$$

$2(-5) -(k + 1) (-2) -1(1) = 0$

$-10 + 2k + 2 - 1 = 0$

$2k = 9 \Rightarrow k = 9/2$

3.[A] equation of plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c} = 1$ ...(1)

P(a, 0, 0), Q(0, b, 0), R(0, 0, c)

centroid of Δ PQR is (x, y, z)

$x = \frac{a}{3}$, $y = \frac{b}{3}$, $z = \frac{c}{3}$

according to question

length of $\perp$ from origin to the plane = 1

$$\frac{1}{\sqrt{\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}}} = 1$$

$$\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2} = 1$$

$$\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2} = 9 \qquad ...(2)$$

above relation (2) compare the equation

$$\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2} = k \Rightarrow k = 9$$

4.[A] equation of plane passing through (1, –2, 1) is given by

$a(x - 1) + b(y + 2) + c(z - 1) = 0$ ...(1)

plane (1) is $\perp$ to planes $2x - 2y + z = 0$ and $x - y + 2z = 4$

$2a - 2b + c = 0$

$a - b + 2c = 0$

$\frac{a}{1}=\frac{b}{1}=\frac{c}{0}$

a, b, c put in equation (1)

$x + y + 1 = 0$ ...(2)

$\perp$ distance from (1, 2, 2) to the plane (2)

$$= \frac{1+2+1}{\sqrt{1+1}} = \frac{4}{\sqrt{2}} = 2\sqrt{2}$$

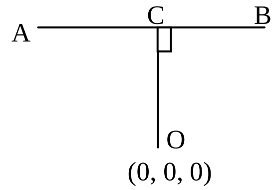
5.[A] Equation of line passing through (0, 1, 0) and perpendicular to plane $x + 2y + 2z = 0$ is given by

$$\frac{x-0}{1} = \frac{y-1}{2} = \frac{z-0}{2} = r$$

$x = r$, $y = 2r + 1$, $z = 2r$

coordinate of C(r, 2r + 1, 2r)

direction ratio of OC; r, 2r + 1, 2r



AB $\perp$ OC

$a_1a_2 + b_1b_2 + c_1c_2 = 0$

$1(r) + 2(2r + 1) + 2(2r) = 0$

$9r = -2$

$r = -2/9$

co-ordinate of C $\left[-\frac{2}{9},\frac{5}{9},-\frac{4}{9}\right]$

$$OC = \sqrt{\frac{4}{(9)^2}+\frac{25}{(9)^2}+\frac{16}{(9)^2}} = \frac{\sqrt{45}}{9} = \frac{\sqrt{9}\sqrt{5}}{9}$$

$$= \sqrt{\frac{5}{9}} = \frac{\sqrt{5}}{3}$$

6.[D] Let ℓ, m, n be d.r.'s of the line of intersection of the plane then

$3\ell - 6m - 2n = 0$

$2\ell + m - 2n = 0$

$\frac{\ell}{14} = \frac{m}{2} = \frac{n}{15}$

$\therefore$ line of intersection is parallel to the vector $14\hat{i} + 2\hat{j} + 15\hat{k}$ also (3, 1, 0) does not lie on the plane $3x - 6y - 2z = 15$ therefore (3, 1, 0) does not lie on the line of intersection.

Hence S_1 is false and S_2 is true.

7.[B] lines are given

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

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

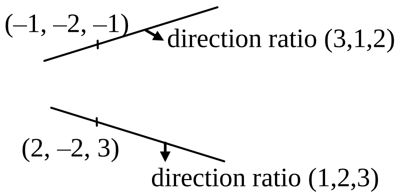
The direction ratio of L_1 and L_2 are (3, 1, 2) and (1, 2, 3) and so the vector perpendicular to both is given by

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{vmatrix} = -\hat{i} - 7\hat{j} + 5\hat{k}$$

Then the unit vector = $\frac{-\hat{i}-7\hat{j}+5\hat{k}}{\sqrt{1+49+25}} = \frac{-\hat{i}-7\hat{j}+5\hat{k}}{5\sqrt{3}}$

8.[D] Let $\vec{n}_1 = 3\hat{i} + \hat{j} + 2\hat{k}$, $\vec{n}_2 = \hat{i} + 2\hat{j} + 3\hat{k}$

$\vec{\alpha} = -\hat{i} - 2\hat{j} - \hat{k}$, $\vec{\beta} = 2\hat{i} - 2\hat{j} + 3\hat{k}$



Shortest distance between L_1 and L_2

$$= \frac{|(\vec{\alpha} - \vec{\beta}).(\vec{n}_1 \times \vec{n}_2)|}{|\vec{n}_1 \times \vec{n}_2|}$$

$$= \frac{|(-3\hat{i} - 4\hat{k}).(-\hat{i} - 7\hat{j} + 5\hat{k})|}{\sqrt{1 + 49 + 25}}$$

$$= \frac{|3 - 20|}{5\sqrt{3}} = \frac{17}{5\sqrt{3}}$$

9.[C] Equation of plane is given by

$a(x - x_1) + b(y - y_1) + c(z - z_1) = 0$

$-1(x + 1) - 7(y + 2) + 5(z + 1) = 0$

$x + 7y - 5z + 10 = 0$

The distance of (1, 1, 1) from the plane

$$= \left(\frac{1 + 7 - 5 + 10}{\sqrt{1 + 49 + 25}}\right) = \frac{13}{\sqrt{75}}$$

10.[A] $P(3, 2, 6), \vec{r} = (-3\mu + 1)\hat{i} + (\mu - 1)\hat{j} + (5\mu + 2)\hat{k}$

$\overrightarrow{PQ} = (-3\mu - 2)\hat{i} + (\mu - 3)\hat{j} + (5\mu - 4)\hat{k}$

$\overrightarrow{PQ}$ is parallel to the plane $x - 4y + 3z = 1$

$\therefore\ (-3\mu - 2) - 4(\mu - 3) + 3(5\mu - 4) = 0$

$8\mu = 2$

$\Rightarrow \mu = 1/4$

11.[C] Equation of line $\frac{x - 2}{1} = \frac{y + 1}{1} = \frac{z - 2}{1} = r$ ...(1)

$x = r + 2,\quad y = r - 1,\quad z = r + 2$

line (1) meet the plane $2x + y + z = 9$ at point Q

$2(r + 2) + r - 1 + r + 2 = 9$

$4r = 4 \quad \Rightarrow r = 1$

coordinate of Q(3, 0, 3)

$PQ = \sqrt{1+1+1} = \sqrt{3}$

12.[B] $\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{vmatrix} = \hat{i}(-1) - \hat{j}(-2) + \hat{k}(-1)$

Plane is normal to vector $\hat{i} - 2\hat{j} + \hat{k}$

$1(X - 1) - 2(Y - 2) + 1(Z - 3) = 0$

$X - 2Y + Z = 0$

$\sqrt{6} = \frac{|d|}{\sqrt{6}} \Rightarrow |d| = 6$

13.[C] Plane passing through origin (0, 0, 0) and normal vector to plane is perpendicular to $3\hat{i} + 4\hat{j} + 2\hat{k}$, $4\hat{i} + 2\hat{j} + 3\hat{k}$ and $2\hat{i} + 3\hat{j} + 4\hat{k}$ i.e. normal vector to plane is $\hat{i} - 2\hat{j} + \hat{k}$ so equation to plane is $x - 2y + z = 0$.

14.[A] $\frac{x - 1}{1} = \frac{y + 2}{2} = \frac{z - 1}{-2} = \lambda$

foot $(1 + \lambda, -2 + 2\lambda, 1 - 2\lambda)$

$(1 + \lambda) + 2(-2 + 2\lambda)$

$- 2(1 - 2\lambda) = 10$

$1 + \lambda - 4 + 4\lambda - 2 + 4\lambda = 10$

$9\lambda = 15, \Rightarrow \lambda = 5/3$

foot $= \left(\frac{8}{3}, \frac{4}{3}, -\frac{7}{3}\right)$

$\frac{|1 - 4 - 2 - \alpha|}{3} = 5$

$|\alpha + 5| = 15$

$\alpha = 10$ (correct),

-20 (wrong)

15.[A] Equation of line

$$\frac{x - 2}{1} = \frac{y - 3}{4} = \frac{z - 5}{1} = \lambda$$

General points $\{\lambda + 2, 4\lambda + 3, \lambda + 5\}$

Intersection point with plane

$5(\lambda + 2) - 4(4\lambda + 3) - (\lambda + 5) = 1$

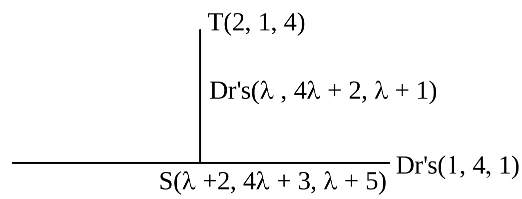
$5\lambda + 10 - 16\lambda - 12 - \lambda - 5 = 1$

$-12\lambda - 8 = 0$

$\lambda = -\frac{8}{12} = -\frac{2}{3}$

Point $\left[\frac{-2}{3} + 2, -\frac{8}{3} + 3, \frac{-2}{3} + 5\right]$

$P\left[\frac{4}{3}, \frac{1}{3}, \frac{13}{3}\right]$



Now

$\lambda + 4(4\lambda + 2) + (\lambda + 1) = 0$

$\lambda + 16\lambda + 8 + \lambda + 1 = 0$

$18\lambda = -9 \quad \Rightarrow \lambda = -\frac{1}{2}$

Points $\left(\frac{-1}{2} + 2,\ -2 + 3,\ -\frac{1}{2} + 5\right) = \left(\frac{3}{2},\ 1,\ \frac{9}{2}\right)$

Distance at PS $= \sqrt{\left(\frac{4}{3} - \frac{3}{2}\right)^2 + \left(\frac{1}{3} - 1\right)^2 + \left(\frac{13}{3} - \frac{9}{2}\right)^2}$

$PS = \sqrt{\frac{1}{36} + \frac{4}{9} + \frac{1}{36}} = \sqrt{\frac{1 + 16 + 1}{36}} = \sqrt{\frac{18}{36}} = \frac{1}{\sqrt{2}}$

16.[A] Equation of plane passing through intersecting of plane P_1 & P_2

is $P_1 + \lambda P_2 = 0$

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

distance of plane from pt (3, 1, –1) is $\dfrac{2}{\sqrt{3}}$

$$\frac{2}{\sqrt{3}} = \frac{|3+3\lambda+2-\lambda-3-\lambda-2-3\lambda|}{\sqrt{(1+\lambda)^2+(2-\lambda)^2+(3-\lambda)^2}}$$

on solving $\lambda = -\dfrac{7}{2}$

so equation of plane is

$$\left(1-\frac{7}{2}\right)x + \left(2+\frac{7}{2}\right)y + \left(3-\frac{7}{2}\right)z - 2 + \frac{21}{2} = 0$$

$5x - 11y + z = 17$

17.[B, C]

If these two lines are coplanar then shortest distance between them = 0

$$\begin{vmatrix} 2 & 0 & 0 \\ 2 & k & 2 \\ 5 & 2 & k \end{vmatrix} = 0$$

k = 2 or –2

$$\text{so lines are} \quad \left.\begin{aligned} &\frac{x-1}{2} = \frac{y+1}{2} = \frac{z}{2} \\ \text{and} \quad &\frac{x+1}{5} = \frac{y+1}{2} = \frac{z}{2} \end{aligned}\right\} \text{set (i)}$$

OR

$$\left.\begin{aligned} &\frac{x-1}{2} = \frac{y+1}{-2} = \frac{z}{2} \\ \text{and} \quad &\frac{x+1}{5} = \frac{y+1}{2} = \frac{z}{-2} \end{aligned}\right\} \text{set (ii)}$$

the plane which contain these set of line should contain the points (1, –1, 0) and (–1, –1, 0) which is satisfied by all the four options and

$(2\hat{i}+2\hat{j}+2\hat{k})$ & $(5\hat{i}+2\hat{j}+2\hat{k})$ OR

$(2\hat{i}-2\hat{j}+2\hat{k})$ & $(5\hat{i}+2\hat{j}-2\hat{k})$ are perpendicular to normal of plane

For first set option (C) is correct.

For second set option (B) is correct.

18.[D] Let point lies on given line is (– 2, –1, 0)

Line $\perp$ to plane and passing through (–2, –1, 0) is

$$\frac{x+2}{1} = \frac{y+1}{1} = \frac{z}{1} = \lambda$$

General point on above line is

$A(\lambda - 2, \lambda - 1, \lambda)$

Now this point lies on plane so put point A in equation of plane so we get $\lambda = 2$

Point A (0, 1, 2)

Let second point on line is (0, –2, 3)

Let line $\perp$ to plane and passing through point (0, –2, 3) is $\dfrac{x}{1} = \dfrac{y+2}{1} = \dfrac{z-3}{1} = \lambda$

General point on above line is $B(\lambda, \lambda - 2, \lambda + 3)$

Now this point lies on plane so we get $\lambda = 2/3$

So point B (2/3, –4/3, 11/3)

Clearly drs of line join foot of $\perp$ i.e. A and B is (2/3, –7/3, 5/3) or (2, –7, 5)

19.[B,D] $\ell_1 = (3\hat{i}+\hat{j}+4\hat{k}) + t(\hat{i}+2\hat{j}+2\hat{k})$

$\ell_2 = (3\hat{i}+3\hat{j}+2\hat{k}) + s(2\hat{i}+2\hat{j}+\hat{k})$

Drs of line $\perp$ to both lines (2, –3, 2)

So line ℓ is $\dfrac{x}{2} = \dfrac{y}{-3} = \dfrac{z}{2}$

Intersection point of line ℓ and ℓ_1 is A (2, –3, 2)

General point on ℓ_2 is B (2k + 3, 2k + 3, k + 2)

Distance between A and B = $\sqrt{17}$

$$\sqrt{(2k+1)^2+(2k+6)^2+k^2} = \sqrt{17}$$

k = –2 and k = $-\dfrac{10}{9}$

So point if k = – 2, is (–1, –1, 0)

if k = $-\dfrac{10}{9}$ is $\left(\dfrac{7}{9}, \dfrac{7}{9}, \dfrac{8}{9}\right)$

20.[A,D] Direction ratios of L_1 are $(0, \alpha - 3, 2)$ and it passes through the point (5, 0, 0)

and direction ratios of L_2 are $(0, 1, \alpha - 2)$ and it passes through the point $(\alpha, 0, 0)$

If L_1 & L_2 are coplanar then

$$\begin{vmatrix} 5-\alpha & 0 & 0 \\ 0 & \alpha-3 & 2 \\ 0 & 1 & \alpha-2 \end{vmatrix} = 0$$

$(5 - \alpha)[(\alpha - 3)(\alpha - 2) - 2] = 0$

$(5 - \alpha)(\alpha^2 - 5\alpha + 4) = 0$

$(5 - \alpha)(\alpha - 1)(\alpha - 4) = 0$

So $\alpha = 1, 4, 5$

21.[A] Any point on line L_1 $(2\lambda + 1, -\lambda, \lambda - 3)$

Any point on line L_2 $(\mu + 4, \mu - 3, 2\mu - 3)$

for point of intersection of L_1 & L_2

$2\lambda + 1 = \mu + 4, -\lambda = \mu - 3, \lambda - 3 = 2\mu - 3$

so $\lambda = 2, \mu = 1$

so point of intersection is (5, –2, –1)

required plane is perpendicular to both given planes so

$7a + b + 2c = 0$ …..(i)

$3a + 5b - 6c = 0$ …..(ii)

From (i) & (ii)

$$\frac{a}{-6-10} = \frac{-b}{-42-6} = \frac{c}{35-3}$$

$$\frac{a}{-1} = \frac{b}{3} = \frac{c}{2}$$

So required equation of plane is

$-1(x - 5) + 3(y + 2) + 2(z + 1) = 0$

$-x + 5 + 3y + 6 + 2z + 2 = 0$

$x - 3y - 2z = 13$

so a = 1, b = –3, c = –2, d = 13