Manzil JEE 2025

Mathematics

DPP: 7

Three Dimensional Geometry

Q1 Consider a plane $\pi : \vec{\mathbf{r}} \cdot \vec{\mathbf{n}} = d$ (where $\vec{\mathbf{n}}$ is not a unit vector). There are two points $A(\vec{\mathbf{a}})$ and $B(\vec{b})$ lying on the same side of the plane. If foot of perpendicular from A and B to the plane π are P and Q respectively, then length of PQ be:

(A) $\frac{|(\vec{\mathbf{b}}-\vec{\mathbf{a}})\cdot\vec{\mathbf{n}}|}{|\vec{\mathbf{n}}|}$

(B) $|(\vec{\mathbf{b}}-\vec{\mathbf{a}})\cdot\vec{\mathbf{n}}|$

(C) $\frac{|(\vec{\mathbf{b}}-\vec{\mathbf{a}})\times\vec{\mathbf{n}}|}{|\vec{\mathbf{n}}|}$

(D) $|(\vec{\mathbf{b}}-\vec{\mathbf{a}})\times\vec{\mathbf{n}}|$

Q2 Given planes

$P_1 : cy + bz = x;$

$P_2 : az + ax = y;$

$P_3 : bx + ay = z;$

P_1, P_2 and P_3 pass through one line, if

(A) $a^2 + b^2 + c^2 = ab + bc + ca$

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

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

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

Q3 Let α be the angle between the lines whose direction cosines satisfy the equations $l + m - n = 0$ and $l^2 + m^2 - n^2 = 0$. Then the value of $\sin^4\alpha + \cos^4\alpha$ is:

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

(B) $\frac{5}{8}$

(C) $\frac{3}{8}$

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

Q4 Let $A(1,2;3), B(0,0,1)$ and $C(-1,1,1)$ are the vertices of $\triangle ABC$.

The equation of altitude through B to side AC is

(A) $r = \mathbf{k} + t(7\hat{\mathbf{i}} - 10\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$

(B) $\mathbf{r} = \mathbf{k} + t(-7\hat{\mathbf{i}} + 10\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$

(C) $\mathbf{r} = \mathbf{k} + t(7\hat{\mathbf{i}} - 10\hat{\mathbf{j}} - 2\hat{\mathbf{k}})$

(D) $\mathbf{r} = \mathbf{k} + t(7\hat{\mathbf{i}} + 10\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$

Q5 Let $\boldsymbol{P_1} : \boldsymbol{r} \cdot (2\hat{\boldsymbol{i}} + \hat{\boldsymbol{j}} - 3\hat{\boldsymbol{k}}) = 4$ be a plane. Let P_2 be another plane which passes through the points $(2,-3,2), (2,-2,-3)$ and $(1,-4,2)$. If the direction ratios of the line of intersection of P_1 and P_2 be $16, \alpha, \beta$, then the value of $\alpha + \beta$ is equal to....

(A) 28 (B) 13

(C) 15 (D) none of these

Q6 Let P be the plane passing through the points $(5,3,0), (13,3,-2)$ and $(1,6,2)$. For $\alpha \in N$, if the distances of the points $A(3,4,\alpha)$ and $B(2,\alpha,a)$ from the plane P are 2 and 3 respectively, then the positive value of a is

(A) 6 (B) 4

(C) 3 (D) 5

Q7 The acute angle between the planes P_1 and P_2, when P_1 and P_2 are the planes passing through the intersection of the planes $5x + 8y + 13z - 29 = 0$ and $8x - 7y + z - 20 = 0$ and the points $(2,1,3)$ and $(0,1,2)$ respectively, is

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

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{12}$

Q8 Find the shortest distance between the l_1 and l_2 whose vector equations are
$\overrightarrow{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} - \hat{j} + \hat{k}\right)$,
$\overrightarrow{r} = 2\hat{i} + \hat{j} - \hat{k} + \mu\left(3\hat{i} - 5\hat{j} + 2\hat{k}\right)$
(A) $\frac{10}{\sqrt{59}}$
(B) $\frac{9}{\sqrt{59}}$
(C) $\frac{8}{\sqrt{59}}$
(D) $\frac{7}{\sqrt{59}}$

Q9 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 :
(A) $(-6, 7)$ (B) $(5, -15)$
(C) $(-5, 5)$ (D) $(6, -17)$

Q10 The line, that is coplanar to the line $\frac{x+3}{-3} = \frac{y-1}{1} = \frac{z-5}{5}$, is
(A) $\frac{x+1}{1} = \frac{y-2}{2} = \frac{z-5}{5}$
(B) $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$
(C) $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{4}$
(D) $\frac{x-1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$

Q11 If the image of the point $P(1, -2, 3)$ in the plane, $2x + 3y - 4z + 22 = 0$ measured parallel to the line $\frac{x}{1} = \frac{y}{4} = \frac{z}{5}$ is Q then PQ is equal to
(A) $\sqrt{42}$
(B) $6\sqrt{5}$
(C) $3\sqrt{5}$
(D) $2\sqrt{42}$

Q12 If the foot of the perpendicular from $(0, 0, 0)$ to a plane is $(1, 2, 2)$, then the equation of the plane is
(A) $-x + 2y + 8z - 9 = 0$
(B) $x + 2y + 2z - 9 = 0$
(C) $x + y + z - 5 = 0$
(D) $x + 2y - 3z + 1 = 0$

Q13 For the line $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$, which one of the following is incorrect?
(A) It lies in the plane $x - 2y + z = 0$
(B) It is same as line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$
(C) It passes through $(2, 3, 5)$
(D) It is parallel to the plane $x - 2y + z - 6 = 0$

Q14 The vector equation of the plane passing through the intersection of the planes $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 1$ and $\vec{r} \cdot (\hat{i} - 2\hat{j}) = -2$, and the point $(1, 0, 2)$ is:
(A) $\vec{r} \cdot (\hat{i} + 7\hat{j} + 3\hat{k}) = \frac{7}{3}$
(B) $\vec{r} \cdot (3\hat{i} + 7\hat{j} + 3\hat{k}) = 7$
(C) $\vec{r} \cdot (\hat{i} - 7\hat{j} + 3\hat{k}) = \frac{7}{3}$
(D) $\vec{r} \cdot (\hat{i} + 7\hat{j} + 3\hat{k}) = 7$

Q15 Consider a plane $x + y - z = 1$ and the point $A(1, 2, -3)$. A line Lhas the equation $x = 1 + 3r, y = 2 - r, z = 3 + 4r$ Equation of the plane containing the line L and the point A has the equation
(A) $x - 3y + 5 = 0$
(B) $x + 3y - 7 = 0$
(C) $3x - y - 1 = 0$
(D) $3x + y - 5 = 0$

Q16 If $\mathrm{P}(x, y, z)$ is a point on the line segment joining $Q\ (2, 2, 4)$ and $R(3, 5, 6)$ such that projections of $\overrightarrow{OP}$ on the axes are $\frac{13}{5}, \frac{19}{5}, \frac{26}{5}$ respectively, then P divides QR in the ratio
(A) $1 : 2$
(B) $3 : 2$
(C) $2 : 3$
(D) $3 : 1$

Q17

Consider three planes
$2x + py + 6z = 8, x + 2y + qz = 5$ and
$x + y + 3z = 4$. Three planes intersect at a point if
(A) $p = 2, q \neq 3$
(B) $p \neq 2, q \neq 3$
(C) $p \neq 2, q = 3$
(D) $p = 2, q = 3$

Q18 Consider a plane $\pi : \vec{\mathbf{r}} \cdot \vec{\mathbf{n}} = d$ (where $\vec{\mathbf{n}}$ is not a unit vector). There are two points $A(\vec{a})$ and $B(\vec{b})$ lying on the same side of the plane. Reflection of $A(\vec{\mathbf{a}})$ in the plane π has the position vector :
(A) $\vec{\mathbf{a}} + \frac{2}{(\vec{\mathbf{n}})^2}(d - \vec{a} \cdot \vec{n})\vec{n}$
(B) $\vec{\mathbf{a}} - \frac{1}{(\vec{\mathbf{n}})^2}(d - \vec{\mathbf{a}} \cdot \vec{\mathbf{n}})\vec{\mathbf{n}}$
(C) $\vec{\mathbf{a}} + \frac{2}{(\vec{\mathbf{n}})^2}(d + \vec{\mathbf{a}} \cdot \vec{\mathbf{n}})\vec{\mathbf{n}}$
(D) $\vec{\mathbf{a}} + \frac{2}{(\vec{\mathbf{n}})^2}\vec{\mathbf{n}}$

Q19 Q is the image of point $P(1, -2, 3)$ with respect to the plane $x - y + z = 7$. The distance of Q from the origin is :
(A) $\sqrt{\frac{70}{3}}$
(B) $\frac{1}{2}\sqrt{\frac{70}{3}}$
(C) $\sqrt{\frac{35}{3}}$
(D) $\sqrt{\frac{15}{2}}$

Q20 If a plane passes through the points $(-1, k, 0), (2, k, -1), (1, 1, 2)$ and is parallel to the line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$, then the value of $\frac{k^2+1}{(k-1)(k-2)}$ is
(A) $\frac{17}{5}$
(B) $\frac{5}{17}$
(C) $\frac{6}{13}$
(D) $\frac{13}{6}$

Q21 If the foot of the perpendicular from the point $A(-1, 4, 3)$ on the plane $P : 2x + my + nz = 4$, is $\left(-2, \frac{7}{2}, \frac{3}{2}\right)$ then the distance of the point A from the plane P measured parallel to a line with direction ratios $3, -1, -4$ is equal to
(A) 1
(B) $\sqrt{26}$
(C) $2\sqrt{2}$
(D) $\sqrt{14}$

Q22 A line passing through $P(3, 7, 1)$ and $R(2, 5, 7)$ meet the plane $3x + 2y + 11z - 9 = 0$ at Q. Then PQ is equal to :
(A) $\frac{5\sqrt{41}}{59}$
(B) $\frac{\sqrt{41}}{59}$
(C) $\frac{50\sqrt{41}}{59}$
(D) $\frac{25\sqrt{41}}{59}$

Q23 Direction cosines of the line that makes equal angles with the three axes in a space are
(A) $\left(\pm\frac{1}{3}, \pm\frac{1}{3}, \pm\frac{1}{3}\right)$
(B) $\left(\pm\frac{6}{7}, \pm\frac{6}{7}, \pm\frac{6}{7}\right)$
(C) $\left(\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}\right)$
(D) $\left(\pm\sqrt{\frac{1}{7}}, \pm\sqrt{\frac{1}{7}}, \pm\sqrt{\frac{1}{7}}\right)$

Q24 The length of the perpendicular from $(1, 6, 3)$ to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ is
(A) 3
(B) $\sqrt{5}$
(C) $\sqrt{13}$
(D) 5

Q25 The co-ordinates of the point P on the line $\mathbf{r} = (\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}) + \lambda(-\hat{\mathbf{i}} + \hat{\mathbf{j}} - \hat{\mathbf{k}})$ which is nearest to the origin is
(A)

$\left(\frac{2}{3}, \frac{4}{3}, \frac{2}{3}\right)$

(B) $\left(-\frac{2}{3}, -\frac{4}{3}, \frac{2}{3}\right)$

(C) $\left(\frac{2}{3}, \frac{4}{3}, -\frac{2}{3}\right)$

(D) None of these

Answer Key

Q1	(C)
Q2	(B)
Q3	(B)
Q4	(B)
Q5	(A)
Q6	(B)
Q7	(A)
Q8	(A)
Q9	(A)
Q10	(B)
Q11	(D)
Q12	(B)
Q13	(C)
Q14	(D)
Q15	(B)
Q16	(B)
Q17	(B)
Q18	(A)
Q19	(A)
Q20	(D)
Q21	(B)
Q22	(D)
Q23	(C)
Q24	(C)
Q25	(A)

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