MATHS

BOOKS - ML KHANNA

CO-ORDINATE GEOMETRY OF THREE DIMENSION

Passage 1 Diraction Cisines Of A Line And Angle Between Two Lines

1. (a) If a makes angle α, β, γ with co-oedinate axes, them $\cos\alpha, \cos\beta, \cos\gamma$ denoted by l,m,n are called the direction cosines of the line. Also $l^2+m^2+n^2=1$.

(b) Any three numbers a,b,c such that

$$\frac{l}{a}=\frac{m}{b}=\frac{n}{c}=\sqrt{\frac{l^2+m^2+n^2}{a^2+b^2+c^2}}=\frac{1}{\sum a^2}$$

are caqlled direction ratios

(c) Condition of perpandicularity of two lines

$\cos\theta=1_1l_2, m_1m_2, +n_1=n_2=0as\theta=\pi/2$

or $\frac{a_1}{a_2} + b_1 b_2 + c_1 c_2 = 0$

Condition of parallelism of two lines $l_1 = 1_2, m_1 = m_2, n_1 = n_2,$ d.c.'s equal

or $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$,i.e.,D.R.'s are proportial

(e) D.r,'s of a line joining two points

$x_2 - x_1, y_2 - y_1, z_2 - z_1$

The direction-cosines of the line which is equally inclined to the axis are

A. 1,1,1

B. $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

C. $-\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$

D. None

Answer: bc

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2. (a) If a makes angle α, β, γ with co-oedinate axes, them $\cos\alpha, \cos\beta, \cos\gamma$ denoted by I,m,n are called the direction cosines of the line. Also $l^2 + m^2 + n^2 = 1$.

(b) Any three numbers a,b,c such that

$$\frac{l}{a} = \frac{m}{b} = \frac{n}{c} = \sqrt{\frac{l^2 + m^2 + n^2}{a^2 + b^2 + c^2}} = \frac{1}{\sum a^2}$$

are caqlled direction ratios

(c) Condition of perpandicularity of two lines

$\cos\theta = 1_1 l_2, m_1 m_2, + n_1 = n_2 = 0 as \theta = \pi/2$

or $\frac{a_1}{a_2} + b_1 b_2 + c_1 c_2 = 0$

Condition of parallelism of two lines $l_1 = 1_2, m_1 = m_2, n_1 = n_2,$ d.c.'s equal

or $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$,i.e.,D.R.'s are proportial

(e) D.r,'s of a line joining two points

$x_2 - x_1, y_2 - y_1, z_2 - z_1$ or $\frac{a_1}{a_2} + b_1 b_2 + c_1 c_2 = 0$

The angle between the lines whose d.c.'s are connected by the relations

$l^2 + m^2 - n^2 = 0, 1 + m + n = 0$ is

A. $\pi/6$

B. $\pi/4$

C. $\pi/3$

D. $\pi/2$

Answer: c

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3. (a) If a makes angle α, β, γ with co-oedinate axes, them $\cos\alpha, \cos\beta, \cos\gamma$ denoted by l,m,n are called the direction cosines of the line. Also $l^2 + m^2 + n^2 = 1$.

(b) Any three numbers a,b,c such that

$$\frac{l}{a} = \frac{m}{b} = \frac{n}{c} = \sqrt{\frac{l^2 + m^2 + n^2}{a^2 + b^2 + c^2}} = \frac{1}{\sum a^2}$$

are caqlled direction ratios

(c) Condition of perpandicularity of two lines $\cos\theta = 1_1 l_2, m_1 m_2, + n_1 = n_2 = 0 as \theta = \pi/2$ or

$$\frac{a_1}{a_2} + b_1 b_2 + c_1 c_2 = 0$$

Condition of parallelism of two lines $l_1 = 1_2, m_1 = m_2, n_1 = n_2,$ d.c.'s equal

or $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$,i.e.,D.R.'s are proportial

(e) D.r,'s of a line joining two points

$x_2 - x_1, y_2 - y_1, z_2 - z_1$

or $\frac{a_1}{a_2} + b_1 b_2 + c_1 c_2 = 0$

If $l_1, m_1 . n_1$ and l_2, m_2, n_2 are D.C.'s of two lines inclined to each other at an angle θ, then the D,c.'S of the internal and external bisectors of the angle between these are

A. $\frac{l_2 + l_2}{2\sin(\theta/2)}, \frac{m_2 + m_2}{2\sin(\theta/2)}, \frac{n_2 + n_2}{2\sin(\theta/2)}$

B. $\frac{l_2 + l_2}{2\cos(\theta/2)}, \frac{m_2 + m_2}{2\cos(\theta/2)}, \frac{n_2 + n_2}{2\cos(\theta/2)}$

C. $\frac{l_2 - l_2}{2\sin(\theta/2)}, \frac{m_2 - m_2}{2\sin(\theta/2)}, \frac{n_2 - n_2}{2\sin(\theta/2)}$

D. $\frac{l_2 - l_2}{2\cos(\theta/2)}, \frac{m_2 - m_2}{2\cos(\theta/2)}, \frac{n_2 - n_2}{2\cos(\theta/2)}$

Answer: bc

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4. The Lines

$\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$ and $\frac{x}{2} = \frac{y+2}{2} = \frac{z-3}{-2}$ are

A. parallel

B. intersecting

C. skew

D. at rt. angles

Answer: d

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Passage 2 The Plane Answer The Following Qurstion Based Upon Above Passage

1. The angle between the planes 2x-y+3z=6 and x+y+2z=7 is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{6}$

Answer: c

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2. The equation of a condition of two plqanes being parellel or perpendicular.

(a) Every equation of first degree in x,y,z,i.e., $Ax + By + Cz + D = 0$ represents a plane The coefficients of x,y,z are the direction ratios of the normal to the plane.

(b) Angle between two planes is equal to the angle between the normal to the planes.

$$\therefore \qquad \cos\theta = \frac{A_1A_2 + B_1B_2 + C_1C_2}{\sqrt{\sum A_1^2}.\sqrt{\sum A_2^2}}$$

Planes are perpendiculer if $\sum A_1, A_2 = 0$ and parallel if $\frac{A_1}{A_2} = \frac{B_1}{B_2} = \frac{C_1}{C_2}$

(c) Planes parallel to co-ordinate planes are $x = \gamma, y = \gamma$ or $z = \gamma$.

Planes perpendicular to co-ordinet planes $x = 0, y = 0, z = 0$ are

$by + cz + d = 0(\text{x missing}), ax + cz + d = 0$

$(\text{y missing}), ax + by + d = 0(\text{z missing})$

A plane is at unit distance from origin. It cuts coordinate axes at P,Q,R respectively. If the locus of centroid of the ΔPQR is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = k$, then $k =$

A. 3

B. 1

C. 2

D. 9

Answer: d

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3. The equation of a condition of two plqanes being parellel or perpendicular.

(a) Every equation of first degree in x,y,z,i.e., $Ax+By+Cz+D=0$ represents a plane The coefficients of x,y,z are the direction ratios of the normal to the plane.

(b) Angle between two planes is equal to the angle between the normal to the planes.

$$\therefore \qquad \cos\theta = \frac{A_1A_2+B_1B_2+C_1C_2}{\sqrt{\sum A_1^2}.\sqrt{\sum A_2^2}}$$

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$by + cz + d = 0(\text{x missing}), ax + cz + d = 0$

$(\text{y missing}), ax + by + d = 0(\text{z missing})$

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

A. $7x - 2y + 3z + 81 = 0$

B. $23x + 14y - 9z + 48 = 0$

C. $15x + 15y - 50z + 173 = 0$

D. None

Answer: c

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4. The equation of a condition of two plqanes being parellel or perpendicular.

(a) Every equation of first degree in x,y,z,i.e., $Ax + By + Cz + D = 0$ represents a plane The coefficients of x,y,z are the direction ratios of the normal to the plane.

(b) Angle between two planes is equal to the angle between the normal to the planes.

$$\therefore \qquad \cos\theta = \frac{A_1A_2 + B_1B_2 + C_1C_2}{\sqrt{\sum A_1^2}.\sqrt{\sum A_2^2}}$$

Planes are perpendiculer if $\sum A_1, A_2 = 0$ and parallel if $\frac{A_1}{A_2} = \frac{B_1}{B_2} = \frac{C_1}{C_2}$

(c) Planes parallel to co-ordinate planes are $x = \gamma, y = \gamma \text{ or } z = \gamma$.

Planes perpendicular to co-ordinet planes $x = 0, y = 0, z = 0$ are

$by + cz + d = 0(\text{x missing}), ax + cz + d = 0$

$(\text{y missing}), ax + by + d = 0(\text{z missing})$

The equation of the plane which bisects the line joining the points $(3, 2, 2), (5, 4, 6)$ at right angle is

A. $x + y + 2z - 15 = 0$

B. $x + 2y + z - 15 = 0$

C. $2x + y + z - 15 = 0$

D. $x + y + z - 8 = 0$

Answer: a

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Passage 3 Equation Of A Line Intersection Of A Line And Plane Answer The Following Qurstion Based Upon Above Passage

1. (a) $\frac{x - x_1}{l} = \frac{y - y_1}{m} = \frac{z - z_1}{n} = r$, say, represent the equation of a line through the point (x_1, y_1, z_1) where l,m,n are d.c.'s of the line.

(b) Angle between line and a plane $ax + cz + d = 0$, It is complement of the angle between line and normal to the plane

$$\therefore \quad \cos(90^\circ - \theta) = \frac{al + bm + cn}{\sqrt{\sum a^2}.\sqrt{\sum l^2}}$$

(d)(i) Line is parallel to plane $\Rightarrow$ it is perpendiculer to normal

$$\therefore \quad al + bm + cn = 0$$

(ii) Line is parallel to plane $\Rightarrow$ it is parallel to normal

$\therefore \quad \frac{a}{1}=\frac{b}{m}=\frac{c}{n}$

(iii) Line to lie in the plane

$\Rightarrow al+bm+cn=0$ and $ax_1+by_1+cz_1+d=0$

Equation of the line passing through the point $(2, 3, 4)$ and perpandiculer to plane $2x+3y+z+5=0$ is

A. $\frac{x-2}{1}=\frac{y-3}{2}=\frac{z-4}{3}$

B. $\frac{x-2}{3}=\frac{y-3}{2}=\frac{z-4}{1}$

C. $\frac{x-2}{1}=\frac{y-3}{3}=\frac{z-4}{2}$

D. $\frac{x-2}{1}=\frac{y-3}{3}=\frac{z-4}{2}$

Answer: c

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2. (a) $\frac{x-x_1}{l}=\frac{y-y_1}{m}=\frac{z-z_1}{n}=r$, say, represent the equation of a line through the point (x_1, y_1, z_1) where l,m,n are d.c.'s of the line.

(b) Angle between line and a plane $ax+cz+d=0$, It is complement of the angle between line and normal to the plane

$$\therefore \quad \cos(90^\circ - \theta) = \frac{al + bm + cn}{\sqrt{\sum a^2}.\sqrt{\sum l^2}}$$

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$$\therefore \quad al + bm + cn = 0$$

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$$\therefore \quad \frac{a}{1} = \frac{b}{m} = \frac{c}{n}$$

(iii) Line to lie in the plane

$$\Rightarrow al + bm + cn = 0 \text{ and } ax_1 + by_1 + cz_1 + d = 0$$

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

Answer: c

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3. (a) $\frac{x - x_1}{l} = \frac{y - y_1}{m} = \frac{z - z_1}{n} = r$, say, represent the equation of a line through the point (x_1, y_1, z_1) where l,m,n are d.c.'s of the line.

(b) Angle between line and a plane $ax + cz + d = 0$, It is complement of the angle between line and normal to the plane

$$\therefore \quad \cos(90^\circ - \theta) = \frac{al + bm + cn}{\sqrt{\sum a^2}.\sqrt{\sum l^2}}$$

(d)(i) Line is parallel to plane $\Rightarrow$ it is perpendiculer to normal

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$$\therefore \quad \frac{a}{1} = \frac{b}{m} = \frac{c}{n}$$

(iii) Line to lie in the plane

$$\Rightarrow al + bm + cn = 0 \text{ and } ax_1 + by_1 + cz_1 + d = 0$$

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.'s of a line $\perp$ to both the given lines are

A. $m_1 n_2 - m_2 n_1 - n_1 l_2 - n_2 l_1, l_1 m(2) - l_2 m_1$

B. $l_1 + l_2, m_1 + m_2, n_1 + n_2$

C. $l_2 - l_2, m_1 - m_2, n_1 + n_2$

D. None of these

Answer: a

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4. (a) $\frac{x-x_1}{l}=\frac{y-y_1}{m}=\frac{z-z_1}{n}=r$, say, represent the equation of a line through the point (x_1, y_1, z_1) where l,m,n are d.c.'s of the line.

(b) Angle between line and a plane $ax+cz+d=0$, It is complement of the angle between line and normal to the plane

$$\therefore \quad \cos(90^\circ-\theta)=\frac{al+bm+cn}{\sqrt{\sum a^2}.\sqrt{\sum l^2}}$$

(d)(i) Line is parallel to plane $\Rightarrow$ it is perpendiculer to normal

$$\therefore \quad al+bm+cn=0$$

(ii) Line is parallel to plane $\Rightarrow$ it is parallel to normal

$$\therefore \quad \frac{a}{1}=\frac{b}{m}=\frac{c}{n}$$

(iii) Line to lie in the plane

$$\Rightarrow al+bm+cn=0 \text{ and } ax_1+by_1+cz_1+d=0$$

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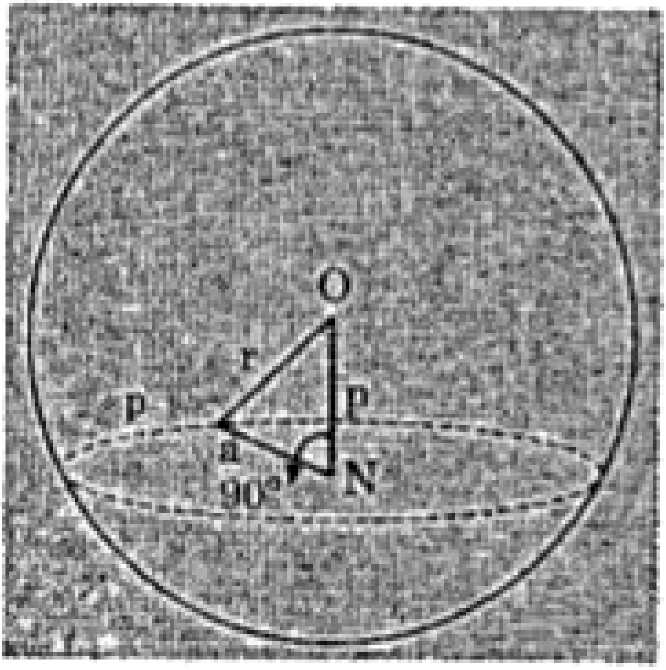
Passage 4 The Sphere Answer The Following Qurstion Based Upon Above Passage

1. Section of a sphere by a plane.

(a) $x^2 + y^2 + z^2 + 2vy + 2wz + d = 09$ represent a sphere with center at $(-u, -v, -w)$ and $r = \sqrt{u^2 + v^2 + w^2 - d}$

The section of a sphere by a plane is a circle.If its redius be a than $a = \sqrt{u^2 + v^2 + w^2 - d}$

(b) The section of a sphere by a plane is a circle. If its radius be a then $a = \sqrt{r^2 - p^2}$, where p mis perpendiculer from center to given plane.



if the plane passes through the center of the sphere, then this section is called great circle.

In this case $p=0 \quad \therefore \quad a=r, i.e.,$ its center and radius is this case

$p=0 \quad \therefore \quad a=r, i.e.,$ its centre and radius is the same as of given sphere

If $S=0$ and $p=0$ be the equations of a sphere and a plane, then $s+\gamma P=0$ represents a sphere through the circle $S=0, P=0$

The equation of a sphere passing through origin and the points, $(a, 0, 0), (0, b, 0)$ and $(0, 0, c)$

Or

The plane $x/a + y/b + z/c = 1$ meets the co-ordinate axes in the points A,B,C and O be the origin. The sphere $OABC$ is

A. $x^2 + y^2 + z^2 + ax + by + cz = 0$

B. $x^2 + y^2 + z^2 = a + b + c = 0$

C. $x^2 + y^2 + z^2 - 2ax - 2by - 2cz = 0$

D. $x^2 + y^2 + z^2 - ax - by - cz = 0$

Answer: d

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2. Section of a sphere by a plane.

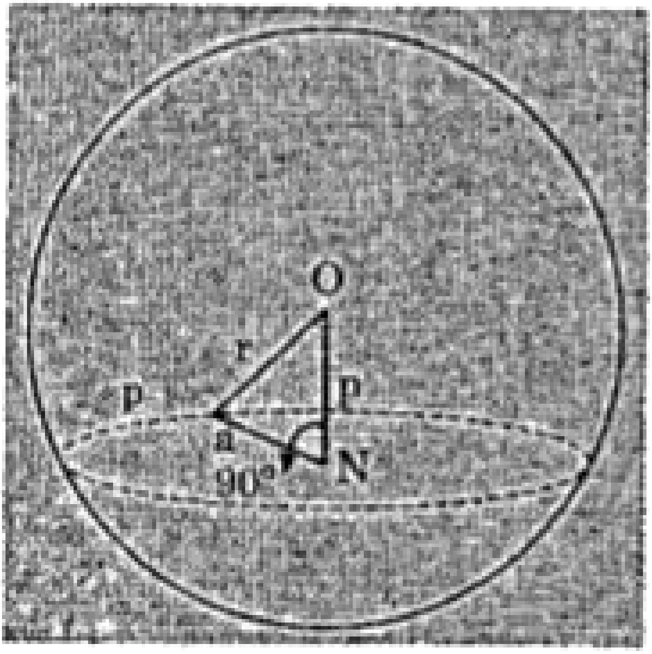
(a) $x^2 + y^2 + z^2 + 2vy + 2wz + d = 09$ represent a sphere with center at $(-u, -v, -w)$ and $r = \sqrt{u^2 + v^2 + w^2 - d}$

The section of a sphere by a plane is a circle.If its redius be a than

$a = \sqrt{u^2 + v^2 + w^2 - d}$

(b) The section of a sphere by a plane is a circle. If its radius be a then

$a = \sqrt{r^2 - p^2}$, where p mis perpendiculer from center to given plane.



if the plane passes through the center of the sphere, then this section is called great circle.

In this case $p = 0 \quad \therefore \quad a = r, i.e.,$ its center and radius is this case

$p = 0 \quad \therefore \quad a = r, i.e.,$ its centre and radius is the same as of given sphere

If $S = 0$ and $p = 0$ be the equations of a sphere and a plane, then $s + \gamma P = 0$ represents a sphere through the circle $S = 0, P = 0$

The co-ordinates of the center and the radius of the circle $x + 2y + 2z = 15, x^2 + y^2 + z^2 - 2y - 4z = 11$ are

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

B. $(3, 4, 1), \sqrt{6}$

C. $(1, 3, 4), \sqrt{7}$

D. None

Answer: c

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3. Section of a sphere by a plane.

(a) $x^2 + y^2 + z^2 + 2vy + 2wz + d = 09$ represent a sphere with center at $(-u, -v, -w)$ and $r = \sqrt{u^2 + v^2 + w^2 - d}$

The section of a sphere by a plane is a circle.If its redius be a than $a = \sqrt{u^2 + v^2 + w^2 - d}$

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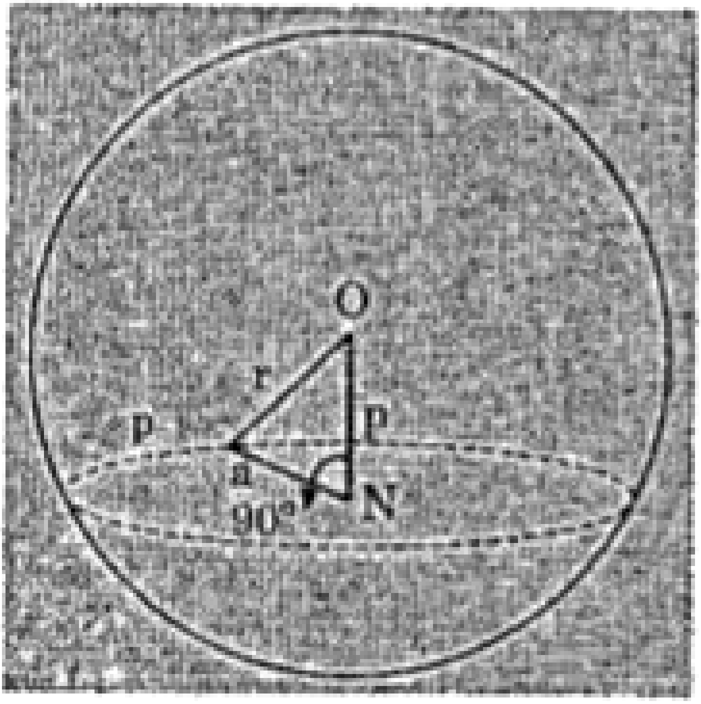

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If $S = 0$ and $p = 0$ be the equations of a sphere and a plane, then $s + \gamma P = 0$ represents a sphere through the circle $S = 0, P = 0$

The equation of the sphere touching the three co-ordinate planes is

A. $\sum x^2 + (x + y + z) + 2a^2 = 0$

B. $\sum x^2 - (x+y+z) + 2a^2 = 0$

C. $\sum x^2 \pm (x+y+z) + 2a^2 = 0$

D. $\sum x^2 \pm 2ax \pm 2ay \pm 2az \pm 2a^2 = 0$

Answer: d

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Problem Set 1

1. A,B,C are three points on the axis of x, y and z respectively at distance a,b,c from the orgain O, then the co-ordinates of the point which is equidistant from A,B,C and O is

A. (a, b, c)

B. $\left(\frac{a}{2}, \frac{b}{2}, \frac{c}{2}\right)$

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

D. None

Answer: B

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2. The ratio in which the sphere $x^2 + y^2 + z^2 = 504$ divides the line joining the points $(12, \ -4, 8)$ and $(27, \ -9, 18)$is

A. $-2:3$

B. 2:3

C. 3:4

D. 1:2

Answer: A::B

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3. Find the ratio in which the $y - z$ plane divides the join of the points $(\ -2, 4, 7) and (3, \ -5, 8)\cdot$

A. 2:3

B. 3:2

C. $-2:3$

D. 4:-3

Answer: A::B

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4. If $P(3, 2, -4), Q(5, 4, -6)$ and $R(9, 8, -10)$ are collinear, then R divides PQ in the ratio

A. 2:1 internally

B. 2:1 externally

C. 3:2 internally

D. 3:2 externally

Answer: D

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5. $A(3, 2, 0), B(5, 3, 2), C(-9, 6, -3)$ are the vertices of a triangle ABC. If the bisector of $\angle BAC$ meets BC at D, then coordinates of D 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. $\left(\frac{19}{8}, \frac{57}{16}, -\frac{17}{16}\right)$

Answer: C

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6. The co-ordinates of the point which divides the line joining $(2, 3, 4)$ and $(3, -4, 7)$ in the ratio 2:4 are :

A. (10,1,1)

B. (1,10,1)

C. (10,-10,10)

D. (1,1,10)

Answer: B

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7. The minimum distance of the point (1, 2, 3) from x-axis is

A. $\sqrt{13}$

B. $\sqrt{5}$

C. $\sqrt{10}$

D. None of these

Answer: A

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8. The locus of $x^2 + y^2 + z^2 = 0$ is

A. (0,0,0)

B. a sphere

C. a circle

D. None of these

Answer: A

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9. A parallelepiped is formed by planes drawn through the points $P(6, 8, 10) and (3, 4, 8)$ parallel to the coordinate planes. Find the length of edges and diagonal of the parallelepiped.

A. 2

B. 3

C. 4

D. 5

Answer: A::B::C

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10. If α, β, γ be angles which a straighat line makes with the positive direction of the axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ is equal to (A) 4 (B) 1 (C) 2 (D) 3

A. 2

B. 3

C. 4

D. None

Answer: A

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11. A line line makes the same angle θ with each of the x and z-axes. 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

A. $\frac{2}{3}$

B. $\frac{1}{5}$

C. $\frac{3}{5}$

D. $\frac{2}{5}$

Answer: C

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12. A line makes angles $\alpha, \beta, \gamma and \delta$ with the diagonals of a cube. Show that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = 4/3$.

A. $\frac{2}{3}$

B. $\frac{4}{3}$

C. $\frac{8}{3}$

D. 1

Answer: B

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13. Which of the following triplets give the direction cosines of a line ?

A. 1,1,1

B. 1,-1,1

C. 1,1,-1

D. $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

Answer: D

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14. The points $A(1, -6, 10), B(-1, -3, 4), C(5, -1, 1)$ and $D(7, -4, 7)$ are the vertices of a

A. parallelogram

B. rhombus

C. rectangle

D. square

Answer: B

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15. A straight line which makes an angle of 60° with each of Y and Z-axis, the angle this lines makes with X-axis is

A. 45°

B. 30°

C. 75°

D. 60º

Answer: A

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16. If a line makes an angle $\frac{\pi}{4}$ 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

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{2}$

Answer: D

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17. A line passes through the point $(6, -7, -1)$ and $(2, -3, 1)$. The direction cosines of the line so directed that the angle made by it with the 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. $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$

Answer: A

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18. If P is a point in space such that OP is inclined to OX at 45° and OY to 60° then OP inclined to ZO at 75°

A. 75°

B. 60° or 120°

C. 75° or 105°

D. 255

Answer: B

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19. The projections of a line segment on the coordinate axes are 12,4,3 respectively. The length and direction cosines of the line segment 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

Answer: A

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20. The direction cosines of the line joining the points $(4, 3, -5)$ and $(-2, 1-8)$ are

A. $< 2, 4, -13 >$

B. $< 6, 2, 3 >$

C. $< 6/7, 2/7, 3/7 >$

D. None of these

Answer: C

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21. 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

Answer: C

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22. If $A(6, 3, 2), B(5, 1, 4), C(3, -4, 7), D(0, 2, 5)$ be from points, the projection of the sement CD on the line AB is

A. $-\frac{13}{3}$

B. $-\frac{13}{7}$

C. $-\frac{3}{13}$

D. $-\frac{7}{13}$

Answer: A

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23. The angle between the lines whose direction ratios are $1, 1, 2, \sqrt{3}-1, -\sqrt{3}-1, 4$ is

A. $\cos^{-1}\left(\frac{1}{65}\right)$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{4}$

Answer: C

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24. The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$ is

A. 45°

B. 30°

C. 0°

D. 90°

Answer: D

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25. Find the angle between the lines whose direction cosines are connected by the relations $l + m + n = 0 and 2/m + 2nl - mn = 0.$

A. $\frac{\pi}{3}$

B. $\frac{\pi}{6}$

C. $\frac{2\pi}{3}$

D. $\frac{3\pi}{3}$

Answer: C

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26. Three lines with direction cosines $(1, 1, 2), \left(\sqrt{3}-1, -\sqrt{3}-1, 4\right), \left(\sqrt{3}-1, \sqrt{3}-1, 4\right)$ enclose

A. an isosceles triangle

B. a right angled tringle

C. an equilateral tringle

D. a right angled isosceles triangle

Answer: C

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27. The co-ordinates of a point P are (3, 12, 4) with respect to 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. $\frac{3}{13}, \frac{12}{13}, \frac{4}{13}$

Answer: D

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28. The vertices of a triangle ABC are $A(-1, 2, -3), B(5, 0, -6), C(0, 4, -1)$. Then the direction rations of the external bisector of $\angle C$ are :

A. 0,0,1

B. 1,-1,1

C. $-1, 0, 0$

D. none

Answer: C

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29. The vertices of a triangles ABC are $A(-1, 2, -3), B(5, 0, -6), C(0, 4, -1)$.Then the direction ratios of the external bisector of $\angle BAC$ are :

A. 11,20,21

B. $-11, 20, 20$

C. $-11, 20, 23$

D. none

Answer: C

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30. The cosine of the angle between any two diagonals of a cube is

A. $1/3$

B. $1/2$

C. $2/3$

D. $1/\sqrt{3}$

Answer: A

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31. The direction rations of the diagonals of a cube which joins the origin to the opposite corner are (when the three concurrent edges of the cube are coordinate axes)

A. $\frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}$

B. 1,1,1

C. 2,-2,1

D. 1,2,3

Answer: B

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32. In three dimensional geometry $ax + by + c = 0$ represents (A) a plane perpendicular to z-axis (B) a plane perpendicular to xy plane (C) a straighat line on xy plane (D) a plane parallel to z-axis

A. xy-plane

B. yz-plane

C. zx-plane

D. none

Answer: A

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33. Prove that the straight lines whose direction cosines are given by the relations $al + bm + cn = 0$ and $fmn + gnl + hlm = 0$ are Perpendicular to each other if $\frac{f}{a} + \frac{g}{b} + \frac{h}{c} = 0$, and parallel if $a^2f^2 + b^2g^2 + c^2h^2 - 2bcgh - 2cahf - 2abfg = 0$.

A. $\sqrt{af} + \sqrt{bg} + \sqrt{ch} = 0$

B. $\frac{a^2}{f} + \frac{b^2}{g} + \frac{c^2}{n} = 0$

C. $\frac{f}{a} + \frac{g}{b} + \frac{h}{c} = 0$

D. $a^2 f^2 + b^2 g^2 + c^2 h^2 - 2bcgh - 2cahf - 2abfg = 0$

Answer: C

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34. If the direction ratio of two lines are given by $3lm - 4\ln + mn = 0$ and $l + 2m + 3n = 0$, then the angle between the lines, is

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{2}$

Answer: D

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35. The plane $2x + y + 2z = 9$ intersects the coordinate axes at A,B,C.The orthocentre of the triangle ABC is

A. $(2, 1, 2)$

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

C. $\left(\frac{3}{13}, \frac{1}{13}, \frac{3}{13}\right)$

D. $\left(\frac{9}{7}, \frac{27}{7}, \frac{9}{7}\right)$

Answer: A

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36. If the line $x = y = z$ intersects the line

$x \sin A + y \sin B + z \sin C = 2d^2$

$x \sin 2A + y \sin 2B + z \sin 2C = d^2$

where $A + B + C = \pi$, then $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} =$

A. $\frac{1}{8}$

B. $\frac{1}{12}$

C. $\frac{1}{16}$

D. $\frac{1}{32}$

Answer: C

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Problem Set 2

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

A. $2x+y-2z=0$

B. $3x+4y+5z=7$

C. $x+y+z=2$

D. $2x+3y+4z=0$

Answer: A

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2. A plane meets the coordinate axes in A,B,C such that the centroid of triangle ABC is the point (p, q, r). If the equation of the plane is $\frac{x}{p}+\frac{y}{q}+\frac{z}{r}=k$ then $k=$

A. $\frac{x}{y}+\frac{y}{q}+\frac{z}{r}=0$

B. $\frac{x}{p}+\frac{y}{q}+\frac{z}{r}=1$

C. $\frac{x}{p}+\frac{y}{q}+\frac{z}{r}=2$

D. None

Answer: D

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3. The plane passing through the point $(-2, -2, 2)$ and containining the line joining the points $(1, 1, 1)$ and $(1, -1, 2)$ marks intercepts a,b,c on the axes of coordinates. The value of $a+b+c$ is

A. 12

B. 6

C. -4

D. -3

Answer: C

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4. If the centroid of tetrahedron OABC where A ,B, C are given by (a, 2, 3) , (1 ,b, 2) and (2, 1, c) respectively is (1, 2, -1) then distance of P(a, b, c) from origin is

A. $\sqrt{(107)}$

B. $\sqrt{(14)}$

C. $\sqrt{(170/14)}$

D. None of these

Answer: A

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5. 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

Answer: B

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6. The equation of the plane passing through the point $(-2, -2, 2)$ and containing the line joining the points $(1, 1, 1)$ and $(1, -1, 2)$ is

A. $x + 2y - 3z + 4 = 0$

B. $3x - 4y + 1 = 0$

C. $5x + 2y - 3z + 1 = 0$

D. $x - 3y - 6z + 8 = 0$

Answer: D

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7. If the planes ax+by + cz=1 meets the co-ordinates axes in the points A,B,C, then the centroid of $\triangle ABC$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. $\left(\frac{1}{3a}, \frac{1}{3b}, \frac{c}{3c}\right)$

Answer: D

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8. If O is the original and A is the point (a,b,c) then the equation of the plane throught A and at right angles to OA is .

A. $a(x-a)-b(x-b)-c(x-c)=0$

B. $a(x+a)+b(x+b)+c(x+c)=0$

C. $a(x-a)+b(x-b)c+(x-c)=0$

D. None of these

Answer: C

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9. The distance between the two parallel planes

$ax + by + cz + d = 0$

and $ax + by + cz + d' = 0$

A. $\dfrac{|d - d'|}{\sqrt{(a^2 + b^2 + c^2)}}$

B. $\dfrac{|d + d'|}{\sqrt{(a^2 + b^2 + c^2)}}$

C. $\dfrac{d}{\sqrt{(a^2 + b^2 + c^2)}}$

D. None of these

Answer: A

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10. Distance between two parallel planes

$2x + y + 2z = 8$ and $4x + 2y + 4z + 5 = 0$ is

A. $\dfrac{3}{2}$

B. $\frac{5}{2}$

C. $\frac{7}{2}$

D. $\frac{9}{2}$

Answer: C

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11. If from a point $P(a, b, c)$ prpendiculars $PAandPB$ are drawn to $yzandzx - planes,$ find the eqution of th plane OAB.

A. $bcx + cay + abz = 0$

B. $bcx + cay - abz = 0$

C. $bcx - cay + abz = 0$

D. $-bcx + cay + abz = 0$

Answer: B

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12. Let $P(3, 2, 6)$ be a point in space and Q be a point on line $\vec{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(-3\hat{i} + \hat{j} + 5\hat{k})$. Then the value of μ for which the vector $\vec{P}Q$ is parallel to the plane $x - 4y + 3z = 1$ is a. 1/4 b. -1/4 c. 1/8 d. -1/8

A. $\frac{1}{4}$

B. $-\frac{1}{4}$

C. $\frac{1}{8}$

D. $-\frac{1}{8}$

Answer: A

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Problem Set 3

1. Find the vector equation of the plane through the points (2,1,-1) and (-1,3,4) and perpendicular to the plane $x - 2y + 4z = 10$.

A. $18x + 17y + 4z = 49$

B. $18x - 17y + 4z = 49$

C. $18x + 17y - 4z + 49 = 0$

D. None of these

Answer: A

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2. The direction ratios of a normal to the plane through $(1, 0, 0) and (0, 1, 0)$, which makes and angle of $\frac{\pi}{4}$ with the plane $x + y = 3,$ are a. $\langle 1, \sqrt{2}, \rangle$ b. $\langle 1, 1, \sqrt{2} \rangle$ c. $\langle 1, 1, 2 \rangle$ d. `<>`

A. 1,1,2

B. $\sqrt{2}, 1, 1$

C. $1, \sqrt{2}, 1$

D. $1, 1, \sqrt{2}$

Answer: D

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3. The two points$(1, 1, 1)$ and $(- 3, 0, 1)$ with respect to the plane $3x + 4y - 12z + 13 = 0$ lie on

A. opposite side

B. same side

C. on the plane

D. None of these

Answer: B

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4. The equation of the plane passing through $(2, 3, -4)$ and $(1, -1, 3)$ and parallel to x-axis is

4(B)The equation of plane passing through $(0, 1, 0)$ and perpendicular to $y = 0$, then the perpendicular distance from $(0, 0, 0)$ to the plane is zero.

A. $7y - 4z - 5 = 0$

B. $4y - 7z - 5 = 0$

C. $4y + 7z + 5 = 0$

D. $7y + 4z - 5 = 0$

Answer: D

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5. Equation of the line passing through the point $(1, 2, 3)$ and parellel to the plane $2x + 3y + z + 5 = 0$ is

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. $\frac{x-1}{1}=\frac{y-2}{4}=\frac{z-3}{7}$

D. $\frac{x-1}{3}=\frac{y-2}{4}=\frac{z-3}{2}$

Answer: A

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6. The equation of the plane through the line of intersection of planes $ax+by+cz+d=0, a'x+b'y+c'z+d'=0$ and parallel to the line $y=0, z=0$ is

A. $(ab'-a'b)x+(bc'-b'c)y+(ad'-a'd)=0$

B. $(ab'-a'b)x+(bc'-b'c)y+(ad'-a'd)z=0$

C. $(ab'-a'b)y+(bc'-b'c)z+(ad'-a'd)=0$

D. none of these

Answer: D

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7. The equation of the plane containing the line $\frac{x-\alpha}{l}=\frac{y-\beta}{m}=\frac{z-\gamma}{n}$ is $A(x-\alpha)+B(y-\beta)+C(z-\gamma)=0$ where

A. $A\alpha+B\beta+C\gamma=0$

B. $Al+Bm+Cn=0$

C. $\frac{A}{l}=\frac{B}{m}=\frac{C}{n}$

D. none

Answer: B

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8. The point at which the line joining the points $(2, -3, 1)$ and $(3, -4, -5)$ intersects the plane $2x+y+z=7$ is

A. $(2, 1, 0)$

B. $(3, 2, 5)$

C. $(1, -2, 7)$

D. None

Answer: C

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9. If the line $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-k}{2}$ lies exactly on the plane $2x-4y+z=7$, the value of k is

A. 7

B. -7

C. 1

D. no real value

Answer: A

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

A. 13

B. 9

C. 5

D. None

Answer: A

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11. The direction cosines of a line equally inclines to three mutually perpendicular lines having D.C.'s

as $(l_1, m_1, n_1), (l_2, m_2, n_2), (l_3, m_3, n_3)$ are

A. $l_1 + l_2 + l_3, m_1 + m_2 + m_3, n_1 + n_2 + n_3$

B. $\frac{l_1 + l_2 + l_3}{\sqrt{3}}, \frac{m_1 + m_2 + m_3}{\sqrt{3}}, \frac{n_1 + n_2 + n_3}{\sqrt{3}}$

C. $\frac{l_1 + l_2 + l_3}{3}, \frac{m_1 + m_2 + m_3}{3}, \frac{n_1 + n_2 + n_3}{3}$

D. none of these

Answer: B

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12. The equation of a plane through the line of intersection of planes $2x + 3y + z - 1 = 0$ and $x + 5y - 2z + 7 = 0$ and parallel to line $y = 0 = z$:

A. $4x + 7y - 5z + 15 = 0$

B. $13y - 3z + 13 = 0$

C. $7x - 5y + 15 = 0$

D. $7y - 5z - 15 = 0$

Answer: D

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13. 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. $\sum \frac{1}{a^2} + \sum \frac{1}{a'^2} = 0$

B. $\sum \frac{1}{a^2} - \sum \frac{1}{a'^2} = 0$

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

Answer: B

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14. Distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$ measured parallel to the line whose direction cosines are proportional to

$2, 3, -6$ is

A. $\frac{1}{5}$

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. 1

Answer: D

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15. The foot of perpendicular drawn from the point $(1, 3, 4)$ to the plane $2x - y + z = -3$ is

A. $(1, 2, 3)$

B. $(3, 1, 4)$

C. $(3, -1, 4)$

D. $(-1, 4, 3)$

Answer: D

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16. The image of the point $(-1, 3, 4)$ in the plane $x - 2y = 0$ is

A. $(15, 11, 4)$

B. $\left(-\frac{17}{3}, -\frac{19}{3}, 1\right)$

C. $(8, 4, 4)$

D. $\left(\frac{9}{5}, -\frac{13}{5}, 4\right)$

Answer: D

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

A. $\pm\sqrt{5}$

B. $\pm\sqrt{3}$

C. $\pm\sqrt{5}$

D. ± 1

Answer: A

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18. The coordinates of the foot of the perpendicular drawn from the point $A(1, 0, 3)$ to the join of the points $B(4, 7, 1)$ 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. $\left(-\frac{5}{3}, \frac{7}{3}, -\frac{17}{3}\right)$

Answer: A

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19. If $ax + by + cz = p$, then minimum value of $x^2 + y^2 + z^2$ is $\left(\frac{p}{a+b+c}\right)^2$ (b) $\frac{p^2}{a^2+b^2+c^2}$ $\frac{a^2+b^2+c^2}{p^2}$ (d) $\left(\frac{a+b+c}{p}\right)^2$

A. $\frac{P}{\sum a}$

B. $\frac{P^2}{\sum a^2}$

C. $\frac{\sum a^2}{P}$

D. 0

Answer: B

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20. The image of the point A (1,0,0) in the line $\frac{x-1}{2} = \frac{x+1}{-3} = \frac{z+10}{8}$ is :

A. $(3, -4, -2)$

B. $(1, -1, 10)$

C. $(5, -8, -4)$

D. $(2, -1, 8)$

Answer: C

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21. Find the angle between line $\frac{x+1}{3} = \frac{y-1}{2} = \frac{z-2}{4}$ and the plane $2x + y - 3z + 4 = 0$.

A. $\cos^{-1}(-4/\sqrt{406})$

B. $\sin^{-1}(-4/\sqrt{406})$

C. 30°

D. None of these

Answer: B

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

A. α

B. $\frac{3}{2}a$

C. $3\frac{a}{2}$

D. $\frac{1}{a}$

Answer: D

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

A. 3

B. $\sqrt{11}$

C. $\sqrt{13}$

D. 5

Answer: C

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24. The equation of line which passes through the intersection of the planes $x+2y-3z-4=0$ and $3x-8y+z+2=0$ is

A. $\dfrac{x-2}{22}=\dfrac{y-1}{10}=\dfrac{z-0}{14}$

B. $\dfrac{x-2}{-22}=\dfrac{y-1}{-10}=\dfrac{z-0}{-14}$

C. $\dfrac{x+2}{22}=\dfrac{y+1}{10}=\dfrac{z-0}{14}$

D. None of these

Answer: B

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25. If $(q+r)x+(r+p)y+(p+q)z=k$

and $(q-r)x+(r-p)y+(p-q)z=k$

represent the equation of a line then the equation of the line through origin and parallel to given lines is :

A. $\frac{x}{q^2-r^2}=\frac{y}{r^2-p^2}=\frac{z}{p^2-q^2}$

B. $\frac{x}{p^2-qr}=\frac{y}{q^2-pr}=\frac{z}{r^2-pq}$

C. $\frac{x}{q}=\frac{y}{r}=\frac{z}{p}$

D. none

Answer: B

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26. Let L be the line of intersection of the planes $2x+3y+z=1$ and $x+3y+2z=2$. If L makes an angles $\alpha$with the positive x-axis, then cos α equals $\frac{1}{\sqrt{3}}$ $\frac{1}{2}$ 1 $\frac{1}{\sqrt{2}}$

A. $\frac{1}{\sqrt{3}}$

B. $\frac{1}{2}$

C. 1

D. $\frac{1}{\sqrt{2}}$

Answer: A

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27. A line passes through two points $A(2, -3, -1)$ and $B(8, -1, 2)$.

The coordinates of a point on this lie at distance of 14 units from a are

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28. Equation of a line passing through $(-1, 2, -3)$ and perpendicular to the plane $2x + 3y + z + 5 = 0$ is

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

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

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

D. none of these

Answer: C

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29. Equation of a line passing through (1,-2,3) and parallel to the plane $2x+3y+z+5=0$ is

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

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

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

D. none of these

Answer: A

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30. The S.D between the lines $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ is equal to

A. $3\sqrt{30}$

B. $\sqrt{30}$

C. $2\sqrt{30}$

D. None of these

Answer: A

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31. If the lines

x=ay +b, z=cy+d and $x=a'y+b', z=c'y+d'$ are perpendicular, then

A. $aa'+cc'+1=0$

B. $ad+\ =1$

C. $ad+\ =0$

D. None

Answer: A

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32. The lines $\frac{x-a+b}{\alpha-\delta}=\frac{y-a}{\alpha}=\frac{z-a-d}{\alpha+\delta}$, $\frac{x-b+c}{\beta-\gamma}=\frac{y-b}{\beta}=\frac{z-a-d}{\beta+\gamma}$

are coplanar, and the 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. $x+y+z=0$

Answer: C

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33. If the straighat 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 (A) $-\frac{1}{2}$ (B) -1 (C) -2 (D) 0

A. -2

B. -1

C. $-\frac{1}{2}$

D. 0

Answer: A

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

A. $2/9$

B. $9/2$

C. 0

D. -1

Answer: B

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35. Consider the planes $3x - 6y - 2z = 15 and 2x + y - 2z = 5.$ Statement 1:The parametric equations of the line intersection of the given planes are $x = 3 + 14t, y = 2t, z = 15t.$ Statement 2: The vector $14\hat{i} + 2\hat{j} + 15\hat{k}$ is parallel to the line of intersection of the given planes.

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36. The lines $\frac{x-2}{\gamma} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplaner if γ is

A. 1,-1

B. 3,-3

C. 0,-3

D. 0,-1

Answer: C

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37. 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

A. $a = 2, b = 8$

B. $a = 4, b = 6$

C. $a = 6, b = 4$

D. $a = 8, b = 2$

Answer: c

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38. 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 integer k is equal to

A. -5

B. 5

C. 2

D. -2

Answer: A

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39. Find the distance of a point $(2, 4, -1)$ from the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$.

A. 3

B. 5

C. 7

D. 9

Answer: C

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40. Distance of the point (x_1, y_1, z_1) from the line

$$\frac{x - x_2}{1} = \frac{y - y_2}{m} = \frac{z - z_2}{n}$$

where l,m,n are direction cosines of the line, is

A.

$$\left[(x_1 - x_2)^z + (y_2 - y_1)^2 + (z_1 + z_2)^2 - \{l(x_1 - x_2) + m(y_1 - y_2) +\right.$$

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

Answer: A

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41. If a line makes angles α, β, γ with co-ordinate axes, then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$

A. -2

B. -1

C. 1

D. 2

Answer: B

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42. The angle between the line $\frac{x+1}{3} = \frac{y-1}{2} = \frac{z-2}{4}$ and the plane $2x + y - 3z + 4 = 0$ is such that $\sin\theta = \frac{1}{3}$, then the value of θ is :

A. 0

B. 30°

C. 45°

D. 90°

Answer: C

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43. 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

A. $\frac{3}{4}$

B. $-\frac{4}{3}$

C. $\frac{5}{3}$

D. $-\frac{3}{5}$

Answer: C

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44. The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$ is

A. 0

B. 30°

C. 45°

D. 90°

Answer: D

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45. The 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. $\frac{2}{\sqrt{41}}, \ -\frac{4}{\sqrt{41}}, \frac{1}{\sqrt{41}},$

Answer: A

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46. A line with direction cosines proportional to 2,1,2 meet each of the lines $x = y + a = zndx + a = 2y = 2z$. The coordinastes of each of the points of intersection are given by (A) $(3a, 2a, 3a), (a, a, 2a)$ (B) $(3a, 2a, 3a), (a, a, a0$ (C) $(3a, 3a, 3a), (a, a, a)$ (D) $92a, 3a, 3a), (2a, a, a0$

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

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

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

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

Answer: B

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47. Read the following passage and answer the questions. 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. The unit vector perpendicular to both $L-(1)$ and L_2 is

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. $\frac{7\hat{i}-7\hat{j}-\hat{k}}{\sqrt{99}}$

Answer: B

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48. Consider the line L 1 : x 1 y 2 z 1 312 +++ ==, L2 : x2y2z3 123

A. 0

B. $\frac{17}{\sqrt{3}}$

C. $\frac{41}{3}\sqrt{3}$

D. $\frac{17}{5}\sqrt{3}$

Answer: D

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49. The distance of the point $(1, 1, 1)$ from the plane passing through the point $(-1, -2, -1)$ and whose normal is perpandicular to both the lines L_1 and L_2 is

A. $\frac{2}{\sqrt{75}}$

B. $\frac{7}{\sqrt{75}}$

C. $\frac{13}{\sqrt{75}}$

D. $\frac{23}{\sqrt{75}}$

Answer: C

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50. Consider the following linear equations

$ax + by + cz = 0$

$bx + cy + az = 0$

$cx + ay + bz = 0$

Match the conditions/expressions in Column-I with statements in

Column-II.

Column-I	Column-II
(a) $a+b+c \neq 0$ and $a^2+b^2+c^2 = ab+bc+ca$	(p) the equations represent planes meeting only at a single point
(b) $a+b+c=0$ and $a^2+b^2+c^2 \neq ab+bc+ca$	(q) the equations represent the line $x=y=z$
(c) $a+b+c \neq 0$ and $a^2+b^2+c^2 \neq ab+bc+ca$	(r) the equations represent identical planes
(d) $a+b+c=0$ and $a^2+b^2+c^2 = ab+bc+ca$	(s) the equations represent the whole of the three dimensional space

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Problem Set 4

1. The equation of the sphere circumscribing the tetrahedron whose faces are $x=0, y=0, z=0$ and $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$, is equal to

A. $x^2+y^2+z^2=a^2+b^2+c^2$

B. $x^2 + y^2 + z^2 - ax + by + cz = 0$

C. $x^2 + y^2 + z^2 - 2ax + 2by + 2cz = 0$

D. none of these

Answer: B

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2. If a sphere of constant radius k passes through the origin and meets the axis in A,B,C then the centroid of the triangle ABC lies on :

A. $9(x^2 + y^2 + z^2) = k^2$

B. $9(x^2 + y^2 + z^2) = 4k^2$

C. $x^2 + y^2 + z^2 = k^2$

D. $x^2 + y^2 + z^2 = 4k^2$

Answer: B

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3. The plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ meets the coordinate axes at A,B and C respectively. Find the equation of the sphere OABC.

A. $x^2 + y^2 + z^2 + ax + by + cz = 0$

B. $x^2 + y^2 + z^2 - ax + by + cz = 0$

C. $x^2 + y^2 + z^2 + 2ax + 2by + 2cz = 0$

D. $x^2 + y^2 + z^2 - 2ax + 2by + 2cz = 0$

Answer: A

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4. A sphere of constant radius $2k$ passes through the origin and meets the axes in $A, B, andC\cdot$ The locus of a centroid of the tetrahedron $OABC$ is a. $x^2 + y^2 + z^2 = 4k^2$ b. $x^2 + y^2 + z^2 = k^2$ c. $2(k^2 + y^2 + z)^2 = k^2$ d. none of these

A. $x^2 + y^2 + z^2 = 4k^2$

B. $x^2 + y^2 + z^2 = k^2$

C. $2(x^2 + y^2 + z^2) = k^2$

D. none of these

Answer: B

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5. The center of the sphere which passes through $(a, 0, 0), (0, b, 0), (0, 0, c)$ and $(0, 0, 0)$ is

A. $\left(\frac{a}{2}, 0, 0\right)$

B. $\left(0, \frac{b}{2}, 0\right)$

C. $\left(0, 0, \frac{c}{2}\right)$

D. $\left(\frac{a}{2}, \frac{b}{2}, \frac{c}{2}\right)$

Answer: D

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6. Find the equation of the sphere which passes through the point (1,0,0), (0,1,0) and 90,0,1)` and has its radus as small as possible.

A. $3\sum x^2 - 2\sum x - 1 = 0$

B. $\sum x^2 - 2\sum x - 1 = 0$

C. $3\sum x^2 - 2\sum x + 1 = 0$

D. $\sum x^2 - \sum x + 1 = 0$

Answer: A

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7. The plane $2x - 2y + z + 12 = 0$ touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$ at the point

A. $(1, -4, -2)$

B. $(-1, 4, -2)$

C. $(-1, -4, 2)$

D. $(1, 4, -2)$

Answer: B

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8. The equation of the sphere concentric with the sphere $x^2 + y^2 + z^2 - 2x - 6y - 8z - 5 = 0$ and which passes through the origin is

A. $x^2 + y^2 + z^2 - 2x - 6y - 8z = 0$

B. $x^2 + y^2 + z^2 - 6y - 8z = 0$

C. $x^2 + y^2 + z^2 = 0$

D. None of these

Answer: A

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9. Equation of the sphere with center $(1, -1, 1)$ and radius equal to that of sphere

$2x^2 + 2y^2 + 2z^2 - 2x + 4y - 6z = 1$ is

A. $x^2 + y^2 + z^2 + 2x - 2y + 2z + 1 = 0$

B. $x^2 + y^2 + z^2 - 2x + 2y - 2z - 1 = 0$

C. $x^2 + y^2 + z^2 + 2x + 2y - 2z + 1 = 0$

D. none of these

Answer: B

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

A. $(4, 3, 5)$

B. $(4, 3, -3)$

C. $(4, 9, -3)$

D. None of these

Answer: C

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

A. $(4, 9, -3)$

B. $(4, -3, 3)$

C. $(4, 3, 5)$

D. $(4, 3, -3)$

Answer: C

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12. Find the number of sphere of radius r touching the coordinate axes.

A. 4

B. 6

C. 8

D. none of these

Answer: C

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13. The radius of the circular section of the sphere $x^2 + y^2 + z^2 = 25$ by plane $x + y + z = 3\sqrt{3}$ is

A. 3

B. 4

C. 5

D. none of these

Answer: B

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14. The radius of the circle in which the sphere $x^{I2} + y^2 + z^2 + 2z - 2y - 4z - 19 = 0$ is cut by the plane $x + 2y + 2z + 7 = 0$ is a. 2 b. 3 c. 4 d. 1

A. 1

B. 2

C. 3

D. 4

Answer: C

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15. The center of the circle

$x^2 + y^2 + z^2 - 3x + 4y - 2z - 5 = 0$

and $5x - 2y + 4z + 7 = 0$ is :

A. $\left(\frac{3}{2}, -2, 1\right)$

B. $(1, 1, 1)$

C. $(-1, -1, -1)$

D. $(0, 0, 0)$

Answer: C

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16. The center of a sphere which touches the lines $y = x, z = c$ and $y = -x, z = -c$ lies on

A. $xy + 2cz = 0$

B. $yz + 2cx = 0$

C. $zx + 2cy = 0$

D. none

Answer: A

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17. The shortest distance from the plane $12x + y + 3z = 327$ to the sphere $x^2 + y^2 + z^2 + 4x - 2y - 6z = 155$ is a. 39 b. 26 c. $41 - \frac{4}{13}$ d. 13

A. 26

B. $11\frac{4}{13}$

C. 13

D. 39

Answer: C

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18. The intersection of the spheres $x^2+y^2+z^2+7x-2y-z=13 and x^2+y^2=z^2-3x+3y+4z=8$ is the same as the intersection of one of the spheres and the plane a. $x-y-z=1$ b. $x-2y-z=1$ c. $x-y-2z=1$ d. $2x-y-z=1$

A. $x-y-z=1$

B. $x-2y-z=1$

C. $x-y-2z=1$

D. $2x-y-z=1$

Answer: D

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19. If the plane $2ax - 3ay + 4az + 6 = 0$ passes through the mid point of the line joining the centre of the spheres $x^2 + y^2 + z^2 + 6x - 8y - 2z = 13$ and $x^2 + y^2 + z^2 - 10x + 4y - 2z = 8$, then α equals

A. -2

B. 2

C. -1

D. 1

Answer: A

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Miscellaneous Exercise True And False

1. Given that $P(3, 2, -4), Q(5, 4, -6)$ and $R(9, 8, -10)$ are collinear. Find the ratio in which Q divides PR.

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2. Show that the joint of the points (1,2,3), (4,5,7) is parallel to the join of the points (-4,3,-6),(2,9,2).

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3. The line, joining the points $(1, 2, 3)(-1, -2, -3)$ is parallel to to the line joining points $(-2, 1, 5), (3, 3, 2)$.

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4. Three concurrent lines with direction cosines $(l_1, m_1, n_1), (l_2, m_2, n_2)$ and (l_3, m_3, n_3) are coplanar if

$$\begin{vmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{vmatrix} = 0.$$

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5. Show that the three lines drawn from the origin with direction cosines proportional to 1,-1,1,2,-3,0 and 1,0,3 are coplanar

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6. If a variable line in two adjacent position has direction cosines l, m, n and $l + \delta l, m + \delta m, n + \delta n$ and $\delta\theta$ is the angel between two positions, then $(\delta l)^2 + (\delta m)^2 + (\delta n)^2 =$

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7. Find the angle between the lines whose direction cosines are connected by the relations $l + m + n = 0and2/m + 2nl - mn = 0.$

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8. Show that the straight lines whose direction cosines are given by the equations $al + bm + cn = 0and \widehat{} 2 + zm^2 = vn^2 + wn^2 = 0$ are parallel or perpendicular as $\frac{a^2}{u} + \frac{b^2}{v} + \frac{c^2}{w} = 0 \text{ or } a^2(v + w) + b^2(w + u) + c^2(u + v) = 0.$

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9. The equation of the plane through the points $(1, 1, 1), (1, -1, 1) \text{ and } (-7, -3, -5)$ is parallel to the axis of y i.e. perpendicular to xz-plane.

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10. The equation of the plane through the points $(2, 2, 1)$ and $(9, 3, 6)$ and perpendicular to the plane $2x + 6y + 6z = 9$ is $3x + 4y + z - 9 = 0$

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11. The equation of the plane through the intersection of the planes $x - 2y + 3z + 4 = 0$ and $2x - 3y + 4z - 7 = 0$ and the point $(1, -1, 1)$ is $9x - 13y + 17z - 39 = 0.$

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12. A variable plane at a constant distance p from the origin meets the axes in A, B and C. Through A,B,C planes are draw parallel to the co-ordinate planes, the locus of their point of intersection is $x^{-2} + y^{-2} + z^{-2} = p^{-2}$

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13. A variable plane is at a constant distance p from the origin and meets the coordinate axes in A, B, C . Show that the locus of the centroid of the tehrahedron $OABCisx^{-2} + y^{-2} + z^{-2} = 16p^{-2}.$

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14. A plane a constant distance p from the origin meets the coordinate axes in A, B, C. Locus of the centroid of the triangle ABC is

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15. The equation $2x^2 - 6y^2 - 12z^2 + 18yz + 2zx + xy = 0$ represents a pair of planes, the angle between them is $\cos^{-1}\left(\frac{16}{21}\right)$

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16. The lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x}{2}=\frac{y+2}{2}=\frac{z-3}{-2}$ are parallel.

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17. The lines $\frac{x-1}{2}=\frac{y-2}{2}=\frac{z-3}{0}$ and $\frac{x-2}{0}=\frac{y+3}{0}=\frac{z-4}{1}$ are parallel.

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18. The plane x-2y+z-6=0 and the line x/1=y/2=z/3` are related as the line (A) meets the plane obliquely (B) lies in the plane (C) meets at righat angle to the plane (D) parallel to the plane

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19. Find the length of the perpendicular from point (3,4,5) on the line $\frac{x-2}{2} = \frac{y-3}{5} = \frac{z-1}{3}$.

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20. Find the angle between the lines in which the planes :

3x - 7y - 5z = 1, 5x - 13y + 3z + 2 = 0

cut the plane 8x - 11y + 2z = 0 .

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21. The lines

$2x + 3y - 4z = 0, 3x - 4y + z = 7$

$5x - y - 3z + 12 = 0, x - 7y + 5z - 6 = 0$ are parellel.

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22. The lines $\frac{x-5}{4}=\frac{y-7}{4}=\frac{z+3}{-5}$ and $\frac{x-8}{7}=\frac{y-4}{1}=\frac{z-5}{3}$ are coplanar, intersecting at $(1, 3, 2)$ and the equation of the plane in which they lie is $17x-47y-24z+172=0.$

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23. A sphere of constant radius k, passes through the origin and meets the axes at $A, BandC\cdot$ Prove that the centroid of triangle ABC lies on the sphere $9(x^2+y^2+z^2)=4k^2\cdot$

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24. A variable plane passes through a fixed point (a, b, c) and cuts the coordinate axes at points $A, B, andC\cdot$ Show that eh locus of the centre of the sphere $OABCis\frac{a}{x}+\frac{b}{y}+\frac{c}{z}=2.$

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25. If any tangent plane to the sphere

$x^2 + y^2 + z^2$ makes intercepts a,b and c on the Co-ordinate axes, then $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{r^2}$

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26. Two spheres of radii r_1 and r_2, cut orthogonally. The radius of the common chord is 1$\frac{r_1 r_2}{\sqrt{(r_1^2 + r_2^2)}}$

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27. The smallest radius of the sphere passing through the points $(1, 0, 0), (0, 1, 0)$ and $(0, 0, 1)$ is equal to $\sqrt{\frac{2}{3}}$.

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Miscellaneous Exercise Fill In The Blanks

1. A point P lies on the line whose end points are $A(1, 2, 3)$ and $B(2, 10, 1)$. If z-co-ordinate of P is 7, then its other co-ordinate is ....

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2. The distance of the point $(1, 2, 0)$ from the point where the line joining $A(2, -3, 1)$ and $B(3, -4, -5)$ cuts the plane $2x - y + z = 7$ is ....

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3. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular lines, show that the direction cosines of the line perpendicular to both of these are $m_1n_2 - m_2n_1, n_1l_2 - n_2l_1, l_1m_2 - l_2m_1$.

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4. If the edges of a rectangular parallelepiped are a,b, c, prove that the angles between the four diagonals are given by $\cos^{-1}\left(\frac{\pm a^2 \pm b^2 \pm c^2}{a^2 + b^2 + c^2}\right)$

.

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5. The equation of the plane through the point $(4, 0, 1)$ and parallel to the plane $4x + 3y - 12z + 6 = 0$ is ....

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6. What are the intercepts of the plane $4x + 3y - 12z + 6 = 0$ on the axes?

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7. The equation of the plane through $(-1, 3, 2)$ and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 9$ is ....

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8. The points in which the line $\frac{x+1}{-1} = \frac{y-12}{5} = \frac{z+7}{2}$ cuts the surface $11x^2 - 5y^2 + z^2 = 0$ are ....

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9. Equation of the straight lines $3x + 2y - z - 4 = 0, 4x + y - 2z + 3 = 0$ in the symmetrical form is ....

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10. Find the shortest distance between the following lines: $\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$ and $\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$

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11. The equation of the plane which contains the line $x=\frac{y-3}{2}=\frac{z-5}{3}$, and which is perpendicular to the plane $2x+7y-3z=1$ is ....

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12. The equation of the plane through the line $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and parallel to the co-ordinate axes are ....

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13. The equation of the perpendicular from $(3, -1, 11)$ to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and the foot of perpandicular are .... and ....

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14. The equation of a sphere through the foue points $(0, 0, 0), (-a, b, c), (a, b, -c)$ is ....

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15. The equation of the sphere through the circle $x^2 + y^2 + z^2 = 9, 2x + 3y + 4z = 5$ and the point $(1, 2, 3)$ is ....

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16. The equation of the sphere on the join of $(2, 3, 5), (4, 9, -3)$ as diameter is ....

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Matching Entries Match The Enteries Of Column Ii With Those Of Column Ii Under The Following Conditions

1.

Column-I	Column-II
(a) $a+b+c \neq 0$ and $a^2+b^2+c^2=ab+bc+ca$	(p) the equations represent planes meeting only at a single point
(b) $a+b+c=0$ and $a^2+b^2+c^2 \neq ab+bc+ca$	(q) the equations represent the line $x=y=z$
(c) $a+b+c \neq 0$ and $a^2+b^2+c^2 \neq ab+bc+ca$	(r) the equations represent identical planes
(d) $a+b+c=0$ and $a^2+b^2+c^2=ab+bc+ca$	(s) the equations represent the whole of the three dimensional space

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2. Match the following Column I to Column II

Column-I	Column-II
(a) A plane parallel to plane $3x-7y+z=5$.	(p) $2x-2y+4z=8$
(b) A plane perpendicular to the plane $3x+7y+2z=5$	(q) $3x-7y+z+6=0$
(c) A plane passing through the point $(2,2,2)$ is	(r) $14x+6y+21z=42$
(d) A plane making intercepts $3,7,2$ on the co-ordinate axes.	(s) $4x-2y+z=6$

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3. Match the following Column I to Column II

	Column-I		Column-II
(a)	$\frac{x-2}{3}=\frac{y-7}{4}=\frac{z+5}{2}$	(p)	perp. to plane $3x+4y+2z=1$
(b)	$\frac{x+1}{3}=\frac{y-3}{4}=\frac{z+7}{2}$	(q)	passes through $(2, 7, -5)$
(c)	$\frac{x-5}{1}=\frac{y+2}{3}=\frac{z-2}{4}$	(r)	d.c.'s are $\frac{2}{\sqrt{30}}, \frac{5}{\sqrt{30}}, \frac{1}{\sqrt{30}}$
(d)	$\frac{x}{2}=\frac{y-2}{5}=\frac{z+6}{1}$	(s)	lies in the plane $7x-y-z=35$

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4.

	Column-I		Column-II
(a)	Point on the line at a distance $10\sqrt{2}$ from $(2, 3, 4)$	(p)	$(-1, -1, -1)$
(b)	Point on the line common to plane $x+y+z+3=0$	(q)	$(2, 3, 4)$
(c)	Point on the line at a distance $\sqrt{29}$ from origin	(r)	$(8, 11, 14)$
(d)	Point on the line common to the plane $x+y-z+3=0$	(s)	$(-4, -5, -6)$

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Assertion Reason

1. Consider the planes $3x-6y-2z=15 and 2x+y-2z=5.$

Statement 1:The parametric equations of the line intersection of the given planes are $x = 3 + 14t, y = 2t, z = 15t$. Statement 2: The vector $14\hat{i} + 2\hat{j} + 15\hat{k}$ is parallel to the line of intersection of the given planes.

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2. 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). Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1. Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1. Statement-1 is true, Statement-2 is false. Statement-1 is false, Statement-2 is true.

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3. 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 $B(1, 3, 4)$

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4. Consider three planes $P_1 : x - y + z = 1$

$P_2 : x + y - z = -1$

and $P_3 : x - 3y + 3z = 2$

Let L_1, L_2, L_3 be the lines of intersection of the planes P_2 and P_3, P_3 and P_1, P_1 and P_2 respectively.

Statement I Atleast two of the lines L_1, L_2 and L_3 are non-parallel.

Statement II The three planes do not have a common point.

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Comprehension

1. The shortest distance from the plane $12x + y + 3z = 327$ to the sphere $x^2 + y^2 + z^2 + 4x - 2y - 6z = 155$ is a. 39 b. 26 c. $41 - \frac{4}{13}$ d. 13

A. 26

B. $11\frac{4}{13}$

C. 13

D. 39

Answer: C

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2. The line x+y=3 meets the circle $x^2 + y^2 - 4x + 6y - 3 = 0$ at A and B . A variable line meets the axes at P and Q respectively so that AQ meets BP at R at a right angle. Show that the locus of R is $x^2 + y^2 - 8x + 2y + 9 = 0$

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3. Circle of constant radius r are draw to pass through the ends of a variable diameter of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. Prove that locus of their centres is the curve

$$\left(x^2 + y^2\right)\left(a^2x^2 + b^2y^2 + a^2b^2\right) = r^2\left(a^2x^2 + b^2y^2\right)$$

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4. If the point P(a, b, c), with reference to (E), lies on the plane 2x + y + z = 1, then the value of 7a + b + c is

A. 0

B. 12

C. 7

D. 6

Answer: D

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5. Let a,b, and c be three real numbers satistying $[a, b, c]\begin{bmatrix}1 & 9 & 7\\ 8 & 2 & 7\\ 7 & 3 & 7\end{bmatrix} = [0, 0, 0]$ Let ω be a solution of $x^3 - 1 = 0$ with $Im(\omega) > 0. Ifa = 2$ with b nd c satisfying (E) then the vlaue of $\frac{3}{\omega^a} + \frac{1}{\omega^b} + \frac{3}{\omega^c}$ is equa to (A) -2 (B) 2 (C) 3 (D) -3

A. -2

B. 2

C. 3

D. -3

Answer: A

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6. Let $b = 6$ with a and c satisfying (1). If α and β are the roots of the quadeatic equation $ax^2 + bx + c = 0, then$

$$[a\, b\, c]\begin{bmatrix}1 & 9 & 7\\ 8 & 2 & 7\\ 7 & 3 & 7\end{bmatrix} = [0\ 0\ 0]$$

is

A. 6

B. 7

C. $\frac{6}{7}$

D. ∞

Answer: B

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Self Assignment Test

1. If the line $2x + y = k$ passes through the point which divides the line segment joining the points $(1, 1)$ and $(2, 4)$ in ratio $3 : 2$,Then k equals

A. $29/5$

B. 5

C. 6

D. $11/5$

Answer: C

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2. A line is drawn through the point (1, 2) to meet the coordinate axes at P and Q such that it forms a triangle OPQ, where O is the origin. If the area of the triangle OPQ is least, then the slope of the line PQ is (1) $-\frac{1}{4}$ (2) -4 (3) -2 (4) $-\frac{1}{2}$

A. $-1/4$

B. -4

C. -2

D. $-1/2$

Answer: C

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3. If the distance of the point $P(1, -2, 1)$ from the plane $x+2y-2z=\alpha, where\alpha>0, is5,$ then the foot of the perpendicular from P to the place is 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. $\left(\frac{2}{3}, -\frac{1}{3}, -\frac{5}{3}\right)$

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. $\left(\frac{2}{3}, -\frac{1}{3}, \frac{5}{2}\right)$

Answer: A

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4. 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

A. 1

B. $\sqrt{2}$

C. $\sqrt{3}$

D. 2

Answer: C

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5. An equation of a plane parallel to the plane $x - 2y + 2z - 5 = 0$ and at a unit distance from the origin is

A. $x - 2y + 2z - 3 = 0$

B. $x - 2y + 2z + 1 = 0$

C. $x-2y+2z-1=0$

D. $x-2y+2x+5=0$

Answer: A

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6. 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 2 3 from the point (3, 1, 1) is (A) 5x 11y + z = 17 (B) 2x y 3 2 1 (C) x + y + z = 3 (D) x 2y 1 2

A. $5x-11y+z=17$

B. $\sqrt{2}xy=3\sqrt{2}-1$

C. $x+y+z=\sqrt{3}$

D. $x-\sqrt{2}y=1-\sqrt{2}$

Answer: A

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7. The 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 :

A. $x+2y-2z=0$

B. $3x+2y-2z=0$

C. $x-2y+z=0$

D. $5x+2y-4z=0$

Answer: C

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8. 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 the value of k is (A) $\frac{2}{9}$ (B) $\frac{9}{2}$ (C) 0 (D) -1

A. $\frac{2}{9}$

B. $\frac{9}{2}$

C. 0

D. none of these

Answer: B

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9. If the distance between the plane $Ax - 2y + z = d$ 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 equal to....

A. 6

B. -6

C. $1/6$

D. none of these

Answer: A

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10. Distance between two parallel planes $2x + y + 2z = 8$ and $4x + 2y + 4z + 5 = 0$ is

A. $\frac{3}{2}$

B. $\frac{1}{2}$

C. $\frac{7}{2}$

D. $\frac{5}{2}$

Answer: C

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11. If the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{x-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar,then k can have

A. any value

B. exactly one value

C. exactly two values

D. exactly three values

Answer: C

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