



MATHS

BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

PLANE AND STRAIGHT LINE IN SPACE

Illustration

1. Find the equation of the plane through the points $A(2, 2, -1)$, $B(3, 4, 2)$ and $C(7, 0, 6)$.

A. $5x + 2y + 3z = 17$

B. $5x + 2y - 3z = 17$

C. $5x - 2y + 3z = 17$

D. none of these

Answer: B



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2. Write the equation of the plane whose intercepts on the coordinate axes are -4 , 2 and 3 respectively.

A. $3x + 6y + 4z = 12$

B. $-3x + 6y + 4z = 12$

C. $-3x - 6y - 4z = 12$

D. none of these

Answer: B



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3. The intercepts of the plane $5x - 3y + 6z - 60 = 0$ on the coordinate axes are

A. $10, 20, -10$

B. 10, - 20, 12

C. 12, - 20, 10

D. 12, 20, - 10

Answer: C



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4. If the plane $7x + 11y + 13z = 3003$ meets the axes in A,B and C then the centorid of ΔABC is

A. (143, 91, 77)

B. (143, 77, 91)

C. (91, 143, 77)

D. (143, 66, 91)

Answer: A



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5. 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

$$\frac{x}{p} + \frac{y}{q} + \frac{z}{r} = k \text{ then } k =$$

A. 1

B. 2

C. 3

D. none of these

Answer: C



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6. The vector equation of a plane passing through a point having position vector $2\hat{i} + 3\hat{j} - 4\hat{k}$ and perpendicular to the vector $2\hat{i} - \hat{j} + 2\hat{k}$, is

A. $\vec{r} \cdot (2\hat{i} - \hat{j} + 2\hat{k}) = 7$

B. $\vec{r} \cdot (2\hat{i} - \hat{j} + 2\hat{k}) = -7$

C. $\vec{r} \cdot (2\hat{i} - \hat{j} + 2\hat{k}) = 4$

D. none of these

Answer: B



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7. The vector equation of the plane which is at a distance of 8 units from the origin which is normal to the vector $2\hat{i} + \hat{j} + 2\hat{k}$ is

A. $\vec{r} \cdot (2\hat{i} + \hat{j} + 2\hat{k}) = 8$

B. $\vec{r} \cdot (2\hat{i} + \hat{j} + 2\hat{k}) = 24$

C. $\vec{r} \cdot (2\hat{i} + \hat{j} + 2\hat{k}) = 4$

D. none of these

Answer: B



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8. The angle between the planes

$$\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) = 6 \text{ and } \vec{r} \cdot (\hat{i} + \hat{j} + 2\hat{k}) = 5 \text{ is}$$

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

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

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

D. $\frac{5\pi}{6}$

Answer: A



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9. Find the angle between the planes

$$x + y + 2z = 9 \text{ and } 2x - y + z = 15.$$

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

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

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

D. none of these

Answer: B

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10. If the planes $\vec{r} \cdot (2\hat{i} - \hat{j} + 2\hat{k}) = 4$ and $\vec{r} \cdot (3\hat{i} + 2\hat{j} + \lambda\hat{k}) = 3$ are perpendicular then $\lambda =$

A. 2

B. -2

C. 3

D. -3

Answer: B

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11. If the planes $2x - y + \lambda z - 5 = 0$ and $x + 4y + 2z - 7 = 0$ are perpendicular then $\lambda =$

A. 1

B. -1

C. 2

D. -2

Answer: A



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12. The acute angle between the planes $2x - y + z = 6$ and $x + y + 2z = 3$ is

A. 45°

B. 60°

C. 30°

D. 75°

Answer: B



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13. In the space the equation $by + cz + d = 0$ represents a plane perpendicular to the plane

A. YOZ

B. ZOX

C. XOY

D. $Z = k$

Answer: A



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14. The equation of the plane passing through the point $(1, 1, 1)$ and perpendicular to the planes $2x + y - 2z = 5$ and $3x - 6y - 2z = 7$ is

A. $14x + 2y - 15z = 1$

B. $14x - 2y + 15z = 27$

C. $14x + 2y + 15z = 31$

D. $-14x + 2y + 15z = 3$

Answer: C



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15. Convert the equation of the plane

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

product form.

A. $\vec{r} \cdot (5\hat{i} - 2\hat{j} - 3\hat{k}) = 7$

B. $\vec{r} \cdot (5\hat{i} + 2\hat{j} + 3\hat{k}) = 7$

C. $\vec{r} \cdot (5\hat{i} - 2\hat{j} - 3\hat{k}) = -7$

D. none of these

Answer: A

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16. The vector equation of the plane passing through the points $\hat{i} + \hat{j} - 2\hat{k}$, $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + \hat{j} + \hat{k}$, is

A. $\vec{r} \cdot (9\hat{i} + 3\hat{j} - \hat{k}) = -14$

B. $\vec{r} \cdot (9\hat{i} + 3\hat{j} - \hat{k}) = 14$

C. $\vec{r} \cdot (3\hat{i} + 9\hat{j} - \hat{k}) = 14$

D. none of these

Answer: B

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17. The equation of plane passing through the point $\hat{i} + \hat{j} + \hat{k}$ and parallel to the plane $\vec{r} \cdot (2\hat{i} - \hat{j} + 2\hat{k}) = 5$ is

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

B. $\vec{r} \cdot (2\hat{i} - \hat{j} + 2\hat{k}) = -3$

C. $\vec{r} \cdot (2\hat{i} - \hat{j} + 2\hat{k}) = 3$

D. none of these

Answer: C



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18. Find the equation of the plane through the point (1,4,-2) and parallel to the plane $-2x + y - 3z = 7$.

A. $2x - y + 3z = 8$

B. $2x - y + 3z + 8 = 0$

C. $2x - y + 3z = 4$

D. none of these

Answer: B



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19. The direction cosines of the line $6x - 2 = 3y + 1 = 2z - 2$ 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. $\frac{3}{\sqrt{4}}, \frac{2}{\sqrt{14}}, \frac{1}{\sqrt{14}}$

D. none of these

Answer: B



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20. The equation of a line passing through (1,-1,0) and parallel to

$$\frac{x-2}{3} = \frac{2y+1}{2} = \frac{5-z}{-1} \text{ is}$$

A. $\frac{x-1}{3} = \frac{y+1}{3} = \frac{z-0}{-1}$

B. $\frac{x-1}{3} = \frac{y+1}{1} = \frac{z-0}{-1}$

C. $\frac{x-1}{3} = \frac{y+1}{1} = \frac{z-0}{1}$

D. $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-0}{1}$

Answer: C



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21. The line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ cuts the plane $x + y + z = 17$ at

A. (3,4,5)

B. (4,6,7)

C. (4,5,8)

D. (8,4,5)

Answer: B



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22. The distance between the point (3,4,5) and the point where the line

$$\frac{x - 3}{1} = \frac{y - 4}{2} = \frac{z - 5}{2} \text{ meets the plane } x + y + z = 17 \text{ is}$$

A. 1

B. 2

C. 3

D. none of these

Answer: C



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23. The distance of the point $(1, 0, 2)$ from the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x + y + z = 16$, is : (1) $2\sqrt{14}$ (2) 8 (3) $3\sqrt{21}$ (4) 27

A. $3\sqrt{21}$

B. 13

C. $2\sqrt{14}$

D. 8

Answer: B



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24. Find the distance of the point $(2, 3, 4)$ from the line $\frac{x+3}{3} = \frac{y-2}{6} = \frac{z}{2}$ measured parallel to the plane $3x + 2y + 2z - 5 = 0$.

A. 2

B. 4

C. 6

D. 7

Answer: D



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25. The distance of the point $(1, -5, 9)$ from the plane $x - y + z = 5$ measured along the line $x = y = z$ is

A. $3\sqrt{10}$

B. $10\sqrt{3}$

C. $\frac{10}{\sqrt{3}}$

D. $\frac{20}{3}$

Answer: B



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26. The vector parallel to the line of intersection of the planes

$$\vec{r} \cdot (3\hat{i} - \hat{j} + \hat{k}) = 1 \text{ and } \vec{r} \cdot (\hat{i} + 4\hat{j} - 2\hat{k}) = 2 \text{ is :}$$

A. $-2\hat{i} + 7\hat{j} + 13\hat{k}$

B. $2\hat{i} + 7\hat{j} - 13\hat{k}$

C. $-2\hat{i} - 7\hat{j} + 13\hat{k}$

D. $2\hat{i} + 7\hat{j} + 13\hat{k}$

Answer: A



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27. The direction cosines of the line $x - y + 2z = 5$, $3x + y + z = 6$ are

A. $\frac{-3}{5\sqrt{2}}, \frac{5}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}$

B. $\frac{3}{5\sqrt{2}}, \frac{-5}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}$

C. $\frac{3}{5\sqrt{2}}, \frac{5}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}$

D. none of these

Answer: A

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28. A symmetrical form of the line of intersection of the planes

$x = ay + b$ and $z = cy + d$ is

A. $\frac{x - b}{a} = \frac{y - 1}{0} = \frac{z - d}{c}$

B. $\frac{x - b}{a} = \frac{y - 0}{1} = \frac{z - d}{c}$

C. $\frac{x - a}{b} = \frac{y - 0}{1} = \frac{z - c}{d}$

D. none of these

Answer: B

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29. The angle between the lines

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

$$\text{and } \vec{r} = (\hat{i} + \hat{j} + \hat{k}) + \mu\{(-\sqrt{3} - 1)\hat{i} + (\sqrt{3} - 1)\hat{j} + 4\hat{k}\} \text{ is}$$

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

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

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

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

Answer: C



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30. Find the angle between the lines

$$\frac{x - 2}{3} = \frac{y + 1}{-2} = z = 2 \text{ and } \frac{x - 1}{1} = \frac{2y + 3}{3} = \frac{z + 5}{2}.$$

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

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

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

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

Answer: C



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31. Find the condition if lines $x = ay + b, z = cy + d$ and $x = a'y + b', z = c'y + d'$ are perpendicular.

A. $aa' + c'c = 1$

B. $aa' + cc' = -1$

C. $ab + cd = a'b' + c'd'$

D. $aa' + bb' = cc' + dd'$

Answer: B



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32. If the lines $6x - 2 = 3y + 1 = 2z - 2$ and

$$\frac{x - 2}{\lambda} = \frac{2y - 5}{-3}, z = -2$$
 are perpendicular then $\lambda =$

A. 3

B. 2

C. -3

D. 1

Answer: A



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33. The lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x - 1}{-2} = \frac{y - 2}{-4} = \frac{z - 3}{-6}$ are

A. coincident

B. skew

C. intersecting

D. parallel

Answer: D



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34. The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$ is (A) 0° (B) 90° (C) 45° (D) 30°

A. 0°

B. 30°

C. 45°

D. 90°

Answer: D



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35. The direction ratios of the line which is perpendicular to the lines

$$\frac{x-7}{2} = \frac{y+17}{-3} = z-6 \text{ and } x+5 = \frac{y+3}{2} = \frac{z-4}{-2} \text{ are (A) (4,5,7)}$$

(B) (4,-5,7) (C) (4,-5,-7) (D) (-4,5,7)

A. 4,5,7

B. 4,-5,7

C. 4,-5,7

D. -4, 5, 7

Answer: A



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36. The lines $\vec{r} = (2\hat{i} - 3\hat{j} + 7\hat{k}) + \lambda(2\hat{i} + p\hat{j} + 5\hat{k})$ and $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \mu(3\hat{i} - p\hat{j} + p\hat{k})$ are perpendicular if $p =$

A. -6, -1

B. -1, 6

C. 2, 3

D. none of these

Answer: B



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37. The plane $2x - (1 + \lambda)y + 3\lambda z = 0$ passes through the intersection of the plane

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

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

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

D. none of these

Answer: A



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38. Find the equation of a plane passing through the intersection of the planes $\vec{r} \cdot (\hat{i} + 3\hat{j} - \hat{k}) = 5$ and $\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) = 3$ and passes through the point $(2, 1, -2)$.

A. $\vec{r} \cdot (3\hat{i} + 2\hat{j}) = 8$

B. $\vec{r} \cdot (2\hat{i} + 3\hat{j}) = 8$

C. $\vec{r} \cdot (3\hat{i} + 2\hat{j}) + 8 = 0$

D. none of these

Answer: A



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39. Find the equation of a plane containing the line of intersection of the planes $x + y + z - 6 = 0$ and $2x + 3y + 4z + 5 = 0$ passing through $(1, 1, 1)$.

A. $20x + 23y + 26z - 69 = 0$

B. $20x + 26y + 23z - 69 = 0$

C. $x + y + z - 3 = 0$

D. $2x + 3y + 4z - 9 = 0$

Answer: A



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

A. $15x + 15y - 20z + 4 = 0$

B. $51x + 15y - 50z + 173 = 0$

C. $3x - 5y + 7 = 0$

D. $3x + 5y - 5z + 9 = 0$

Answer: B

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41. If the equation of the plane through the line of intersection of $\vec{r} \cdot (2\hat{i} - 3\hat{j} + \hat{k}) = 1$ and $\vec{r} \cdot (\hat{i} - \hat{j}) + 4 = 0$ and perpendicular to $\vec{r} \cdot (2\hat{i} + \hat{j} + \hat{k}) + 8 = 0$ is $\vec{r} \cdot (5\hat{i} - 2\hat{j} - 12\hat{k}) = \lambda$ Then $\lambda =$

A. 47

B. -47

C. 37

D. -37

Answer: A

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42. The equation of the plane containing the line $2x - 5y + z = 3; x + y + 4z = 5$, and parallel to the plane,

$$x + 3y + 6z = 1, \text{ is : (1) } 2x + 6y + 12z = 13 \text{ (2) } x + 3y + 6z = -7 \text{ (3)}$$

$$x + 3y + 6z = 7 \text{ (4) } 2x + 6y + 12z = -13$$

A. $x + 3y + 6z = 7$

B. $2x + 6y + 12z = -13$

C. $2x + 6y + 12z = 13$

D. $x + 3y + 6z = 7$

Answer: A



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43. Distance between two parallel planes $2x + y + 2z = 8$ and

$$4x + 2y + 4z + 5 = 0 \text{ is (1) } \frac{5}{2} \text{ (2) } \frac{7}{2} \text{ (3) } \frac{9}{2} \text{ (4) } \frac{3}{2}$$

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

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

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

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

Answer: C



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44. 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 $2\sqrt{3}$ from the point $(3, 1, 1)$ is (A) $5x - 11y + z = 17$ (B) $2x - y + z = 1$ (C) $x + y + z = 3$ (D) $x - 2y + z = 2$

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

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

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

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

Answer: A



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45. In R^3 , consider the planes $P_1: y = 0$ and $P_2, x + z = 1$. Let P_3 be a plane, different from P_1 and P_2 which passes through the intersection of P_1 and P_2 , If the distance of the point $(0,1,0)$ from P_3 is 1 and the distance of a point (α, β, γ) from P_3 is 2, then which of the following relation(s) is/are true?

A. $2\alpha + \beta + 2\gamma + 2 = 0$

B. $2\alpha - \beta + 2\gamma + 4 = 0$

C. $2\alpha + \beta - 2\gamma - 10 = 0$

D. $2\alpha - \beta + 2\gamma - 8 = 8$

Answer: B::D

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46. Find the distance of the point $(21, 0)$ from the plane $2x + y + 2z + 5 = 0$.

A. $\frac{10}{3}$

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

C. $\frac{10}{9}$

D. none of these

Answer: A



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47. The equation of the plane through the intersection of the planes $\vec{r} \cdot (2\hat{i} + 6\hat{j}) + 12 = 0$ and $\vec{r} \cdot (3\hat{i} - \hat{j} + 4\hat{k}) = 0$ and at a unit distance from the origin, is

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

B. $\vec{r} \cdot (\hat{i} - 2\hat{j} + 2\hat{k}) + 3 = 0$

C. $\vec{r} \cdot (\hat{i} - 2\hat{j} - 2\hat{k}) + 3 = 0$

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

Answer: A

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48. A variable plane is at a distance p from the origin O and meets the set of rectangular axes $OX_i (i = 1, 2, 3)$ at points $A_i (i = 1, 2, 3)$ respectively. If planes are drawn through A_1, A_2, A_3 which are parallel to the coordinate planes, then the locus of their point of intersection is

A. $x^2 + y^2 + z^2 = p^2$

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

C. $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$

D. $\frac{1}{x^3} + \frac{1}{y^3} + \frac{1}{z^3} = \frac{1}{p^3}$

Answer: C

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49. The distance of the point $(1, 3, -7)$ from the plane passing through the point $(1, -1, -1)$, having normal perpendicular to both the lines

$$\frac{x-1}{1} = \frac{y+2}{-2} = \frac{z-4}{3} \text{ and } \frac{x-2}{2} = \frac{y+1}{-1} = \frac{z+7}{-1} \text{ is: } \frac{5}{\sqrt{83}} \quad (2)$$

$$\frac{10}{\sqrt{74}} \quad (3) \quad \frac{20}{\sqrt{74}} \quad (4) \quad \frac{10}{\sqrt{83}}$$

A. $\frac{20}{\sqrt{74}}$

B. $\frac{10}{\sqrt{83}}$

C. $\frac{10}{\sqrt{74}}$

D. $\frac{5}{\sqrt{83}}$

Answer: B



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50. Find the distance between the parallel planes

$$2x - y + 2z + 3 = 0 \text{ and } 4x - 2y + 4z + 5 = 0.$$

A. $1/3$

B. $2/6$

C. $2/3$

D. none of these

Answer: B



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51. Find the distance between the parallel planes

$$\vec{r} \cdot (2\hat{i} - 3\hat{j} + 6\hat{k}) = 5 \text{ and}$$

$$\vec{r} \cdot (6\hat{i} - 9\hat{j} + 18\hat{k}) + 20 = 0.$$

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

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

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

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

Answer: B



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52. If d_1, d_2, d_3 denote the distances of the plane $2x - 3y + 4z = 0$ from the planes $2x - 3y + 4z + 6 = 0$, $4x - 6y + 8z + 3 = 0$ and $2x - 3y + 4z - 6 = 0$ respectively, then

A. $d_1 + 8d_2 + d_3 = 0$

B. $d_1 + 16d_2 = 0$

C. $8d_2 = d_1$

D. $d_1 - 2d_2 + 3d_3 = \sqrt{29}$

Answer: C



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53. The distance of the point $(1, -2, 4)$ from the plane passing through the point $(1, 2, 2)$ perpendicular to the planes $x - y + 2z = 3$ and $2x - 2y + z + 12 = 0$ is

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

B. 2

C. $\sqrt{2}$

D. $2\sqrt{2}$

Answer: D



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54. Find the length of the perpendicular from the point $(1, 2, 3)$ to the

line $\frac{x - 6}{3} = \frac{y - 7}{2} = \frac{z - 7}{-2}$.

A. 5 units

B. 7 units

C. 4 units

D. none of these

Answer: B



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55. The position vector of the foot of the perpendicular draw from the point $2\hat{i} - \hat{j} + 5\hat{k}$ to the line

$$\vec{r} = (11\hat{i} - 2\hat{j} - 8\hat{k}) + \lambda(10\hat{i} - 4\hat{j} - 11\hat{k}) \text{ is}$$

A. $\hat{i} + 3\hat{j} + 2\hat{k}$

B. $-\hat{i} + 3\hat{j} - 2\hat{k}$

C. $\hat{i} - 3\hat{j} - 2\hat{k}$

D. $\hat{i} + 2\hat{j} + 3\hat{k}$

Answer: D



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56. Find the image of the point $(1, 3, 4)$ in the plane

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

A. $(3, 5, 2)$

B. $(-3, 5, 2)$

C. $(3, 5, -2)$

D. $(3, -5, 2)$

Answer: B



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57. For all $d, 0 < d < 1$, which one of the following points is the reflection of the point $(d, 2d, 3d)$ in the plane passing through the points $(1, 0, 0)$, $(0, 1, 0)$ and $(0, 0, 1)$?

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

B. $\left(-\frac{1}{3} + 3d, 2d, \frac{1}{3} + d\right)$

C. $(3d, 2d, d)$

D. $\left(\frac{1}{3} + d, \frac{2}{3} - 2d, -\frac{1}{3} + d\right)$

Answer: A



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58. Find the image of the point $(1, 6, 3)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$

A. $(1,1,7)$

B. $(0,1,7)$

C. $(1,0,7)$

D. none of these

Answer: C



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59. 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. $2\sqrt{42}$

Answer: D



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60. The foot of the perpendicular from the point (1,2,3) on the line

$\vec{r} = (6\hat{i} + 7\hat{j} + 7\hat{k}) + \lambda(3\hat{i} + 2\hat{j} - 2\hat{k})$ has the coordinates

A. (5,8,15)

B. (8,5,15)

C. (3,5,9)

D. (3,5,-9)

Answer: C



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61. The shortest distance between the lines

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

$$\text{and } \vec{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(2\hat{i} + 4\hat{j} - 5\hat{k}) \text{ is}$$

A. 6

B. $\frac{6}{\sqrt{5}}$

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

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

Answer: B



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62. The shortest distance between the lines

$$\frac{x}{2} = \frac{y}{2} = \frac{z}{1} \text{ and } \frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4} \text{ in the interval:}$$

A. (2, 3]

B. [0, 1)

C. $(3, 4]$

D. $[1, 2)$

Answer: A



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63. Find the angle between the line $\vec{r} = (\hat{i} + 2\hat{j} - \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k})$ and the plane *ver.* $(2\hat{i} - \hat{j} + \hat{k}) = 4$

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

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

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

D. none of these

Answer: C



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64. The value of m for which the line $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-1}{m}$ is perpendicular to normal to the plane $\vec{r} \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = 0$ is

A. $-\frac{13}{4}$

B. $-\frac{17}{4}$

C. 4

D. none of these

Answer: A



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65. The distance of the plane through (1,1,1) and perpendicular to the line

$$\frac{x-1}{3} = \frac{y-1}{0} = \frac{z-1}{4}$$
 from the origin is

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

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

C. $\frac{7}{5}$

D. 1

Answer: C



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66. The equation of the plane through the line $x + y + z + 3 = 0 = 2x - y + 3z + 1$ and parallel to the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ is

A. $x - 5y + 3z = 7$

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

C. $x + 5y + z = 7$

D. $x + 5y + 3z = -7$

Answer: A



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67. Find the vector equation of the plane in which the lines

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

lie.

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

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

C. $\vec{r} \cdot (-\hat{i} + \hat{j} + \hat{k}) = 1$

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

Answer: B



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68. If the line, $\frac{x-3}{2} = \frac{y+2}{-1} = \frac{z+4}{3}$ lies in the plane,

$lx + my - z = 9$, then $l^2 + m^2$ is equal to: (1) 26 (2) 18 (3) 5 (4) 2

A. 26

B. 18

C. 5

D. 2

Answer: D



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69. Find ten equation of the plane passing through the point $(0, 7, -7)$

and containing the line $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$.

A. $x + y + z = 0$

B. $x - y - z = 0$

C. $3x + y + z = 0$

D. $x - y - z + 14 = 0$

Answer: A



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70. The vector equation of the plane containing the line $\vec{r} = (-2\hat{i} - 3\hat{j} + 4\hat{k}) + \lambda(3\hat{i} - 2\hat{j} - \hat{k})$ and the point $\hat{i} + 2\hat{j} + 3\hat{k}$ is

A. $\vec{r} \cdot (\hat{i} + 3\hat{k}) = 10$

B. $\vec{r} \cdot (\hat{i} - 3\hat{k}) = 10$

C. $\vec{r} \cdot (3\hat{i} + \hat{k}) = 10$

D. none of these

Answer: A



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71. The equation $3y + 4z = 0$ represents a

A. plane containing z-axis

B. plane containing x-axis

C. plane containing y-axis

D. line with direction numbers 0,3,4

Answer: B



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72. the mirror image of point $(3, 1, 7)$ with respect to the plane $x - y + z = 3$ is P . then equation plane which is passes through the point P and contains the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{1}$.

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

B. $3x + z = 0$

C. $x - 4y + 7z = 0$

D. $2x - y = 0$

Answer: C



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73. The equation of the plane containing the lines

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

A. $\vec{r} \cdot (3\hat{i} + 9\hat{j} - 2\hat{k}) + 14 = 0$

B. $\vec{r} \cdot (3\hat{i} + 9\hat{j} + 2\hat{k}) = 14$

C. $\vec{r} \cdot (3\hat{i} + 9\hat{j} - 2\hat{k}) = 14$

D. none of these

Answer: C



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74. Prove that the lines

$$\frac{x+1}{3} = \frac{y+3}{5} = \frac{z+5}{7} \text{ and } \frac{x-2}{1} = \frac{y-4}{4} = \frac{z-6}{7} \text{ are coplanar.}$$

Also, find the plane containing these two lines.

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

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

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

D. none of these

Answer: A



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75. The equation of the plane containing the two lines

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

A. $8x + y - 5z - 7 = 0$

B. $8x + y + 5z - 7 = 0$

C. $8x - y - 5z - 7 = 0$

D. none of these

Answer: D



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76. 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 (A) exactly two values (B) exactly three values (C) any value (D) exactly one value

- A. any value
- B. exactly one value
- C. exactly two values
- D. exactly three values

Answer: C



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77. If the lines $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-\lambda}{3}$ and $\frac{x}{1} = \frac{y+2}{2} = \frac{z}{4}$ intersect each other, then λ lies in the interval

- A. (9,11)
- B. (-5,-3)

C. (13,15)

D. (11,13)

Answer: D



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78. 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) a. 1 b. 2 c. 3 d. 4

A. 1,4,5

B. 1,2,5

C. 3,4,5

D. 2,4,5

Answer: A



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79. The number of distinct real values of λ for which $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z+3}{\lambda^2}$ and $\frac{x-3}{1} = \frac{y-2}{\lambda^2} = \frac{z-1}{2}$ are coplanar, is

A. 3

B. 2

C. 1

D. 4

Answer: A



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Section I Solved Mcqs

1. The locus of a point $P(x, y, z)$ which moves in such a way that $z = c$ (constant), is a

A. line parallel to z-axis

B. plane parallel to xy -plane

C. line parallel to y -axis

D. line parallel to x -axis

Answer: B



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2. The locus of a point $P(x, y, z)$ which moves in such away that $x = a$ and $y = b$ is a

A. plane parallel to xy -plane

B. line parallel to x -axis

C. line parallel to y -axis

D. line parallel to z -axis

Answer: D



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3. In a three dimensional space the equation $x^2 - 5x + 6 = 0$ represents

a. points b. planes c. curves d. pair of straight lines

A. two points

B. two parallel planes

C. two parallel lines

D. a pair of non -parallel lines

Answer: B



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4. If the equation of a plane is $lx + my + nz = p$ which is in the normal form, then which one of the following is not true?

A. l, m and n are the direction cosines of the normal to the plane

B. p is the length of the perpendicular from the origin to the plane

C. the plane passes through the origin for all values of

D. $l^2 + m^2 + n^2 = 1$

Answer: C



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5. The equation $ax + by + c = 0$ represents a plane perpendicular to the

A. xy-plane

B. yz-plane

C. zx-plane

D. none of these

Answer: A



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6. The plane $2x - (1 + \lambda)y + 3\lambda z = 0$ passes through the intersection of the plane

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

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

C. $2x + 3yz = 0$ and $y = 0$

D. none of these

Answer: B



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7. If a plane meets the coordinates axes at A, B and C, in such a way that the centroid of ΔABC is at the point $(1, 2, 3)$, the equation of the plane is

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

B. $\frac{x}{3} + \frac{y}{6} + \frac{z}{9} = 1$

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

D. none of these

Answer: B



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8. The equation $12x^2 - 2y^2 - 6z^2 - 2xy - 8xz + 6xz = 0$ represents

A. a pair of straight lines

B. a pair of planes

C. a sphere

D. a pair of planes not passing through the origin.

Answer: B



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9. Find the image of the point $(1, 3, 4)$ in the plane $2x - y + z + 3 = 0$.

A. $(3, 5, -2)$

B. $(-3, 5, 2)$

C. $(3, -5, 2)$

D. $(3, 5, 2)$

Answer: B



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10. The line $\frac{x-2}{3} = \frac{y+1}{2} = \frac{z-1}{1}$ intersects the curve

$xy = c^{I^2}, z = 0$ if c is equal to a. ± 1 b. $\pm 1/3$ c. $\pm \sqrt{5}$ d. none of these

A. ± 1

B. $\pm 1/3$

C. $\pm \sqrt{5}$

D. none of these

Answer: C



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11. A non vector \vec{a} is parallel to the line of intersection of the plane determined by the vectors $\hat{i}, \hat{i} + \hat{j}$ and the plane determined by the vectors $\hat{i} - \hat{j}, \hat{i} + \hat{k}$ then angle between \vec{a} and $\hat{i} - 2\hat{j} + 2\hat{k}$ is = (A) $\frac{\pi}{2}$
(B) $\frac{\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{4}$

A. $\pi/3$

B. $\pi/4$

C. $\pi/6$

D. none of these

Answer: B



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12. 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

A. $\frac{10}{9}$

B. $\frac{10}{3\sqrt{3}}$

C. $\frac{10}{3}$

D. none of these

Answer: B



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13. Equation of the line passing through $(1, 1, 1)$ and parallel to the plane

$2x + 3y + z + 5 = 0$ is

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

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

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

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

Answer: B



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14. The vector parallel to the line of intersection of the planes

$$\vec{r} \cdot (3\hat{i} - \hat{j} + \hat{k}) = 1 \text{ and } \vec{r} \cdot (\hat{i} + 4\hat{j} - 2\hat{k}) = 2 \text{ is :}$$

A. $2\hat{i} + 7\hat{j} + 13\hat{k}$

B. $-2\hat{i} - 7\hat{j} + 13\hat{k}$

C. $2\hat{i} + 7\hat{j} + 13\hat{k}$

D. $-2\hat{i} + 7\hat{j} + 13\hat{k}$

Answer: D



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15. For the $l: \frac{x-1}{3} = \frac{y+1}{2} = \frac{z-3}{-1}$ and the plane $P: x - 2y - z = 0$ of the following assertions the only one which is true is (A) l lies in P (B) l is parallel to P (C) l is perpendicular to P (D) none of these

A. L is \perp to Π

B. L lies in Π

C. L is parallel to Π

D. none of these

Answer: B

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16. The equation of the plane containing the line

$$\vec{r} = \hat{i} + \hat{j} + \lambda(2\hat{i} + \hat{j} + 4\hat{k}) \text{ is}$$

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

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

C. $\vec{r} \cdot (\hat{i} + 2\hat{j} - \hat{k}) = 3$

D. none of these

Answer: C



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17. The ratio in which the plane $\vec{r} \cdot (\hat{i} - 2\hat{j} + 3\hat{k}) = 17$ divides the line joining points $-2\hat{i} + 4\hat{j} + 7\hat{k}$ and $3\hat{i} - 5\hat{j} + 8\hat{k}$ is

A. 3:5

B. 1:10

C. 3:10

D. 1:5

Answer: C



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18. The sine of the angle between the straight line

$$\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5} \text{ and the plane } 2x - 2y + z = 5 \text{ is}$$

A. $\frac{10}{6\sqrt{5}}$

B. $\frac{4}{5\sqrt{2}}$

C. $\frac{\sqrt{2}}{10}$

D. $\frac{2\sqrt{3}}{5}$

Answer: C



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19. The plane $\frac{x}{2} + \frac{y}{3} + \frac{z}{4} = 1$ cuts the co-ordinate axes in A, B, C :

then the area of the ΔABC is

A. $\sqrt{29}$ sq. units

B. $\sqrt{41}$ sq. units

C. $\sqrt{61}$ sq. units

D. none of these

Answer: C



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20. Let the pair of vector \vec{a}, \vec{b} and \vec{c}, \vec{d} each determine a plane. Then the planes are parallel if

A. $(\vec{a} \times \vec{c}) \times (\vec{b} \times \vec{d}) = \vec{0}$

B. $(\vec{a} \times \vec{c}) \cdot (\vec{b} \times \vec{d}) = \vec{0}$

C. $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = \vec{0}$

D. $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d}) = 0$

Answer: C



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21. The equation of the plane containing the lines $\vec{r} = \vec{a}_1 + \lambda \vec{b}$ and $\vec{r} = \vec{a}_2 + \mu \vec{b}$ is

A. $\begin{bmatrix} \vec{r} & \vec{a} & \vec{b} \end{bmatrix} = 0$

B. $\begin{bmatrix} \vec{r} & \vec{a} & \vec{b} \end{bmatrix} = \vec{a} \cdot \vec{b}$

C. $\begin{bmatrix} \vec{a} & \vec{b} & \vec{a} \end{bmatrix} = \vec{a} \cdot \vec{b}$

D. none of these

Answer: A



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22. The coplanar points A, B, C, D are $(2 - x, 2, 2), (2, 2 - y, 2), (2, 2, 2 - z)$ and $(1, 1, 1)$ respectively then

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

B. $x + y + z = 1$

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

D. none of these

Answer: A



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23. Find the vector equation of the plane in which the lines $\vec{r} = \hat{i} + \hat{j} + \lambda(\hat{i} + 2\hat{j} - \hat{k})$ and $\vec{r} = (\hat{i} + \hat{j}) + \mu(-\hat{i} + \hat{j} - 2\hat{k})$ lie.

A. $\vec{r} \cdot (2\hat{i} + \hat{j} - 3\hat{k}) = -4$

B. $\vec{r} \times (-\hat{i} + \hat{j} + \hat{k}) = \vec{0}$

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

D. none of these

Answer: C



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24. The equation of the plane which contains the origin and the line of intersection of the plane $\vec{r} \cdot \vec{a} = d_1$ and $\vec{r} \cdot \vec{b} = d_2$ is

A. $\vec{r} \cdot (d_1 \vec{a} - d_2 \vec{b}) = 0$

B. $\vec{r} \cdot (d_1 \vec{a} + d_2 \vec{b}) = 0$

C. $\vec{r} \cdot (d_2 \vec{a} + d_1 \vec{b}) = 0$

D. $\vec{r} \cdot (d_2 \vec{a} - d_2 \vec{b}) = 0$

Answer: D



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25. The length of the perpendicular from the origin to the plane passing through the points \vec{a} and containing the line $\vec{r} = \vec{b} + \lambda \vec{c}$ is

A. $\frac{[\vec{a} \ \vec{b} \ \vec{c}]}{|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|}$

B. $\frac{[\vec{a} \ \vec{b} \ \vec{c}]}{|\vec{a} \times \vec{b} + \vec{b} \times \vec{c}|}$

$$C. \frac{[\vec{a} \quad \vec{b} \quad \vec{c}]}{|\vec{b} \times \vec{c} + \vec{c} \times \vec{a}|}$$

$$D. \frac{[\vec{a} \quad \vec{b} \quad \vec{c}]}{|\vec{a} \times \vec{b} + \vec{c} \times \vec{a}|}$$

Answer: C

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26. The distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$ measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$, is

A. 1

B. 2

C. 4

D. none of these

Answer: A

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

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

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

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

D. $x + y + z - 15 = 0$

Answer: D



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28. Distance of the point $P(\vec{c})$ from the line $\vec{r} = \vec{a} + \lambda \vec{b}$ is

A. $\frac{\left| (\vec{c} - \vec{a}) \times \vec{b} \right|}{\left| \vec{b} \right|}$

$$\text{B. } \frac{\left| (\vec{c} - \vec{a}) \cdot \vec{b} \right|}{\left| \vec{b} \right|}$$

$$\text{C. } \frac{\left| (\vec{c} - \vec{a}) \times \vec{b} \right|}{\left| \vec{b} \right|^2}$$

D. none of these

Answer: A

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29. Distance of the point $P(x_2, y_2, z_2)$ from the line

$$\frac{x - x_1}{l} = \frac{y - y_1}{m} = \frac{z - z_1}{n}, \text{ where } l, m, n \text{ are the direction cosines of}$$

the line, is

$$\text{A. } \sqrt{l^2(x_2 - x_1)^2 + m^2(y_2 - y_1)^2 + n^2(z_2 - z_1)^2}$$

$$\text{B. } |l(x_2 - x_1) + m(y_2 - y_1) + n(z_2 - z_1)|$$

C.

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

D. none of these

Answer: C

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30. If \vec{a} , \vec{b} and \vec{c} are three non-coplanar vectors then the length of projection of vector \vec{a} in the plane of the vectors \vec{b} and \vec{c} may be given by

A.
$$\frac{|\vec{a} \cdot (\vec{b} \times \vec{c})|}{|\vec{b} \times \vec{c}|}$$

B.
$$\frac{|\vec{a} \times (\vec{b} \times \vec{c})|}{|\vec{b} \times \vec{c}|}$$

C.
$$\frac{[\vec{a} \ \vec{b} \ \vec{c}]}{\vec{b} \cdot \vec{c}}$$

D. none of these

Answer: B



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31. If $P = (0, 1, 0)$ and $Q = (0, 0, 1)$ then the projection of PQ on the plane $x + y + z = 3$ is

A. 2

B. 3

C. $\sqrt{2}$

D. $\sqrt{3}$

Answer: C

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32. A plane Π passes through the point $(1,1,1)$. If b, c, a are the direction ratios of a normal to the plane where $a, b, c (a < b < c)$ are the prime factors of 2001, then the equation of the plane Π is

A. $29x + 31y + z = 63$

B. $23x + 29y - 29z = 23$

C. $23x + 29y + 3z = 55$

D. $31x + 37y + 3z = 71$

Answer: C



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33. If the foot of the perpendicular from $O(0, 0, 0)$ to a plane is $P(1, 2, 2)$

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

Answer: B



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34. The equation of the plane through the point (1,2,3) and parallel to the plane $x + 2y + 5z = 0$ is

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

B. $x + 2y + 5z = 14$

C. $x + 2y + 5z = 6$

D. none of these

Answer: A



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35. The straight line $\frac{x - 3}{3} = \frac{y - 2}{1} = \frac{z - 1}{0}$ is Parallel to x-axis

Parallel to the y-axis Parallel to the z-axis Perpendicular to the z-axis

A. parallel to x-axis

B. parallel to y-axis

C. parallel to z-axis

D. perpendicular to z-axis

Answer: A



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36. The dr. of normal to the plane through $(1, 0, 0)$, $(0, 1, 0)$ which makes an angle $\frac{\pi}{4}$ with plane, $x + y = 3$ are

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

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

C. $1, 1, 2$

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

Answer: B



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37. The plane which passes through the point $(3, 2, 0)$ and the line $\frac{x-3}{1} = \frac{y-6}{5} = \frac{z-4}{4}$ is a. $x - y + z = 1$ b. $x + y + z = 5$ c. $x + 2y - z = 1$ d. $2x - y + z = 5$

A. $x - y + z = 1$

B. $x + y + z = 5$

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

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

Answer: A



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38. 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 find the value of k .

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

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

C. $-\frac{2}{9}$

D. $-\frac{3}{2}$

Answer: B



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39. the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{1} = \frac{z-5}{1}$ are coplanar if $k=?$

A. $k = 3$ or -3

B. $k = 0$ or -1

C. $k = 1$ or -1

D. $k = 0$ or -3

Answer: D



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40. Two systems of rectangular axes have the same origin. If a plane cuts them at distances a, b, c and a', b', c' respectively, prove that

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

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

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

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

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

Answer: A



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41. A tetrahedron has vertices $O(0, 0, 0)$, $A(1, 2, 1)$, $B(2, 1, 3)$, and $C(-1, 1, 2)$, then angle between face OAB and ABC will be a. $\cos^{-1}\left(\frac{17}{31}\right)$ b. 30° c. 90° d. $\cos^{-1}\left(\frac{19}{35}\right)$

A. 90°

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

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

D. 30°

Answer: B



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42. The value of k such that $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-k}{2}$ lies in the plane $2x - 4y = z = 7$ is a. 7 b. -7 c. no real value d. 4

A. 7

B. -7

C. no real value

D. 4

Answer: A



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

A. 10

B. 8

C. 21

D. 13

Answer: D



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44. The length of the perpendicular drawn from $(1, 2, 3)$ to the line

$$\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2} \text{ is a. 4 b. 5 c. 6 d. 7}$$

A. 4

B. 5

C. 6

D. 7

Answer: D



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45. Distance between two parallel planes $2x + y + 2z = 8$ and $4x + 2y + 4z + 5 = 0$ is (1) $\frac{5}{2}$ (2) $\frac{7}{2}$ (3) $\frac{9}{2}$ (4) $\frac{3}{2}$

A. $9/2$

B. $5/2$

C. $7/2$

D. $3/2$

Answer: C



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46. A line with directional 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

A. $(2a, 3a, a), (2a, a, a)$

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

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

D. $(3a, 3a, 3a), (a, a, a)$

Answer: B



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47. 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 (A) $-\frac{1}{2}$ (B) -1 (C) -2 (D) 0

A. 0

B. -1

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

D. -2

Answer: D



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48. If \vec{a} , \vec{b} and \vec{c} are three non-coplanar vectors, then the vector equation $\vec{r} - (1 - p - q)\vec{a} + p\vec{b} + q\vec{c}$ represents a

A. straight line

B. plane

C. plane passing through the origin

D. sphere

Answer: B

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49. A plane Π makes intercept 3 and 4 respectively on x and z axes. If Π is parallel to y -axis, then its equation is

A. $3x + 4y = 12$

B. $4x + 3z = 12$

C. $3y + 4z = 12$

D. $4y + 3y = 12$

Answer: B

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

A. $y - z + 6 = 0$

B. $3y - z + 6 = 0$

C. $y + 3z + 6 = 0$

D. $3y - 2z + 6 = 0$

Answer: A



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51. Find the distance of the point $P(3, 8, 2)$ from the line $\frac{1}{2}(x - 1) = \frac{1}{4}(y - 3) = \frac{1}{3}(z - 2)$ measured parallel to the plane $3x + 2y - 2z + 15 = 0$.

A. 2

B. 3

C. 6

D. 7

Answer: D



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52. If from a point $P(a, b, c)$ perpendiculars PA and PB are drawn to yz and zx - planes, find the equation of the 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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53. A non vector \vec{a} is parallel to the line of intersection of the plane determined by the vectors $\hat{i}, \hat{i} + \hat{j}$ and the plane determined by the vectors $\hat{i} - \hat{j}, \hat{i} + \hat{k}$ then angle between \vec{a} and $\hat{i} - 2\hat{j} + 2\hat{k}$ is = (A) $\frac{\pi}{2}$
(B) $\frac{\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{4}$

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

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

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

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

Answer: D



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54. If M denotes the mid point of the line segment joining $A(4\hat{i} + 6\hat{j} - 10\hat{k})$ and $B(-\hat{i} + 2\hat{j} + \hat{k})$, then the equation, of the plane through M and perpendicular to AB is

A. $\vec{r} \cdot (-5\hat{i} - 3\hat{j} + 11\hat{k}) + \frac{135}{2} = 0$

B. $\vec{r} \cdot \left(\frac{3}{2}\hat{i} + \frac{7}{2}\hat{j} - \frac{9}{2}\hat{k}\right) + \frac{135}{2} = 0$

C. $\vec{r} \cdot (4\hat{i} + 5\hat{j} - 10\hat{k}) + 4 = 0$

D. $\vec{r} \cdot (-\hat{i} + 2\hat{j} + \hat{k}) + 4 = 0$

Answer: A



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55. 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

- A. $\frac{10}{3}$
- B. $\frac{3}{10}$
- C. $\frac{10}{3\sqrt{3}}$
- D. $\frac{10}{9}$

Answer: C



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56. 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. $-4/3$

B. $3/4$

C. $-3/5$

D. $5/3$

Answer: D



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

A. $\left(-\frac{17}{3}, -\frac{19}{3}, 4\right)$

B. $(15, 11, 4)$

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

D. none of these

Answer: D



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58. 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 $\frac{1}{\sqrt{3}}$, $\frac{1}{2}$, 1 , $\frac{1}{\sqrt{2}}$

A. 1

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

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

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

Answer: C



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59. 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. $a = 6, b = 4$

B. $a = 8, b = 2$

C. $a = 2, b = 8$

D. $a = 4, b = 6$

Answer: A



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60. 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 (1) -5 (2) 5 (3) 2 (4) -2

A. 2

B. -2

C. -5

D. 5

Answer: C



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61. 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) $(6, -17)$ (B) $(-6, 7)$ (C) $(5, 15)$ (D) $(-5, 5)$

A. $(6, -17)$

B. $(-6, 7)$

C. $(5, -15)$

D. $(-5, 5)$

Answer: B



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62. Read the following passage and answer the questions. Consider the lines

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

The unit vector perpendicular to both L_1 and L_2 is

A. $\frac{1}{\sqrt{99}}(-\hat{i} + 7\hat{j} + 7\hat{k})$

B. $\frac{1}{5\sqrt{5}}(-\hat{i} - 7\hat{j} + 5\hat{k})$

C. $\frac{1}{5\sqrt{3}}(-\hat{i} + 7\hat{j} + 5\hat{k})$

D. $\frac{1}{\sqrt{99}}(7\hat{i} - 7\hat{j} - \hat{k})$

Answer: B



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63. 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{PQ} 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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64. A plane passes through $(1,-2,1)$ and is perpendicular to two planes $2x - 2y + z = 0$ and $x - y + 2z = 4$, then the distance of the plane from the point $(1,2,2)$ is

A. 0

B. 1

C. $\sqrt{2}$

D. $2\sqrt{2}$

Answer: D



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65. Let \vec{a} be vector parallel to line of intersection of planes P_1 and P_2 through origin. If P_1 is parallel to the vectors $2\vec{j} + 3\vec{k}$ and $4\vec{j} - 3\vec{k}$ and P_2 is parallel to $\vec{j} - \vec{k}$ and $3\vec{i} + 3\vec{j}$, then the angle between \vec{a} and $2\vec{i} + \vec{j} - 2\vec{k}$ is :

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

B. $\frac{\pi}{2}$ or $\frac{3\pi}{2}$

C. $\frac{\pi}{6}$ or $\frac{\pi}{3}$

D. $\frac{\pi}{3}$ or $\frac{2\pi}{3}$

Answer: A



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66. If $\alpha + \beta + \gamma = 2$ and $\vec{a} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$, $\hat{k} \times (\hat{k} \times \vec{a}) = \vec{0}$

then $\gamma =$ (A) 1 (B) -1 (C) 2 (D) none of these

A. 0

B. 1

C. 2

D. 3

Answer: C



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67. A variable plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ at a unit distance from origin cuts the coordinate axes at A, B and C . Centroid (x, y, z) satisfies the equation $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = K$. The value of K is

A. 9

B. 3

C. $1/9$

D. $1/3$

Answer: A



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68. 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 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

69. 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 $\frac{x}{2} = \frac{y}{4} = \frac{z}{2}$ 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

70. If the distance between the plane $Ax + 2y + z = d$ and the plane containing the lines $2x = 3y = 4z$ and $3x = 4y = 5z$ is 6, then $|d|$ is

A. 3

B. 4

C. 6

D. 1

Answer: C



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71. A line from the origin meets the lines $\frac{x-2}{1} = \frac{y-1}{-2} = \frac{z+1}{1}$ and $\frac{x-\frac{8}{3}}{2} = \frac{y+3}{-1} = \frac{z-1}{1}$ at P and Q respectively. If length $PQ = d$, then d^2 is

A. 3

B. 4

C. 5

D. 6

Answer: D



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72. The number of 3×3 matrices A whose entries are either 0 or 1 and for which the system $A[xyz] = [100]$ has exactly two distinct solution is
a. 0 b. $2^9 - 1$ c. 168 d. 2

A. 0

B. $2^9 - 1$

C. 168

D. 2

Answer: A



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73. 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 $\lambda =$ (A) $\frac{2}{5}$ (B) $\frac{5}{3}$ (C) $\frac{2}{3}$ (D) $\frac{3}{2}$

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

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

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

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

Answer: A



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74. Let $a, b,$ and c be three real numbers satisfying

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

Let ω be a solution of $x^3 - 1 = 0$ with

$Im(\omega) > 0$. If $a = 2$ with b and c satisfying (E) then the value of

$$\frac{3}{\omega^a} + \frac{1}{\omega^b} + \frac{3}{\omega^c}$$

is equal to (A) -2 (B) 2 (C) 3 (D) -3

A. 0

B. 12

C. 7

D. 6

Answer: D



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75. The distance of the point $(1, -5, 9)$ from the plane $x - y + z = 5$ measured along the line $x = y = z$ is

A. $5\sqrt{3}$

B. $3\sqrt{10}$

C. $3\sqrt{5}$

D. $10\sqrt{3}$

Answer: D



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76. Find the equation of the perpendicular from point $(3, -1, 11)$ to line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$. Also, find the coordinates of foot of perpendicular and the length of perpendicular.

A. $\sqrt{33}$

B. $\sqrt{53}$

C. $\sqrt{66}$

D. $\sqrt{29}$

Answer: B



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

A. $1/\sqrt{2}$

B. $\sqrt{2}$

C. 2

D. $2\sqrt{2}$

Answer: A



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78. If the straight lines $x + y + z = 2k$ and $x + y + z = 5k$ are coplanar, then the plane(s) containing these two lines is (are) (A) $y + 2z = 1$ (B) $y + z = 1$ (C) $yz = 1$ (D) $y + 2z = 1$

A. $y + 12z = -1$

B. $y + 1z = -1$

C. $y \pm 2z = 1$

$$D. y \pm z = 1$$

Answer: B



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79. If the three planes $x = 5$, $2x - 5ay + 3z - 2 = 0$ and $3bx + y - 3z = 0$ contain a common line, then (a, b) is equal to

- A. $\left(-\frac{1}{5}, \frac{8}{15}\right)$
- B. $\left(\frac{1}{5}, -\frac{8}{15}\right)$
- C. $\left(-\frac{8}{15}, \frac{1}{5}\right)$
- D. $\left(\frac{8}{15}, -\frac{1}{5}\right)$

Answer: B



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80. 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 (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)

$\frac{x}{2} = \frac{y-1}{-7} = \frac{z-2}{5}$

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. $\frac{x}{2} = \frac{y-1}{-7} = \frac{z-2}{5}$

Answer: D



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

$l_1: (3+t)\hat{i} + (-1+2t)\hat{j} + (4+2t)\hat{k}, \infty < t < \infty, l_2: (3+s)\hat{i} + (3+2s)\hat{j} + (4+2s)\hat{k}, \infty < s < \infty$

then the coordinates of the point on l_2 at a distance of $\sqrt{17}$ from the point of intersection of l & l_1 is/are:

A. $\left(\frac{7}{3}, \frac{7}{3}, \frac{5}{3}\right)$ and $(-1, -1, 0)$

B. $(-1, -1, 0)$ and $(1, 1, 1)$

C. $\left(\frac{7}{9}, \frac{7}{9}, \frac{8}{9}\right)$ and $\left(\frac{7}{3}, \frac{7}{3}, \frac{5}{3}\right)$

D. $(1, 1, 1)$ and $\left(\frac{7}{9}, \frac{7}{9}, \frac{8}{9}\right)$

Answer: D



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82. Consider the set of eight vector

$V = \{a\hat{i} + b\hat{j} + c\hat{k}; a, b, c \in \{-1, 1\}\}$. Three non-coplanar vectors can

be chosen from V in 2^p ways. Then p is _____.

A. 3

B. 5

C. 6

Answer: B



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

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

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

A. $\frac{x-3}{3} = \frac{y+5}{1} = \frac{z-2}{-5}$

B. $\frac{x-3}{-3} = \frac{y+5}{-1} = \frac{z-2}{5}$

C. $\frac{x+3}{3} = \frac{y-5}{1} = \frac{z-2}{-5}$

D. $\frac{x+3}{-3} = \frac{y-5}{-3} = \frac{y-5}{-1} = \frac{z+2}{5}$

Answer: C



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84. From a point $P(\lambda, \lambda, \lambda)$, perpendicular PQ and PR are drawn respectively on the lines $y = x, z = 1$ and $y = -x, z = -1$. If P is such that $\angle QPR$ is a right angle, then the possible value(s) of λ is/(are)

A. $\sqrt{2}$

B. 1

C. -1

D. $-\sqrt{2}$

Answer: C



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85. Let L be a straight line passing through the origin. Suppose that all the points on L are at a constant distance from the two planes $P_1: x + 2y - z + 1 = 0$ and $P_2: 2x - y + z - 1 = 0$. Let M be the locus of the feet of the perpendiculars drawn from the points on L to the plane P_1 . Which of the following points lie(s) on M?

A. $\left(0, -\frac{5}{6}, -\frac{2}{3}\right)$

B. $\left(-\frac{1}{6}, -\frac{1}{3}, \frac{1}{6}\right)$

C. $\left(-\frac{5}{6}, 0, \frac{1}{6}\right)$

D. $\left(-\frac{1}{3}, 0, \frac{2}{3}\right)$

Answer: A:B



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86. The distance between the line $x = 2 + t, y = 1 + t, z = -\frac{1}{2} - \frac{t}{2}$ and the plane $\vec{r} \cdot (\hat{i} + 2\hat{j} + 6\hat{k}) = 10$, is

A. $\frac{1}{6}$

B. $\frac{1}{\sqrt{41}}$

C. $\frac{1}{7}$

D. $\frac{9}{\sqrt{41}}$

Answer: D

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87. The shortest distance between the lines $2x + y + z - 1 = 0 = 3x + y + 2z - 2$ and $x = y = z$, is

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

B. $\sqrt{2}$

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

D. $\frac{\sqrt{3}}{2}$

Answer: A

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88. Consider a pyramid OPQRS located in the first octant ($x \geq 0, y \geq 0, z \geq 0$) with O as origin, and OP and OR along the x-axis and the y-axis, respectively. The base OPQR of the pyramid is a square with

$OP = 3$. The point S is directly above the mid-point T of diagonal OQ

such that $TS = 3$. Then

A. $x - y = 0$

B. $y - z = 0$

C. $z - x = 0$

D. $x - y - z = 0$

Answer: A



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89. From a point A with position vector $p(\hat{i} + \hat{j} + \hat{k})$, AB and AC are drawn perpendicular to the lines $\vec{r} = \hat{k} + \lambda(\hat{i} + \hat{j})$ and $\vec{r} = -\hat{k} + \mu(\hat{i} - \hat{j})$, respectively. A value of p is equal to

A. -2

B. -1

C. $\sqrt{2}$

D. all of these

Answer: D

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Section II Assertion Reason Type

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.

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.

Answer: D

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2. 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.

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.

Answer: D



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3. Statement 1: Let A,B,C be the image of point $P(a, b, c)$ in YZ , ZX and XY planes respectively. Then, the equation of the plane passing through points A,B,C cuts intercepts a,b,c on the coordinate axes. **Statement 2:** The

image (α, β, γ) of a point (x_1, y_1, z_1) in the plane $ax + by + cz + d = 0$ is given by
$$\frac{\alpha - x_1}{a} = \frac{\beta - y_1}{b} = \frac{\gamma - z_1}{c} = -\frac{2(ax_1 + by_1 + cz_1 + d)}{a^2 + b^2 + c^2}$$

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.

Answer: A



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4. Consider the plane $\pi: x + y - 2z = 3$ and two points $P(2, 1, 6)$ and $Q(6, 5, -2)$.

Statement 1: PQ is parallel to the normal to the plane.

Statement 2: Q is the image of point P in the plane π

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.

Answer: B



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5. Statement 1: The cartesian equation of the plane

$$\vec{r} = (\hat{i} - \hat{j}) + \lambda(\hat{i} + \hat{j} + \hat{k}) + \mu(\hat{i} - 2\hat{j} + 3\hat{k}) \text{ is } 5x - 2y - 3z = 7$$

Statement 2: The non parametric form of the plane

$$\vec{r} = \vec{a} + \lambda\vec{b} + \mu\vec{c} \text{ is } \begin{bmatrix} \vec{r} & \vec{b} & \vec{c} \end{bmatrix} = \begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}$$

- 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.

Answer: A



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6. Statement 1: If the vectors \vec{a} and \vec{c} are non collinear, then the lines $\vec{r} = 6\vec{a} - \vec{c} + \lambda(2\vec{c} - \vec{a})$ and $\vec{r} = \vec{a} - \vec{c} + \mu(\vec{a} + 3\vec{c})$ are coplanar.

Statement 2: There exists λ and μ such that the two values of \vec{r} in statement -1 become same

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.

Answer: A

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7. Statement 1: If a is an integer the the straight lines

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

and $\vec{r} = 2\hat{i} + 3\hat{j} + \hat{k} + \mu(3\hat{i} + \hat{j} + 2\hat{k})$ intersect at a point for

$$a = -5.$$

Statement 2: Two straight lines intersect if the shortest distance between them is zero.

- 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.

Answer: A



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8. Statement 1: The lines $\frac{x-1}{1} = \frac{y}{-1} = \frac{z+1}{1}$ and $\frac{x-2}{2} = \frac{y+1}{2} = \frac{z}{3}$ are coplanar and the equation of the plane containing them is $5x + 2y - 3z - 8 = 0$

Statement 2: The line $\frac{x-2}{1} = \frac{y+1}{2} = \frac{z}{3}$ is perpendicular to the plane $3x + 5y + 9z - 8 = 0$ and parallel to the plane $x + y - z = 0$

- 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.

Answer: B



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9. Statement 1: A point on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance $3\sqrt{2}$ from the point $(1, 2, 3)$ lies on the line $\frac{x+7}{5} = \frac{y+t}{4} = \frac{z-2}{1}$

Statement 2: If d is the distance between the point $(-1, -5, -10)$ and the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ with the plane $x - y + z = 5$ then $d = 13$

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.

Answer: B



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10. Consider the line $L: \vec{r}(\hat{i} + 3\hat{j} - \hat{k}) + \lambda(\hat{j} + 2\hat{k})$ and the plane $\pi: \vec{r}(\hat{i} + 4\hat{j} + \hat{k}) + 6 = 0$

Statement 1: The line L intersects the plane π at the point $(1,0,-7)$.

Statement 2: The angle θ between the line L and the plane π is given by

$$\theta = \frac{1}{2} \cos^{-1} \left(\frac{1}{5} \right).$$

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.

Answer: B



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11. Statement 1: The plane $5x + 2z - 8 = 0$ contains the line $2x - y + z - 3 = 0$ and $3x + y + z = 5$, and is perpendicular to $2x - y - 5z - 3 = 0$. Statement 2: The plane $3x + y + z = 5$, meets the line $x - 1 = y + 1 = z - 1$ at the point (1,1,1)

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.

Answer: C



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

- 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.

Answer: B



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13. 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.

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.

Answer: B



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14. The equations of two straight lines are

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

Statement 1: The given lines are coplanar.

Statement 2: The equations

$$2r - s = 1$$

$$r + 3s = 4$$

$$3r + 2s = 5$$

are consistent.

- 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.

Answer: A



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15. Given two straight lines whose equations are

$$\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1} \text{ and } \frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$$

Statement 1: The line of shortest distance between the given lines is perpendicular to the plane $x + 3y + 5z = 0$.

Statement 2 : The direction ratios of the normal to the plane $ax + by + cz + d = 0$ are proportional to $\frac{a}{d}, \frac{b}{d}, \frac{c}{d}$.

- 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.

Answer: D



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16. Statement 1: The shortest distance between the lines $\frac{x}{2} = \frac{y}{-1} = \frac{z}{2}$ and $\frac{x-1}{-2} = \frac{y-1}{-2} = \frac{z-1}{4}$ is $\sqrt{2}$. Statement 2: The shortest distance between two parallel lines is the perpendicular distance from any point on one of the lines to the other line.

- 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.

Answer: A



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1. The perpendicular distance from the origin to the plane through the point $(2,3,-1)$ and perpendicular to the vector $3\hat{i} - 4\hat{j} + 7\hat{k}$ is

A. $\frac{13}{\sqrt{74}}$

B. $\frac{-13}{\sqrt{74}}$

C. 13

D. none of these

Answer: A



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2. The equation of the plane perpendicular to the line $\frac{x-1}{1} = \frac{y-2}{-1} = \frac{z+1}{2}$ and passing through the point $(2,3,1)$, is

A. $\vec{r} \cdot (\hat{i} + \hat{j} + 2\hat{k}) = 1$

B. $\vec{r} \cdot (\hat{i} - \hat{j} + 2\hat{k}) = 1$

C. $\vec{r} \cdot (\hat{i} - \hat{j} + 2\hat{k}) = 7$

D. none of these

Answer: B



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3. The locus of a point which moves so that the difference of the squares of its distances from two given points is constant, is a

A. straight line

B. plane

C. sphere

D. none of these

Answer: B



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4. If the position vectors of the points A and B are $3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} - 2\hat{j} - 4\hat{k}$ respectively then the equation of the plane through B and perpendicular to AB is

A. $\vec{r} \cdot (2\hat{i} + 3\hat{j} + 6\hat{k}) = 28$

B. $\vec{r} \cdot (2\hat{i} + 3\hat{j} + 6\hat{k}) = 32$

C. $\vec{r} \cdot (2\hat{i} + 3\hat{j} + 6\hat{k}) + 28 = 0$

D. none of these

Answer: C



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5. The vector equation of the plane passing through the origin and the line of intersection of the planes $\vec{r} \cdot \vec{a} = \lambda$ and $\vec{r} \cdot \vec{b} = \mu$ is

A. $\vec{r} \cdot (\lambda \vec{a} - \mu \vec{b}) = 0$

B. $\vec{r} \cdot (\lambda \vec{b} - \mu \vec{a}) = 0$

$$C. \vec{r} \cdot (\lambda \vec{a} + \mu \vec{b}) = 0$$

$$D. \vec{r} \cdot (\lambda \vec{b} + \mu \vec{a}) = 0$$

Answer: B



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6. The position vectors of points A and B are

$\hat{i} - \hat{j} + 3\hat{k}$ and $3\hat{i} + 3\hat{j} - \hat{k}$ respectively. The

equation of a plane is $\vec{r} \cdot (5\hat{i} + 2\hat{j} - 7\hat{k}) = 0$ The

points A and B

- A. lie on the plane
- B. are on the same side of the plane
- C. are on the opposite side of the plane
- D. none of these

Answer: C



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7. The vector equation of the plane through the point $2\hat{i} - \hat{j} - 4\hat{k}$ and parallel to the plane $\vec{r} \cdot (4\hat{i} - 12\hat{j} - 3\hat{k}) - 7 = 0$, is

A. $\vec{r} \cdot (4\hat{i} - 12\hat{j} - 3\hat{k}) = 0$

B. $\vec{r} \cdot (4\hat{i} - 12\hat{j} - 3\hat{k}) = 32$

C. $\vec{r} \cdot (4\hat{i} - 12\hat{j} - 3\hat{k}) = 12$

D. none of these

Answer: B

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8. Find the vector equation to the plane through the point $(2, 1, -1)$ passing through the line of intersection of the planes $\vec{r} \cdot (\hat{i} + 3\hat{j} - \hat{k}) = 0$ and $\vec{r} \cdot (\hat{j} + 2\hat{k}) = 0$

A. $\vec{r} \cdot (\hat{i} + 9\hat{j} + 11\hat{k}) = 0$

B. $\hat{r} \cdot (\hat{i} + 9\hat{j} + 11\hat{k}) = 6$

C. $\hat{r} \cdot (\hat{i} - 3\hat{j} - 13\hat{k}) = 0$

D. none of these

Answer: A



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9. Equation of a plane passing through the intersection of the planes $\vec{r} \cdot (3\hat{i} - \hat{j} + \hat{k}) = 1$ and $\vec{r} \cdot (\hat{i} + 4\hat{j} - 2\hat{k}) = 2$ and passing through the point $(\hat{i} + 2\hat{j} - \hat{k})$ is :

A. $\vec{r} \cdot (2\hat{i} + 7\hat{j} - 13\hat{k}) = 1$

B. $\vec{r} \cdot (2\hat{i} - 7\hat{j} - 13\hat{k}) = 1$

C. $\vec{r} \cdot (2\hat{i} + 7\hat{j} + 13\hat{k}) = 0$

D. none of these

Answer: B

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10. The vector equation of a plane which contains the line

$$\vec{r} = 2\hat{i} + \lambda(\hat{j} - \hat{k}) \text{ and perpendicular to the plane } \vec{r} \cdot (\hat{i} + \hat{k}) = 3 \text{ is}$$

A. $\vec{r} \cdot (\hat{i} - \hat{j} - \hat{k}) = 2$

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

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

D. none of these

Answer: A

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11. The equation of the plane containing the lines $\vec{r} = \vec{a}_1 + \lambda \vec{b}$ and

$$\vec{r} = \vec{a}_2 + \mu \vec{b} \text{ is}$$

A. $\vec{r} \cdot (\vec{a}_1 - \vec{a}_2) \times \vec{b} = \begin{vmatrix} \vec{a}_1 & \vec{a}_2 & \vec{b} \end{vmatrix}$

B. $\vec{r} \cdot (\vec{a}_2 - \vec{a}_1) \times \vec{b} = \begin{bmatrix} \vec{a}_1 & \vec{a}_2 & \vec{b} \end{bmatrix}$

C. $\vec{r} \cdot (\vec{a}_1 + \vec{a}_2) \times \vec{b} = \begin{bmatrix} \vec{a}_2 & \vec{a}_1 & \vec{b} \end{bmatrix}$

D. none of these

Answer: B



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12. The equation of the plane containing the lines $\vec{r} = \vec{a}_1 + \lambda \vec{b}$ and $\vec{r} = \vec{a}_2 + \mu \vec{b}$ is

A. $\begin{bmatrix} \vec{r} & \vec{a}_1 & \vec{a}_2 \end{bmatrix} = 0$

B. $\begin{bmatrix} \vec{r}, \vec{a}_1, \vec{a}_2 \end{bmatrix} = \vec{a}_1 \cdot \vec{a}_2$

C. $\begin{bmatrix} \vec{r} & \vec{a}_2 & \vec{a}_1 \end{bmatrix} = \vec{a}_1 \cdot \vec{a}_2$

D. none of these

Answer: A



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13. The vector parallel to the line of intersection of the planes

$$\vec{r} \cdot (3\hat{i} - \hat{j} + \hat{k}) = 1 \text{ and } \vec{r} \cdot (\hat{i} + 4\hat{j} - 2\hat{k}) = 2 \text{ is :}$$

A. $-2\hat{i} + 7\hat{j} + 13\hat{k}$

B. $2\hat{i} + 7\hat{j} - 13\hat{k}$

C. $-2\hat{i} - 7\hat{j} + 13\hat{k}$

D. $2\hat{i} + 7\hat{j} + 13\hat{k}$

Answer: A

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14. Find the vector equation of the plane in which the lines

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

lie.

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

B. $\vec{r} \cdot (\hat{i} - \hat{j} - \hat{k}) = 0$

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

D. none of these

Answer: B



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15. The Cartesian equation of the plane

$\vec{r} = (1 + \lambda - \mu)\hat{i} + (2 - \lambda + \mu)\hat{j} + (3 - 2\lambda + 2\mu)\hat{k}$ is

A. $2x + y = 5$

B. $2x - y = 5$

C. $2x + z = 5$

D. $2x - z = 5$

Answer: C



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16. The perpendicular 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

:

A. $\frac{10}{3\sqrt{3}}$

B. $\frac{10}{3}$

C. $10/9$

D. none of these

Answer: A



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17. The vector equation of the line of intersection of the planes

$$\vec{r} \cdot (2\hat{i} + 3\hat{k}) = 0 \text{ and } \vec{r} \cdot (3\hat{i} + 2\hat{j} + \hat{k}) = 0 \text{ is}$$

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

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

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

D. none of these

Answer: B



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18. A straight line $\vec{r} = \vec{a} + \lambda \vec{b}$ meets the plane $\vec{r} \cdot \vec{n} = 0$ at P. Then position vector of P is

$$A. \vec{a} + \frac{\vec{a} \cdot \vec{n}}{\vec{b} \cdot \vec{n}} \vec{b}$$

$$B. \vec{a} \frac{\vec{b} \cdot \vec{n}}{\vec{a} \cdot \vec{n}} \vec{b}$$

$$C. \vec{a} - \frac{\vec{a} \cdot \vec{n}}{\vec{b} \cdot \vec{n}} \vec{b}$$

D. none of these

Answer: C



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19. The equation of the plane passing through three non-collinear points with position vectors $\vec{a}, \vec{b}, \vec{c}$, is

A. $\vec{r} \cdot (\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}) = 0$

B. $\vec{r} \times (\vec{a} \times \vec{b} + \vec{b} \times \vec{c}) = \begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}$

C. $\vec{r} \cdot (\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}) + \begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix} = 0$

D. none of these

Answer: D



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20. The length of the perpendicular from the origin to the plane passing through three non-collinear points $\vec{a}, \vec{b}, \vec{c}$ is

A. $\frac{\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}}{\left| \vec{a} \times \vec{b} + \vec{c} \times \vec{a} + \vec{b} \times \vec{c} \right|}$

B. $\frac{2 \begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}}{\left| \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} \right|}$

C. $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}$

D. none of these

Answer: A



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21. The equation of the plane containing the line

$$\frac{x - x_1}{l} = \frac{y - y_1}{m} = \frac{z - z_1}{n} \quad \text{is}$$

$a(x - x_1) + b(y - y_1) + c(z - z_1) = 0$, where $ax_1 + by_1 + cz_1 = 0$ b.

$al + bm + cn = 0$ c. $\frac{a}{l} = \frac{b}{m} = \frac{c}{n}$ d. $lx_1 + my_1 + nz_1 = 0$

A. $ax_1 + by_1 + cz_1 = 0$

B. $al + bm + cn = 0$

C. $a/l = b/m = c/n$

D. $lx_1 + my_1 + nz_1 = 0$

Answer: B



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22. Find the shortest distance between the lines

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4} \text{ and } \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}.$$

A. $1/\sqrt{6}$

B. $1/6$

C. $1/3$

D. $1/\sqrt{3}$

Answer: A



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23. If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$

are perpendicular, find the value of k.

A. $-7/10$

B. $-10/7$

C. -10

D. $10/7$

Answer: B



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24. The direction ratios of a normal to the plane passing through $(0,0,1)$, $(0,1,2)$ and $(1,2,3)$ are proportional to

A. $0,1,-1$

B. $1,0,-1$

C. $0,0,-1$

D. $1,0,1$

Answer: A



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25. A variable plane is at a distance k from the origin and meets the coordinates axes is A,B,C. Then the locus of the centroid of $\triangle ABC$ is

A. $x^{-2} + y^{-2} + z^{-2} = k^{-2}$

B. $x^{-2} + y^{-2} + z^{-2} = 4k^{-2}$

C. $x^{-2} + y^{-2} + z^{-2} = 16k^{-2}$

D. $x^{-2} + y^{-2} + z^{-2} = 9k^{-2}$

Answer: D



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26. Find the equation of the plane perpendicular to the line

$\frac{x-1}{2} = \frac{y-3}{-1} = \frac{z-4}{2}$ and passing through the origin.

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

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

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

D. $2x - y - z = 0$

Answer: C



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27. Find the equation of the plane through the points (2,2,1) and (9,3,6) and *perpendicular* \rightarrow *the plane* $\neq 2x+6y+6z=1$

A. $3x + 4y + 6z = 9$

B. $3x + 4y - 5z + 9 = 0$

C. $3x + 4y - 5z - 9 = 0$

D. none of these

Answer: C



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28. The equation of the plane containing the two lines

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

A. $8x + y - 5z - 7 = 0$

B. $8x + y + 5z - 7 = 0$

C. $8x - y - 5z - 7 = 0$

D. none of these

Answer: A



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29. The direction ratios of the normal to the plane passing through the points $(1, -2, 3)$, $(-1, 2, -1)$ and parallel to the line

$$\frac{x-2}{2} = \frac{y+1}{3} = \frac{z}{4} \text{ are proportional to}$$

A. 2, 3, 4

B. $4, 0, 7$

C. $-2, 0, -1$

D. $2, 0, -1$

Answer: D



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30. The equation of a plane through the point $(2, 3, 1)$ and $(4, -5, 3)$ and parallel to x-axis

A. $y - 4z = 7$

B. $y + 4z = 7$

C. $7 + 4z = -7$

D. $x + 4z = 7$

Answer: B



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31. The angle between the lines $\frac{x+4}{1} = \frac{y-3}{2} = \frac{z+2}{3}$ and $\frac{x}{3} = \frac{y-1}{-2} = \frac{z}{1}$ is

A. $\sin^{-1} \frac{1}{7}$

B. $\cos^{-1} \frac{2}{7}$

C. $\cos^{-1} \frac{1}{7}$

D. none of these

Answer: C



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32. The equation of the plane which is perpendicular bisector of the line joining the points $A(1, 2, 3)$ and $B(3, 4, 5)$ is

A. $x + y + z = 9$

B. $x + y + z = -9$

$$C. 2x + 3y + 4z = 9$$

$$D. 2x + 3y + 4z = -9$$

Answer: A



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33. If the position vectors of the points A and B are $3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} - 2\hat{j} - 4\hat{k}$ respectively then the equation of the plane through B and perpendicular to AB is

A. $2x + 3y + 6z + 28 = 0$

B. $3x + 2y + 6z = 28$

C. $2x - 3y + 6z + 28 = 0$

D. $3x - 2y + 6z = 28$

Answer: A



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1. The length of the perpendicular from the origin to the plane passing through the points \vec{a} and containing the line $\vec{r} = \vec{b} + \lambda \vec{c}$ is

$$\text{A. } \frac{\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}}{\left| \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} \right|}$$

$$\text{B. } \frac{\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}}{\left| \vec{a} \times \vec{b} + \vec{b} \times \vec{c} \right|}$$

$$\text{C. } \frac{\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}}{\left| \vec{b} \times \vec{c} + \vec{c} \times \vec{a} \right|}$$

$$\text{D. } \frac{\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}}{\left| \vec{c} \times \vec{a} + \vec{a} \times \vec{b} \right|}$$

Answer: C



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2. The value of λ for which the lines $\frac{x-1}{1} = \frac{y-2}{\lambda} = \frac{z+1}{-1}$ and $\frac{x+1}{-\lambda} = \frac{y+1}{2} = \frac{z-2}{1}$ are perpendicular to each other is

A. 0

B. 1

C. -1

D. none of these

Answer: B



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3. The angle between the lines $\frac{x+4}{1} = \frac{y-3}{2} = \frac{z+2}{3}$ and

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

$$\frac{x-2}{3} = \frac{y+1}{-2}, z=2 \text{ and } \frac{x-1}{1} = (2y+3).3 = \frac{z+5}{2}$$
 is

A. $\pi/2$

B. $\pi/3$

C. $\pi/6$

D. none of these

Answer: A



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4. The direction cosines of the line $6x - 2 = 3y + 1 = 2z - 2$ are

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

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

C. 1, 2, 3

D. none of these

Answer: B



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

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

A. $(14, 1, 5)$

B. $(-10, -7, 7)$

C. $(86, 25, 41)$

D. none of these

Answer: A



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6. The position vector of a point at a distance of $3\sqrt{11}$ units from

$\hat{i} - \hat{j} + 2\hat{k}$ on a line passing through the points $\hat{i} - \hat{j} + 2\hat{k}$ and parallel

to the vector $3\hat{i} + \hat{j} + \hat{k}$ is

A. $10\hat{i} + 2\hat{j} - 5\hat{k}$

B. $-8\hat{i} - 4\hat{j} - \hat{k}$

C. $8\hat{i} + 4\hat{j} + \hat{k}$

D. $-10\hat{i} - 2\hat{j} - 5\hat{k}$

Answer: B



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7. The line joining the points $6\vec{a} - 4\vec{b} + 4\vec{c}$, $-4\vec{c}$ and the line joining the points $-\vec{a} - 2\vec{b} - 3\vec{c}$, $\vec{a} + 2\vec{b} - 5\vec{c}$ intersect at

A. $-4\vec{a}$

B. $4\vec{a} - \vec{b} - \vec{c}$

C. $4\vec{c}$

D. none of these

Answer: D



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8. The image (or reflection) of the point (1,2-1) in the plane

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

A. $\left(73/5, -6/4, \frac{39}{25}\right)$

B. $(73/25, 6/5, 39/25)$

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

D. none of these

Answer: D



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

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

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

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

D. none of these

Answer: C

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10. Angle between the line $\vec{r} = (2\hat{i} - \hat{j} + \hat{k}) + \lambda(-\hat{i} + \hat{j} + \hat{k})$ and the plane $\vec{r} \cdot (3\hat{i} + 2\hat{j} - \hat{k}) = 4$ is

A. $\cos^{-1}\left(\frac{2}{\sqrt{42}}\right)$

B. $\cos^{-1}\left(\frac{-2}{\sqrt{42}}\right)$

C. $\sin^{-1}\left(\frac{2}{\sqrt{42}}\right)$

D. $\sin^{-1}\left(\frac{-2}{\sqrt{42}}\right)$

Answer: D

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11. The line through $\hat{i} + 3\hat{j} + 2\hat{k}$ and perpendicular to the lines

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

$$\vec{r} = (2\hat{i} + 6\hat{j} + \hat{k}) + \mu(\hat{i} + 2\hat{j} + 3\hat{k}) \text{ is}$$

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

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

C. $\vec{r} = \hat{i} + 3\hat{j} + 2\hat{k} + \lambda(\hat{i} + 5\hat{j} + 3\hat{k})$

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

Answer: B



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12. The distance from the point $-\hat{i} + 2\hat{j} + 6\hat{k}$ to the straight line through the point (2,3,-4) and parallel to the vector $6\hat{i} + 3\hat{j} - 4\hat{k}$, is

A. 7

B. 10

C. 9

D. none of these

Answer: D



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13. The position vector of the point in which the line joining the points $\hat{i} - 2\hat{j} + \hat{k}$ and $3\hat{k} - 2\hat{j}$ cuts the plane through the origin and the points $4\hat{j}$ and $2\hat{i} + \hat{k}$ is

A. $5\hat{i} - 10\hat{j} + 3\hat{k}$

B. $\frac{1}{5}(6\hat{i} - 10\hat{j} + 3\hat{k})$

C. $-6\hat{i} + 10\hat{j} - 3\hat{k}$

D. none of these

Answer: B



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14. The two lines $\vec{r} = \vec{a} + \lambda(\vec{b} \times \vec{c})$ and $\vec{r} = \vec{b} + \mu(\vec{c} \times \vec{a})$ intersect at a point where λ and μ are scalars then (A) $\vec{a}, \vec{b}, \vec{c}$ are non coplanar (B) $|\vec{a}| = |\vec{b}| = |\vec{c}|$ (C) $\vec{a} \cdot \vec{c} = \vec{b} \cdot \vec{c}$ (D) *[Math Processing Error]*

Processing Error]

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

Answer: B

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15. The lines $\vec{r} = \vec{a}_1 + \lambda \vec{b}_1$ and $\vec{r} = \vec{a}_2 + \mu \vec{b}_2$ are coplanar if

A. $\vec{a}_1 \times \vec{a}_2 = \vec{0}$

$$\text{B. } \vec{b}_1 \times \vec{b}_2 = 0$$

$$\text{C. } (\vec{a}_2 - \vec{a}_1) \times (\vec{b}_1 \times \vec{b}_2) = 0$$

$$\text{D. } \begin{bmatrix} \vec{a}_1 & \vec{b}_1 & \vec{b}_1 \end{bmatrix} = \begin{bmatrix} \vec{a}_2 & \vec{b}_2 & \vec{b}_2 \end{bmatrix}$$

Answer: D



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

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

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

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

D. none of these

Answer: C



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17. Equation of a line passing through (1,-2,3) and parallel to the plane

$$2x + 3y + z + 5 = 0 \text{ is}$$

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

D. none of these

Answer: A



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18. The distance between the planes given by

$$\vec{r} \cdot (\hat{i} + 2\hat{j} - 2\hat{k}) + 5 = 0 \text{ and } \vec{r} \cdot (\hat{i} + 2\hat{j} - 2\hat{k}) - 8 = 0 \text{ is}$$

A. 1 unit

B. $\frac{13}{3}$ units

C. 13 units

D. none of these

Answer: B



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19. Find shortest distance between the line

$$\vec{r} = (5\hat{i} + 7\hat{j} + 3\hat{k}) + \lambda(5\hat{i} - 6\hat{j} + 2\hat{k}) \text{ and } \vec{r} = (9\hat{i} + 13\hat{j} + 15\hat{k}) +$$

A. 10 units

B. 12 units

C. 14 units

D. none of these

Answer: C



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20. Find the shortest distance between the lines $\vec{r} = (\hat{i}i + 2\hat{j} + \hat{k}) + \lambda(2\hat{i} + \hat{j} = 2\hat{k})$ and $\vec{r} = 2\hat{i} - \hat{j} - \hat{k} + \mu(2\hat{i} + \hat{j}$

A. 0

B. $\sqrt{101}/3$

C. $101/3$

D. none of these

Answer: B



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21. Find the equation of the plane through the points (2,2,1) and (9,3,6) and perpendicular \rightarrow the pla $\neq 2x+6y+6z=1$

A. $3x + 4y + 5z = 9$

B. $3x + 4y - 5z = 9$

C. $3x + 4y - 5z - 9 = 0$

D. none of these

Answer: B



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22. The equation of the plane containing the line

$$\vec{r} = \hat{i} + \hat{j} + \lambda(2\hat{i} + \hat{j} + 4\hat{k}) \text{ is}$$

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

B. $\vec{r} \cdot (\hat{i} + 2\hat{j} - \hat{k}) = 6$

C. $\vec{r} \cdot (-\hat{i} - 2\hat{j} + \hat{k}) = 3$

D. none of these

Answer: A



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23. Find ten equation of the plane passing through the point $(0, 7, -7)$ and containing the line $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$.

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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24. Equation of the plane passing through the point $(1,1,1)$ and perpendicular to each of the planes $x + 2y + 3z = 7$ and $2x - 3y + 4z = 0$ is

A. $17x - 2y + 7z = 12$

B. $17x + 2y - 7z = 12$

$$C. 17x + 2y + 7z = 12$$

$$D. 17x - 2y - 7z = 12$$

Answer: B

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25. A variable plane at constant distance p from the origin meets the coordinate axes at $P, Q,$ and $R.$ Find the locus of the point of intersection of planes drawn through P, Q, r and parallel to the coordinate planes.

$$A. \frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 1$$

$$B. ax + by + cz = 1$$

$$C. \frac{a}{x} + \frac{b}{y} + \frac{c}{z} = -1$$

$$D. ax + by + cz = -1$$

Answer: A

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26. The equation of the line of intersection of the planes $x + 2y + z = 3$ and $6x + 8y + 3z = 13$ can be written as

A. $\frac{1 - 2x}{4} = \frac{4y + 5}{12} = \frac{-z}{4}$

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

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

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

Answer: A



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27. Find the Cartesian from the equation of the plane

$$\vec{r} = (s - 2t)\hat{i} + (3 - t)\hat{j} + (2s + t)\hat{k}.$$

A. $2x - 5y - z - 15 = 0$

B. $2x - 5y + z - 15 = 0$

C. $2x - 5y - z + 15 = 0$

D. $2x + 5y - z + 15 = 0$

Answer: C



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28. If the planes $\vec{r} \cdot (2\hat{i} - \lambda\hat{j} + 3\hat{k}) = 0$ and $\vec{r} \cdot (\lambda\hat{i} + 5\hat{j} - \hat{k}) = 5$ are perpendicular to each other then value of $\lambda^2 + \lambda$ is

A. 0

B. 2

C. 3

D. 1

Answer: A



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29. The equation of the plane perpendicular to the line $\frac{x-1}{1} = \frac{y-2}{-1} = \frac{z+1}{2}$ and passing through the point (2,3,1), is

A. $\vec{r} \cdot (\hat{i} + \hat{j} + 2\hat{k}) = 1$

B. $\vec{r} \cdot (\hat{i} - \hat{j} + 2\hat{k}) = 1$

C. $\vec{r} \cdot (\hat{i} - \hat{j} + 2\hat{k}) = 7$

D. $\vec{r} \cdot (\hat{i} + \hat{j} - 2\hat{k}) = 10$

Answer: B



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30. Find the equation of a plane which passes through the point (3, 2, 0) and contains the line $\frac{x-3}{1} = \frac{y-6}{5} = \frac{z-4}{4}$.

A. $x - y + z = 1$

B. $x + y + z = 5$

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

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

Answer: A



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31. Determine the point in XY-plane which is equidistant from three points

$A(2, 0, 3)$, $B(0, 3, 2)$ and $C(0, 0, 1)$.

A. (1,2,3)

B. (-3,2,0)

C. (3,-2,0)

D. (3,2,0)

Answer: D



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