GRADE XII
Question Bank (MATHEMATICS)
Chapter-11 Three Dimensional Geometry

1 Marks:

1. Distance of the point (p, q, r) from y-axis is **[BOARD 2023]**

   a) q b) $|q|$ c) $|q| + |r|$ d) $\sqrt{p^2 + r^2}$

2. The direction ratios of a line parallel to z-axis are **[BOARD 2023]**

   a) 1, 1, 0 b) 1, 1, 1 c) 0, 0, 0 d) 0, 0, 1

3. The direction ratios of the line $\frac{x-1}{3} = \frac{2-y}{1} = \frac{3z}{2}$ are **[BOARD 2024]**

   a) 3, 1, 2 b) 4, 3, 2 c) 9, -3, 2 d) 9, 3, 2

4. Direction ratios of a vector parallel to line $\frac{x-1}{2} = -y = \frac{2z+1}{6}$ are **[BOARD 2024]**

   a) 2, -1, 6 b) 2, 1, 6 c) 2, 1, 3 d) 2, -1, 3

5. If the direction cosines of a line are $\left(\frac{1}{a}, \frac{1}{a}, \frac{1}{a}\right)$ then **[BOARD 2023]**

   a) $0 < a < 1$ b) $a > 2$ c) $a > 0$ d) $a = \pm\sqrt{3}$

6. If the direction cosines of a line are $\sqrt{3}k, \sqrt{3}k, \sqrt{3}k$ then k is **[BOARD 2024]**

   a) ± 1 b) $\pm\sqrt{3}$ c) ± 3 d) $\pm\frac{1}{3}$

7. Direction cosines of the line $\frac{x-1}{2} = \frac{1-y}{3} = \frac{2z-1}{12}$ are **[BOARD 2023]**

   a) $\frac{2}{7}, \frac{3}{7}, \frac{6}{7}$ b) $\frac{2}{\sqrt{157}}, \frac{-3}{\sqrt{157}}, \frac{12}{\sqrt{157}}$ c) $\frac{2}{7}, \frac{-3}{7}, \frac{-6}{7}$ d) $\frac{2}{7}, \frac{-3}{7}, \frac{6}{7}$

8. Direction cosines of a line perpendicular to both x-axis and z-axis are **[BOARD 2023]**

   a) 1, 0, 1 b) 1, 1, 1 c) 0, 0, 1 d) 0, 1, 0

9. If a line makes angles of $90°, 135°$ and $45°$ with the x, y and z axes respectively, then its direction cosines are **[BOARD 2023]**

   a) $0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ b) $-\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}}$ c) $\frac{1}{\sqrt{2}}, 0, -\frac{1}{\sqrt{2}}$ d) $0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

10. If a line makes an angle of $\frac{\pi}{4}$ with positive directions of both x-axis and z-axis then the angle which it makes with the positive direction of y-axis is **[BOARD 2024]**

    a) 0 b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) π

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11. If a line makes angles of $\frac{3\pi}{4}, \frac{\pi}{3}$ and θ with positive directions of x, y and z-axis respectively, then θ is **[BOARD 2025]**

a) $\frac{-\pi}{3}$ only b) $\frac{\pi}{3}$ only c) $\frac{\pi}{6}$ d) $\pm\frac{\pi}{3}$

12. The angle which the line $\frac{x}{1} = \frac{y}{-1} = \frac{z}{0}$ makes with the positive direction of Y-axis is **[BOARD 2024]**

a) $\frac{5\pi}{6}$ b) $\frac{3\pi}{4}$ c) $\frac{5\pi}{4}$ d) $\frac{7\pi}{4}$

13. The coordinates of the foot of the perpendicular drawn from the point $A(-2, 3, 5)$ on the y-axis is **[BOARD 2025]**

a) $(0, 0, 5)$ b) $(0, 3, 0)$ c) $(-2, 0, 5)$ d) $(-2, 0, 0)$

14. If the point $P(a, b, 0)$ lies on the line $\frac{x+1}{2} = \frac{y+2}{3} = \frac{z+3}{4}$, then (a, b) is **[BOARD 2023]**

a) $(1, 2)$ b) $\left(\frac{1}{2}, \frac{2}{3}\right)$ c) $\left(\frac{1}{2}, \frac{1}{4}\right)$ d) $(0, 0)$

15. If P is a point on the line segment joining $(3, 6, -1), (6, 2, -2)$ and y-coordinate of P is 4, then its z-coordinate is **[BOARD 2025]**

a) $\frac{-3}{2}$ b) 0 c) 1 d) $\frac{3}{2}$

16. The line $x = 1 + 5\mu, y = -5 + \mu, z = -6 - 3\mu$ passes through which of the following point? **[BOARD 2025]**

a) $(1, -5, 6)$ b) $(1, 5, 6)$ c) $(1, -5, -6)$ d) $(-1, -5, 6)$

17. The equation of a line parallel to the vector $3\hat{\imath} + \hat{\jmath} + 2\hat{k}$ and passing through the point $(4, -3, 7)$ is **[BOARD 2025]**

a) $x = 4t + 3, y = -3t + 1, z = 7t + 2$ c) $x = 3t + 4, y = t - 3, z = 2t + 7$

b) $x = 3t + 4, y = t + 3, z = 2t + 7$ d) $x = 3t + 4, y = -t + 3, z = 2t + 7$

18. The vector equation of line passing through the point $(1, -1, 0)$ and parallel to Y-axis is **[BOARD 2024]**

a) $\vec{r} = \hat{\imath} - \hat{\jmath} + \lambda(\hat{\imath} - \hat{\jmath})$ c) $\vec{r} = \hat{\imath} - \hat{\jmath} + \lambda\hat{k}$

b) $\vec{r} = \hat{\imath} - \hat{\jmath} + \lambda\hat{k}$ d) $\vec{r} = \lambda\hat{\jmath}$

19. The vector equation of the line passing through the point $(2, -4, 5)$ and is parallel to the line $\frac{x+3}{3} = \frac{4-y}{2} = \frac{z+8}{6}$ is **[BOARD 2023]**

a) $\vec{r} = \left(-2\hat{\imath} + 4\hat{\jmath} - 5\hat{k}\right) + \lambda(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$

b) $\vec{r} = \left(2\hat{\imath} - 4\hat{\jmath} + 5\hat{k}\right) + \lambda(3\hat{\imath} - 2\hat{\jmath} + 6\hat{k})$

c) $\vec{r} = \left(2\hat{\imath} - 4\hat{\jmath} + 5\hat{k}\right) + \lambda(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$

d) $\vec{r} = \left(-2\hat{\imath} + 4\hat{\jmath} - 5\hat{k}\right) + \lambda(3\hat{\imath} - 2\hat{\jmath} - 6\hat{k})$

20. The vector equation of the line passing through the point $(1, -2, 3)$ and is parallel to the vector $3\hat{\imath} - 2\hat{\jmath} + 4\hat{k}$ is **[BOARD 2023]**

a) $\vec{r} = \left(-\hat{\imath} + 2\hat{\jmath} + 3\hat{k}\right) + \lambda(3\hat{\imath} - 2\hat{\jmath} + 4\hat{k})$

b) $\vec{r} = \left(-3\hat{\imath} + 2\hat{\jmath} - 4\hat{k}\right) + \lambda(\hat{\imath} - 2\hat{\jmath} + 3\hat{k})$

c) $\vec{r} = \left(\hat{\imath} - 2\hat{\jmath} + 3\hat{k}\right) + \lambda(3\hat{\imath} - 2\hat{\jmath} + 4\hat{k})$

d) $\vec{r} = \left(3\hat{\imath} - 2\hat{\jmath} + 4\hat{k}\right) + \lambda(\hat{\imath} - 2\hat{\jmath} + 3\hat{k})$

21. The vector equation of the line passing through the origin and perpendicular to the lines $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$ and $\frac{x}{0} = \frac{y}{0} = \frac{z}{1}$ is **[BOARD 2024]**

a) $\vec{r} = \lambda\hat{\imath}$ b) $\vec{r} = \lambda\hat{\jmath}$ c) $\vec{r} = \lambda\hat{k}$ d) $\vec{r} = \lambda(\hat{\imath} + \hat{k})$

22. The vector equation of the line passing through the points $(0, 0, 2)$ and $(3, -2, 5)$ is **[BOARD 2024]**

a) $\vec{r} = 2\hat{k} + \lambda(3\hat{\imath} + 2\hat{\jmath} - 5\hat{k})$ c) $\vec{r} = 2\hat{k} + \lambda(3\hat{\imath} - 2\hat{\jmath} + 3\hat{k})$

b) $\vec{r} = 2\hat{k} + \lambda(3\hat{\imath} - 2\hat{\jmath} + 5\hat{k})$ d) $\vec{r} = 3\hat{\imath} - 2\hat{\jmath} + 5\hat{k} + \lambda(2\hat{k})$

23. Equation of a line passing through the point $(1, 1, 1)$ and parallel to z-axis is **[BOARD 2023]**

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

24. Equation of a line passing through the point $(2, -1, 0)$ and parallel to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{2-z}{2}$ is **[BOARD 2023]**

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

25. The Cartesian equation of the line passing through the point $(1, -3, 2)$ and parallel to the line $\vec{r} = (2 + \lambda)\hat{\imath} + \lambda\hat{\jmath} + (2\lambda - 1)\hat{k}$ is **[BOARD 2024]**

a) $\frac{x-1}{2} = \frac{y+3}{0} = \frac{z-2}{-1}$ b) $\frac{x+1}{1} = \frac{y-3}{1} = \frac{z+2}{2}$ c) $\frac{x+1}{2} = \frac{y-3}{0} = \frac{z+2}{-1}$ d) $\frac{x-1}{1} = \frac{y+3}{1} = \frac{z-2}{2}$

26. The Cartesian equation of a line passing through the point with position vector $\vec{a} = \hat{\imath} - \hat{\jmath}$ and parallel to the line $\vec{r} = \hat{\imath} + \hat{k} + \mu(2\hat{\imath} - \hat{\jmath})$ is **[BOARD 2024]**

a) $\frac{x-2}{1} = \frac{y+1}{0} = \frac{z}{1}$ b) $\frac{x-1}{2} = \frac{y+1}{-1} = \frac{z}{0}$ c) $\frac{x+1}{2} = \frac{y+1}{-1} = \frac{z}{0}$ d) $\frac{x-1}{2} = \frac{y}{-1} = \frac{z-1}{0}$

27. Equation of a line passing through origin and making $30°, 60°$ and $90°$ with x, y, z axes respectively, is **[BOARD 2023]**

a) $\frac{2x}{\sqrt{3}} = \frac{y}{2} = \frac{z}{0}$ b) $\frac{2z}{\sqrt{3}} = \frac{2y}{1} = \frac{z}{0}$ c) $2x = \frac{2y}{\sqrt{3}} = \frac{z}{1}$ d) $\frac{2x}{\sqrt{3}} = \frac{2y}{1} = \frac{z}{1}$

28. Equation of the line passing through point $(1,2,3)$ and equally inclined to the coordinate axes, is **[BOARD 2023]**

a) $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ b) $\frac{x}{1}=\frac{y}{1}=\frac{z}{1}$ c) $\frac{x-1}{1}=\frac{y-1}{2}=\frac{z-1}{3}$ d) $\frac{x-1}{1}=\frac{y-2}{1}=\frac{z-3}{1}$

29. The angle between the lines $\frac{x+1}{1}=\frac{4-y}{-1}=\frac{z-5}{2}$ and $\frac{x+3}{-3}=\frac{y-2}{5}=\frac{z+5}{4}$ is **[BOARD 2023]**

a) $\cos^{-1}\left(\frac{2}{3}\right)$ b) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

30. The angle between the lines $2x=3y=-z$ and $6x=-y=-4z$ is **[BOARD 2023]**

a) 0° b) 30° c) 45° d) 90°

31. A vector perpendicular to the line $\vec{r}=\hat{\imath}+\hat{\jmath}-\hat{k}+\lambda(3\hat{\imath}-\hat{\jmath})$ is **[BOARD 2024]**

a) $5\hat{\imath}+\hat{\jmath}+6\hat{k}$ b) $\hat{\imath}+3\hat{\jmath}+5\hat{k}$ c) $2\hat{\imath}-2\hat{\jmath}$ d) $9\hat{\imath}-3\hat{\jmath}$

32. The lines $\frac{1-x}{2}=\frac{y-1}{3}=\frac{z}{1}$ and $\frac{2x-3}{2p}=\frac{y}{-1}=\frac{z-4}{7}$ are perpendicular to each other for p is equal to **[BOARD 2024]**

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

33. The value of λ for which the angle between the lines $\vec{r}=\left(\hat{\imath}+\hat{\jmath}+\hat{k}\right)+p(2\hat{\imath}+\hat{\jmath}+2\hat{k})$ and $\vec{r}=(1+q)\hat{\imath}+(1+q\lambda)\hat{\jmath}+(1+q)\hat{k}$ is $\frac{\pi}{2}$, is **[BOARD 2023]**

a) -4 b) 4 c) 2 d) -2

Options for Assertion and Reasoning Questions:

a) Both assertion(A) and reason(R) are true and reason(R) is the correct explanation of assertion(A)

b) Both assertion(A) and reason(R) are true but reason(R) is not the correct explanation of assertion(A)

c) Assertion (A) is true but reason (R) is false.

d) Assertion (A) is false but reason (R) is true.

34. **Assertion (A):** Equation of a line passing through the points $(1,2,3)$ and $(3,-1,3)$ is $\frac{x-3}{2}=\frac{y+1}{3}=\frac{z-3}{0}$. **[BOARD 2023]**

Reason (R): Equation of a line passing through the points (x_1,y_1,z_1) and (x_2,y_2,z_2) is given by $\frac{x-x_1}{x_2-x_1}=\frac{y-y_1}{y_2-y_1}=\frac{z-z_1}{z_2-z_1}$.

35. **Assertion (A):** If a line makes angles α,β and γ with positive direction of the coordinate axes then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=2$. **[BOARD 2023]**

Reason (R): The sum of squares of the direction cosines of a line is 1.

36. **Assertion (A):** A line through points $(4,7,8)$ and $(2,3,4)$ is parallel to a line through the points $(-1,-2,1)$ and $(1,2,5)$. **[BOARD 2023]**

Reason (R): Lines $\vec{r} = \overrightarrow{a_1} + \lambda\overrightarrow{b_1}$ and $\vec{r} = \overrightarrow{a_2} + \mu\overrightarrow{b_2}$ are parallel if $\overrightarrow{b_1}.\overrightarrow{b_2} = 0$.

37. **Assertion (A):** The lines $\vec{r} = \overrightarrow{a_1} + \lambda\overrightarrow{b_1}$ and $\vec{r} = \overrightarrow{a_2} + \mu\overrightarrow{b_2}$ are perpendicular when $\overrightarrow{b_1}.\overrightarrow{b_2} = 0$. **[BOARD 2023]**

Reason (R): The angle θ between the lines $\vec{r} = \overrightarrow{a_1} + \lambda\overrightarrow{b_1}$ and $\vec{r} = \overrightarrow{a_2} + \mu\overrightarrow{b_2}$ is given by $\cos\theta = \frac{\overrightarrow{b_1}.\overrightarrow{b_2}}{|\overrightarrow{b_1}||\overrightarrow{b_2}|}$.

2 Marks:

1. If a line makes angle α, β and γ with x-axis, y-axis and z-axis respectively, then prove that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$. **[BOARD 2023]**
2. Check whether the lines given by equations $x = 2\lambda + 2, y = 7\lambda + 1, z = -3\lambda - 3$ and $x = -\mu - 2, y = 2\mu + 8, z = 4\mu + 5$ are perpendicular to each other or not. **[BOARD 2023]**
3. Find the coordinates of points on line $\frac{x}{1} = \frac{y-1}{2} = \frac{z+1}{2}$ which are at a distance of $\sqrt{11}$ units from origin. **[BOARD 2023]**
4. If the equation of a line is $x = ay + b, z = cy + d$ then find the direction ratios of the line and a point on the line. **[BOARD 2023]**
5. Find the angle between the two lines: **[BOARD 2023]**

$$\vec{r} = \left(2\hat{\imath} - 5\hat{\jmath} + \hat{k}\right) + \lambda\left(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k}\right)$$

$$\vec{r} = \left(7\hat{\imath} - 6\hat{k}\right) + \mu(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$$

6. Find the angle between the lines $\frac{5-x}{-7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$. **[BOARD 2024]**
7. Find the angle at which the given lines are inclined to each other: **[BOARD 2025]**

$$l_1 : \frac{x-5}{2} = \frac{y+3}{1} = \frac{z-1}{-3}$$

$$l_2 : \frac{x}{3} = \frac{y-1}{2} = \frac{z+5}{-1}$$

8. If the angle between the lines $\frac{x-5}{\alpha} = \frac{y+2}{-5} = \frac{z+\frac{24}{5}}{\beta}$ and $\frac{x}{1} = \frac{y}{0} = \frac{z}{1}$ is $\frac{\pi}{4}$, find the relation between α and β. **[BOARD 2023]**

9. Find the value of p, so that lines $\frac{x-1}{-2}=\frac{y-4}{3p}=\frac{z-3}{4}$ and $\frac{x-2}{4p}=\frac{y-5}{2}=\frac{1-z}{7}$ are perpendicular to each other. **[BOARD 2023]**
10. Find the value of λ if the following lines are perpendicular to each other:

[BOARD 2025]

$$l_1: \frac{1-x}{-3}=\frac{3y-2}{2\lambda}=\frac{z-3}{3}$$
$$l_2: \frac{x-1}{3\lambda}=\frac{1-y}{1}=\frac{2z-5}{3}$$

11. Find the direction cosines of the line whose Cartesian equations are $5x-3=15y+7=3-10z$. **[BOARD 2023]**
12. The equations of a line are $5x-3=15y+7=3-10z$. Write the direction cosines of the line and find coordinates of a point through which it passes.

[BOARD 2023]

13. Find the vector equation of the line passing through the point $A(1,2,-1)$ and parallel to the line $5x-25=14-7y=35z$. **[BOARD 2023]**
14. Find the vector equation of the line passing through the point $(2,1,3)$ and perpendicular to both the lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x}{-3}=\frac{y}{2}=\frac{z}{5}$. **[BOARD 2023]**
15. Find the value of k so that the lines joining the points $(1,-1,2)$ and $(3,4,k)$ is perpendicular to the line joining the points $(0,3,2)$ and $(3,5,6)$. **[BOARD 2024]**
16. Find the Cartesian equation of the line passing through the origin, perpendicular to y-axis and making equal acute angles with x and z axes.

[BOARD 2024]

17. Determine if the lines $\vec{r}=\left(\hat{\imath}+\hat{\jmath}-\hat{k}\right)+\lambda(3\hat{\imath}-\hat{\jmath})$ and $\vec{r}=\left(4\hat{\imath}-\hat{k}\right)+\mu(2\hat{\imath}+3\hat{k})$ intersect with each other. **[BOARD 2025]**

3 Marks:

1. Find the coordinates of the foot of the perpendicular drawn from the point $P(0,2,3)$ to the line $\frac{x+3}{5}=\frac{y-1}{2}=\frac{z+4}{3}$. **[BOARD 2023]**
2. Find the distance between the lines **[BOARD 2023]**

$$\vec{r}=\left(\hat{\imath}+2\hat{\jmath}-4\hat{k}\right)+\lambda(2\hat{\imath}+3\hat{\jmath}+6\hat{k})$$
$$\vec{r}=\left(3\hat{\imath}+3\hat{\jmath}-5\hat{k}\right)+\mu(4\hat{\imath}+6\hat{\jmath}+12\hat{k})$$

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3. Verify the lines given by $\vec{r} = (1-\lambda)\hat{\imath} + (\lambda-2)\hat{\jmath} + (3-2\lambda)\hat{k}$ and $\vec{r} = (\mu+1)\hat{\imath} + (2\mu-1)\hat{\jmath} - (2\mu+1)\hat{k}$ are skew lines. Hence, find shortest distance between the lines. **[BOARD 2025]**
4. Find the distance of the point $P(2,4,-1)$ from the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$. **[BOARD 2025]**
5. Find the distance of the point $(-1,-5,-10)$ from the point of intersection of the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = z$. **[BOARD 2025]**
6. Let the position vectors of the points A, B and C be $3\hat{\imath} - \hat{\jmath} - 2\hat{k}, \hat{\imath} + 2\hat{\jmath} - \hat{k}$ and $\hat{\imath} + 5\hat{\jmath} + 3\hat{k}$ respectively. Find the vector and Cartesian equations of the line passing through A and parallel to the line BC. **[BOARD 2025]**
7. Find the shortest distance between the lines **[BOARD 2025]**

$$\vec{r} = \left(2\hat{\imath} - \hat{\jmath} + 3\hat{k}\right) + \lambda(\hat{\imath} - 2\hat{\jmath} + 3\hat{k})$$

$$\vec{r} = \left(\hat{\imath} + 4\hat{k}\right) + \mu(3\hat{\imath} - 6\hat{\jmath} + 9\hat{k})$$

5 Marks:

1. Find the vector and Cartesian equations of a line passing through the point $(1,2,-4)$ and parallel to the line joining the points $A(3,-3,5)$ and $B(1,0,-11)$. Hence, find the distance between the two lines. **[BOARD 2023]**
2. Find the equations of the line passing through the points $A(1,2,3)$ and $B(3,5,9)$. Hence find the coordinates of the points on this line which are at a distance of 14 units from point B. **[BOARD 2023]**
3. Find the distance between the line $\frac{x}{2} = \frac{2y-6}{4} = \frac{1-z}{-1}$ and another line parallel to it passing through the point $(4,0,-5)$. **[BOARD 2024]**
4. Find the equation of the line in vector and Cartesian form which passes through the point $(1,2,-4)$ and is perpendicular to the lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\vec{r} = \left(15\hat{\imath} + 29\hat{\jmath} + 5\hat{k}\right) + \mu\left(3\hat{\imath} + 8\hat{\jmath} - 5\hat{k}\right)$. **[BOARD 2025]**
5. A line l passes through point $(-1,3,-2)$ and is perpendicular to both the lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x+2}{-3} = \frac{y-1}{2} = \frac{z+1}{5}$. Find the vector equation of the line l. Hence obtain its distance from origin. **[BOARD 2023]**
6. Show that the lines $\frac{x+1}{3} = \frac{y+3}{5} = \frac{z+5}{7}$ and $\frac{x-2}{1} = \frac{y-4}{3} = \frac{z-6}{5}$ intersect. Also find their point of intersection. **[BOARD 2023]**

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7. Show that the line passing through the points $A(0,-1,-1)$ and $B(4,5,1)$ intersects the line joining the points $C(3,9,4)$ and $D(-4,4,4)$. **[BOARD 2025]**
8. Find the point of intersection of the lines $\vec{r} = \hat{\imath} - \hat{\jmath} + 6\hat{k} + \lambda(3\hat{\imath} - \hat{k})$ and $\vec{r} = -3\hat{\jmath} + 3\hat{k} + \mu(\hat{\imath} + 2\hat{\jmath} - \hat{k})$. Also, find the vector equation of the line passing through the point of intersection of the given lines and perpendicular to both the lines. **[BOARD 2024]**
9. Find the value of b so that the lines $\frac{x-1}{2} = \frac{y-b}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = z$ are intersecting lines. Also, find the point of intersection. **[BOARD 2023]**
10. Find the value of p for which lines $\vec{r} = \lambda\hat{\imath} + (2\lambda + 1)\hat{\jmath} + (3\lambda + 2)\hat{k}$ and $\vec{r} = \hat{\imath} - 3\mu\hat{\jmath} + (p\mu + 7)\hat{k}$ are perpendicular to each other and also intersect. Also, find the point of intersection of the given lines. **[BOARD 2024]**
11. If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-7}$ are perpendicular to each other, find the value of k and hence write the vector equation of a line perpendicular to these two lines and passing through the point $(3,-4,7)$. **[BOARD 2024]**
12. Find the foot of the perpendicular drawn from the point $(1,1,4)$ on the line $\frac{x+2}{5} = \frac{y+1}{2} = \frac{-z+4}{-3}$. **[BOARD 2025]**
13. Find the foot of the perpendicular drawn from point $(2,-1,5)$ to the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$. Also, find the length of the perpendicular. **[BOARD 2025]**
14. Find the coordinates of the foot of the perpendicular drawn from the point $(2,3,-8)$ to the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$. Also, find the perpendicular distance of the given point from the lines. **[BOARD 2024]**
15. Show that the following lines do not intersect each other: **[BOARD 2023]**

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

16. Find the equation of the line passing through the point of intersection of the lines $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ and $\frac{x-1}{0} = \frac{y}{-3} = \frac{z-7}{2}$ and perpendicular to these given lines. **[BOARD 2024]**
17. Find the point on the line $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-4}{3}$ at a distance of $2\sqrt{2}$ units from the point $(-1,-1,2)$. **[BOARD 2025]**

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18. Find the point Q on the line $\frac{2x+4}{6} = \frac{y+1}{2} = \frac{-2z+6}{-4}$ at a distance of $3\sqrt{2}$ from the point $P(1, 2, 3)$. **[BOARD 2025]**

19. Find a point P on the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$ such that its distance from point $Q(2, 4, -1)$ is 7 units. Also, find the equation of line joining P and Q. **[BOARD 2025]**

20. Find the equations of the diagonals of the parallelogram PQRS whose vertices are $P(4, 2, -6), Q(5, -3, 1), R(12, 4, 5)$ and $S(11, 9, -2)$. Use these equations to find the point of intersection of diagonals. **[BOARD 2023]**

21. Find the equations of all the sides of the parallelogram ABCD whose vertices are $A(4, 7, 8), B(2, 3, 4), C(-1, -2, 1)$ and $D(1, 2, 5)$. Also, find the coordinates of the foot of the perpendicular from A to CD. **[BOARD 2023]**

22. Two vertices of the parallelogram ABCD are given as $A(-1, 2, 1)$ and $B(1, -2, 5)$. If the equation of the line passing through C and D is $\frac{x-4}{1} = \frac{y+7}{-2} = \frac{z-8}{2}$ then find the distance between sides AB and CD. Hence, find the area of parallelogram ABCD. **[BOARD 2024]**

23. Equations of sides of a parallelogram ABCD are as follows:

$$AB: \frac{x+1}{1} = \frac{y-2}{-2} = \frac{z-1}{2}$$
$$BC: \frac{x-1}{3} = \frac{y+2}{-5} = \frac{z-5}{3}$$
$$CD: \frac{x-4}{1} = \frac{y+7}{-2} = \frac{z-8}{2}$$
$$AD: \frac{x-2}{3} = \frac{y+3}{-5} = \frac{z-4}{3}$$

Find the equation of diagonal BD. **[BOARD 2024]**

24. Find the shortest distance between the pair of lines $\frac{x-1}{2} = \frac{y+1}{3} = z$ and $\frac{x+1}{5} = \frac{y-2}{1}; z = 2$. **[BOARD 2023]**

25. Find the shortest distance between the lines $\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$. **[BOARD 2024]**

26. Find the shortest distance between the lines L_1 and L_2 given below: **[BOARD 2024]**

L_1: The line passing through $(2, -1, 1)$ and parallel to $\frac{x}{1} = \frac{y}{1} = \frac{z}{3}$

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$$L_2: \vec{r} = \hat{\imath} + (2\mu + 1)\hat{\jmath} - (\mu + 2)\hat{k}$$

27. Find the shortest distance between the lines $\frac{x+1}{2} = \frac{y-1}{1} = \frac{z-9}{-3}$ and $\frac{x-3}{2} = \frac{y+15}{-7} = \frac{z-9}{5}$. **[BOARD 2025]**
28. Find the angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$. **[BOARD 2023]**
29. Find the image of the point $(2, -1, 5)$ in the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$. **[BOARD 2023]**
30. The image of point $P(x, y, z)$ with respect to line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ is $P'(1, 0, 7)$. Find the coordinates of P. **[BOARD 2024]**
31. Find the image A' of the point $A(1, 6, 3)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$. Also, find the equation of the line joining A and A'. **[BOARD 2025]**
32. Find the image of the point $(-1, 5, 2)$ in the line $\frac{2x-4}{2} = \frac{y}{2} = \frac{2-z}{3}$. Find the length of the line segment joining the points (given point and image point). **[BOARD 2025]**
33. Find the image A' of the point $A(2, 1, 2)$ in the line $l: \vec{r} = \left(4\hat{\imath} + 2\hat{\jmath} + 2\hat{k}\right) + \lambda(\hat{\imath} - \hat{\jmath} - \hat{k})$. Also, find the equation of line joining AA'. Find the foot of the perpendicular from point A on the line l. **[BOARD 2025]**
34. Let the polished side of the mirror be along the line $\frac{x}{1} = \frac{1-y}{-2} = \frac{2z-4}{6}$. A point $P(1, 6, 3)$ some distance away from the mirror, has its image formed behind the mirror. Find the coordinates of the image point and the distance between the point P and its image. **[BOARD 2025]**
35. Find the equation of the line l_2 which is mirror image of the line l_1 with respect to line l: $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$, given that line l_1 passes through the point $P(1, 6, 3)$ and parallel to line l. **[BOARD 2024]**
36. Vertices B and C of ΔABC lie on the line $\frac{x+2}{2} = \frac{y-1}{1} = \frac{z}{4}$. Find the area of ΔABC given that point A has coordinates $(1, -1, 2)$ and the line segment BC has length of 5 units. **[BOARD 2023]**
37. The vertices of ΔABC are $A(1, 1, 0), B(1, 2, 1)$ and $C(-2, 2, -1)$. Find the equations of the median through A and B. Use the equations so obtained to find the coordinates of the centroid. **[BOARD 2024]**

38. Find the equation of the line which bisects the line segment joining the points $A(2,3,4)$ and $B(4,5,8)$ and is perpendicular to the lines $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$. **[BOARD 2024]**