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Dept. of Mathematics 2025 – 2026
Class XII – Mathematics
Work Sheet – Three-Dimensional Geometry

1	**The co-ordinates of the foot of the perpendicular drawn from the point (2, –3, 4) on the *y*-axis is** ***[CBSE 2020, (65/2/1)]*** (*a*) (2, 3, 4) (*b*) (– 2, – 3, – 4) (*c*) (0, –3, 0) (*d*) (2, 0, 4)
2	**If a line makes angles α, β and γ with the axes respectively, then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$** ***[CBSE 2020, (65/4/1)]*** (*a*) –2 (*b*) –1 (*c*) 1 (*d*) 2
3	**Distance of the point (α, β, γ) from *y*-axis is** (*a*) β (*b*) $\lvert\beta\rvert$ (*c*) $\lvert\beta\rvert+\lvert\gamma\rvert$ (*d*) $\sqrt{\alpha^2+\gamma^2}$
4	**Direction cosines of the line $\frac{x-1}{2}=\frac{1-y}{3}=\frac{2z-1}{12}$ are** ***[CBSE 2023, (65/1/1)]*** (*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*) $\frac{2}{7},-\frac{3}{7},\frac{6}{7}$
5	**The angle between the two diagonals of a cube is** (*a*) 30° (*b*) 45° (*c*) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (*d*) $\cos^{-1}\left(\frac{1}{3}\right)$
6	**If a line makes angles $\alpha, \beta, \gamma, \delta$ with four diagonals of a cube, then $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta$ is equal to** (*a*) $\frac{1}{3}$ (*b*) $\frac{2}{3}$ (*c*) $\frac{4}{3}$ (*d*) $\frac{8}{3}$
7	**If a line makes angle $\frac{\pi}{3}$ and $\frac{\pi}{4}$ with *x*-axis and *y*-axis respectively, then the angle made by the line with *z*-axis is** (*a*) $\frac{\pi}{2}$ (*b*) $\frac{\pi}{3}$ (*c*) $\frac{\pi}{4}$ (*d*) $\frac{15\pi}{12}$
8	***P* is a point on the line segment joining the points (3, 2, –1) and (6, 2, –2). If *x* co-ordinate of *P* is 5, then its *y* co-ordinate is** ***[NCERT Exemplar]*** (*a*) 2 (*b*) 1 (*c*) –1 (*d*) –2
9	**If a line makes angles of 90°, 135° and 45° with the *x*, *y* and *z* axes respectively, then its direction cosines are** ***[CBSE 2023, (65/5/1)]*** (*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 Equation of a line passing through point (1, 1, 1) and parallel to z-axis is **[CBSE 2023, (65/2/1)]**

(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) $\frac{x-1}{0}=\frac{y-1}{0}=\frac{z-1}{1}$

11 The equations of x-axis in space are **[NCERT Exemplar]**

(a) $x=0, y=0$ (b) $x=0, z=0$ (c) $x=0$ (d) $y=0, z=0$

12 A line makes equal angles with co-ordinate axis. Direction cosines of this line are **[NCERT Exemplar]**

(a) $\pm(1,1,1)$ (b) $\pm\left(\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}}\right)$ (c) $\pm\left(\frac{1}{3},\frac{1}{3},\frac{1}{3}\right)$ (d) $\pm\left(\frac{1}{\sqrt{3}},\frac{-1}{\sqrt{3}},\frac{-1}{\sqrt{3}}\right)$

13 The distance of the point (1, 6, 3) to the line $\vec{r}=(\hat{j}+2\hat{k})+\lambda(\hat{i}+2\hat{j}+3\hat{k})$ is

(a) $\sqrt{13}$ (b) 13 (c) $2\sqrt{13}$ (d) None of these

14 The two lines $x=ay+b, z=cy+d$ and $x=a'y+b', z=c'y+d'$ will be perpendicular, if and only if

(a) $aa'+cc'+1=0$ (b) $aa'+bb'+cc'+1=0$

(c) $aa'+bb'+cc'=0$ (d) $(a'+a')(b'+b')+(c'+c')=0$

15 The area of the quadrilateral $ABCD$ where A (0, 4, 1), B (2, 3, –1), C (4, 5, 0) and D (2, 6, 2) is equal to

(a) 9 sq units (b) 18 sq units (c) 27 sq units (d) 81 sq units

The following questions consist of two statements—Assertion(A) and Reason(R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation for A.

(b) Both A and R are true but R is not the correct explanation for A.

(c) A is true but R is false.

(d) A is false but R is true.

16 **Assertion (A):** A line through the points (4, 7, 8) and (2, 3, 4) is parallel to a line through the points (–1, –2, 1) and (1, 2, 5).

Reason (R): Lines $\vec{r}=\vec{a_1}+\lambda\vec{b_1}$ and $\vec{r}=\vec{a_2}+\mu\vec{b_2}$ are parallel if $\vec{b_1}.\vec{b_2}=0$ **[CBSE 2023 (65/3/2)]**

17 **Assertion (A):** If a line makes angles α, β, γ with positive direction of the coordinate axes then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=2$. **[CBSE 2023 (65/2/1)]**

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

18	**Assertion (A):** Equation of a line passing through the points (1, 2, 3) and (3, –1, 3) is $\frac{x-3}{2}=\frac{y+1}{3}=\frac{z-3}{0}$. **[CBSE 2023 (65/1/1)]** **Reason (R):** Equation of a line passing through points (x_1, y_1, z_1), (x_2, y_2, z_2), is given by $\frac{x-x_1}{x_2-x_1}=\frac{y-y_1}{y_2-y_1}=\frac{z-z_1}{z_2-z_1}$.
19	**Assertion (A):** The angle between the lines whose direction cosines are $\frac{-\sqrt{3}}{4}, \frac{1}{4}, \frac{-\sqrt{3}}{2}$, $\frac{-\sqrt{3}}{4}, \frac{1}{4}, \frac{\sqrt{3}}{2}$ is 120°. **Reason (R):** The angle between two lines whose direction ratios are l_1, m_1, n_1 and l_2, m_2, n_2 is given by $\cos\theta = l_1l_2 + m_1m_2 + n_1n_2$.
20	**Read the following passage and answer the following questions.** Two motorcycles A and B are running at the speed more than the allowed speed on the roads represented by the lines $\vec{r}=\lambda(\hat{i}+2\hat{j}-\hat{k})$ and $\vec{r}=(3\hat{i}+3\hat{j})+\mu(2\hat{i}+\hat{j}+\hat{k})$ respectively.  **(i) Write the certesian equation of the line along which motorcycle A is running.** **(ii) Find the direction cosines of the line along which motorcycle B is running.** **(iii) (a) Find the shortest distance between the given lines.** **Or** **(iii) (b) Find the point at which the motorcycles may collide.** Vector equation of line through which motorcycles A and B running are
21	**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.** **[CBSE 2023 (65/1/1)]**
22	**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.**
23	**Find the vector and the cartesian equations of a line that passes through the point $A(1, 2, -1)$ and parallel to the line $5x - 25 = 14 - 7y = 35z$.** **[CBSE 2023 (65/5/1)]**

Answers

1	C
2	B
3	D
4	D
5	D
6	C
7	B
8	A
9	A
10	D
11	D
12	B
13	A
14	A
15	A
16	C
17	A

18	D
19	A
20	(i) $\therefore \frac{x}{1} = \frac{y}{2} = \frac{z}{-1}$, which is required equation. (ii) $\frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}$ (iii) $\left\lvert \frac{9-9-0}{3\sqrt{3}} \right\rvert = 0$ units - Or – Required point be (1, 2, – 1).
21	$a_1a_2 + b_1b_2 + c_1c_2 = 2 \times (-1) + 7 \times 2 + (-3) \times 4$ $= -2 + 14 - 12 = 14 - 14 = 0$ $\therefore$ Both lines are perpendicular to each other.
22	P = - 14
23	$\vec{r} = (\hat{i} + 2\hat{j} - \hat{k}) + \lambda\left(\frac{1}{5}\hat{i} - \frac{1}{7}\hat{j} + \frac{1}{35}\hat{k}\right)$