MATHS

BOOKS - JEEVITH PUBLICATIONS MATHS (KANNADA ENGLISH)

THREE DIMENSIONAL GEOMETRY

One Marks Questions With Answers

1. If a line makes angles $90^\circ, 135^\circ, 45^\circ$ with the positive X, Y and Z-axes respectively, find its direction cosines.

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2. Find the direction cosines of a line which makes equal angles with the coordinate axes.

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3. If a line has the direction ratios -18, 12, -4, then what are its direction cosines?

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4. Find the intercepts cut-off by the plane $2x + y - z = 5$.

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5. Find the equation of the plane with intercept 3 on the Y-axis and parallel to ZOX - plane.

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6. In the following problems find the distance of each of the given points from the corresponding given plane:

	Point	Plane
(a)	$(0,0,0)$	$3x - 4y + 12z = 3$
(b)	$(3,-2,1)$	$2x - y + 2z + 3 = 0$
(c)	$(2,3,-5)$	$x + 2y - 2z = 9$
(d)	$(-6,0,0)$	$2x - 3y + 6z$

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Two Marks Questions With Answers

1. Show that the points (2, 3, 4), (-1, -2, 1), (5, 8, 7) are collinear.

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2. Find the direction cosines of the sides of the triangle whose vertices are (3, 5, -4), (-1, 1, 2) and (-5, -5, -2).

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3. Show that the line through the points (1, -1, 2), (3, 4, -2) is perpendicular to the line through the points (0, 3, 2) and (3, 5, 6).

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4. Show that the line through the points (4,7,8), (2,3,4) is parallel to the line through the points (-1,-2,1), (1,2,5).

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5. Find the equation of the line which passes through the point (1,2,3) and is parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$.

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6. Find the equation of the line in vector and in Cartesian form that passes through the point with position vector and $2\hat{i} - \hat{j} + 4\hat{k}$ is in the

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

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7. Find the Cartesian equation of the line which passes through the point (-2,4,-5) and parallel to the line given by $\frac{x+3}{3}=\frac{y-4}{5}=\frac{z+8}{6}$.

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8. The Cartesian equation of a line is $\frac{x-5}{3}=\frac{y+4}{7}=\frac{z-6}{2}$, write its vector form.

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9. Find the vector and the Cartesian equations of the line that passes through the origin and (5,-2,3).

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10. Find the vector and the Cartesian equation of the line that passes through the points (3,-2,-5), (3,-2,6).

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11. Find the value of p so that the lines $\frac{1-x}{3}=\frac{7y-14}{2p}=\frac{z-3}{2}$ and $\frac{7-7x}{3p}=\frac{y-5}{1}=\frac{6-z}{5}$ are at right angles.

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12. Show that the lines $\frac{x-5}{7}=\frac{y+2}{-5}=\frac{z}{1}$ and $\frac{x}{1}=\frac{y}{2}=\frac{x}{3}$ are perpendicular to each other.

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13. Find the Cartesian equation of the following planes:

$r.\left(\hat{i}+\hat{j}-\hat{k}\right)=0$

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14. Find the Cartesian equation of the following planes:

$r.\left(2\hat{i}+3\hat{j}-4\hat{k}\right)=1$

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15. Find the Cartesian equation of the following planes:

$r.\left[(s-2t)\hat{i}+(3-t)\hat{j}+(2s+t)\hat{k}\right]=15$

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Three Marks Questions With Answers

1. Find the shortest distance between the lines.

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

.

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2. Find the shortest distance between the lines.

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

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3. Find the angle between the following pairs of lines :

$\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$ & $\vec{r} = 5\hat{i} - 2\hat{j} + \mu\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$

Note : Angle between two lines is the angle between $\vec{b_1}$ and $\vec{b_2}$

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4. Find the angle between the following pairs of lines :

$r = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and $r = 7\hat{i} - 6\hat{k} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

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5. Find the angle between the following pairs of lines :

$r = 3\hat{i} + \hat{j} - 2\hat{k} + \lambda\left(\hat{i} - \hat{j} - 2\hat{k}\right)$ and $r = 2\hat{i} - \hat{j} - 56\hat{k} + \mu\left(3\hat{i} - 5\hat{j} -$

.

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6. Find the angle between the following pairs of lines :

$\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$.

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7. Find the angle between the following pairs of lines :

$$\frac{x}{2}=\frac{y}{2}=\frac{z}{1} \text{ and } \frac{z-5}{4}=\frac{y-2}{1}=\frac{z-3}{8}.$$

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8. Find the distance between the parallel lines

$$\vec{r}=\hat{i}+2\hat{j}-4\hat{k}+m\left(2\hat{i}+3\hat{j}+6\hat{k}\right) \text{ and } \vec{r}=3\hat{i}+3\hat{j}-5\hat{k}+n\left(2\hat{i}+$$

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9. Find the angle between the planes whose vector equations are

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

Note : Angle between two planes is the angle between $\vec{n_1}$ and $\vec{n_2}$

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10. Find the angle between the planes whose vector equations are

$3x - 6y + 2z = 7$ and $2x + 2y - 2z = 5$

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11. Find the angle between the line $\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}$ and the plane $10x + 2y - 11z = 0$.

Note : The angle between a line and a plane is the complement of the angle between $\vec{b}$ and $\vec{a}$

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12. In the following cases, find the coordinates of the foot of the perpendicular drawn from the origin:

$2x + 3y + 4z - 12 = 0$

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13. In the following cases, find the coordinates of the foot of the perpendicular drawn from the origin:

$3y + 4z - 6 = 0$

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14. In the following cases, find the coordinates of the foot of the perpendicular drawn from the origin:

$x + y + z = 1$

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15. In the following cases, find the coordinates of the foot of the perpendicular drawn from the origin:

$5y + 8 = 0$

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16. Find the vector and Cartesian equations of the planes.

That passes through the point (1, 0, -2) and the normal to the plane is $\hat{i} - 2\hat{j} + \hat{k}$.

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17. Find the vector and Cartesian equations of the planes.

That passes through the point (1, 4, 6) and the normal to the plane is $\hat{i} - 2\hat{j} + \hat{k}$.

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18. Find the equation of the planes that passes through the sets of three points.

$(1, 1, -1), (6, 4, -5)$ and $(-4, -2, 3)$

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19. Find the equation of the planes that passes through the sets of three points.

$(1, 1, 0), (1, 2, 1), (-2, 2, -1).$

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Five Marks Questions With Answers

1. Obtain the equation of a line passing through a point A with Position vector $\vec{a}$ and parallel to a vector $\vec{b}$ both in vector and cartesion form.

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2. Derive the equation of a line in 3D passing through two points A and B with position vectors $\vec{a}$ and $\vec{b}$ respectively both in vector and Cartesian form.

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3. Derive the formula for the shortest distance between skew lines $\vec{r} = \vec{a} + \lambda \vec{b}$ and $\vec{r} = \vec{a}_2 + \lambda \vec{b_2}$ in vector form.

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4. Derive the formula for the distance between two parallel lines $\vec{r} = \vec{a_1} + \lambda \vec{b}$ and $\vec{r} = \vec{a_2} + \mu \vec{b}$ in vector form.

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5. Derive the equation of a plane in normal form both in the vector and Cartesian form .

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6. Derive the equation of a plane perpendicular to a given vector and passing through a given point in both vector form and Cartesian form.

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7. Derive the condition for the coplanarity two lines in space both in the vector form and Cartesian form.

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Try Yourself

1. Find the equation of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $z + y + z - 2 = 0$ and the point (2,2,1)`.

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2. Findt the vector equation of the plane passing through the intersection of the planes $r \cdot \left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 7, r \cdot \left(2\hat{i} + 5\hat{j} + 3\hat{k}\right) = 9$ and through the point (2, 1, 3).

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3. Find the equation of the plane through the line of intersection of the planes $x + y + z = 1$ and $2x + 3y + 4z = 5$ which is perpendicular to the plane $x - y + z = 0$.

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4. Find the angle between the planes whose vector equation are $r.\left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 5, r.\left(3\hat{i} - 3\hat{j} + 5\hat{k}\right) = 3.$

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5. In the following exercise determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle between them.

$7x + 5y + 6z + 30 = 0$ and $3x - y - 10z + 4 = 0$

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6. In the following exercise determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle between them.

$2x + y + 3z - 2 = 0$ and $x - 2y + 5 = 0$

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7. In the following exercise determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle between them.

$2x - 2y + 4z + 5 = 0$ and $3x - 3y + 6z = 1 = 0$

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8. In the following exercise determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle

between them.

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

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9. In the following exercise determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle between them.

$4x + 8y + z - 8 = 0$ and $y + z - 4 = 0$

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10. Obtain the equation of a plane in the intercept form.

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11. Obtain the distance betweenn two parallel lines $\vec{r} = \vec{a}_1 + \lambda \vec{b}, \vec{r} = \vec{a}_2 + \mu \vec{b}$.

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