MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

STRAIGHT LINE IN SPACE

Solved Examples

1. Find the vector equation of a line which is parallel to the vector $2\hat{i} - \hat{j} + 3\hat{k}$ and which passes through the point (5, -2,4). Also reduce it to Cartesian form.

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2. The cartesian equations of a line are 3x -3 =2y +1=5-6z (a) Write these equations in standard form and find the direction ratios of the given line .

(b) write the equations for the given line in vector form.

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3. The Cartesian equations of a line are 6x -2 =3y +1 =2z-2

(a) Write these equations in standard form and find the direction cosines of the given line.

(b) Write down the Cartesian and vector equations of a line passsing through (2,-1,1) and parallel to the given line.

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4. Find the vector and Cartesian equations of the line passing through the point (1,2-4) and perpendicular to each of the lines

$$\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7} \text{ and } \frac{x-15}{3}=\frac{y+29}{8}=\frac{z-5}{-5}$$

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5. Find the equations of a line passing through the point P(2,-1,3) and perpendicular to the lines

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

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

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6. Find the vector equation of the line passing through the point A(2,-1,1) and parallel to the line joining the points B (-1,4,1) and C(1,2,2) .Also find the Cartesian equations of the line .

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7. find the vector and Cartesian equations of the line passing through the points A(2,-1,4) and B(1,1,-2).

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8. Show that the lines

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

intersect. Also find their point of intersection.

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9. Show that the lines

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

do not intersect .

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10. Show that the lines $\vec{r}=\left(\hat{i}+\hat{j}-\hat{k}\right)+\lambda\left(3\hat{i}-\hat{j}\right) and \vec{r}=\left(4\hat{i}-\hat{k}\right)+\mu\left(2\hat{i}+3\hat{k}\right)$ are coplanar. Also, find the plane containing these two lines.

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11. Show that the lines

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

Do not intersect .

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12. Find the points on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance of 5 units from the point $P(1, 3, 3,)$.

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13. 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.

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14. Find the coordinates of foot of perpendicular and the length of the perpendicular drawn from the point P(5,4,2) to the line $\vec{r} = \left(-\hat{i} + 3\hat{j} + \hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} \pm \hat{k}\right)$ Also find the image of p in this line .

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

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16. Find the equation of line passing through points $A(0, 6, -9)$ and $B(-3, -6, 3)$. If D is the foot of perpendicular drawn from the point $C(7, 4, -1)$ on the line AB, then find the coordinates of point D and equation of line CD.

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17. The points A(4, 5, 10), B(2, 3, 4) and C (1, 2,-1) are three vertices of a parallelogram ABCD. Find the vector equations of the sides AB and BC and also find the coordinates of point D.

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18. Prove that the points $A(2, 0, -3), B(1, -2, -5)$ and $C(3, 2, -1)$ are collinear.

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19. If the points $A(-1, 3, 2), B(-4, 2, -2) and C(5, 5, \lambda)$ are collinear, find the value of λ .

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20. show that the points whose position vectors are $\left(-2\hat{i}+3\hat{j}+5\hat{k}\right)$ $\left(\hat{i}+2\hat{j}+3\hat{k}\right)$ and $\left(7\hat{i}-\hat{k}\right)$ are collinear.

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21. Using the vector method , find the values of λ and μ for which the points

$A(3, \lambda, \mu) B(2, 0, -2)$ and $C(1, -2, -5)$ are collinear

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22. Find the shortest distance between the following lines: $\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and $\vec{r} = 7\hat{i} - 6\hat{k} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

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23. Find the angle between the following pair of lines: $\frac{-x+2}{-2} = \frac{y-1}{7} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{2y-8}{4} = \frac{z-5}{4}$ and check whether the lines are parallel or perpendicular.

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24. Find the value of λ so that the following lines are perpendicular to each other. $\frac{x-5}{5\lambda+2}=\frac{2-y}{5}=\frac{1-z}{-1}, \frac{x}{1}=\frac{2y+1}{4\lambda}=\frac{1-z}{-3}$

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25. Find the angle between the lines

$\frac{x+1}{1}=\frac{2y-3}{3}=\frac{z-6}{2}$ and $\frac{x-4}{3}=\frac{y+3}{-2}, z=5$

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26. Find the angle between the lines

$\frac{5-x}{3}=\frac{y+3}{-4}, z=7$ and $\frac{x}{1}=\frac{1-y}{2}=\frac{z-6}{2}$

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27. Find the value of k so that the lines

$$\frac{1-x}{3}=\frac{7y-14}{2k}=\frac{z-3}{2} \quad \text{and} \quad \frac{7-7x}{3k}=\frac{5-y}{1}=\frac{6-z}{5}$$

are at right angles.

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28. Prove that the lines x=ay +b,z =cy +d and x=a'y +b' z =c'y +a'

are perpendicular if aa'+cc' +1=0

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29. Find the angle between the two lines one of which has direction rations 2,2,1 and the other is obtained by joining the points (3,1,4)and (7,2,12)

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30. Find the shortest distance between lines $\rightarrow r = 6\hat{i} + 2\hat{j} + \hat{k} + \lambda\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$ and $\rightarrow r = -4\hat{i} - \hat{k} + \mu\left(3\hat{i} - 2\hat{j} - 2\hat{k}\right)$.

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31. Find the shortest distance between the lines whose vector equations are $\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} - \hat{j} + \hat{k}\right)$ and $\vec{r} = 2\hat{i} + \hat{j} - \hat{k} + \mu\left(3\hat{i} - 5\hat{j} + 2\hat{k}\right)$.

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32. रेखाएँ, जिनकी सदिश समीकरण निम्नलिखित है, के बीच की न्यूनतम ज्ञात कीजिए :

$\vec{r} = (1-t)\hat{i} + (t-2)\hat{j} + (3-2t)\hat{k}$ और

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

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33. Show that the lines

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

intersect . Find the point of the intersection.

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34. Show that the lines

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

do not intersect .

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35. Find the shortest distance between the lines L_1 and L_2 given by

$$\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} - \hat{j} + \hat{k}\right) \quad \text{and} \quad \vec{r} = 2\hat{i} + \hat{j} - \hat{k} + \mu\left(4\hat{i} - 2\hat{j} + 2\hat{k}\right)$$

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

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37. Find the shortest distance between the lines

$\frac{x+3}{-4}=\frac{y-6}{3}=\frac{z}{2}$ and $\frac{x+2}{-4}=\frac{y}{1}=\frac{z-7}{1}$

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38. Find the length and the equations of the line of shortest distance between the lines

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

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39. Find the shortest distance between the lines

$$\frac{x-8}{3}=\frac{y+9}{-16}=\frac{z-10}{7} \quad \text{and} \quad \frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$$

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40. Show that the lines

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

intersect each other . Find their point of intersection.

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41. Show that the lines

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

do not intersect each other .

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Exercise 27 A

1. A line passes through the point (3,4,5) and is parallel to the vector $\left(2\hat{i}+2\hat{j}-3\hat{k}\right)$. Find the equations of the line in the vector as well as Cartesian forms.

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2. A line passes through the point (2,1,-3) and is parallel to the vector $\left(\hat{i}-2\hat{j}+2\hat{k}\right)$. Find the equations of the line in vector and Cartesian forms .

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3. Find the vector equations of the line passing through the point with position vector $\left(2\hat{i}+\hat{j}-5\hat{k}\right)$ and parallel to the vector $\left(\hat{i}+3\hat{j}-\hat{k}\right)$ .Deduce the Cartesian equations of the line .

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4. A line is drawn in the direction of $\left(\hat{i}+\hat{j}-2\hat{k}\right)$ and it passes through a point with position vector $\left(2\hat{i}-\hat{j}-4\hat{k}\right)$ .Find the equations of the line in the vector as well as Cartesian forms.

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5. The Cartesian equations of a line are

$$\frac{x-3}{2}=\frac{y+2}{-5}=\frac{z-6}{4}$$

Find the vector equations of the line .

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6. The Cartesian equations of a line are $3x+1=6y-2=1-z$, finding the fixed point through which it passes, its direction ratios and also its vector equation.

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7. Find the Cartesian equations of the line which passes through the point (1,3-2) and is parallel to the given by ltbgt $\frac{x+1}{3} = \frac{y-4}{5} = \frac{z+3}{-6}$

Also the find the vector form of the equations so obtained .

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8. Find the equations of the line passing through the point (1,-2,3) and parallel to the line $\frac{x-6}{3} = \frac{y-2}{-4} = \frac{z+7}{5}$

Also find the vector form of this equations so obtained .

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9. Find the Cartesian and vector equations of a line which passes through the point (1,2,3) and is parallel to the line .

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

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10. Find the equations of the line passing through the point (-1,3,-2) and perpendicular to each of the lines $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and $\frac{x+2}{-3}=\frac{y-1}{2}=\frac{z+1}{5}$

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11. Find the Vector and Cartesian equations of the line passing through the point (1, 2, 4) and perpendicular to the two lines $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$

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12. Show that the following pairs of lines intersect. Also find their point of intersection :

(i) $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=z$

(ii) $\frac{x-4}{1}=\frac{y+3}{-4}=\frac{z+1}{7}$ and $\frac{x-1}{2}=\frac{y+1}{-3}=\frac{z+10}{8}$

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13. Show that the line $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4} and \frac{x-4}{5}=\frac{y-1}{2}$ intersect. Find their point of intersection.

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14. Show that the lines

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

do not intersect each other .

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15. Find the co-ordiantes of the foot of perpendicular drawn from the point $(1, 2, 3)$ to the line $\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$.

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16. Find the length and the foot of the perpendicular drawn from the point $(2, -1, 5)$ to the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{x+8}{11}$

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17. Find the vector and Cartesian equations of the line passing through the points A(3,4-6) and B(5,-2,7) .

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18. Find the vector and Cartesian equations of the line passing through the points A(2,-3,0) and B(-2,4,3).

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19. Find the vector and Cartesian equations of the line joining the points whose position vectors are $\left(\hat{i} - 2\hat{j} + \hat{k}\right)$ and $\left(\hat{i} + 3\hat{j} - 2\hat{k}\right)$

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20. Find the vector equations of a line passing through the point A(3,-2,1) and parallel to the line joining B(-2,4,2) and C(2,3,,3). Also find the Cartesian equations of the line.

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21. Find the vector equation of a line passing through the point having the position vector $\left(\hat{i}+2\hat{j}-3\hat{k}\right)$ and parallel to the line joining the points with position vectors $\left(\hat{i}-\hat{j}+5\hat{k}\right)$ and $\left(2\hat{i}+3\hat{j}-4\hat{k}\right)$ .Also find the Cartesian equivalents of this equations.

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22. Find the coordinates of the foot of the perpendicular drawn from the point $A(1, 2, 1)$ to the line joining $B(1, 4, 6) and C(5, 4, 4)$.

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23. Find the coordinates of the foot of the perpendicular drawn from the point $A(1, 8, 4)$ to the line joining the points $B(0, -1, 3)$ and $C(2, -3, -1)$.

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24. Find the image of the point $(0, 2, 3)$ in the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$.

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25. Find the image of the point (5,9,3) in the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$

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26. Find the foot of the perpendicular drawn from the point $2\hat{i} - \hat{j} + 5\hat{k}$ to the line $\vec{r} = \left(11\hat{i} - 2\hat{j} - 8\hat{k}\right) + \lambda\left(10\hat{i} - 4\hat{j} - 11\hat{k}\right)$. Also find the length of the perpendicular.

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Exercise 27 B

1. Show that the points A(2,1,3) ,B(5,0,5) and C(-4,3,-1) are collinear .

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2. Show that the points $A(2, 3, 4)$, $B(1, 2, 3)$and $C(3, 8, 11)$are collinear.

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3. Find the value of λ or which the points A(2,5,1) ,B(1,2,-1) and C(3,λ,3) are collinear .

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4. Find the values of λ and μ so that the points A(3,2-4) ,B(9,8,-10) and C($\lambda, \mu, -6$) are colliinear .

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5. Find the values of λ ad μ if the points $A(-1, 4, -2), B(\lambda, \mu, 1)$ and $C(0, 2, -1)$ are collinear.

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6. The position vectors of three points A,B anc C $\left(-4\hat{i}+2\hat{j}-3\hat{k}\right)$ $\left(\hat{i}+3\hat{j}-2\hat{k}\right)$and $\left(-9\hat{i}+\hat{j}-4\hat{k}\right)$ respectively . Show that the

points A,B and C are collinear.

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Exercise 27 C

1.

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

FInd angle between the lines

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2.

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

Find angle between the lines .

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

Find angle

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4. $\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$ and $\frac{x+3}{3} = \frac{y-2}{5} = \frac{z+5}{4}$ Find angle between the lines .

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5. $\frac{x-4}{3} = \frac{y+1}{4} = \frac{z-6}{5}$ and $\frac{x-5}{1} = \frac{2y+5}{-2} = \frac{z-3}{1}$ Find angle between the lines

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6. $\frac{x-3}{-3} = \frac{y+1}{4} = \frac{z-6}{3}$ and $\frac{x}{3} = \frac{y-1}{2} = \frac{z+2}{-1}$ Find the angle between the lines

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7. $\frac{x}{1}=\frac{y}{1}=\frac{z}{-1}$ and $\frac{x}{3}=\frac{y}{4}=\frac{z}{5}$ Find the angle between the lines .

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8. $\frac{5-x}{3}=\frac{y+3}{-2}, z=5$ and $\frac{x-1}{1}=\frac{1-y}{3}=\frac{z-5}{2}$ Find the angle between the lines.

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9. Show that the lines $\frac{x-3}{2}=\frac{y+1}{-3}=\frac{z-2}{4}$ and $\frac{x+2}{2}=\frac{y-2}{4}=\frac{z+5}{2}$ are perpendicular to each other .

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10. If the lines $\frac{x-1}{-3}=\frac{y-2}{2\lambda}=\frac{z-3}{2}$ and $\frac{x-1}{3\lambda}=\frac{y-1}{1}=\frac{6-z}{5}$ are perpendicular to each other then find the value of λ

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11. Show that the lines $x=-y=2z$ and $x+2=2y-1=-z+1$ are perpendicular to each other .

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12. Find the angle between two lines whose direction ratios are

(i) 2,1,2 and 4,8,1 (ii) 5 ,-12 ,13 and -3,4,5

(iii) 1 ,1,2 and $\left(\sqrt{3}-1\right), \left(-\sqrt{3}-1\right), 4$ (iv) a,b,c and (b-c) ,(c-a),(a-b

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13. If A(1,2,3),B(4,5,7) ,C(-4,3,-6) and D(2,9,2) are four given points then find the angle between the lines AB and CD.

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Exercise 27 D

1. Find the shortest distance between the given line

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

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

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

$\vec{r} = \left(-3\hat{i} - 8\hat{j} - 3\hat{k}\right) + \mu\left(2\hat{i} + 3\hat{j} + 3\hat{k}\right)$

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

$\vec{r} = \left(4\hat{i} + 5\hat{j} + 6\hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ Find the the shortest between the lines

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4. Find the shortest distance between the given line

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

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

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5. Find the shortest distance between the given line

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

$\vec{r} = \left(3\hat{i} + 3\hat{j} - 5\hat{k}\right) + \mu\left(-2\hat{i} + 3\hat{j} + 8\hat{k}\right)$

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6. Find the shortest distance between the given line

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

$\vec{r} = \left(-9\hat{i} + \hat{j} - 10\hat{k}\right) + \mu\left(4\hat{i} + \hat{j} + 6\hat{k}\right)$

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7. Find the shortest distance between the given line

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

$\vec{r} = (1 + s)\hat{i} + (3s - 7)\hat{j} + (2s - 2)\hat{k}$

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8. Find the shortest distance between the given line

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

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

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9. Compute the shortest distance between the lines

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

Determine whether these lines intersect of not.

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10. Show that the lines

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

$$\vec{r} = \left(-\hat{i} + \hat{j} + 9\hat{k}\right) + \mu\left(2\hat{i} + \hat{j} - 3\hat{k}\right)$$

do not intersect.

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11. Show that the lines

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

intersect.

Also find their point of intersection.

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12. Show that the lines

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

intersect .

Also find their point of the intersection.

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13. Find the shortest distance between the lines

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

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14. Find the distance between the parallel lines L_1 and L_2 whose vector equations are

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

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15. Find the vector equtions of a line passing through the point (2,3,2) and parallel to the line $\vec{r} = \left(-2\hat{i} + 3\hat{j}\right) + \lambda\left(2\hat{i} - 3\hat{j} + 6\hat{k}\right)$ Also find the distance between these lines .

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16. Write the vector equations of each of the following lines and hence determine the distance between them:

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z+4}{6} \quad \text{and} \quad \frac{x-3}{4} = \frac{y-3}{6} = \frac{z+5}{12}$$

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17. Find the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4} and \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$.

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18. Find the shortest distance distance between the following lines :

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

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19. Find the shortest distance between the lines

$$\frac{x-12}{-9}=\frac{y-1}{4}=\frac{z-5}{2} \text{ and } \frac{x-23}{-6}=\frac{y-19}{-4}=\frac{z-25}{3}$$

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Exercise 27 E

1. The shortest distance between line $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}is$

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2. The shortest distance between the skew line $\frac{x-3}{-1}=\frac{y-4}{2}=\frac{z+2}{1}$ and $\frac{x-1}{1}=\frac{y+7}{3}=\frac{z+2}{2}$

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3. Find the length and the equations of the line of shortest distance between the line given by $\frac{x+1}{2}=\frac{y-1}{1}=\frac{z-9}{-3}$ and $\frac{x-3}{2}=\frac{y+15}{-7}=\frac{z-9}{5}$

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4. Find the shortest distance between the lines $\frac{x-6}{3}=\frac{y-7}{-1}=\frac{z-4}{1}$ and $\frac{x}{-3}=\frac{y-9}{2}=\frac{z-2}{4}$

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5. Show that the lines

$$\frac{x}{1}=\frac{y-2}{2}=\frac{z+3}{3} \quad \text{and} \quad \frac{x-2}{2}=\frac{y-6}{3}=\frac{z-3}{4}$$

intersect and find their point of intersection.

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6. Show that the lines

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

do not intersect each other .

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Exercise 27 F

1. If a line has direction ratios 2,-1,-2 then what are its direction cosines ?

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2. Find the direction cosines of the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$

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3. If a equations of a line are `(3-x)/(-3) =(y+2)/(-2) =(z+2)/(6) , Find the direction cosines of a line parallel to the given line.

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4. Write the equations of a line parallel to the line $\frac{x-2}{-3} = \frac{y+3}{2} = \frac{z+5}{6}$ and passing through the point (1,-2,3)

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5. Find the Cartesian equations of the line which passes through the point

$(-2, 4, 5)$ and which is parallel to the line $\frac{x+3}{3} = \frac{4-y}{5} = \frac{z+8}{6}$

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6. Write the vector equation of a line whose Cartesian equations are ,

$$\frac{x-5}{3}=\frac{y+4}{7}=\frac{6-z}{2}$$

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7. The Cartesian equations of a line are $\frac{3-x}{5}=\frac{y+4}{7}=\frac{2z-6}{4}$.

Write the vector equations of the line .

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8. Write the vector equation of a line passing through the point (1,-2,2) and parallel to the line whose equations are $\frac{x-3}{1}=\frac{y-1}{2}=\frac{z+1}{-2}$

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9. If $P\equiv(1,5,4)$ and $Q\equiv(4,1,-2)$ find the direction ratios of $\overrightarrow{PQ}$

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10. The equations of a line are `(4-x)/(2) =(y+3)/(2)=(z+2)/(1).Find the direction cosines of a line parallel to this line.

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11. The Cartesian equations of a line are $\frac{x-1}{2}=\frac{y+2}{3}=\frac{5-z}{1}$. Find its vector equation.

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12. 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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13. Write the cartesian equation of the following line given in vector form : $\vec{r} = 2\hat{i} + \hat{j} - 4\hat{k} + \lambda\left(\hat{i} - \hat{j} - \hat{k}\right)$

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14. Find the cartesian equation of the line which passes through the point $(-2, 4, -5)$ and parallel and line are $(3, 5, 6)$. So, the equation of line is,

$$\frac{x-(-2)}{3} = \frac{y-4}{5} = \frac{z-(-5)}{6}.$$

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15. Find the Cartesian equation of a line which passes through the point having position vector $\left(2\hat{i} - \hat{j} + 4\hat{k}\right)$ and is in the direction of the vector ,$\left(\hat{i} + 2\hat{j} - \hat{k}\right)$

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16. Find the angle between the lines $\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and $\vec{r} = 7\hat{i} - 6\hat{k} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$.

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17. Find the angle between the pair of lines $\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$ and $\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$.

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18. Show that the lines $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ are at right angles .

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19. The direction ratios of a line are 2,6,-9 .What are its direction cosines ?

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20. If a line makes angles $90o, \quad 135o, \quad 45o$ with the x, y and z-axes respectively, find its direction cosines.

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21. What are the direction cosines of the y-axis ?

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22. What are the direction cosines of the vector $\left(2\hat{i}+\hat{j}-2\hat{k}\right)$?

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23. What is the angle between the vector $\vec{r}=\left(4\hat{i}+8\hat{j}+\hat{k}\right)$ and the x-axis ?

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Objective Questions

1. The directions rations of two lines are 3,2,-6 and , 1,2,2 respectively . The acute

angle between these lines is

A. $\cos^{-1}.\left(\frac{5}{18}\right)$

B. $\cos^{-1}.\left(\frac{3}{20}\right)$

C. $\cos^{-1}.\left(\frac{5}{21}\right)$

D. $\cos^{-1}\left(\frac{8}{21}\right)$

Answer: C

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2. The direction rations of two lines are a,b,c and (b-c) , (c-a),(a-b) respectively . The angle between these lines is

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

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

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

D. $\frac{3\pi}{4}$

Answer: B

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3. The angle between the lines $\frac{x-2}{2}=\frac{y-1}{7}=\frac{z+3}{-3}$ and $\frac{x+2}{-1}=\frac{y-4}{2}=\frac{z-5}{4}$ is

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

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

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

D. $\cos^{-1}\left(\frac{3}{8}\right)$

Answer: C

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4. Assertion: 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 to each other , then $k=\frac{10}{7}$, Reason: Two lines having diection ratios l_1, m_1, n_1 and l_2, m_2, n_2 are perpendiculr to each other if and only if $l_1l_2+m_1m_2+n_1n_2=0$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

A. $\frac{-5}{7}$

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

C. $\frac{10}{7}$

D. $\frac{-10}{7}$

Answer: D

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5. A line passes through the points A(2,-1,1) and B(1,2-2) .The equations of the lines AB are

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

B. $\frac{x+2}{-1}=\frac{y+1}{2}=\frac{z-4}{6}$

C. $\frac{x-2}{1}=\frac{y+1}{2}=\frac{z-4}{6}$

D. none of these

Answer: A

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6. Find the angle between the following pair of lines $\frac{x}{2}=\frac{y}{2}=\frac{z}{1}$ and $\frac{x-5}{4}=\frac{y2}{1}=\frac{z-3}{8}$

A. $\cos^{-1}\left(\frac{3}{4}\right)$

B. $\cos^{-1}\left(\frac{5}{6}\right)$

C. $\cos^{-1}.\left(\frac{2}{3}\right)$

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

Answer: C

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7. Find the angle between the following pairs of lines:(i) $\rightarrow r = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and $\rightarrow r = 7\hat{i} - 6\hat{k} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$ (ii) $\rightarrow r = 3\hat{i} + \hat{j} - 2\hat{k} + \lambda\left(\hat{i} - \hat{j} - 2\hat{k}\right)$ and `-

A. $\cos^{-1}\left(\frac{8\sqrt{3}}{15}\right)$

B. $\cos^{-1}\left(\frac{6\sqrt{2}}{5}\right)$

C. $\cos^{-1}\left(\frac{5\sqrt{3}}{8}\right)$

D. $\frac{\cos^{-1}\left(5\sqrt{2}\right)}{6}\Bigg)$

Answer: A

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8. The direction cosines of the line which is perpendicular to the lines with direction cosines proportional to $(1, -2, -2), (0, 2, 1)$

A. $\frac{-2}{3}, \frac{1}{3}, \frac{2}{3}$

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

C. $\frac{2}{3}, \frac{-1}{3}, \frac{2}{3}$

D. none of these

Answer: C

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9. A line passes through the point A(5,-2.4) and it is parallel to the vector $\left(2\hat{i} - \hat{j} + 3\hat{k}\right)$ .The vector equations of the line is

A. $\overrightarrow{r} = \left(2\hat{i} - \hat{j} + 3\hat{k}\right) + \lambda\left(5\hat{i} - 2\hat{j} + 4\hat{k}\right)$

B. $\overrightarrow{r} = \left(5\hat{i} - 2\hat{j} + 4\hat{k}\right) + \lambda\left(2\hat{i} - \hat{j} + 3\hat{k}\right)$

C. $\vec{r}.\left(5\hat{i}-2\hat{j}+4\hat{k}\right)=\sqrt{14}$

D. none of these

Answer: B

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10. The Cartesian equations of a line are $\frac{x-1}{2}=\frac{y+2}{3}=\frac{z-5}{-1}$. Its vector equations is

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

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

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

D. none of these

Answer: C

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11. Find the cartesian equation of the line which passes through the point $(-2, 4, -5)$ and parallel and line are $(3, 5, 6)$. So, the equation of line is,

$$\frac{x-(-2)}{3} = \frac{y-4}{5} = \frac{z-(-5)}{6}.$$

A. $\vec{r} = \left(-3\hat{i} + 4\hat{j} - 8\hat{k}\right) + \lambda\left(-2\hat{i} + 4\hat{j} - 5\hat{k}\right)$

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

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

D. none of these

Answer: B

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12. The coordinates of the point where the line through the point A (5,1,6) and B(3,4,1) crosses the yz-plane is

A. $(0, 17, -13)$

B. $\left(0, \frac{-17}{2}, \frac{13}{2}\right)$

C. $\left(0, \frac{17}{2}, \frac{-13}{2}\right)$

D. none of these

Answer: C

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13. The vector equation of the x-axis is given by

A. $\overrightarrow{r} = \hat{i}$

B. $\overrightarrow{r} = \hat{j} + \hat{k}$

C. $\overrightarrow{r} = \lambda\hat{i}$

D. none of these

Answer: C

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14. The Cartesian equations of a line are $\frac{x-2}{2}=\frac{y+1}{3}=\frac{z-3}{-2}$ .What is its vector equations ?

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

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

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

D. none of these

Answer: B

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15. Find the angle between two lines whose direction ratios are proportional to $1, 1, 2 and \left(\sqrt{3}-1\right), \left(-\sqrt{3}-1\right), 4$.

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

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

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

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

Answer: C

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16. The straight line $\frac{x-2}{3} = \frac{y-3}{1} = \frac{z+1}{0}$ is

A. parallel to the x-axis

B. parallel to the y-axis

C. parallel to the z-axis

D. perpendicular to the z-axis

Answer: D

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17. If a vector makes angle α, β, γ with OX, OY and OZ respectively, then write the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$.

A. 1

B. 3

C. 2

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

Answer: C

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18. If (a_1, b_1, c_1) and (a_2, b_2, c_2) be the direction rations of two parallel lines then

A. $a_1 = a_2, b_1 = b_2, c_1 = c_2$

B. $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

C. $a_1^2 + b_1^2 + c_1^2 = a_2^2 + b_2^2 + c_2^2$

D. $a_1a_2 + b_1b_2 + c_1c_2 = 0$

Answer: B

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19. If the points $A(-1, 3, 2), B(-4, 2, -2) and C(5, 5, \lambda)$ are collinear, find the value of λ .

A. 5

B. 7

C. 8

D. 10

Answer: D

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