# MATHS

## BOOKS - KC SINHA ENGLISH

## VECTOR AND 3D - PREVIOUS YEAR QUESTIONS

### Exercise

**1.** Let $\overrightarrow{a} = 2\hat{i} + \hat{j} + \hat{k}$, and $\overrightarrow{b} = \hat{i} + \hat{j}$ if c is a vector such that $\overrightarrow{a} . \overrightarrow{c} = \left|\overrightarrow{c}\right|, \left|\overrightarrow{c} - \overrightarrow{a}\right| = 2\sqrt{2}$ and the angle between $\overrightarrow{a} \times \overrightarrow{b}$ and $\overrightarrow{i} s30^\circ$ , then $\left|\left(\overrightarrow{a} \times \overrightarrow{b}\right)\right| \times \overrightarrow{c}\Big|$ is equal to



**2.** Let $e\overrightarrow{a} = \hat{i} + \hat{j} - \hat{k}, \overrightarrow{b} = \hat{i} - \hat{j} + \hat{k}$ and $\overrightarrow{c}$ be as unit vector perpendicular to veca and vecb$the$vecc=$(A)$1/sqrt(j+k)$(B)$1/sqrt(2)(j-k)$(C)$

1/sqrt(6) (i-2jk)$(D)$1/sqrt(6) (2i-j+k)`

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**3.** ABCDEF is a regular hexagon with centre of the origin such that $\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}$ is equal to $\lambda(ED)$, then $\lambda$ is:

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

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**5.** If $\overrightarrow{a}=\frac{\hat{i}-2\hat{j}}{\sqrt{5}}$ and $\overrightarrow{b}=\frac{2\hat{i}+\hat{j}+3\hat{k}}{\sqrt{14}}$, then the value of $\left(2\overrightarrow{a}+\overrightarrow{b}\right).\left[\left(\overrightarrow{a}\times\overrightarrow{b}\right)\times\left(\overrightarrow{a}-2\overrightarrow{b}\right)\right]$

6. Let $P, Q, R$ and $S$ be the points on the plane with position vectors $-2i - j, 4i, 3i + 3j and -3j + 2j,$ respectively. The quadrilateral $PQRS$ must be a Parallelogram, which is neither a rhombus nor a rectangle Square Rectangle, but not a square Rhombus, but not a square



7. Two adjacent sides of a parallelogram $ABCD$ are given by $\overrightarrow{A}B = 2\hat{i} + 10\hat{j} + 11\hat{k} and \overrightarrow{A}D = -\hat{i} + 2\hat{j} + 2\hat{k}.$ The side $AD$ is rotated by an acute angle $\alpha$ in the plane of the parallelogram so that $AD$ becomes $AD'.$ If $AD'$ makes a right angle with the side $AB,$ then the cosine of the angel $\alpha$ is given by $\frac{8}{9}$ b. $\frac{\sqrt{17}}{9}$ c. $\frac{1}{9}$ d. $\frac{4\sqrt{5}}{9}$

8. Let $\vec{a} = \vec{i} - \vec{k}, \vec{b} = x\vec{i} + \vec{j} + (1-x)\vec{k}$ and $\vec{c} = y\vec{i} + x\vec{j} + (1+x-y)\vec{k}$. Then $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ depends on

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9. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors of which every pair is non colinear. If the vector $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$ are collinear with the vector $\vec{c}$ and $\vec{a}$ respectively then which one of the following is correct? (A) $\vec{a} + \vec{b} + \vec{c}$ is a nul vector$(B)$veca+vecb+vecc$isaunit\overrightarrow{}r(C)$veca+vecb+vecc $isa\overrightarrow{}rofmagnitude2units(D)$veca+vecb+vecc` isd a vector of magnitude 3 units

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10. $\vec{a} = \frac{1}{\sqrt{10}}\left(3\hat{i} + \hat{k}\right)$ and $\vec{b} = \frac{1}{7}\left(2\hat{i} + 3\hat{j} - 6\hat{k}\right)$, then the value of $\left(2\vec{a} - \vec{b}\right).\left[\left(\vec{a} \times \vec{b}\right) \times \left(\vec{a} + 2\vec{b}\right)\right]$ is:

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11. The vectors $\vec{a}$ and $\vec{b}$ are not perpendicular and $\vec{c}$ and $\vec{d}$ are two vectors satisfying : $\vec{b} \times \vec{c} = \vec{b} \times \vec{d}$ and $\vec{a} . \vec{d} = 0$. Then the $\vec{d}$ is equal to (A) $\vec{c} + \frac{\vec{a} . \vec{c}}{\vec{a} . \vec{b}} \vec{b}$ (B) $\vec{b} + \frac{\vec{b} . \vec{c}}{\vec{a} . \vec{b}} \vec{c}$ (C) $\vec{c} - \frac{\vec{a} . \vec{c}}{\vec{a} . \vec{b}} \vec{b}$ (D) $\vec{b} - \frac{\vec{b} . \vec{c}}{\vec{a} . \vec{b}} \vec{c}$

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12. If the vector $8\hat{i} + a\hat{j}$ of magnitude 10 is the directionn of the vector $4\hat{i} - 3\hat{j}$, then the value of a is equal to (A) 6 (B) 3 (C) -3 (D) -6

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13. If the angle between $\vec{a}$ and $\vec{c}$ is $25^0$ the angle between $\vec{b}$ and $\vec{c}$ is $65^0$ and $\vec{a} + \vec{b} = \vec{c}$, then the angle between $\vec{a}$ and $\vec{b}$ is (A) $40^0$ (B) $115^0$ (C) $25^0$ (D) $90^0$

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**14.** The positon vector of the centroid of the triangle ABC is $2i + 4j + 2k$.

If the position vector of the vector A is

$2i + 6j + 4k.$ , $thenthepositionvec{t}$ $rofmidpo\int ofBCis(A)$2i+3j+k$(B)$

2i+3jk$(C)$2i-3j-k$(D)$-2i-3j-k`

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**15.** The projection of the vector $2\hat{i} + a\hat{j} - \hat{k}$ on the vector $\hat{i} - 2\hat{j} + \hat{k}is$

-5/sqrt(6)` then the value of a is equal to (A) 1 (B) 2 (C) -2 (D) 3

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**16.** Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$ be three vectors. A vectors $\vec{v}$ in the plane of $\vec{a}$ and $\vec{b}$ , whose projection on $\vec{c}\,is\dfrac{1}{\sqrt{3}}$ is given by

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17. The vector(s) which is /are coplanar with vectors $\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} + 2\hat{j} + \hat{k}$ and perpendicular to vector $\hat{i} + \hat{j} + \hat{k}$ , is /are

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18. The angle between the line $\vec{r} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$ and the plane $\vec{r} . \left(\hat{i} + 2\hat{j} - 2\hat{k}\right) = 3$ is (A) $0^0$ (B) $60^0$ (C) $30^0$ (D) $90^0$

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19. Statement 1 : Lines $\vec{r} = \hat{i} + \hat{j} - \hat{k} + \lambda\left(3\hat{i} - \hat{j}\right)$ and $\vec{r} = 4\hat{i} - \hat{k} + \mu\left(2\hat{i} + 3\hat{k}\right)$ intersect.

Statement 2 : If $\vec{b} \times \vec{d} = \vec{0}$, then lines $\vec{r} = \vec{a} + \lambda\vec{b}$ and $\vec{r} = \vec{c} + \lambda\vec{d}$ do not intersect.

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**20.** If $\vec{a}$ and $\vec{b}$ are vectors such that $\left|\vec{a}+\vec{b}\right|=\sqrt{29}$ and $\vec{a}\times\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=\left(2\hat{i}+3\hat{j}+4\hat{k}\right)\times\vec{b}$, then possible value of $\left(\vec{a}+\vec{b}\right).\left(-7\hat{i}+2\hat{j}+3\hat{k}\right)$ is (A) 0 (B) 3 (C) 4 (D) 8

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**21.** If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors satisfying $\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2+\left|\vec{c}-\vec{a}\right|^2=9$ then find the value of $\left|2\vec{a}+5$

.

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**22.** Let $\overrightarrow{PR}=3\hat{i}+\hat{j}-2\hat{k}$ and $\overrightarrow{SQ}=\hat{i}-3\hat{j}-4\hat{k}$ determine diagonals of a parallelogram PQRS. And $\overrightarrow{PT}=\hat{i}+2\hat{j}+3\hat{k}$ be onther vector. Then the volume of the parallelepiped determined by the vectors $\overrightarrow{PT}, \overrightarrow{PQ}$ and $\overrightarrow{PS}$ is

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**23.** Consider the set of eight vectors $V\left[a\hat{i}+b\hat{j}+c\hat{k}: a, b, c \in \{1-1\}\right]$. Three non-coplanar vectors cann be chosen from V in $2^p$ ways, then p is

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**24.** If $\overrightarrow{a}$ and $\overrightarrow{b}$ are non-collinear vector, find the value of x such that the vectors $\overrightarrow{\alpha}=(x-2)\overrightarrow{a}+\overrightarrow{b}$ and $\overrightarrow{\beta}=(3+2x)\overrightarrow{a}-2\overrightarrow{b}$ are collinear.

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**25.** If vectors $\overrightarrow{AB}=-3\hat{i}+4\hat{k}$ and $\overrightarrow{AC}=5\hat{i}-2\hat{j}+4\hat{k}$ are the sides of a $\Delta ABC$, then the length of the median throught A is

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**26.** If $\vec{a} \perp \vec{b}$ and $\left(\vec{a} + \vec{b}\right) \perp \left(\vec{a} + m\vec{b}\right)$, then m= (A) -1 (B) 1 (C) $\dfrac{-\left|\vec{a}\right|^2}{\left|\vec{b}\right|^2}$ (D) 0

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**27.** if $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vector such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$. Then find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} = \vec{c}.\vec{a}$.

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**28.** If $\vec{a}$ is perpendiculasr to both $\vec{b}$ and $\vec{c}$ then (A) $\vec{a}.\left(\vec{b} \times \vec{c}\right) = \vec{0}$ (B) $\vec{a} \times \left(\vec{b}\, x\, \vec{c}\right) = \vec{0}$ (C) $\vec{a} \times \left(\vec{b} + \vec{c}\right) = \vec{0}$ (D) $\vec{a} + \left(\vec{b} + \vec{c}\right) = \vec{0}$

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**29.** If $\vec{a}$ *and* $\vec{b}$ are two non collinear unit vectors such that $\left|\vec{a}+\vec{b}\right|=\sqrt{3}$, find $\left(2\vec{a}-5\vec{b}\right).\left(3\vec{a}+\vec{b}\right)$

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**30.** If the position vectors of the vertices of a triangle be $2\hat{i}+4\hat{j}-\hat{k}, 4\hat{i}+5\hat{j}+\hat{k}$ and $3\hat{i}+6\hat{j}-3\hat{k}$, then the triangle is

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**31.** If $(1, 2, 4)$ and $(2, -\lambda, -3)$ are the initial and terminal points of the vector $\hat{i}+5\hat{j}-7\hat{k}$ then the value $\lambda$ is equal to (A) $7$ (B) $-7$ (C) $-5$ (D) $5$

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**32.** Let $\overrightarrow{u} = 5\overrightarrow{a} + 6\overrightarrow{b} + 7\overrightarrow{c}, v = 7\overrightarrow{a} + \overrightarrow{b} + 9\overrightarrow{c}$ and $\overrightarrow{w} = 3\overrightarrow{a} + 11\overrightarrow{b} + 5\overrightarrow{c}$ where $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are non zero vectors.If $\overrightarrow{u} = l\overrightarrow{v} + m\overrightarrow{w}$ then the values of l and m respectively are (A) $\frac{1}{2}, \frac{1}{2}$ (B) $\frac{1}{2}, -\frac{1}{2}$ (C) $-\frac{1}{2}, \frac{1}{2}$ (D) $\frac{1}{3}, \frac{1}{3}$

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**33.** If $3\overrightarrow{p} + 2\overrightarrow{q} = \hat{i} + \hat{j} + \hat{k}$ and $3\overrightarrow{p} - 2\overrightarrow{q} = \hat{i} - \hat{j} - \hat{k}$ then the angle between $\overrightarrow{p}$ and $\overrightarrow{q}$ is (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

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**34.** 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 $\frac{x}{3} = \frac{y}{4} = \frac{z}{2}$ and $\frac{x}{4} = \frac{y}{2} = \frac{z}{3}$ is

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**35.** If the distance between the plane $Ax - 2y + z = d.$ and the plane containing the lies $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{4-3}{4} = \frac{z-4}{5}$ is $\sqrt{6}$, then $|d|$ is

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**36.** A parallelopied is formed by planes drawn through the points $(2, 4, 5)$ and $(5, 9, 7)$ parallel to the coordinate planes. The length of the diagonal of parallelopiped is

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**37.** If $P(x, y, z)$ is a point on the line segment joining Q(2,2,4) and R(3,5,6) such that the projection of $\overrightarrow{OP}$ on the axes are $\frac{13}{9}, \frac{19}{5}, \frac{26}{5}$ respectively, then P divides QR in the ratio:

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**38.** If the angle between the line $x = \frac{y-1}{2} = (z-3)(\lambda)$ and the plane $x + 2y + 3z = 4 is \cos^{-1}\left(\sqrt{\frac{5}{14}}\right)$, then $\lambda$ equals

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**39.** Find the equation of the plane passing through the points (1,0,0) and (0,2,0) and c at a distance 6/7 units from the origin

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**40.** 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, if

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**41.** 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 equal to

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**42.** Assertion: The point $A(3, 1, 6)$ is the mirror image of the point $B(1, 3, 4)$ in the plane $x - y + z = 5.$ Reason: The plane $x - y + z = 5$ bisects the line segment joining $A(3, 1, 6)$ and $B(1, 3, 4)$ (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 the correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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**43.** Statement-I 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-II The line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ bisect the line segment joining $A(1, 0, 7)$ and $B(1, 6, 3).$

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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/ √ 3 from the point (3, 1, -1) is ?

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**45.** If the straight lines $\frac{x-1}{2}=\frac{y+1}{k}=\frac{z}{2}$ and $\frac{x+1}{5}=\frac{y+1}{2}=\frac{z}{k}$ are coplanar, then the plane(s) containing these two lines is/are

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**48.** 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 $\alpha$ can take value (s) a. $1$ b. $2$ c. $3$ d. $4$

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**49.** If the projection of a line segment of the x,y and z-axes in 3-dimensional space are 12,4, and 3 respectively, then the length of the line segmetn is (A) 13 (B) 9 (C) 6 (D) 7

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**50.** 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

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**51.** The point of intersection of the straighat line $\frac{x-2}{2}=\frac{y-1}{-3}=\frac{z+2}{1}$ with the plane $x+3y-z+1=0$ (A) (3,-1,1) (B) (-5,1,-1) (C) (2,0,3) (D) (4,-2,-1)

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**52.** If the lines $\frac{2x-1}{2}=\frac{3-y}{1}=\frac{z-1}{3}\text{ and }\frac{x+3}{2}=\frac{z+1}{p}=\frac{y+2}{5}$ are perpendicular to each other then p is equal to (A) 1 (B) -1 (C) 10 (D) $-\frac{7}{5}$

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**53.** If O be the origin and OP makes an angle of $45^0$ and $60^0$ with the positive direction of x and y axes respectively and OP=12 units, find the coordinates of P.

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**54.** The distance between the plane $\vec{r}.\left(\hat{i}+2\hat{j}-2\hat{k}\right)+5=0$ and $\vec{r}.\left(2\hat{i}+4\hat{j}-4\hat{k}\right)-16=0$ is (A) 3 (B) $\frac{11}{3}$ (C) 13 (D) $\frac{13}{3}$

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**55.** If the straight lines $\frac{x+1}{2}=\frac{-y+1}{3}=\frac{z+1}{-2}$ and $\frac{x-3}{1}=\frac{y-\lambda}{2}=\frac{z}{3}$ intersect then the value of $\lambda$ is (A) $-\frac{5}{8}$ (B) $-\frac{17}{8}$ (C) $-\frac{13}{8}$ (D) $-\frac{15}{8}$

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**56.** If $\angle\theta$ 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 $\lambda$ is

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**57.** The ratio in which the plane $y-1=0$ divides the straight line joining (1,-1,3) and (-2,5,4)$is(A)$1:2$(B)$3:1$(C)$5:2$(D)$1:3`

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**58.** Equation of theine passing through $\hat{i}+\hat{j}-3\hat{k}$ and perpendiculr to the plane 2x-4y+3z+5=0 is (A) $\frac{x-1}{2}=\frac{1-y}{-4}=\frac{z-3}{3}$ (B) $\frac{x-1}{2}=\frac{1-y}{4}=\frac{z+3}{3}$ (C) $\frac{x-2}{1}=\frac{y+4}{1}\Big)=\frac{z-3}{3}$ (D) $\frac{x-1}{-2}=\frac{1-y}{-4}=\frac{z-3}{3}$

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