



# MATHS

# **BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)**

# **APPLICATIONS OF VECTOR ALGEBRA**

**Example Questions Solved** 

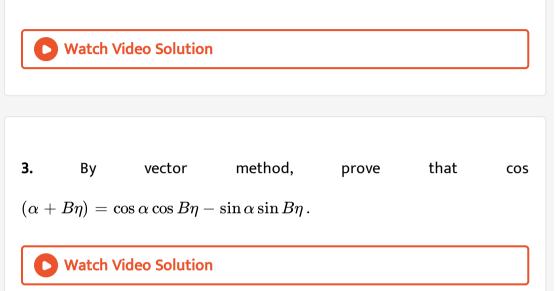
1. With usual notations, in any triangle ABC, prove the following by vector

method .

- (i)  $a^2 = b^2 + c^2 2bc\cos A$
- (ii)  $b^2 = c^2 + a^2 2bc\cos B$
- (iii)  $c^2 = a^2 + b^2 2bc\cos C$

# 2. Projection formula:

Prove that  $a = b \cos C + c \cos B$ .



# 4. Sine formula:

With usual notation in a  $\Delta ABC$ 

Prove that 
$$\displaystyle rac{a}{\sin A} = \displaystyle rac{b}{\sin B} = \displaystyle rac{c}{\sin C}$$

Watch Video Solution

5. By vector method, Prove that  $\sin(lpha-eta)=\sinlpha\coseta-\coslpha\sineta$ 



6. (Apollonius theorem): If D is the midpoint of the side BC of a triangle

ABC, then show by vector method that

$$\left|\overrightarrow{AB}
ight|^2+\left|\overrightarrow{AC}
ight|^2=2igg(\left|\overrightarrow{AD}
ight|^2+\left|\overrightarrow{BD}
ight|^2igg).$$

Watch Video Solution

**7.** Prove by vector method that the perpendiculars (altitudes) from the vertices to the sides of a triangle are concurrent.

Watch Video Solution

8. In trigle ABC, the points D, E, F are the midpoints of the sides BC,CA, and

AB respee. Tively. Using vector methed ,show that the area of  $\Delta$  DEF is equal to  $\frac{1}{4}$  (area of ABC).

**9.** A particale acted upon by constant forces  $2\hat{i} + 5\hat{j} + 6\hat{k}$  and  $-\hat{i} - 2\hat{j} - \hat{k}$  is displaced from the piont (4,-3,-2) to the point (6,1,-3). Find the total wrok done by the forces.

# Watch Video Solution

**10.** A particale acted upon by constant forces  $3\hat{i} + 2\hat{j} + 2\hat{k}$  and  $2\hat{k} - \hat{j} - \hat{k}$  is displaced from the piont (1,3,-1) to the point (4,-1,  $\lambda$ ). If the wrok done by the forces is 16 units , find the value of  $\lambda$ 

# Watch Video Solution

**11.** Find the magnitude and the direction cosines of the torque about the point (2,0,-1) of a force  $2\hat{i} + \hat{j} - \hat{k}$ , whose line of action passes through the origin.

12. If 
$$\overrightarrow{a} = -3\hat{i} - \hat{j} + 5\hat{k}$$
,  $\overrightarrow{b} = \hat{i} - 2\hat{j} + \widehat{K}$ ,  $\overrightarrow{c} = 4\hat{j} - 5\hat{k}$ , find  
 $\overrightarrow{a} \cdot \left(\overrightarrow{b} \times \overrightarrow{c}\right)$ .

13. Find the volume of the parallelepiped whose coterminus edges are given by the vectors  $2\hat{i} - 3\hat{j} + 4\hat{k}$ ,  $\hat{i} + 2\hat{j} - \hat{k}$  and  $3\hat{i} - \hat{j} + 2\hat{k}$ .

Watch Video Solution

14. Show that the vectors  $\hat{i}+2\hat{j}-3\hat{k}$  ,  $2\hat{i}-\hat{j}+2\hat{k}$  and  $3\hat{i}+\hat{j}-\hat{k}$  are

coplanar.

Watch Video Solution

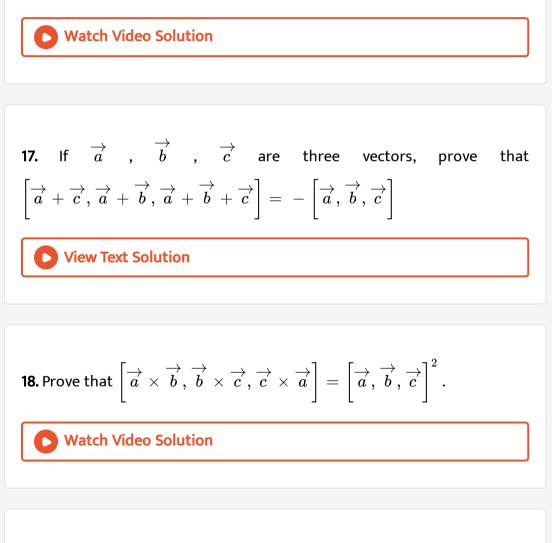
15. If  $2\hat{i}-\hat{j}+3\hat{k},3\hat{i}+2\hat{j}+\hat{k},\hat{i}+m\hat{j}+4\hat{k}$  are coplanar, find the value

of m.



16. Show that the four points (6,-7,0),(16,-19,-4),(0,3,-6),(2,-5,10) lie on a same

plane.



**19.** Prove that  $\left(\overrightarrow{a}, \left(\overrightarrow{b} \times \overrightarrow{c}\right)\right) \overrightarrow{a} = \left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{a} \times \overrightarrow{c}\right)$ .

**20.** For any four vectors 
$$\overrightarrow{a}$$
,  $\overrightarrow{b}$ ,  $\overrightarrow{c}$ ,  $\overrightarrow{d}$  we have  
 $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{c} \times \overrightarrow{d}\right) = \left[\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{d}\right] \overrightarrow{c} - \left[\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}\right] \overrightarrow{d} = \left[\overrightarrow{a}, \overrightarrow{c}, \overrightarrow{d}\right]$ 

.

**21.** If 
$$\overrightarrow{a} = -2\hat{i} + 3\hat{j} - 2\hat{k}$$
,  $\overrightarrow{b} = 3\hat{i} - \hat{j} + 3\hat{k}$ ,  $\overrightarrow{c} = 2\hat{i} - 5\hat{j} + \hat{k}$  find  $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \overrightarrow{c}$  and  $\overrightarrow{a} \times \left(\overrightarrow{b} \times \overrightarrow{c}\right)$ . State whether they are equal.

Watch Video Solution

22. If 
$$\overrightarrow{a}=\hat{i}-\hat{j}$$
 ,  $\overrightarrow{b}=\hat{i}-\hat{j}-4\hat{k}$  ,  $\overrightarrow{c}=3\hat{j}-\hat{k}$  and  $\overrightarrow{d}=2\hat{i}+5\hat{j}+\hat{k}$ 

, verify that

(i) 
$$\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{c} \times \overrightarrow{d}\right) = \left[\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{d}\right] \overrightarrow{c} - \left[\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}\right] \overrightarrow{d}$$
  
(ii)  $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{c} \times \overrightarrow{d}\right) = \left[\overrightarrow{a}, \overrightarrow{c}, \overrightarrow{d}\right] \overrightarrow{b} - \left[\overrightarrow{b}, \overrightarrow{c}, \overrightarrow{d}\right] \overrightarrow{a}$ 

**23.** A straight line passes through the point (1, 2, -3) and parallel to  $4\hat{i} + 5\hat{j} - 7\hat{k}$ . What vector equation in parametric form (ii) vector equation in non-parametric form (iii) Cartesian equations of the straight line.

# Watch Video Solution

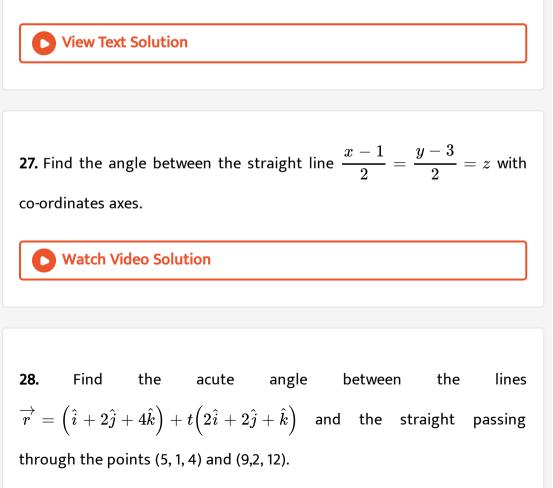
24. The vector equation in parametric form of a line is  $\vec{r} = (3\hat{i} - 2\hat{j} + 6\hat{k}) + t(2\hat{i} - \hat{j} + 3\hat{k})$ . Find (i) the direction cosines of the straight line (ii) vector equation in non-parametric form of the line (iii) Cartesian equations of the line.

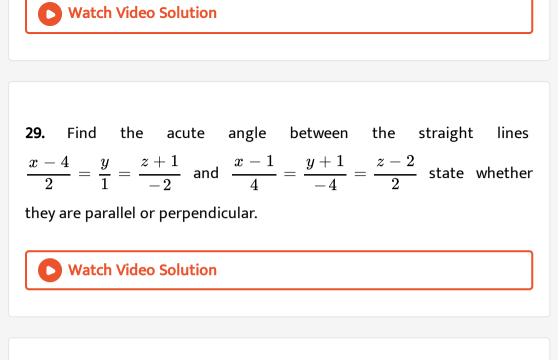
# **Watch Video Solution**

**25.** Find the vector equation in parametric form and Cartesian equations of the line passo through (-4, 2,-3) and is parallel to the line

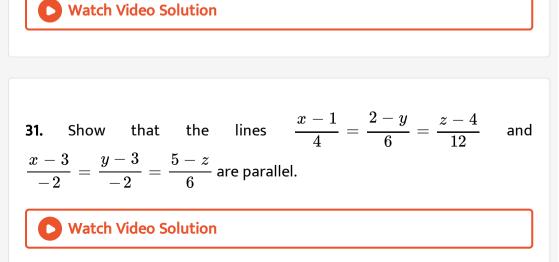
$$\frac{-x-2}{4} = \frac{y+3}{-2} = \frac{2z-6}{3}$$

**26.** Find the vector equation in parametric form and Cartesian equations of a through the points (-3, 7, -4) and (13,-5, 2). Find the point where the straight line crosses the xy -plane.





**30.** show that the straight line passing through the points A (6,7,5) and B (8,10,6) is perpendicular to the straight line passing through the points C (10, 2,-5) and D (8,3,-4).



**32.** Find the point of intersection of the lines 
$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$$
  
and  $\frac{x-4}{5} = \frac{y-1}{2} = z$ .  
Watch Video Solution

**33.** Find the parametric form of vector equation of a straight line passing through the point of intersection of the straight lines  $\vec{r} = (\hat{i} + 3\hat{j} - \hat{k}) + t(2\hat{i} + 3\hat{j} + 2\hat{k})$  and  $\frac{x-2}{1} = \frac{y-4}{2} = \frac{z+3}{4}$  and perpendicular to both straight lines. **Watch Video Solution** 

34. Determine whether the pair of straight lines

$$\overrightarrow{r}=\left(2\hat{i}+6\hat{j}+3\hat{k}
ight)+t\Big(2\hat{i}+3\hat{j}+4\hat{k}\Big),\,\overrightarrow{r}=\left(2\hat{j}-3\hat{k}
ight)+s\Big(\hat{i}+2\hat{j}+3\hat{k}\Big)$$

are parallel. Find the shortest distance between them.

**35.** Find the shortest distance between the two given straight lines 
$$\vec{r} = (2\hat{i} + 3\hat{j} + \hat{k}) + t(-2\hat{i} + \hat{j} + 2\hat{k})$$
 and  $\frac{x-3}{2} = \frac{y}{-1} = \frac{z+2}{2}$ 

**View Text Solution** 

**36.** Find the coordinates of the foot of the perpendicular drawn from the point (-1,2,3) the straight line  $\vec{r} = (\hat{i} - 4\hat{j} + 3\hat{k}) + t(2\hat{i} + 3\hat{j} + \hat{k})$ Also, find the shortest distance from point to the straight line.

View Text Solution

**37.** Find the vector and Cartesian form of the equations of a plane which is at a distance of 12 units from the origin and perpendicular to  $6\hat{i} + 2\hat{j} - 3\hat{k}$ .

**38.** If the Cartesian equation of a plane is 3x - 4y + 32 - 8, find the vector equation of the plane in the standard form.



**39.** Find the direction cosines of the normal to the plane and length of the perpendicular from the origin to the plane  $\overrightarrow{r}$ .  $\left(3\hat{i} - 4\hat{j} + 12\hat{k}\right) = 5$ 

Watch Video Solution

**40.** Find the vector and Cartesian equations of the plane passing through the point with position vector  $4\hat{1} + 2\hat{j} - 3\hat{k}$  and normal to vector  $2\hat{i} - \hat{j} + \hat{k}$ .

**41.** A variable plane moves in such a way that the sum of the reciprocals of its intercepts on the coordinate axes is a constant. Show that the plane passes through a fixed point.

Watch Video Solution

**42.** Find the non-parametric form of vector equation, and Cartesian equation vector equation, and Cartesian equation of the plane passing through the point (0, 1,-5) and parallel to the straight lines  $\vec{r} = (\hat{i} = 2\hat{j} - 4\hat{k}) + s(2\hat{i} + 3\hat{j} + 6\hat{k})$  and  $\vec{r} = (\hat{i} = 3\hat{j} - 4\hat{k}) + t(\hat{i} + \hat{j} + \hat{k})$ 

Watch Video Solution

**43.** Find the vector parametric, vector non-parametric and Cartesian form of the equation of the plane passing through the points (-1, 2, 0), (2, 2, -1) and parallel to the straight line  $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$ 



**44.** Verify whether the line 
$$\frac{x-3}{-4} = \frac{y-4}{-7} = \frac{z+3}{12}$$
 lies in the plane 5x - y +z = 8.

**45.** Find the acute angle between the planes  $\overrightarrow{r}$ .  $\left(2\hat{\mathbf{i}}+2\hat{j}+2\hat{k}
ight)=11$ 

and 4x-2y + 2z =15

Watch Video Solution

**46.** Find the angle between the straight line  

$$\vec{r} = \left(2\hat{i} + 3\hat{j} + \hat{k}\right) + k + t\left(\hat{i} - \hat{j} + \hat{k}\right)$$
 and the plane 2x-y+z=5

47. Find the distance of a point (2,5,-3) from the plane  $\overrightarrow{r}.\left(6\hat{i}-3\hat{j}+2\hat{k}
ight)=5$ 

Watch Video Solution

**48.** Find the distance of the point (5,-5, -10) from the point of intersection of a straight line passing through the points A(4, 1, 2) and B(7, 5, 4) with the plane x-y+z=5.

Watch Video Solution

**49.** Find the distance between the parallel planes x + 2y-2z + 1 = 0 and 2x + 1 = 0

4y - 4z+5=0.



**50.** Find the distance between the parallel planes  $\overrightarrow{r}.\left(2\hat{i}-\hat{j}-2\hat{k}
ight)=6$ 

and 
$$\overrightarrow{r}.\left(6\hat{i}-3\hat{j}-6\hat{k}
ight)=27$$

## Watch Video Solution

**51.** Find the equation of the plane passing through the intersection of the planes  $\overrightarrow{r}$ .  $(\hat{i} + \hat{j} + k) = 0$  and  $\overrightarrow{r}(2\hat{i} - 3\hat{j} + 5\hat{k}) = 2$  and the point (-1, 2, 1).

Watch Video Solution

**52.** Find the image of the point whose position vector is  $\hat{i} + 2\hat{j} + 3\hat{k}$  in

the plane 
$$\overrightarrow{r}.\left(\hat{i}+2\hat{j}+4\hat{k}
ight)=38.$$

53. Find the coordinates of the points where the straight line 
$$\overrightarrow{r} = (\hat{i} - 2\hat{j} - 2\hat{k}) + t(4\hat{i} + 3\hat{j} + 2\hat{k})$$
 intersects the plane  $x - 2y + 3z + 9 = 0.$ 

## Exercise 61

**1.** Prove by vertor metord that if a line is drawn frome the centre of a circle of a circle to the midpoint of a chord then the line is perpendicular to the chord

Watch Video Solution

2. Prove by vector method that median to the base of an isoscels triangle

is perpendicular to the base.

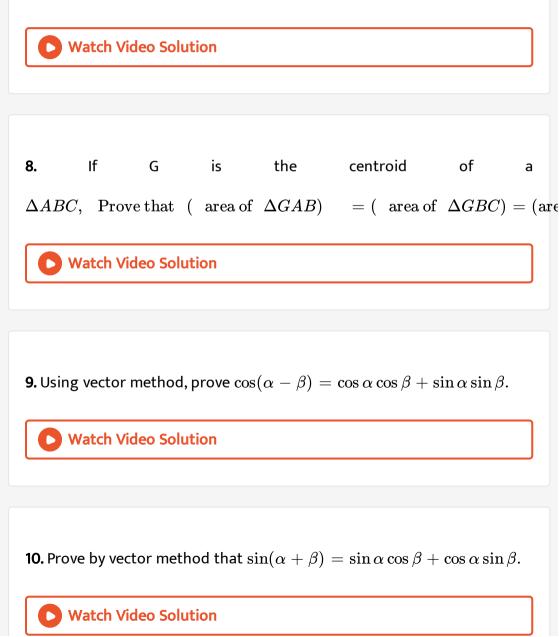
**3.** Prove by vector method that an angle in a semi-circle is a right angle.

Watch Video Solution
<b>4.</b> Prove by vector method that the diagonals of a rhombus bisect each
other at right angles.
Watch Video Solution
<b>5.</b> Using vector method, prove that if the diagonals of a parallelogram are equal, then it is a rectangle.
Watch Video Solution

6. Prove by vector method that the area of the quadrilateral ABCD having diagonals AC and is  $\frac{1}{2} |\overline{AC} \times \overline{BD}|$ 

7. Prove by vector method that the parallelograms on the same base and

between the same parallels are equal in area.



11. A particle acted on by constant forces $8\hat{i} + 2\hat{j} - 6\hat{k}$  and  $6\hat{i} + 2\hat{j} - 2\hat{k}$ is displaced from the point (1, 2, 3) to the point (5, 4, 1).

Find the total work done by the forces.

Watch Video Solution

**12.** Forces of magnitude  $5\sqrt{2}$  and  $10\sqrt{2}$  units acting in the directions  $3\hat{i} + 4\hat{j} + 5k$  and  $10\hat{j} + 6\hat{j} - 8\hat{k}$ , respectively, act on a particle which is displaced from the point with position vector  $4\hat{i} - 3\hat{j} - 2\hat{k}$  to the with position vector  $6\hat{i} + \hat{j} - 3\hat{k}$ . Find the work done by the forces.

#### Watch Video Solution

**13.** Find the magnidude and direction cosines of the torque of a force represented by  $3\hat{i} + 4\hat{j} - 5\hat{k}$  about the point with position vector  $2\hat{i} - 3\hat{j} + 4\hat{k}$  acting through a point whose position vector is  $4\hat{i} + 2\hat{j} - 3\hat{k}$ .

14. Find the torque of the resultant of the three forces represented by  $-3\hat{i} + 6\hat{j} - 3\hat{k}, 4\hat{i} - 10\hat{j} + 12\hat{k}$  and  $4\hat{i} + 7\hat{j}$  acting at the point with position vector  $8\hat{i} - 6\hat{j} - 4\hat{k}$ , about the point with position vector  $18\hat{i} + 3\hat{j} - 9\hat{k}$ .

Watch Video Solution

#### Exercise 6 2

1. If 
$$\overrightarrow{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \ \overrightarrow{b} = 2\hat{i} + \hat{j} - 2\hat{k}, \ \overrightarrow{c} = 3\hat{i} + 2\hat{j} + \hat{k}, \ \text{find}$$
  
 $\overrightarrow{a} \cdot \left(\overrightarrow{b} \times \overrightarrow{c}\right).$ 

2. Find the volume of the parallelepiped whose coterminous edges are

represented by the vector $-6\hat{i}+14\hat{j}+10\hat{k}, 14\hat{i}-10\hat{j}-6\hat{k}, ext{ and } 2\hat{i}+4\hat{j}-2\hat{k}.$ 

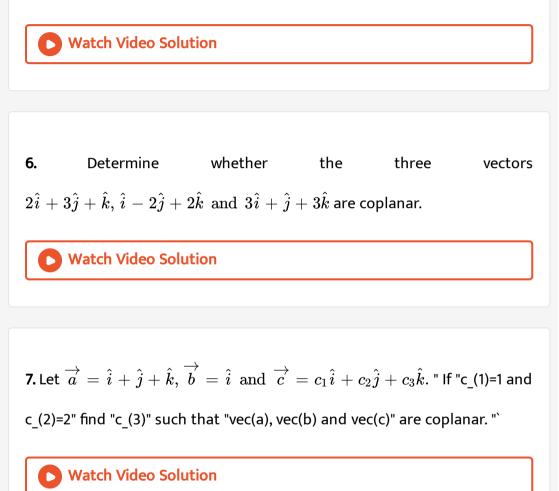
Watch Video Solution

**3.** The volume of the parallelepiped whose coterminus edges are  $7\hat{i} + \lambda\hat{j} - 3\hat{k}, \hat{i} + 2\hat{j} - \hat{k} - 3\hat{i} + 7\hat{j} + 5\hat{k}$  is 90 cubic units. Find the value of  $\lambda$ .

Watch Video Solution

**4.** If  $\overrightarrow{a}$ ,  $\overrightarrow{b}$ ,  $\overrightarrow{c}$  are three non-coplanar vectors represented by concurrent edges of a parallelepiped of volume 4 cubic units, find the value of  $\left(\overrightarrow{a} + \overrightarrow{b}\right) \cdot \left(\overrightarrow{b} \times \overrightarrow{c}\right) + \left(\overrightarrow{b} + \overrightarrow{c}\right) \cdot \left(\overrightarrow{c} \times \overrightarrow{a}\right) + \left(\overrightarrow{c} + \overrightarrow{a}\right) \cdot \left(\overrightarrow{a} \times \overrightarrow{c}\right)$ 

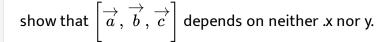
5. Find the altitude of a parallelepiped determined by the vectors  $\vec{a} = -2\hat{i} + 5\hat{j} + 3\hat{k}$   $\vec{b} = \hat{i} + 3\hat{j} - 2\hat{k}$  and  $\vec{c} = -3\hat{i} + \hat{j} + 4\hat{k}$  if the base is taken as the parallelogram determined by  $\vec{b}$  and  $\vec{c}$ .



$$\overrightarrow{a} = \hat{i} - \hat{k}, \, \overrightarrow{b} = x \hat{i} + \hat{j} + (1-x) \hat{k}, \, \overrightarrow{c} = y \hat{i} + x \hat{j} + (1+x-y) \hat{k}$$

8.

If



**9.** If the vectors  $a\hat{i}+a\hat{j}+c\hat{k},\,\hat{i}+\hat{j}$ andchat(i)+chat(j)+bhat(k)` are

coplanar, prove that c is the geometric mean of a and b .

Watch Video Solution

**10.** Let  $\overrightarrow{a}$ ,  $\overrightarrow{b}$ ,  $\overrightarrow{c}$  be three non-zero vectors such that  $\overrightarrow{c}$  is a unit vector perpendicular to both  $\overrightarrow{a}$  and  $\overrightarrow{c}$ . If the angle between  $\overrightarrow{a}$  and  $\overrightarrow{c}$  is  $\frac{\pi}{6}$ , show that  $\left[\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}\right]^2 = \frac{1}{4} |\overrightarrow{a}|^2 |\overrightarrow{b}|^2$ .



1. If 
$$\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$$
,  $\vec{b} = 2\hat{i} + \hat{j} - 2\hat{k}$ ,  $\vec{c} = 3\hat{i} + 2\hat{j} + \hat{k}$ , find  
 $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$   
Watch Video Solution  
2. For any vector  $\vec{a}$  prove that  
 $\hat{i} \times \left(\vec{a} \times \hat{i}\right) + \hat{j} \times \left(\vec{a} \times \hat{j}\right) + \hat{k} \times \left(\vec{a} \times \hat{k}\right) = 2\vec{a}$   
Watch Video Solution

**3.** Prove that 
$$\left[\overrightarrow{a} - \overrightarrow{b}, \overrightarrow{b} - \overrightarrow{c}, \overrightarrow{c} - \overrightarrow{a}\right] = 0$$

**4.** If  $\overrightarrow{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ ,  $\overrightarrow{b} = 3\hat{i} + 5\hat{j} + 2\hat{k}$ ,  $\overrightarrow{c} = -\hat{i} - 2\hat{j} + 3\hat{k}$ , verify that  $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \overrightarrow{c} = \left(\overrightarrow{a} \cdot \overrightarrow{c}\right) \overrightarrow{b} - \left(\overrightarrow{b} \cdot \overrightarrow{c}\right) \overrightarrow{a}$ 

Watch Video Solution

5. If 
$$\overrightarrow{a} = 2\hat{i} + 3\hat{j} - \hat{k}$$
,  $\overrightarrow{b} = -\hat{i} + 2\hat{j} - 4\hat{k}$ ,  $\overrightarrow{c} = \hat{i} + \hat{j} + \hat{k}$ , then find the value of  $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \cdot \left(\overrightarrow{a} \times \overrightarrow{c}\right)$ .

6. If 
$$\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$$
 are coplanar vectors, show that  $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{c} \times \overrightarrow{d}\right) = \overrightarrow{0}$ 

Watch Video Solution

7. If 
$$\overrightarrow{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \overrightarrow{b} = 2\hat{i} + \hat{j} - 2\hat{k}, \overrightarrow{c} = 3\hat{i} + 2\hat{j} + \hat{k}$$
, find  
 $\overrightarrow{a} \cdot \left(\overrightarrow{b} \times \overrightarrow{c}\right)$ .

**8.** If  $\hat{a}, \hat{b}, \hat{c}$  are three unit vectors such that  $\hat{b}$  and  $\hat{c}$  are non-parallel and  $\hat{a} \times (\hat{b} \times \hat{c}) = \frac{1}{2}\hat{b}$ , find the angle between  $\overrightarrow{a}$  and  $\overrightarrow{c}$ .

# Watch Video Solution

### Exercise 64

**1.** Find the non-parametric form of vector equation and Cartesian equations of the straight line passing through the point with position vector  $4\hat{i} + 3\hat{j} - 7\hat{k}$  and parallel to the vector  $2\hat{i} - 6\hat{j} + 7\hat{k}$ .

#### Watch Video Solution

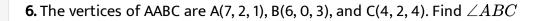
2. Find the parametric form of vector equation and Cartesian equtions of the straight line passing through the point (-2, 3, 4) and parallel to the straight line  $\frac{x-1}{-4} = \frac{y+3}{5} = \frac{8-z}{-6}$ 

**3.** Find the point where the straight line passes through (6, 7, 4) and (8, 4, 9) cut the xz and yz planes.

**4.** Find the direction cosines of the straight line passing through the points (5, 6, 7) and (7, 9, 13). Also, find the parametric form of vector equation and Cartesian equations of the straight line passing through two given points.

5. Find the angle between the following lines.

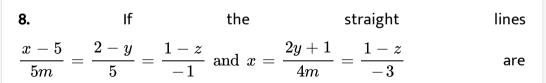
$$egin{aligned} \overrightarrow{r} &= \left(4\hat{i}-\hat{j}
ight) + t\Big(\hat{i}+2\hat{j}-2\hat{k}\Big) \ \overrightarrow{r} &= \left(\hat{i}-2\hat{j}+4\hat{k}
ight) + s\Big(-\hat{i}-2\hat{j}+2\hat{k}\Big) \end{aligned}$$





7. If the straight line joining the points (2, 1, 4) and (a - 1, 4, -1) is parallel to the line joining the points (0, 2, b - 1) and (5, 3, -2), find the values of a and b.

Watch Video Solution

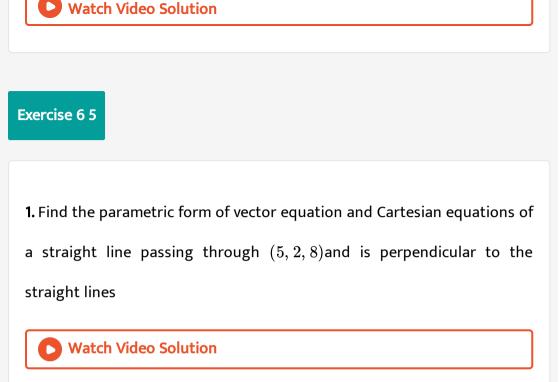


perpendicular to each other, find the value of m.

# Watch Video Solution

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

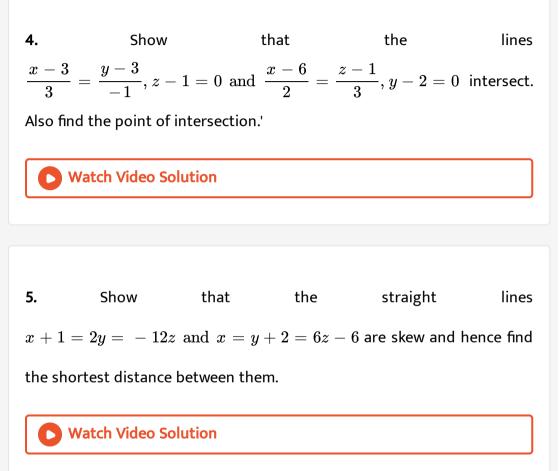




**2.** Show that the lines 
$$\overrightarrow{r} = \left(6\hat{i} + \hat{j} + 2\hat{k}\right) + s\left(\hat{i} + 2\hat{j} - 3\hat{k}\right) ext{ and } \overrightarrow{r} = \left(3\hat{i} + 2\hat{j} - 2\hat{k}\right) + t\left(2\hat{k}\right)$$

are skew lines and hence find the shortest distance between them.

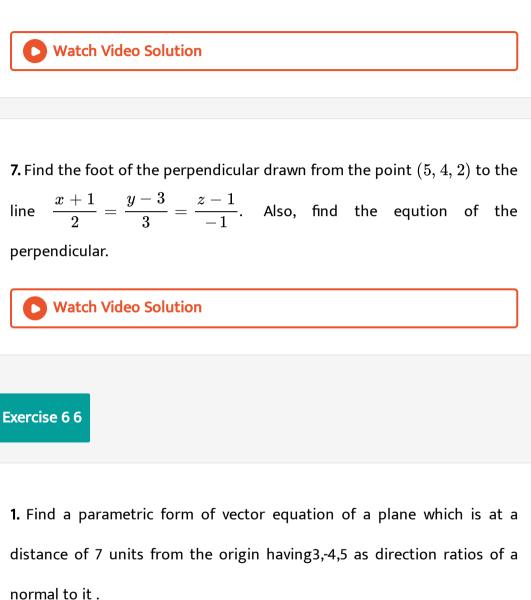
**3.** If the two lines 
$$\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$$
 and  $\frac{x-3}{1} = \frac{y-m}{2} = z$  intersect at a point, find the value of m.



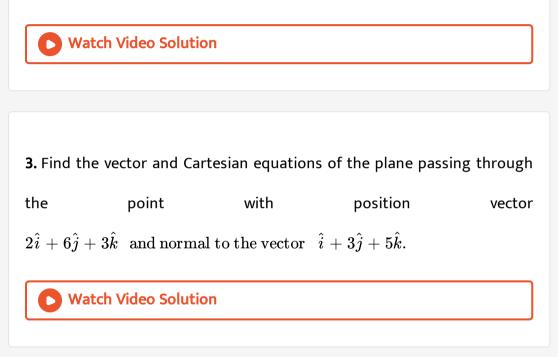
**6.** Find the parametric form of vector eqution of the straight line passing through (-1, 2, 1) and paralle to the straight line

$$\overrightarrow{r}=\left(2\hat{i}+3\hat{j}-\hat{k}
ight)+t\Bigl(\hat{i}-2\hat{j}+\hat{k}\Bigr)$$
 and lines find the shortest

distance between the lines.



**2.** Find the direction cosines of the normal to the plane 12x + 3y - 4z = 65. Also, find the non-parametric form of vector equation of a plane and the length of the perpendicular to the plane from the origin.



**4.** A plane passes through the point (1, 1, 2) - and the normal to the plane of magnitude  $3\sqrt{3}$  makes equal acute angles with the coordinate axes. Find the equation of the plane.



5. Find the intercept cut off by the plane  $\overrightarrow{r}=\left(6\hat{i}+4\hat{j}-3\hat{k}
ight)=12$  on

the coordinate axes.



**6.** If a plane meets the coordinate axes at A,B,C such that the centroid of the triangle ABC is the point (u, v, w), find the equation of the plane.

Watch Video Solution

#### Exercise 67

**1.** Find the non-parametric form of vector equation, and Cartesian eqution of the plane passing through the point (2, 3, 6) and parallel to the straight lines

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

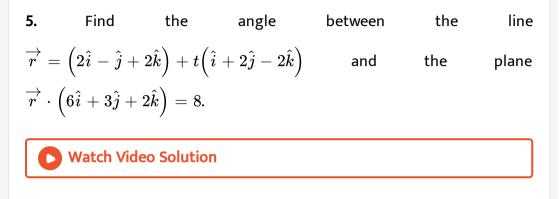
**2.** Find the parametric form of vector equation, and Cartesian equations of the plane passing through the points (2, 2, 1), (9, 3, 6) and perpendicular to the plane 2x + 6y + 6z = 9.

Watch Video Solution

**3.** Find the parametric form vector eqution and Cartesian equations of the plane passing through the points (2, 2, 1), (1, -2, 3) and parallel to the straight line passing through the points (2, 1, -3) and (-1, 5, -8).

## Watch Video Solution

4. Find the non-parametric form of vector equation and Cartesian equation of the plane passing through the point (1, -2, 4) and perpendicular to the plane x + 2y - 3z = 11 and parallel to the line  $\frac{x+7}{3} = \frac{y+3}{-1} = \frac{z}{1}$ .

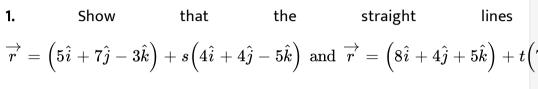


**6.** Find the parametric vector, non-parametric vector and Cartesian form of the equations of the plane passing through the three non-collinear points `(3,6,-2),(-1,-2,6)and(6,4,-2).

Watch Video Solution

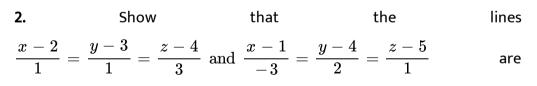
7. Find the non-parametric form of vector equation, and Cartesian equations of the plane  $\overrightarrow{r} = \left(6\hat{i} - \hat{j} + \hat{k}\right) + s\left(-\hat{i} + 2\hat{j} + \hat{k}\right) + t\left(-5\hat{j} - 4\hat{j} - 5\hat{k}\right)$ 

### Exercise 68



are coplanar. Find the vector equation of the plane in which they lie.



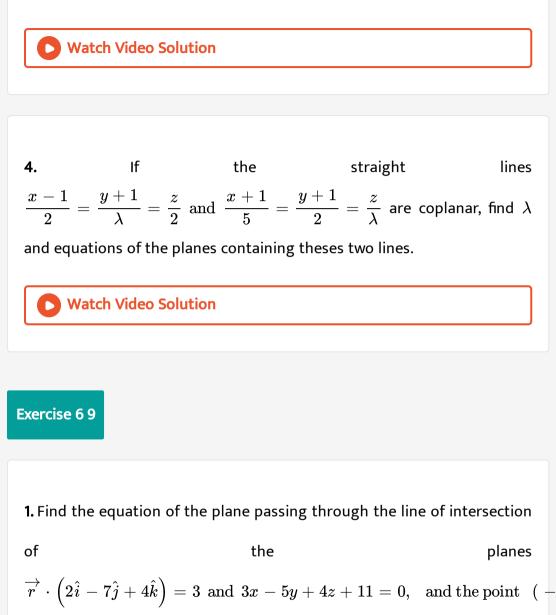


coplanar. Also, find the plane containing these lines.



**3.** If the straight lines 
$$\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{m^2}$$
 and  $\frac{x-3}{1} = \frac{y-2}{m^2} = \frac{z-1}{2}$  are

coplanar, find the distinct real values of m.



**2.** Find the equation of the plane passing through the line of intersection of the planes x +2y + 3z = 2 and x - y + z= 3, and at a distance  $\frac{2}{\sqrt{3}}$  from point (3, 1, -1).

Watch Video Solution  
3. Find the angle between the line  

$$\vec{r} = (2\hat{i} - \hat{j} + 2\hat{k}) + t(\hat{i} + 2\hat{j} - 2\hat{k})$$
 and the plane  
 $\vec{r} \cdot (6\hat{i} + 3\hat{j} + 2\hat{k}) = 8.$   
Watch Video Solution

**4.** Findtheanglebetweentheplanes
$$\overrightarrow{r} \cdot (\hat{i} + \hat{j} - 2\hat{k}) = 3$$
 and  $2x - 2y + z = 2$ A.  $[\overline{\alpha}, \overline{\beta}, \overline{\gamma}] = 1$ B.  $[\overline{\alpha}, \overline{\beta}, \overline{\gamma}] = -1$ 

 $\mathsf{C}.\left[\overline{\alpha},\bar{\beta},\bar{\gamma}\right]=0$ 

D.  $\left[\overline{lpha},ar{eta},ar{\gamma}
ight]=2$ 

#### Answer:

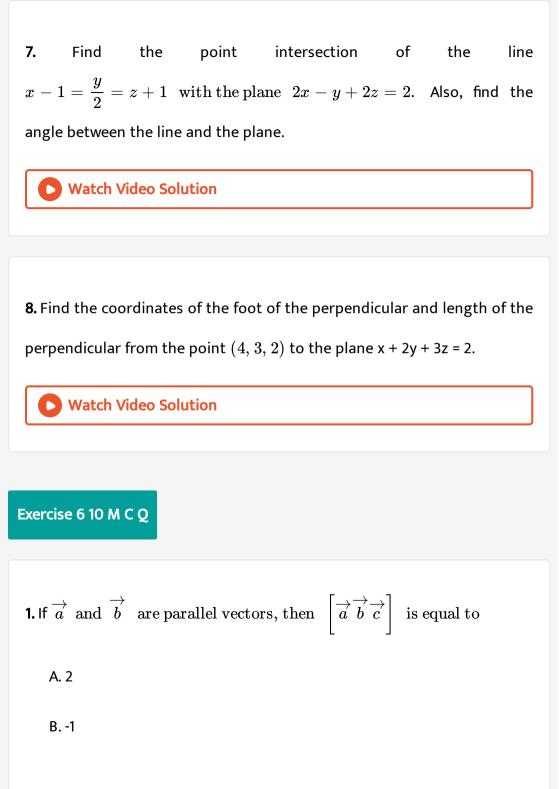
**Watch Video Solution** 

**5.** Find the equation of the plane which passes through the point (3, 4, -1) and is parallel to the plane 2x - 3y + 5z + 7 = 0. Also, find the distance between the two planes.

## Watch Video Solution

**6.** Find the length of the perpendicular from the point (1, -2, 3) to the

plane x - y + z = 5.



C. 1

D. 0

## Answer: d

**2.** If a vector 
$$\overrightarrow{\alpha}$$
 lies in the plane of  $\overrightarrow{\beta}$  and  $\overrightarrow{\gamma}$ , then

A. 
$$\begin{bmatrix} \overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma} \end{bmatrix} = 1$$
  
B.  $\begin{bmatrix} \overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma} \end{bmatrix} = -1$   
C.  $\begin{bmatrix} \overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma} \end{bmatrix} = 0$   
D.  $\begin{bmatrix} \overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma} \end{bmatrix} = 2$ 

## Answer: c

<b>3.</b> If $\overrightarrow{a}$ . $\overrightarrow{b} = \overrightarrow{b}$ . $\overrightarrow{c} = \overrightarrow{c}$ . $\overrightarrow{a} = 0$ ,then the value of $\begin{vmatrix} \overrightarrow{a} & \overrightarrow{b} & \overrightarrow{c} \end{vmatrix}$
is
A. $\left \overrightarrow{a}\right \left \overrightarrow{b}\right \left \overrightarrow{C}\right $
$B.\frac{1}{3} \Big  \overrightarrow{a} \Big  \Big  \overrightarrow{b} \Big  \Big  \overrightarrow{C} \Big $
C. 1
D1
Answer: a

# Watch Video Solution

**4.** If  $\overrightarrow{a}$ ,  $\overrightarrow{b}$ ,  $\overrightarrow{c}$  are three unit vectors such that  $\overrightarrow{a}$  is perpendicular to  $\overrightarrow{b}$ , and is parallel to  $\overrightarrow{c}$  then  $\overrightarrow{a} \times \left(\overrightarrow{b} \times \overrightarrow{c}\right)$  is equal to

A.  $\overrightarrow{a}$ B.  $\overrightarrow{b}$ 

 $\mathsf{C}.\overrightarrow{c}$ 

## Answer: b

## Watch Video Solution

5. If 
$$\left[\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}\right] = 1$$
 then the value of  $\frac{\overrightarrow{a} \cdot \left(\overrightarrow{b} \times \overrightarrow{c}\right)}{\left(\overrightarrow{c} \times \overrightarrow{a}\right) \cdot \overrightarrow{b}} + \frac{\overrightarrow{b} \cdot \left(\overrightarrow{c} \times \overrightarrow{a}\right)}{\left(\overrightarrow{a} \times \overrightarrow{b}\right) \cdot \overrightarrow{c}} + \frac{\overrightarrow{c} \cdot \left(\overrightarrow{a} \times \overrightarrow{b}\right)}{\left(\overrightarrow{c} \times \overrightarrow{b}\right) \cdot \overrightarrow{a}}$  is\_\_\_\_\_  
A.1  
B.-1  
C.2

D. 3

## Answer: a

6. The volume of the parallelepiped with its edges represented by the vectors  $\hat{i}+\hat{j},\,\hat{i}+2\hat{j},\,\hat{i}+\hat{j}+\pi\hat{k}$  is

A. 
$$\frac{\pi}{2}$$
  
B.  $\frac{\pi}{3}$   
C.  $(\pi)$   
D.  $\frac{\pi}{4}$ 

### Answer: c

**Watch Video Solution** 

7. If 
$$\left|\overrightarrow{a}\right| = 2$$
,  $\left|\overrightarrow{b}\right| = 7$  and  $\overrightarrow{a} \times \overrightarrow{b} = 3\hat{i} - 2\hat{j} + 6\hat{k}$  find the angle between  $\overrightarrow{a}$  and  $\overrightarrow{b}$ .

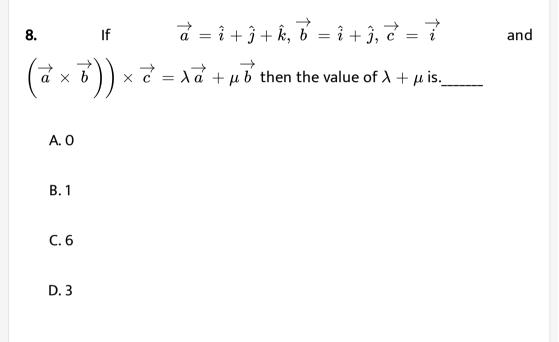
A. 
$$(i)\frac{\pi}{6}(ii)\frac{\pi}{4}(ii)\frac{\pi}{3}(iv)\frac{\pi}{2}$$

Β.

C.

#### Answer: a

# Watch Video Solution



#### Answer: a

### Answer: a



,

**10.** If 
$$\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$$
 are three non-coplanar vectors such that  $\overrightarrow{a} \times \left(\overrightarrow{b} \times \overrightarrow{c}\right) = \frac{b+c}{\sqrt{2}}$ , then the angle between  $\overrightarrow{a}$  and  $\overrightarrow{b}$  is  
A.  $\frac{\pi}{2}$   
B.  $\frac{3\pi}{4}$ 

C. 
$$\frac{\pi}{4}$$
  
D.  $(\pi)$ 

#### Answer: b

Watch Video Solution

11. If the volume of the parallelpiped with  $\overrightarrow{a} \times \overrightarrow{b}, \overrightarrow{b} \times \overrightarrow{c}, \overrightarrow{c} \times \overrightarrow{c} \times \overrightarrow{a}$  as coterminous edges is 8 cubic units, then the volume of the parallelepiped with  $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{b} \times \overrightarrow{c}\right), \left(\overrightarrow{b} \times \overrightarrow{c}\right) \times \left(\overrightarrow{c} \times \overrightarrow{a}\right)$  and  $\left(\overrightarrow{c} \times \overrightarrow{a}\right) \times \left(\overrightarrow{a}$  as coterminous edges is,

A. 64 cubic units

B. 512cubic units

C. 64cubic units

D. 24cubic units

#### Answer: c



12. Consider the vectors,  $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}, \overrightarrow{d}$  such that  $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{c} \times \overrightarrow{d}\right) = \overrightarrow{0}$  Let  $P_1$  and  $P_2$  be the planes determined by the pairs of vectors,  $\overrightarrow{a}, \overrightarrow{b}$  and  $\overrightarrow{c}, \overrightarrow{d}$  respectively. Then the angle between  $P_1$  and  $P_2$  is

A.  $0^{\circ}$ 

B.  $45^{\circ}$ 

C.  $60^{\circ}$ 

D.  $90^{\circ}$ 

#### Answer: a

**13.** if  $(\overrightarrow{a} \times \overrightarrow{b}) \times \overrightarrow{c} = \overrightarrow{a} \times (\overrightarrow{b} \times \overrightarrow{c})$  where  $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$  are any three vectors such that  $\overrightarrow{b}, \overrightarrow{c} \neq 0$  and  $\overrightarrow{a}, \overrightarrow{b} \neq 0$  then  $\overrightarrow{a}$  and  $\overrightarrow{c}$  are\_\_\_\_\_

A. perpendicular

B. parallel

C. inclined at an angle  $\frac{\pi}{3}$ D. inclined at an angle  $\frac{\pi}{6}$ 

#### Answer: b

Watch Video Solution

**14.** If  $\overrightarrow{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ ,  $\overrightarrow{b} = \hat{i} + 2\hat{j} - 5\hat{k}$ ,  $\overrightarrow{c} = 3\hat{i} + 5\hat{j} - \hat{k}$ , then a vector perpendicular to  $\overrightarrow{a}$  and lies in the plane containing  $\overrightarrow{b}$  and  $\overrightarrow{c}$  is

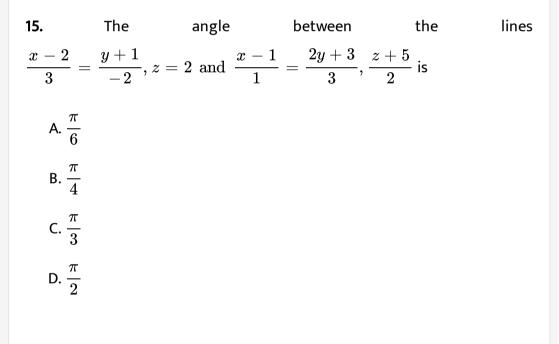
A. 
$$-17\hat{i}+21\hat{j}-97\hat{k}$$
  
B.  $-17\hat{i}+21\hat{j}-123\hat{k}$ 

C. 
$$-17\hat{i}-21\hat{j}+97\hat{k}$$

D. 
$$-17\hat{i}-21\hat{j}-97\hat{k}$$

#### Answer: d





## Answer: d

16. If the line  $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$  lies in the plane  $x + 3y - az + \beta = 0$  then ( is A. (-5,5) B. (-6,7) C. (5, -5) D. (6, -7)

#### Answer: b

# Watch Video Solution

17. The angle between the line  $\overrightarrow{r} = \left(\hat{i} + 2\hat{j} - 3\hat{k}\right) + t\left(2\hat{i} + \hat{j} - 2\hat{k}\right)$ and the plane  $\overrightarrow{r} \cdot \left(\hat{i} + \hat{j}\right) + 4 = 0$  is :

A.  $0^{\circ}$ 

B.  $30^{\circ}$ 

C.  $45^{\circ}$ 

D.  $90^{\circ}$ 

#### Answer: c

18. The coordinates of the point where the line  

$$\overrightarrow{r} = (6\hat{i} - \hat{j} - 3\hat{k}) + t(-\hat{i} + 4\hat{k})$$
 meets the planeb  
 $\overrightarrow{r} \cdot (\hat{i} + \hat{j} - \hat{k}) = 3$  are \_\_\_\_\_\_  
A.  $(2, 1, 0)$   
B.  $(7, -1, -7)$   
C.  $(1, 2, -6)$   
D.  $(5, -1, 1)$ 

## Answer: d

19. Distance from the origin to the plane 3x - 6y + 2z + 7 = 0 is
A. 0
B. 1
C. 2
D. 3

### Answer: b

Watch Video Solution

**20.** The distance between the planes x + 2y + 3z + 7 = 0 and 2x + 4y + 6z + 2y + 3z + 7 = 0

7 = 0 is

A. 
$$\frac{\sqrt{7}}{2\sqrt{2}}$$
  
B. 
$$\frac{7}{2}$$
  
C. 
$$\frac{\sqrt{7}}{2}$$

D. 
$$\frac{7}{2\sqrt{2}}$$

Answer: a



**21.** If direction cosines of a line are  $\frac{1}{c}$ ,  $\frac{1}{c}$ ,  $\frac{1}{c}$ , then.

A.  $c=\pm 3$ 

B.  $c\pm\sqrt{3}$ 

C. cgt0

 ${\sf D}.\, 0 < c < 1$ 

### Answer: b

22. The vector equation  $\overrightarrow{r}=\left(\hat{i}-2\hat{j}-\hat{k}
ight)+t\Bigl(6\hat{j}-\hat{k}\Bigr)$  represents a

straight line passing through the points

A. 
$$(0, 6, -1)$$
 and  $(1, -2, -1)$   
B.  $(0, 6, -1)$  and  $(-1, 4, -2)$   
C.  $(1, -2, -1)$  and  $(1, 4, -2)$   
D.  $(1, -2, -1)$  and  $(0, -6, 1)$ 

> Watch Video Solution

**23.** If the distance of the point (1, 1, 1) from the origin is half of its distance from the plane x + y + z + k = 0, then the value of k are

A.  $\pm 3$ 

 $\mathsf{B.}\pm 6$ 

C. -3, 9

D. 3, -9

## Answer: d

## Watch Video Solution

**24.** If the planes 
$$\overrightarrow{r} \cdot \left(2\hat{i} - \lambda\hat{j} + \hat{k}\right) = 3 \,\, ext{and} \,\, \overrightarrow{r} \left(4\hat{i} + \hat{j} - \mu\hat{k}\right) = 5 \,\, ext{are}$$

parallel, then the value of  $\lambda$  and  $\mu$  are

A. 
$$\frac{1}{2}, -2$$
  
B.  $\frac{-1}{2}, 2$   
C.  $\frac{-1}{2}, -2$   
D.  $\frac{1}{2}, 2$ 

#### Answer: c

25. If the length of the perpendicular from the origin to the plane
$2x+3y+\lambda z=1,\lambda>0 \ \  ext{is} \ \ rac{1}{5} \ \  ext{then the value of is} \ \ \lambda \ \  ext{is}$
A. $2\sqrt{3}$
B. $3\sqrt{2}$
C. 0
D. 1

#### Answer: a

Watch Video Solution

Additional Questions Solved

**1.** The work done by the force  $\overrightarrow{F} = a\hat{i} + \hat{j} + \hat{k}$  in moving the point of application from (1.1.1) 1 (2. 2. 2) along a straight line is given to be 5 units. Find the value of a.

2. If the position vectors of three points A, B and Care respectively  $\overrightarrow{i} + \overrightarrow{j} + 3\overrightarrow{k}$ ,  $4\overrightarrow{i} + \overrightarrow{j} + 5\overrightarrow{k}$  and  $7\left(\overrightarrow{i} + \overrightarrow{k}\right)$ . Find  $\overrightarrow{AB} \times \overrightarrow{AC}$ .

Interpret the result geometrically.

Watch Video Solution

**3.** A force given by and  $3\overrightarrow{i} + 2\overrightarrow{j} - 4\overrightarrow{k}$  is applied at the point (1,-1,2).

Find the moment of the force about the point (2,-1,3).



**4.** Show that the area of a parallelogram having diagonals  $3\overrightarrow{i} + \overrightarrow{j} - 2\overrightarrow{k}$  and  $\overrightarrow{i} + 3\overrightarrow{j} + 4\overrightarrow{k}$  is  $5\sqrt{3}$ .

5. If the edges  $\overrightarrow{a} = -3\overrightarrow{i} + 7\overrightarrow{j} + 5\overrightarrow{k}$ ,  $\overrightarrow{b} = -5\overrightarrow{i} + 7\overrightarrow{j} - 3\overrightarrow{k}$ ,  $\overrightarrow{c} = -7\overrightarrow{i} - 5\overrightarrow{j} - 3\overrightarrow{k}$  meet a vertex, find the volume of the parallelepiped.

Watch Video Solution

**6.** If 
$$\overrightarrow{x} \cdot \overrightarrow{a} = 0$$
,  $\overrightarrow{x} \cdot \overrightarrow{b} = 0$ ,  $\overrightarrow{x} \cdot \overrightarrow{c} = 0$  and  $\overrightarrow{x} \neq \overrightarrow{0}$  then show yhat  $\overrightarrow{a}$ ,  $\overrightarrow{b}$ ,  $\overrightarrow{c}$  are coplanar.

Watch Video Solution

7. The volume of the parallelepiped whose edges are represented by

 $-12\hat{i}+\lambda\hat{k},3\hat{j}-\hat{k},2\hat{I}+\hat{j}-15\hat{k}$  is 546 cubic units. Find the value of  $\lambda$ 

8. Prove that  $\left|\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right| = abc$  if and only if  $\overrightarrow{a}$ ,  $\overrightarrow{b}$ ,  $\overrightarrow{c}$  are mutually

perpendicular.



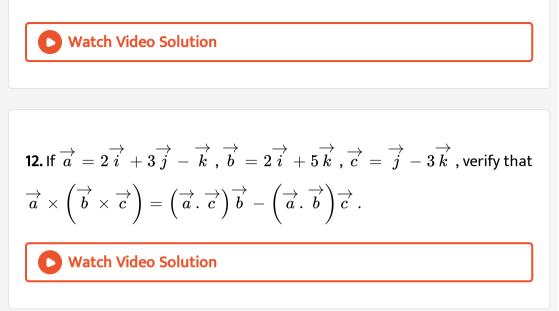
**9.** Show that the points (1, 3, 1), (1, 1,-1), (-1, 1, 1), (2,2, -1) are lying on the same plane.

Watch Video Solution

10. If 
$$\overrightarrow{a} = 2\overrightarrow{i} + 3\overrightarrow{j} - 5\overrightarrow{k}$$
,  $\overrightarrow{b} = -\overrightarrow{i} - \overrightarrow{j} + 2\overrightarrow{k}$  and  
 $\overrightarrow{c} = 4\overrightarrow{i} - 2\overrightarrow{j} + 2\overrightarrow{k}$  Show that  $(\overrightarrow{a} \times \overrightarrow{b}) \times \overrightarrow{c} \neq \overrightarrow{a} \times (\overrightarrow{b} \times \overrightarrow{c})$ .

11. If 
$$\overrightarrow{a} = 3\overrightarrow{i} + 2\overrightarrow{j} - 4\overrightarrow{k}$$
,  $\overrightarrow{b} = 5\overrightarrow{i} - 3\overrightarrow{j} + 6\overrightarrow{k}$ ,  
 $\overrightarrow{c} = 5\overrightarrow{i} + \overrightarrow{j} + 2\overrightarrow{k}$ , fin(i)  $\overrightarrow{a} \times (\overrightarrow{b} \times \overrightarrow{c})$  (ii)  $(\overrightarrow{a} \times \overrightarrow{b}) \times \overrightarrow{c}$  and

show that they are not equal.



**13.** Find the vector and cartesian equations of the straight line passing through the point A with position vector  $3\overrightarrow{i} - \overrightarrow{j} + 4\overrightarrow{k}$  and parallel to the vector  $-5\overrightarrow{i} + 7\overrightarrow{j} + 3\overrightarrow{k}$ .

## Watch Video Solution

14. Find the vector and cartesian equations of the straight line passing

through (-5, 2, 3) and (4, -3, 6).

**15.** Find the angle between the following lines  

$$\vec{r} = 3\vec{i} + 2\vec{j} - \vec{k} + t\left(\vec{i} + 2\vec{j} + 2\vec{k}\right)$$
 and  
 $\vec{r} = 5\vec{j} + 2\vec{k} + s\left(3\vec{i} + 2\vec{j} + 6\vec{k}\right)$ 

**D** Watch Video Solution

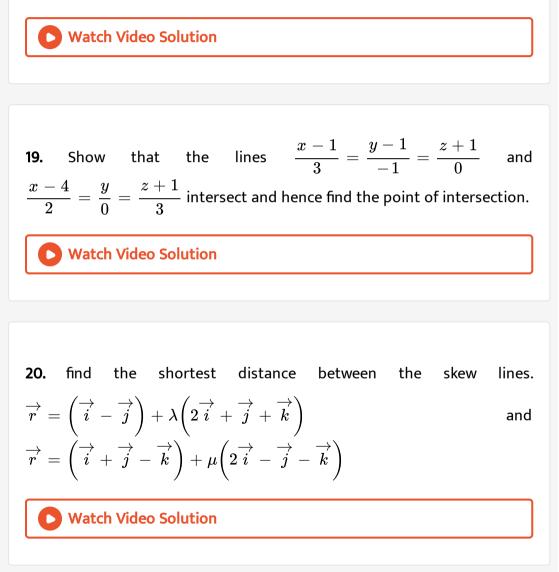
16. Find the angle between the following lines 
$$rac{x-1}{2}=rac{y+1}{3}=rac{z-4}{6}$$

and x+1= 
$$rac{y+2}{2}=rac{z-4}{2}$$

# **Watch Video Solution**

**17.** Find the distance between the parallel lines  
$$\overrightarrow{r} = (\hat{i} - \hat{j}) + t(2\hat{i} - \hat{j} + \hat{k}) \text{ and } \overrightarrow{r} = (2\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} - \hat{j} + \hat{k})$$

**18.** Show that the lines  $\overrightarrow{r} = (\hat{i} - \hat{j}) + t(2\hat{i} + \hat{k})$  and  $\overrightarrow{r} = (2\hat{i} - \hat{j}) + s(\hat{i} + \hat{j} - \hat{k})$  are skew lines and find the distance between them .



**21.** find the shortest distance between the skew lines.  

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

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

Watch Video Solution

**22.** Find the vector and cartesian equations of a plane which is at a distance of 18 units from the origin and which is normal to the vector  $2\overrightarrow{i} + 7\overrightarrow{j} + 8\overrightarrow{k}$ .

Watch Video Solution

23. The unit normal vector to the plane 2x - y + 2z = 5 are .....

24. Find the length of the perpendicular from the origin to the plane

$$\overrightarrow{r}.\left(\overrightarrow{3\,i}+4\,\overrightarrow{j}+12\,\overrightarrow{k}
ight)=26$$

Watch Video Solution

**25.** The foot of the perpendicular drawn from the origin to a plane is 18, equation of the plane.

View Text Solution

**26.** Find the Cartesian equation of the plane through the point with position vector  $2\hat{i} - \hat{j} + \hat{k}$  and perpendicular to the vector  $4\hat{i} + 2\hat{j} - 3\hat{k}$ 

**27.** Find the vector and cartesian equations of the plane passing through

the point (2,-1, 4) and parallel to the plane  $\overrightarrow{r}$ .  $\left(4\overrightarrow{i}-12\overrightarrow{j}-3\overrightarrow{k}\right)=7$ 



28. Find the Vector and Cartesian equation of the plane containing the

$rac{x+1}{3} = rac{y-1}{2} = rac{z+1}{1}$	line $\frac{x-2}{2} = \frac{y-2}{3} = \frac{z-1}{3}$	and	parallel	to	the	line

Watch Video Solution

29. Find the vector and cartesian equation of the plane passing through

the point (1, 3, 2) and parallel to the lines \*  $\frac{x+1}{2} = \frac{y+2}{-1} = \frac{z+3}{3}$ and  $\frac{x-2}{1} = \frac{y+1}{2} = \frac{z+2}{2}$ .

**30.** Find the vector and cartesian equations of the plane passing through the point (-1,3,2) and perpendicular to the planes.x + 2y + 2=5 and 3x+y+2z=8.

**31.** Find the vector and cartesian equations of the plane passing through the points A(1, -2, 3) and B(-1,2,-1) and is parallel to the line  $\frac{x-2}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ .

Watch Video Solution

**32.** Find the vector and certesian equation of the plane through the points (1, 2, 3) and (2, 3, 1) and perpendicular to the plane  $\vec{r} \cdot (3\hat{i} - 2\hat{j} + 4\hat{k}) = 5.$ 

33. Find the vector and cartesian equations of the plane containing the

line  $\frac{x-2}{2} = \frac{y-2}{3} = \frac{z-1}{-2}$  and passing through the point (-1, 1,-1).

Watch Video Solution

34. Derive the equation of the plane in the intercept form.

Watch Video Solution  
**35.** Find the Cartesian form of the equation of the plane  

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

Watch Video Solution

**36.** Show that the straigh lines  $\overrightarrow{r} = \left(\overrightarrow{i} + \overrightarrow{j} - \overrightarrow{k}\right) + \lambda \left(3\overrightarrow{i} - \overrightarrow{j}\right)$  $\overrightarrow{r} = \left(4\overrightarrow{i} - \overrightarrow{k}\right) + \mu \left(2\overrightarrow{i} + 3\overrightarrow{k}\right)$  are coplanar . Find the vector

equation of the which they lie.

**37.** If the straight lines  

$$\frac{x-1}{2} = \frac{y+1}{\lambda} = \frac{z}{2} \text{ and } \frac{x+1}{5} = \frac{y+1}{2} = \frac{z}{\lambda} \text{ are coplanar, find } \lambda$$
and equations of the planes containing theses two lines.  
**38.** 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 find the value of k.  
**38.** Watch Video Solution

**39.** Show that the lines  $\frac{x+3}{-3} = \frac{y-1}{1} = \frac{z-5}{5}$  and  $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$  are coplanar .Al,so find the equation of the

plane containing these two lines.

**40.** Find the point of intersection of the line passing through the two points (1, 1, -1), (-1, 0, 1) and the xy-plane.



**41.** Find the coordinates of the point where the line  

$$\overrightarrow{r} = (\hat{i} + 2\hat{j} - 5\hat{k}) + t(2\hat{i} - 3\hat{j} + 4\hat{k})$$
 meets the plane  
 $\overrightarrow{r} \cdot (2\overrightarrow{i} + 4\overrightarrow{j} - \overrightarrow{k}) = 3.$ 

**Watch Video Solution** 

**42.** Find the point of intersection of the line  

$$\overrightarrow{r} = \left(\overrightarrow{j} - \overrightarrow{k}\right) + s\left(2\overrightarrow{i} - \overrightarrow{j} + \overrightarrow{k}\right)$$
 and Xz-plane

**43.** Find the meeting point of the line  

$$\overrightarrow{r} = \left(2\overrightarrow{i} + \overrightarrow{j} - 3\overrightarrow{k}\right) + t\left(2\overrightarrow{i} - \overrightarrow{j} - \overrightarrow{k}\right)$$
 and the x - 2y + 3z + 7 = 0.  
**Watch Video Solution**

# **44.** Show that the following planes are at right angles:

$$\overrightarrow{r}.\left(2\overrightarrow{i}+\overrightarrow{j}+\overrightarrow{k}
ight)=15$$
 and  $\overrightarrow{r}.\left(\overrightarrow{i}+\overrightarrow{j}-3\overrightarrow{k}
ight)=3$  .

**Watch Video Solution** 

**45.** The planes 
$$\overrightarrow{r}.\left(2\overrightarrow{+}\lambda\overrightarrow{j}-3\overrightarrow{k}\right)=10$$
 and

$$\overrightarrow{r}.\left(\lambda\overrightarrow{+}3\overrightarrow{j}+\overrightarrow{k}
ight)=5$$
 are perpendicular. Find  $\lambda$ 

46. Find the angle between the line 
$$\frac{x-2}{3} = \frac{y-1}{-1} = \frac{z-3}{2}$$
 and the plane  $3x + 4y + z + 5 = 0$ .

**47.** Find the angle between the line  $\overrightarrow{r} = \overrightarrow{i} + \overrightarrow{j} + 3\overrightarrow{k} + \lambda\left(2\overrightarrow{i} + \overrightarrow{j} - \overrightarrow{k}\right)$  and the plane  $\overrightarrow{r} \cdot \left(\overrightarrow{i} + \overrightarrow{j}\right) = 1$ 

Watch Video Solution

**48.** If 
$$\overrightarrow{a} = 2\overrightarrow{i} + \overrightarrow{j} - \overrightarrow{k}$$
,  $\overrightarrow{b} = \overrightarrow{i} + 2\overrightarrow{j} + \overrightarrow{k}$  and  $\overrightarrow{c} = \overrightarrow{i} - \overrightarrow{j} + 2\overrightarrow{k}$  then  $\overrightarrow{a} \cdot (\overrightarrow{b} \times \overrightarrow{c}) =$ 

A. 6

B. 10

C. 12

D. 24

Answer: (c)



$$ec{a} = \hat{i} - \hat{k}, ec{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}, ec{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}$$
show that  $\left[ec{a}, ec{b}, ec{c}
ight]$  depends on neither .x nor y.

If

#### A. onlyx

B. onlyy

C. Neither x or y

D. Both x and y

#### Answer: c

## Watch Video Solution

**50.** If  $\overrightarrow{a}$ ,  $\overrightarrow{b}$ ,  $\overrightarrow{c}$  are three non-coplanar vector and  $\overrightarrow{p}$ ,  $\overrightarrow{q}$ ,  $\overrightarrow{r}$  are defind by the relations  $\overrightarrow{p} = \frac{\overrightarrow{b} \times \overrightarrow{c}}{\left[\overrightarrow{a} \overrightarrow{b} \overrightarrow{c}\right]}$ ,  $\overrightarrow{q} = \frac{\overrightarrow{c} \times \overrightarrow{a}}{\left[\overrightarrow{a} \overrightarrow{b} \overrightarrow{c}\right]}$ ,  $\overrightarrow{r} = \frac{\overrightarrow{a} \times \overrightarrow{b}}{\left[\overrightarrow{a} \overrightarrow{b} \overrightarrow{c}\right]}$ ,

then 
$$\overrightarrow{p}$$
.  $\left(\overrightarrow{a} + \overrightarrow{b}\right) + \overrightarrow{q}$ .  $\left(\overrightarrow{b} + \overrightarrow{c}\right) + \overrightarrow{r}$ .  $\left(\overrightarrow{c} + \overrightarrow{a}\right)$  =.....

A. 0

B. 1

C. 2

D. 3

Answer: d

**Watch Video Solution** 

51. The value of 
$$\hat{i}.$$
  $\left(\hat{j} imes\hat{k}
ight)+\hat{j}.$   $\left(\hat{k} imes\hat{i}
ight)+\hat{k}.$   $\left(\hat{j} imes\hat{i}
ight)$  =.....

A. 1

B. 3

C. -3

D. 0

### Answer: A



**52.** Let a, b, c be distinct non-negative numbers. If the vectors  $a\hat{i} + a\hat{j} + c\hat{k}$ ,  $\hat{i} + \hat{k}$  and  $c\hat{i} + c\hat{j} + b\hat{k}$  lies in a plane then c is

A. the A.M of a and b

B. the G.M of a and b

C. the H.M of a and b

D. equal to zero

Answer: b



53. The value of  $\hat{i}.\left(\hat{j} imes\hat{k}
ight)+\left(\hat{i} imes\hat{k}
ight).\hat{j}$  ......

A. 1

 $\mathsf{B.}-1$ 

C. 0

D.  $\hat{j}$ 

#### Answer: c

Watch Video Solution

**54.** The value of 
$$\left[\hat{i}-\hat{j},\hat{j}-\hat{k},\hat{k}-\hat{i}
ight]$$
 is :

A. 0

B. 1

C. 2

D. 3

#### Answer: a

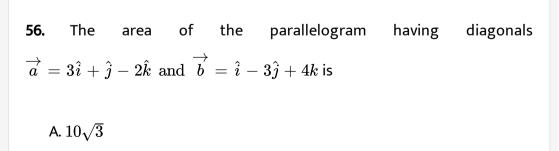
55. Show that  

$$\overrightarrow{a} \times (\overrightarrow{b} + \overrightarrow{c}) + \overrightarrow{b} \times (\overrightarrow{c} + \overrightarrow{a}) + \overrightarrow{c} \times (\overrightarrow{a} + \overrightarrow{b}) = \overrightarrow{0}$$
.  
A.  $\overrightarrow{u}$  is a unit vector  
B.  $\overrightarrow{u} = \overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c}$   
C.  $\overrightarrow{u} = \overrightarrow{0}$ 

D. 
$$\overrightarrow{u} \neq \overrightarrow{0}$$

Watch Video Solution

#### Answer: c

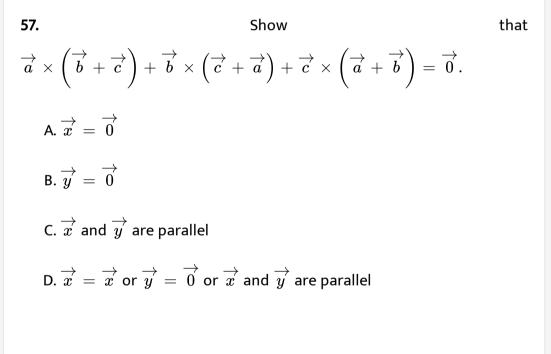


B.  $6\sqrt{30}$ 

C. 
$$\frac{3}{2}\sqrt{30}$$
  
D.  $3\sqrt{30}$ 

Answer: d





Answer: d

**58.** If  $\overline{PR} = 2\hat{i} + \hat{j} + \hat{k}, \overline{QS} = \hat{i} + 3\hat{j} + 2\hat{k}$ , then the area of the quadrilateral PQRS is

A.  $5\sqrt{3}$ B.  $10\sqrt{3}$ C.  $\frac{5\sqrt{3}}{2}$ D.  $\frac{3}{2}$ 

#### Answer: c

Watch Video Solution

**59.** if 
$$(\overrightarrow{a} \times \overrightarrow{b}) \times \overrightarrow{c} = \overrightarrow{a} \times (\overrightarrow{b} \times \overrightarrow{c})$$
 where  $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$  are any three vectors such that  $\overrightarrow{b}, \overrightarrow{c} \neq 0$  and  $\overrightarrow{a}, \overrightarrow{b} \neq 0$  then  $\overrightarrow{a}$  and  $\overrightarrow{c}$  are

A. 
$$\overrightarrow{a}$$
 parellel to  $\overrightarrow{b}$ 

B.  $\overrightarrow{b}$  parellel to  $\overrightarrow{c}$ 

C.  $\overrightarrow{c}$  parellel to  $\overrightarrow{a}$ 

D. 
$$\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = \overrightarrow{0}$$

Answer: c