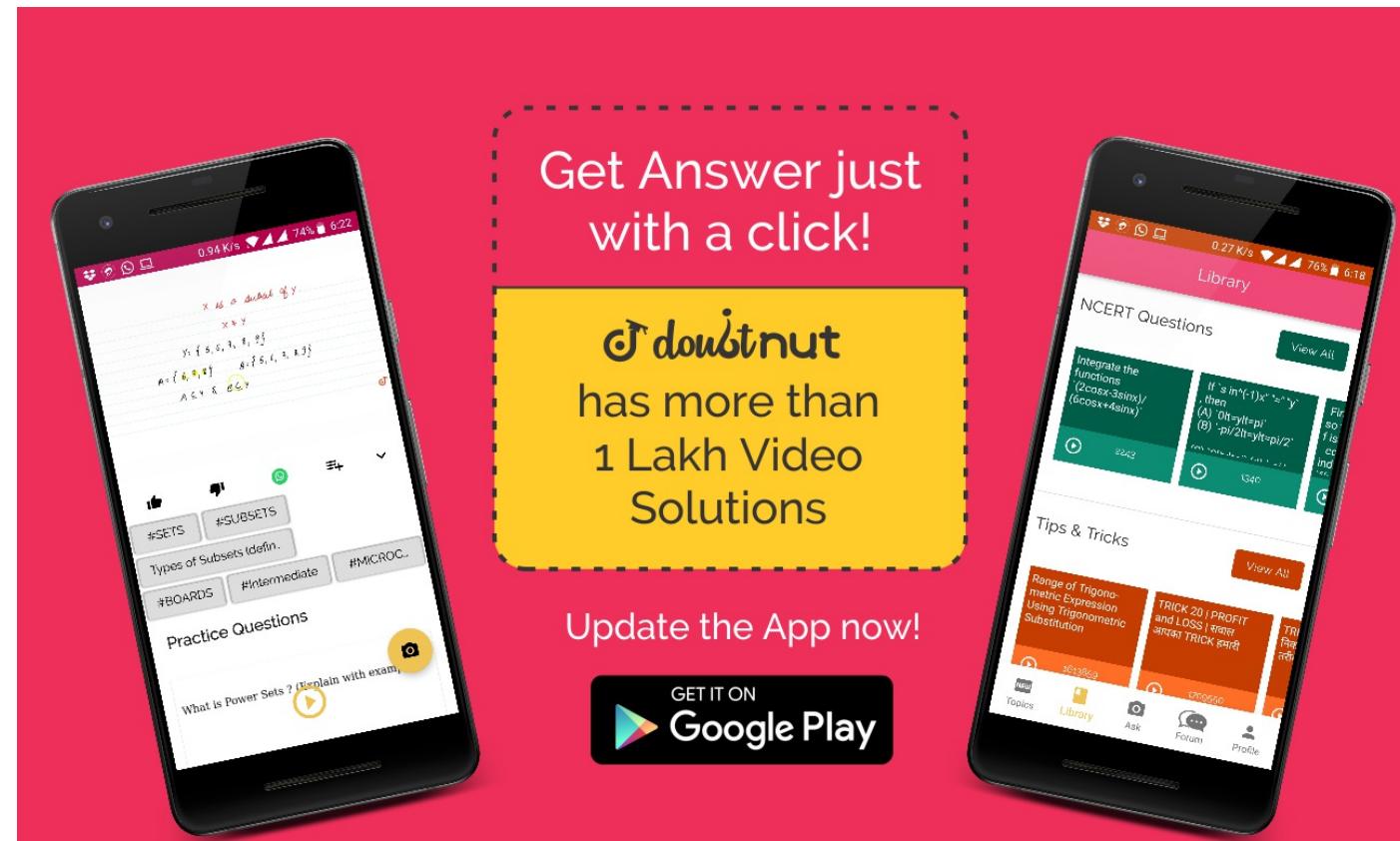


## CHAPTER VECTOR ALGEBRA || VECTORS AND 3D GEOMETRY

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Ques No.	Question
1	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA&gt;Addition Of Vector</b> AND 3D <b>GEOMETRY_VECTOR</b></p> <p>If vector <math>\vec{a} + \vec{b}</math> bisects the angle between <math>\vec{a}</math> and <math>\vec{b}</math>, then prove that <math> \vec{a}  =  \vec{b} </math>.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
2	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA&gt;Addition Of Vector</b> AND 3D <b>GEOMETRY_VECTOR</b></p> <p>if <math>\vec{AO} + \vec{OB} = \vec{BO} + \vec{OC}</math>, then prove that B is the midpoint of AC.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
3	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA&gt;Addition Of Vector</b> AND 3D <b>GEOMETRY_VECTOR</b></p> <p>ABCDE is a pentagon .prove that the resultant of force <math>\vec{AB}</math>, <math>\vec{AE}</math>, <math>\vec{BC}</math>, <math>\vec{DC}</math>, <math>\vec{ED}</math> and <math>\vec{AC}</math>,is <math>3\vec{AC}</math>.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
4	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA&gt;Addition Of Vector</b> AND 3D <b>GEOMETRY_VECTOR</b></p> <p>Prove that the resultant of two forces acting at point O and represented by <math>\vec{OB}</math> and <math>\vec{OC}</math> is given by <math>2\vec{OD}</math>,where D is the midpoint of BC.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
5	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA&gt;Addition Of Vector</b> AND 3D <b>GEOMETRY_VECTOR</b></p> <p>Prove that the sum of three vectors determined by the medians of a triangle directed from the vertices is zero.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>



**CENGAGE\_MATHS\_VECTORS  
ALGEBRA>Addition Of Vector**

AND

3D

**GEOMETRY\_VECTOR**

6

ABC is a triangle and P any point on BC. if  $\vec{PQ}$  is the sum of  $\vec{AP} + \vec{PB} + \vec{PC}$ , show that ABPQ is a parallelogram and Q , therefore , is a fixed point.

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA>Addition Of Vector**

AND

3D

**GEOMETRY\_VECTOR**

Two forces  $\vec{AB}$  and  $\vec{AD}$  are acting at vertex A of a quadrilateral ABCD and two forces  $\vec{CB}$  and  $\vec{CD}$  at C prove that their resultant is given by  $4\vec{EF}$  , where E and F are the midpoints of AC and BD, respectively.

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA>Components Of A Vector**

AND

3D

**GEOMETRY\_VECTOR**

A unit vector of modulus 2 is equally inclined to  $x$  - and  $y$  -axes at an angle  $\pi / 3$  . Find the length of projection of the vector on the  $z$  -axis.

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA>Components Of A Vector**

AND

3D

**GEOMETRY\_VECTOR**

If the projections of vector  $\vec{a}$  on  $x$  -,  $y$  - and  $z$  -axes are 2, 1 and 2 units ,respectively, find the angle at which vector  $\vec{a}$  is inclined to the  $z$  -axis.

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Find a vector in the direction of the vector  $5\hat{i} - \hat{j} + 2\hat{k}$  which has magnitude 8 units.

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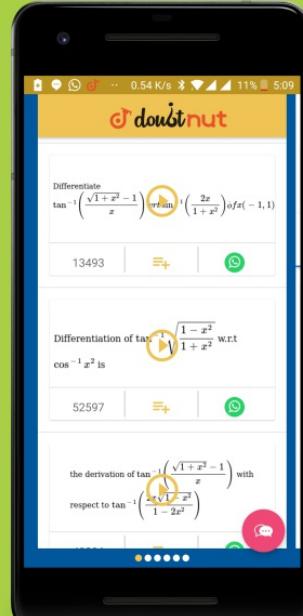
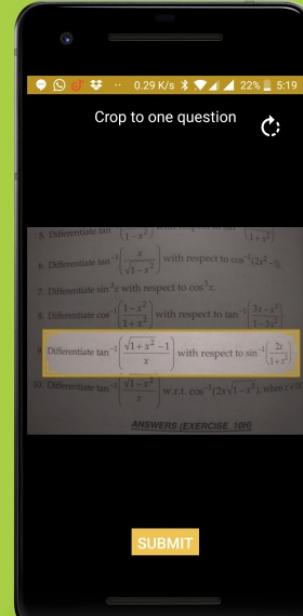
**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Joining Two Points**

Find the unit vector in the direction of vector  $\vec{PQ}$ , where  $P$  and  $Q$  are the points (1,2,3) and (4,5,6), respectively.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Joining Two Points**

For given vector,  $\vec{a} = 2\hat{i} + 2\hat{k}$  and  $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$ , find the unit vector in the direction of the vector  $\vec{a} + \vec{b}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Joining Two Points**

Show that the point  $A$ ,  $B$  and  $C$  with position vectors  $\vec{a} = 3\hat{i} - 4\hat{j} - 4\hat{k} = 2\hat{i} + \hat{k}$  and  $\vec{c} = \hat{i} - 3\hat{j} - 5\hat{k}$ , respectively from the vertices of a right angled triangle.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Joining Two Points**

If  $2\vec{AC} = 3\vec{CB}$ , then prove that  $2\vec{OA} = 3\vec{CB}$  then prove that  $2\vec{OA} + 3\vec{OB} = 5$

$\vec{OC}$  where  $O$  is the origin.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Joining Two Points**

15 Prove that point  $\hat{i} + 2\hat{j} - 3\hat{k}$ ,  $2\hat{i} - \hat{j} + \hat{k}$  and  $2\hat{i} + 5\hat{j} - \hat{k}$  from a triangle in space.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Section Formula**

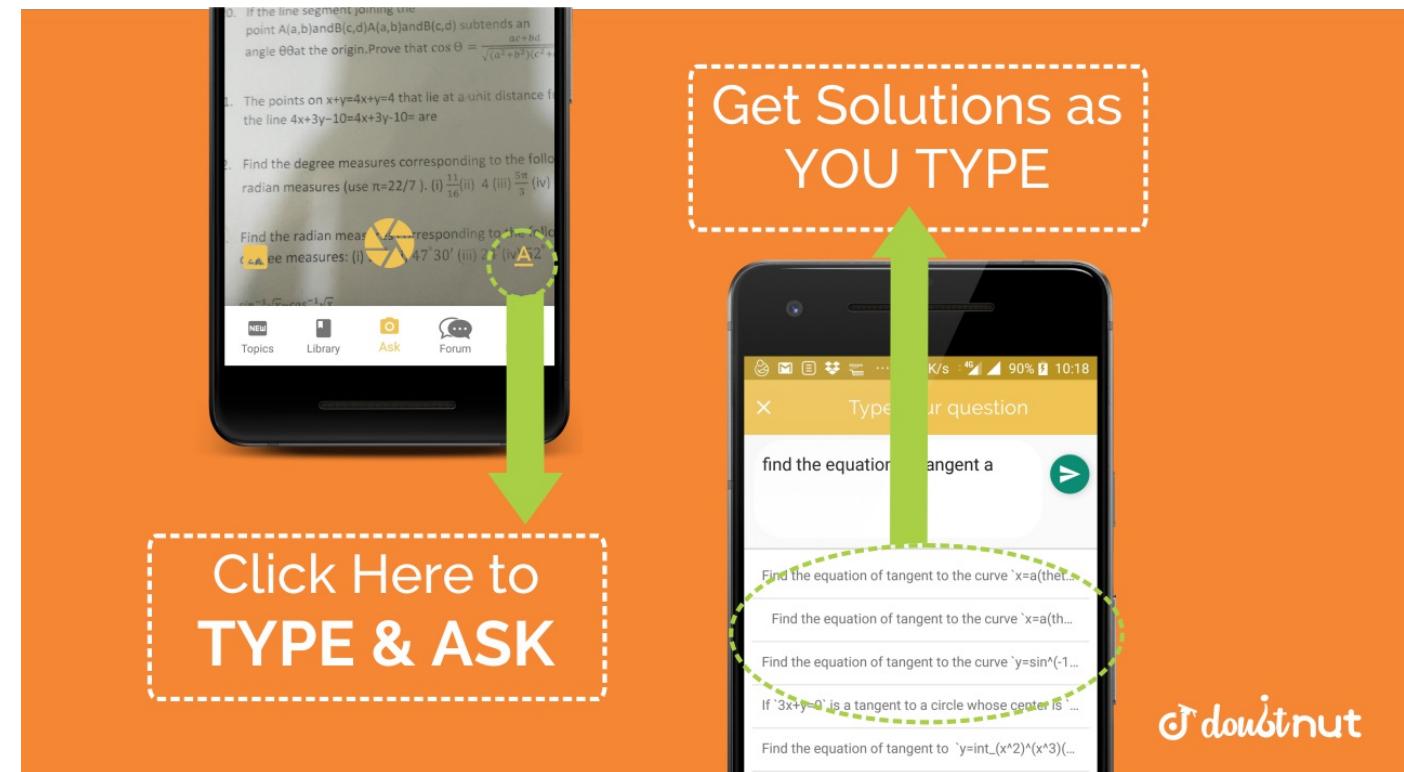
16 If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$ ,  $\vec{d}$  are the position vector of point  $A$ ,  $B$ ,  $C$  and  $D$ , respectively referred to the same origin  $O$  such that no three of these points are collinear and  $\vec{a} + \vec{c} = \vec{b} + \vec{d}$ , then prove that quadrilateral  $ABCD$  is a parallelogram.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Section Formula**

17 Find the point of intersection of AB and  $A(-6, -7, 0)$ ,  $B(16, -19, -4)$ ,  $C(0, 3, -6)$  and  $D(2, -5, 10)$ .

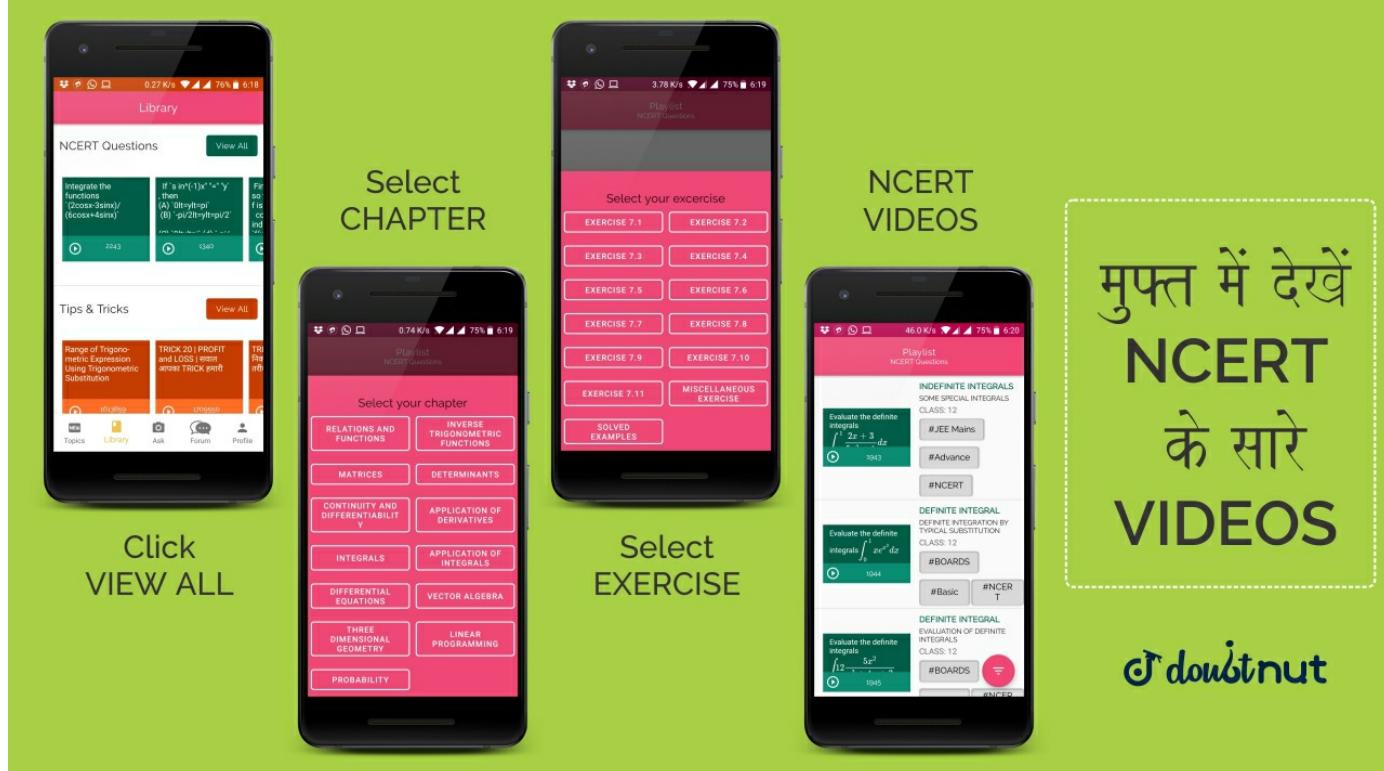
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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Section Formula**

18 Find the angle of vector  $\vec{a} = 6\hat{i} + 2\hat{j} - 3\hat{k}$  with  $x$ -axis.

	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Section Formula</b>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
19	The lines joining the vertices of a tetrahedron to the centroids of opposite faces are concurrent.			
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20	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Section Formula</b>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
	The midpoint of two opposite sides of a quadrilateral and the midpoint of the diagonals are the vertices of a parallelogram. Prove that using vectors.			
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21	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
	Check whether the three vectors $2\hat{i} + 2\hat{j} + 3\hat{k}$ , $-3\hat{i} + 3\hat{j} + 2\hat{k}$ and $3\hat{i} + 4\hat{k}$ from a triangle or not			
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22	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
	Find the resultant of vectors $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 4\hat{k}$ . Find the unit vector in the direction of the resultant vector.			
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23	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
	If in parallelogram ABCD, diagonal vectors are $\vec{AC} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{BD} = -6\hat{i} + 7\hat{j} - 2\hat{k}$ , then find the adjacent side vectors $\vec{AB}$ and $\vec{AD}$			
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	<b>CENGAGE_MATHS_VECTORS</b> <b>ALGEBRA_Miscellaneous</b>	AND	3D	<b>GEOMETRY_VECTOR</b>
24	If two sides of a triangle are $\hat{i} + 2\hat{j}$ and $\hat{i} + \hat{k}$ , then find the length of the third side.	<a href="#">Watch Free Video Solution on Doubtnut</a>		
25	<b>CENGAGE_MATHS_VECTORS</b> <b>ALGEBRA_Miscellaneous</b> <p>Three coinitial vectors of magnitudes <math>a</math>, <math>2a</math> and <math>3a</math> meet at a point and their directions are along the diagonals of three adjacent faces of a cube. Determine their resultant <math>R</math>. Also prove that the sum of the three vectors determined by the diagonals of three adjacent faces of a cube passing through the same corner, the vectors being directed from the corner, is twice the vector determined by the diagonal of the cube.</p>	<a href="#">Watch Free Video Solution on Doubtnut</a>	3D	<b>GEOMETRY_VECTOR</b>
26	<b>CENGAGE_MATHS_VECTORS</b> <b>ALGEBRA_Miscellaneous</b> <p>The axes of coordinates are rotated about the <math>z</math>-axis through an angle of <math>\pi/4</math> in the anticlockwise direction and the components of a vector are <math>2\sqrt{2}</math>, <math>3\sqrt{2}</math>, 4. Prove that the components of the same vector in the original system are -1, 5, 4.</p>	<a href="#">Watch Free Video Solution on Doubtnut</a>	3D	<b>GEOMETRY_VECTOR</b>
27	<b>CENGAGE_MATHS_VECTORS</b> <b>ALGEBRA_Miscellaneous</b> <p>If the resultant of two forces is equal in magnitude to one of the components and perpendicular to its direction, find the other components using the vector method.</p>	<a href="#">Watch Free Video Solution on Doubtnut</a>	3D	<b>GEOMETRY_VECTOR</b>
28	<b>CENGAGE_MATHS_VECTORS</b> <b>ALGEBRA_Miscellaneous</b> <p>A man travelling towards east at 8 km/h finds that the wind seems to blow directly from the north. On doubling the speed, he finds that it appears to come from the north-east.</p>		3D	<b>GEOMETRY_VECTOR</b>

Find the velocity of the wind.

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Miscellaneous**

AND

3D

**GEOMETRY\_VECTOR**

OABCDE is a regular hexagon of side 2 units in the XY-plane in the first quadrant. O being the origin and OA taken along the x-axis. A point P is taken on a line parallel to the z-axis through the centre of the hexagon at a distance of 3 unit from O in the positive Z direction. Then find vector AP.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Along The Bisector Of Given Two Vectors**

If

$$\vec{a} = 7\hat{i} - 4\hat{k} \text{ and } \vec{b} = -2\hat{i} - \hat{j} + 2\hat{k},$$

determine vector  $\vec{c}$  along the internal bisector of the angle between of the angle

between vectors  $\vec{a}$  and  $\vec{b}$  such that  $|\vec{c}| = 5\sqrt{6}$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

Find a unit vector  $\vec{c}$  if  $\vec{i} + \vec{j} - \vec{k}$  bisects the angle between  $\vec{c}$  and  $3\vec{i} + 4\vec{j}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

The vectors  $2\hat{i} + 3\hat{j}$ ,  $5\hat{i} + 6\hat{j}$  and  $8\hat{i} + \lambda\hat{j}$  have initial points at  $(1, 1)$ . Find the value of  $\lambda$  so that the vectors terminate on one straight line.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are three non-zero vectors, no two of which are collinear,  $\vec{a} + 2\vec{b}$  is collinear with  $\vec{c}$  and  $\vec{b} + 3\vec{c}$  is collinear with  $\vec{a}$ , then find the value of  $|\vec{a} + 2\vec{b} + 6\vec{c}|$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

i. Prove that the points

$$\vec{a} - 2\vec{b} + 3\vec{c}, 2\vec{a} + 3\vec{b}$$

$$- 4\vec{c}$$
 and  $- 7\vec{b} + 10\vec{c}$

are collinear, where  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are non-coplanar. ii. Prove that the points  $A(1, 2, 3)$ ,  $B(3, 4, 7)$ ,

and  $C(-3, -2, -5)$

are collinear. find the ratio in which point C divides AB.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

Check whether the given three vectors are coplanar or non-coplanar.

$$-2\hat{i} - 2\hat{j} + 4\hat{k}, \quad -2\hat{i} + 4\hat{j}, \\ 4\hat{i} - 2\hat{j} - 2\hat{k}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors

Prove that the four points

$$6\hat{i} - 7\hat{j}, 16\hat{i} - 19\hat{j} - 4\hat{k}, 3\hat{j}$$

$$- 6\hat{k} \text{ and } 2\hat{i} + 5\hat{j} + 10\hat{k}$$

form a tetrahedron in space.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors

If  $\vec{a}$  and  $\vec{b}$  are two non-collinear vectors, show that points  $l_1\vec{a} + m_1\vec{b}$ ,  $l_2\vec{a} + m_2\vec{b}$  and  $l_3\vec{a} + m_3\vec{b}$  are collinear if  $|l_1l_2l_3m_1m_2m_3| = 0$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors

Vectors  $\vec{a}$  and  $\vec{b}$  are non-collinear. Find for what value of  $n$  vectors  $\vec{c} = (n-2)\vec{a}$

$$+ \vec{b} \text{ and } \vec{d} = (2n+1)\vec{a}$$

$$- \vec{b}$$

are collinear?

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### **CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

39

The median AD of the triangle ABC is bisected at E and BE meets AC at F. Find AF:FC.

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### **CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

Prove that the necessary and sufficient condition for any four points in three-dimensional space to be coplanar is that there exists a liner relation connecting their position vectors such that the algebraic sum of the coefficients (not all zero) in it is zero.

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### **CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are non-coplanar vectors, prove that the four points  
 $2\vec{a} + 3\vec{b} - \vec{c}$ ,  $\vec{a} - 2\vec{b} + 3\vec{c}$ ,  $3\vec{a} + \vec{b} - 2\vec{c}$  and  $\vec{a} - 6\vec{b} + 6\vec{c}$  are coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

Points

$$A\left(\vec{a}\right), B\left(\vec{b}\right),$$

$$C\left(\vec{c}\right) \text{ and } D\left(\vec{d}\right)$$

are related as  $x\vec{a} + y\vec{b} + z\vec{c} + w\vec{d} = 0$  and  $x + y + z + w = 0$ ,

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where  $x, y, z,$  and  $w$

are scalars (sum of any two of  $x, y, z$  and  $w$  is not zero). Prove that if  $A, B, C$  and  $D$  are concyclic, then

$$\begin{aligned}|xy|\left|\vec{a} - \vec{b}\right|^2 \\= |wz|\left|\vec{c} - \vec{d}\right|^2.\end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

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Find the unit vector in the direction of the vector  $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

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Find the direction cosines of the vector  $\hat{i} + 2\hat{j} + 3\hat{k}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

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Find the direction cosines of the vector joining the points

$$A(1, 2, -3)\hat{a}$$

$$\cap B(-1, -2, 1)$$

directed from  $A \rightarrow B$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

46

The position vectors of  $P$  and  $Q$  are  $5\hat{i} + 4\hat{j} + a\hat{k}$  and  $-\hat{i} + 2\hat{j} - 2\hat{k}$ , respectively. If the distance between them is 7, then find the value of  $a$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors

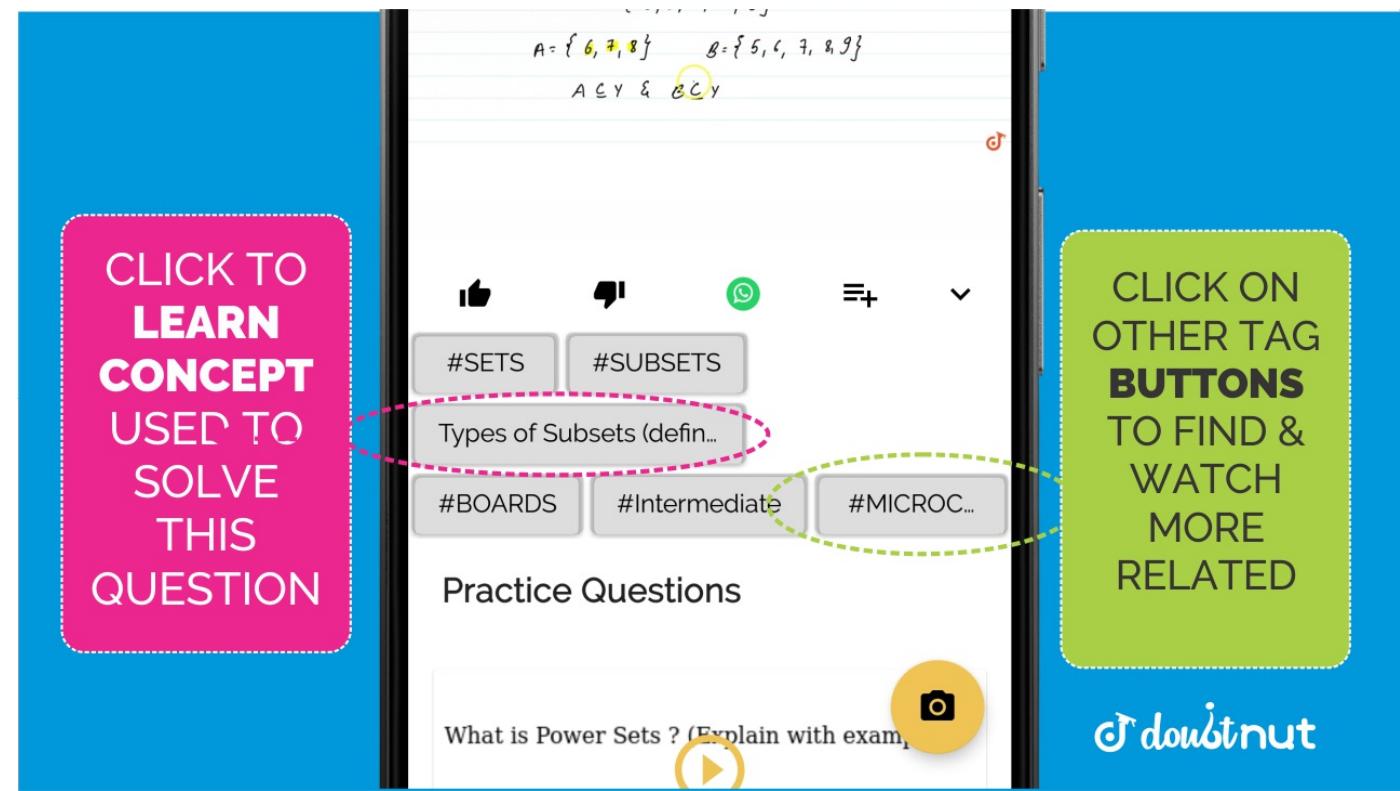
Given three points are

$$A(-3, -2, 0),$$

$$B(3, -3, 1) \text{ and } C(5, 0, 2).$$

Then find a vector having the same direction as that of  $\vec{AB}$  and magnitude equal to  $|\vec{AC}|$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors

Find a vector magnitude 5 units, and parallel to the resultant of the vectors  $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$  and  $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

Show that the points

$$A(1, -2, -8),$$

$$B(5, 0, -2) \text{ and } C(1, 3, 7)$$

are collinear, and find the ratio in which  $B$  divides  $AC$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

If  $ABCD$  is a rhombus whose diagonals cut at the origin  $O$ , then proved that

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$$\vec{OA} + \vec{OB} + \vec{OC} + \vec{OD} + \vec{O}.$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

Let  $D, E$  and  $F$  be the middle points of the sides  $BC, CA$  and  $AB$ , respectively of a triangle  $ABC$ . Then prove that  $\vec{AD} + \vec{BE} + \vec{CF} = \vec{0}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

Let  $ABCD$  be a parallelogram whose diagonals intersect at  $P$  and let  $O$  be the origin. Then prove that

$$\begin{aligned}\vec{OA} + \vec{OB} + \vec{OC} + \vec{OD} \\ = 4\vec{OP}.\end{aligned}$$

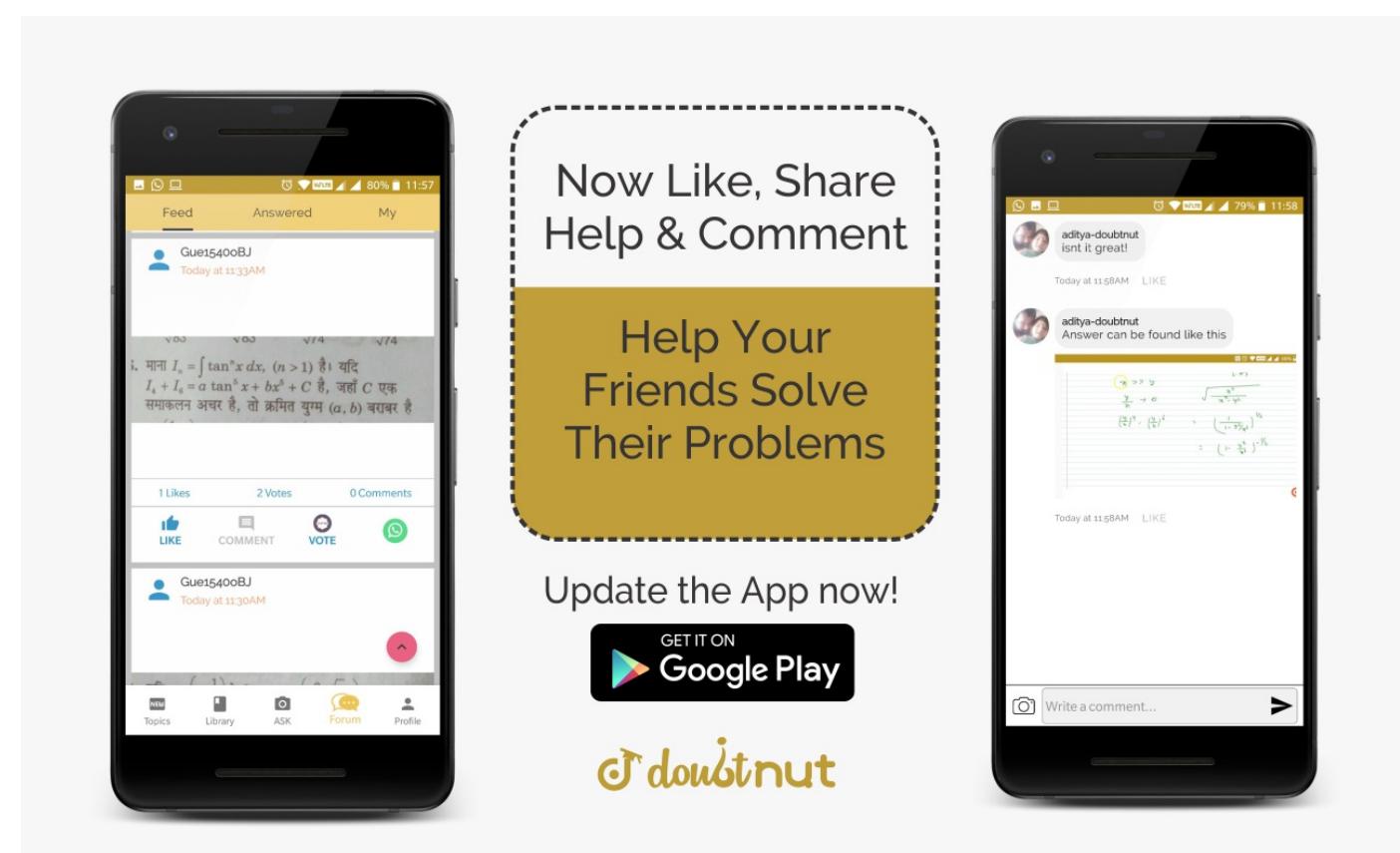
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

If  $ABCD$  is quadrilateral and  $E$  and  $F$  are the mid-points of  $AC$  and  $BD$  respectively, prove that  $\vec{AB} + \vec{AD} + \vec{CB} + \vec{CD} = 4\vec{EF}$ .

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**Combination Linear Independence And Linear Dependence**

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If  $\vec{AO} + \vec{OB} = \vec{BO} + \vec{OC}$ , then  $A, B$  and  $C$  are (where  $O$  is the origin) a. coplanar b. collinear c. non-collinear d. none of these

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

$ABCD$  is a parallelogram. If  $L$  and  $M$  are the mid-points of  $BC$  and  $DC$  respectively, then express  $\vec{AL}$  and  $\vec{AM}$  in terms of  $\vec{AB}$  and  $\vec{AD}$ . Also, prove that  $\vec{AL} + \vec{AM} = \frac{3}{2}\vec{AC}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

$ABCD$  is a quadrilateral and  $E$  is the point of intersection of the lines joining the middle points of opposite side. Show that the resultant of

$$\vec{OA}, \vec{OB}, \vec{OC}$$

$$\text{and } \vec{OD} = 4\vec{OE}, \text{ where } O \text{ is any point.}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

What is the unit vector parallel to  $\vec{a} = 3\hat{i} + 4\hat{j} - 2\hat{k}$ ? What vector should be added to  $\vec{a}$  so that the resultant is the unit vector  $\hat{i}$ ?

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

The position vectors of points  $A$  and  $B$  w.r.t. the origin are  $\vec{a} = \hat{i} + 3\hat{j} - 2\hat{k}$ ,  $\vec{b} = 3\hat{i} + \hat{j} - 2\hat{k}$  respectively. Determine vector  $\vec{OP}$  which bisects angle  $AOB$ , where  $P$  is a point on  $AB$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If  $\vec{r}_1, \vec{r}_2, \vec{r}_3$  are the position vectors of the collinear points and scalar  $p$  and  $q$  exist

such that  $\vec{r}_3 = p\vec{r}_1 + q\vec{r}_2$ , then show that  $p + q = 1$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If  $\vec{a}$  and  $\vec{b}$  are two vectors of magnitude 1 inclined at  $120^\circ$ , then find the angle between  $\vec{b}$  and  $\vec{b} - \vec{a}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Find the vector of magnitude 3, bisecting the angle between the vectors  $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$  and  $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  and  $\vec{d}$  are four vectors in three-dimensional space with the same initial point and such that  $3\vec{a} - 2\vec{b} + \vec{c} - 2\vec{d} = 0$ , show that terminals  $A, B, C$  and  $D$  of these vectors are coplanar. Find the point at which  $AC$  and  $BD$  meet. Find the ratio in which  $P$  divides  $AC$  and  $BD$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Show that the vectors

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$$2\vec{a} - \vec{b} + 3\vec{c}, \vec{a} + \vec{b}$$

$$- 2\vec{c} \text{ and } \vec{a} + \vec{b} - 3\vec{c}$$

are non-coplanar vectors (where  $\vec{a}, \vec{b}, \vec{c}$  are non-coplanar vectors)

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

Examine the following vector for linear independence: (1)

$$\vec{i} + \vec{j} + \vec{k}, 2\vec{i} + 3\vec{j}$$

$$- \vec{k}, -\vec{i} - 2\vec{j} + 2\vec{k}$$

(2)

$$3\vec{i} + \vec{j} - \vec{k}, 2\vec{i} - \vec{j}$$

$$+ 7\vec{k}, 7\vec{i} - \vec{j} + 13\vec{k}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

If  $\vec{a}$  and  $\vec{b}$  are non-collinear vectors and

$$\vec{A} = (p + 4q)\vec{a}$$

$$= (2p + q + 1)\vec{b} \text{ and } \vec{B}$$

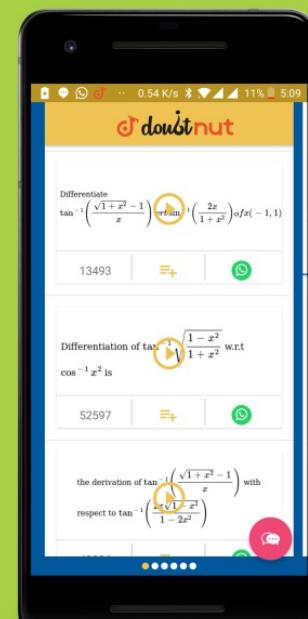
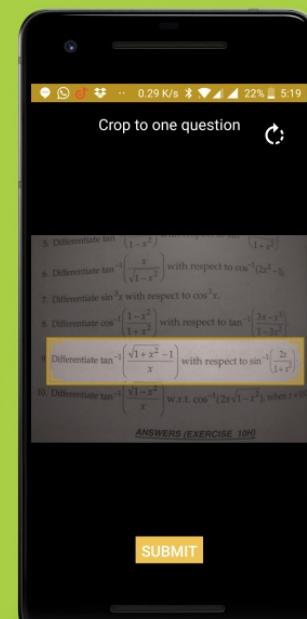
$$= (-2p + q + 2)\vec{a}$$

$$+ (2p - 3q - 1)\vec{b}$$

, and if  $3\vec{A} = 2\vec{B}$ , then determine p and q.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

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If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are any three non-coplanar vectors, then prove that points  
 $l_1 \vec{a} + m_1 \vec{b} + n_1 \vec{c}, l_2 \vec{a}$   
 $+ m_2 \vec{b} + n_2 \vec{c}, l_3 \vec{a}$   
 $+ m_3 \vec{b} + n_3 \vec{c}, l_4 \vec{a}$   
 $+ m_4 \vec{b} + n_4 \vec{c}$   
are coplanar if 
$$\begin{bmatrix} l_1 & l_2 & l_3 & l_4 \\ m_1 & m_2 & m_3 & m_4 \\ n_1 & n_2 & n_3 & n_4 \\ 1 & 1 & 1 & 1 \end{bmatrix} = 0$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are three non-zero non-coplanar vectors, then find the linear relation between the following four vectors:

$$\begin{aligned} & \vec{a} - 2\vec{b} + 3\vec{c}, 2\vec{a} - 3\vec{b} \\ & + 4\vec{c}, 3\vec{a} - 4\vec{b} + 5\vec{c}, \\ & 7\vec{a} - 11\vec{b} + 15\vec{c} \end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Let  $a, b, c$  be distinct non-negative numbers and the vectors

$$a\hat{i} + a\hat{j} + c\hat{k}, \hat{i} + \hat{k}, c\hat{i} + c\hat{j}$$

$$+ b\hat{k}$$

lie in a plane, and then prove that the quadratic equation  $ax^2 + 2cx + b = 0$  has equal roots.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

Find the angle between the vectors  $\hat{i} - 2\hat{j} + 3\hat{k}$  and  $3\hat{i} - 2\hat{j} + \hat{k}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

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If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are non-zero vectors such that  $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ , then find the geometrical relation between the vectors.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$\vec{r} \cdot \hat{i} = \vec{r} \cdot \hat{j} = \vec{r} \cdot \hat{k} \text{ and } |\vec{r}| = 3,$$

then find the vector  $\vec{r}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are unit vectors such that  $\vec{a} + \vec{b} + \vec{c} = 0$ , then find the value of  $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are mutually perpendicular vectors of equal magnitudes, then find the angle between vectors  $\vec{a}$  and  $\vec{a} + \vec{b} + \vec{c}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

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If  
 $|\vec{a}| + |\vec{b}| = |\vec{c}| \text{ and } \vec{a} + \vec{b} = \vec{c},$

then find the angle between  $\vec{a}$  and  $\vec{b}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If three unit vectors  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  satisfy  $\vec{a} + \vec{b} + \vec{c} = 0$ , then find the angle between  $\vec{a}$  and  $\vec{b}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If  $\theta$  is the angle between the unit vectors  $a$  and  $b$ , then prove that  $\frac{\cos \theta}{2} = \frac{1}{2} \left| \vec{a} + \vec{b} \right| \quad \frac{\sin \theta}{2} = \frac{1}{2} \left| \vec{a} - \vec{b} \right|$

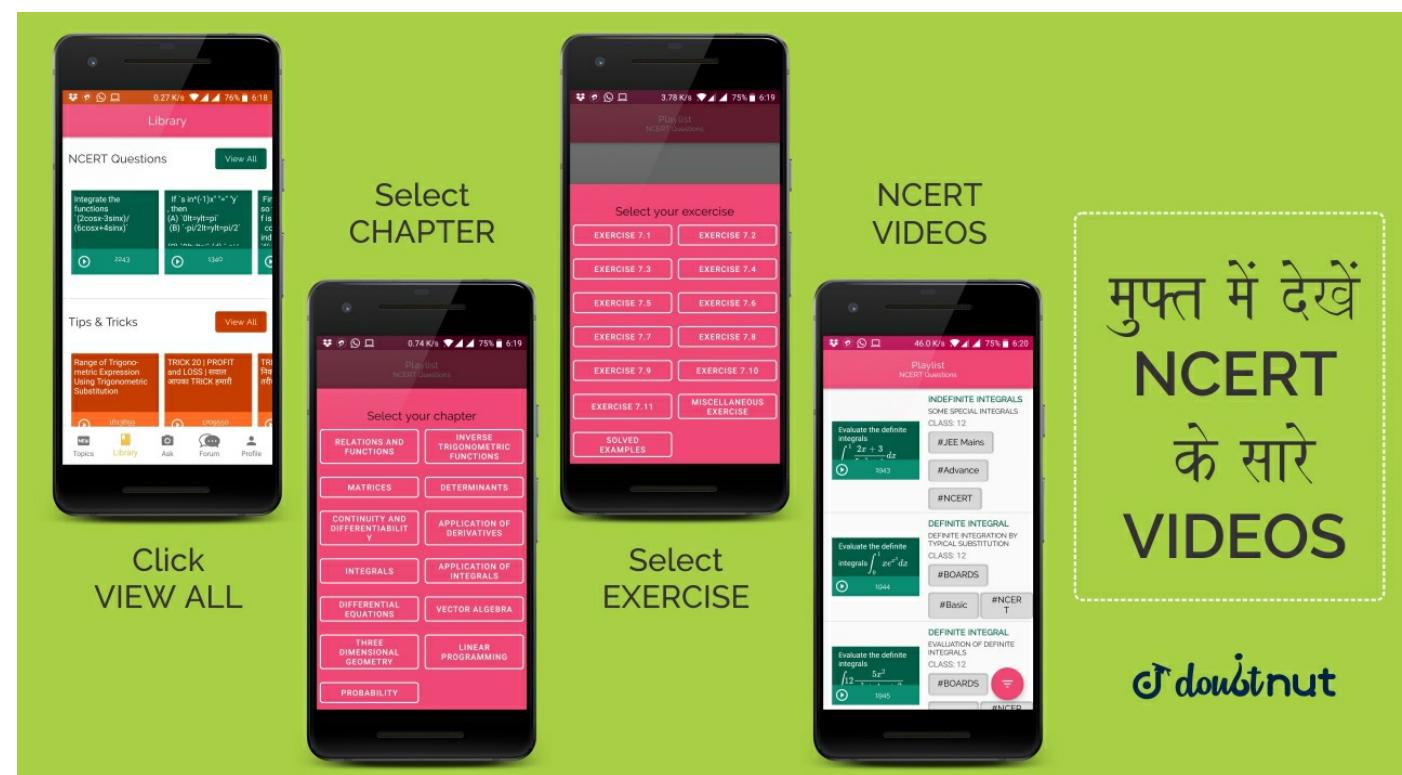
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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

Find the projection of vector  $\hat{i} + 3\hat{j} + 7\hat{k}$  on the vector  $7\hat{i} - \hat{j} + 8\hat{k}$ .

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78	<p>If the scalar projection of vector <math>x\hat{i} - \hat{j} + \hat{k}</math> on vector <math>2\hat{i} - \hat{j} + 5\hat{k}</math> is <math>\frac{1}{\sqrt{30}}</math>, then find the value of <math>x</math>.</p>
79	<p><b>CENGAGE_MATHS_VECTORS AND 3D GEOMETRY_VECTOR ALGEBRA_Applications Of Dot (Scalar) Product</b></p> <p>If  <math>\vec{a} = x\hat{i} + (x-1)\hat{j} + \hat{k}</math> and <math>\vec{b} = (x+1)\hat{i} + \hat{j} + a\hat{k}</math>  make an acute angle <math>\forall x \in R</math>, then find the values of <math>a</math>.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
80	<p><b>CENGAGE_MATHS_VECTORS AND 3D GEOMETRY_VECTOR ALGEBRA_Applications Of Dot (Scalar) Product</b></p> <p>If  <math>\vec{a} \cdot \hat{i} = \vec{a} \cdot (\hat{i} + \hat{j}) = \vec{a} \cdot (\hat{i} + \hat{j} + \hat{k})</math>, then find the unit vector <math>\vec{a}</math></p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
81	<p><b>CENGAGE_MATHS_VECTORS AND 3D GEOMETRY_VECTOR ALGEBRA_Applications Of Dot (Scalar) Product</b></p> <p>Prove by vector method that  <math>\cos(A+B)\cos A \cos B - \sin A \sin B</math>.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
82	<p><b>CENGAGE_MATHS_VECTORS AND 3D GEOMETRY_VECTOR ALGEBRA_Applications Of Dot (Scalar) Product</b></p> <p>In any triangle <math>ABC</math>, prove the projection formula <math>a = b \cos C + c \cos B</math> using vector method.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>
83	<p><b>CENGAGE_MATHS_VECTORS AND 3D GEOMETRY_VECTOR ALGEBRA_Applications Of Dot (Scalar) Product</b></p> <p>Prove that an angle inscribed in a semi-circle is a right angle using vector method.</p> <p><a href="#">Watch Free Video Solution on Doubtnut</a></p>

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

Using dot product of vectors, prove that a parallelogram, whose diagonals are equal, is a rectangle

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If  $a + 2b + 3c = 4$ , then find the least value of  $a^2 + b^2 + c^2$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

A unit vector  $\mathbf{a}$  makes an angle  $\frac{\pi}{4}$  with  $z$ -axis. If  $\mathbf{a} + \mathbf{i} + \mathbf{j}$  is a unit vector, then  $\mathbf{a}$  can be equal to

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

if  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are there mutually perpendicular unit vectors and  $\vec{a}$  ia a unit vector make equal angles which  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  then find the value of  $|\vec{a} + \vec{b} + \vec{c} + \vec{d}|^2$

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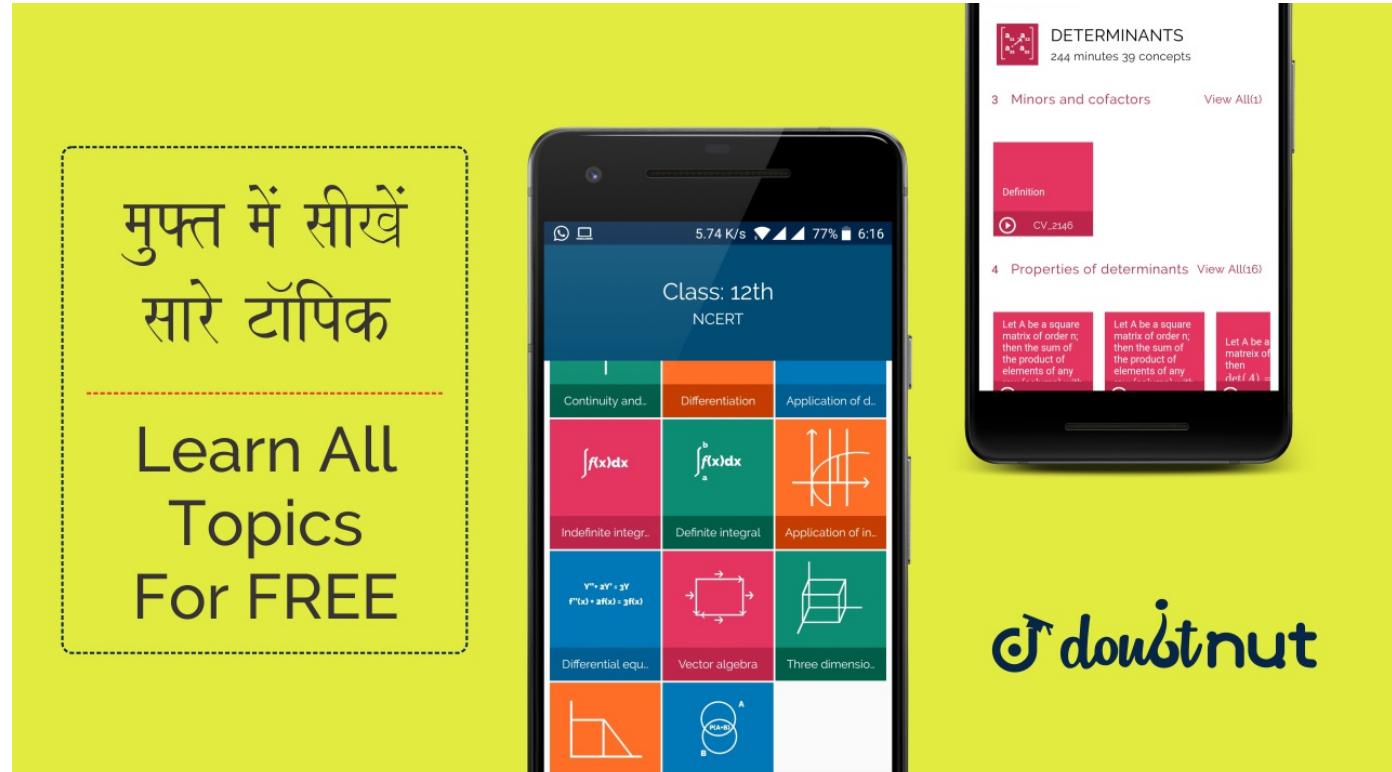
If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are three mutually perpendicular unit vectors and  $\vec{d}$  is a unit vector which makes equal angles with  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$ , then find the value of  $|\vec{a} + \vec{b} + \vec{c} + \vec{d}|^2$ .

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A particle acted by constant forces  $4\hat{i} + \hat{j} - 3\hat{k}$  and  $3\hat{i} + 9\hat{j} - \hat{k}$  is displaced from point  $\hat{i} + 2\hat{j} + 3\hat{k}$  to point  $5\hat{i} + 4\hat{j} + \hat{k}$ . Find the total work done by the forces in units.

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are mutually perpendicular vectors of equal magnitudes, show that the vector  $\vec{a} + \vec{b} + \vec{c}$  is equally inclined to  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\vec{a} = 4\hat{i} + 6\hat{j} \text{ and } \vec{b} = 3\hat{j} + 4\hat{k},$$

then find the component of  $\vec{a}$  and  $\vec{b}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
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If  $|\vec{a}| = |\vec{b}| = |\vec{a} + \vec{b}| = 1$ , then find the value of  $|\vec{a} - \vec{b}|$ .

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Let  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are vectors such that

$$|\vec{a}| = 3, |\vec{b}| = 4 \text{ and } |\vec{c}|$$

$$= 5, \text{ and } (\vec{a} + \vec{b})$$

is perpendicular to  $\vec{c}$ ,  $(\vec{b} + \vec{c})$  is perpendicular to  $\vec{a}$  and  $(\vec{c} + \vec{a})$  is perpendicular to  $\vec{b}$ . Then find the value of  $|\vec{a} + \vec{b} + \vec{c}|$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
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Prove that in a tetrahedron if two pairs of opposite edges are perpendicular , then the third pair is also perpendicular.

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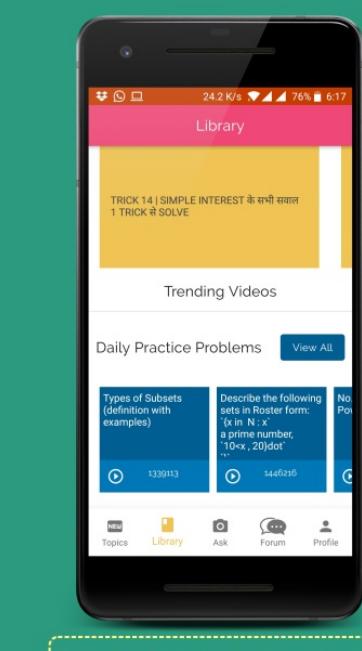
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ALGEBRA\_Applications Of Dot (Scalar) Product**

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In isosceles triangles  $ABC$ ,  $|\vec{A}B| = |\vec{B}C| = 8$ , a point  $E$  divides  $AB$  internally in the ratio 1:3, then find the angle between

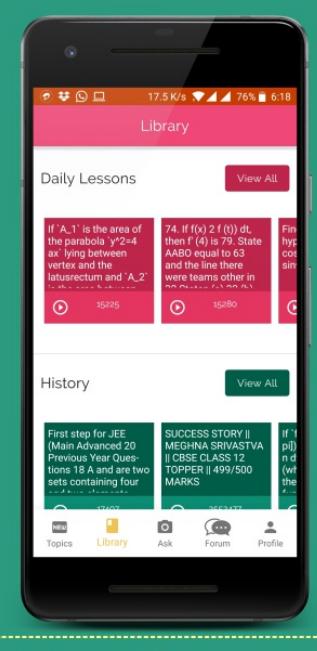
$$\vec{C}E \text{ and } \vec{C}A \left( \text{where } |\vec{C}A| = 12 \right).$$

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Vector  $\vec{OA} = \hat{i} + 2\hat{j} + 2\hat{k}$  turns through a right angle passing through the positive x-axis on the way. Show that the vector in its new position is  $\frac{4\hat{i} - \hat{j} - \hat{k}}{\sqrt{2}}$ .

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The base of the pyramid  $AOBC$  is an equilateral triangle  $OBC$  with each side equal to  $4\sqrt{2}$ ,  $O$  is the origin of reference,  $AO$  is perpendicular to the plane of  $OBC$  and  $|\vec{AO}| = 2$ . Then find the cosine of the angle between the skew straight lines, one passing through  $A$  and the midpoint of  $OB$  and the other passing through  $O$  and the mid point of  $BC$ .

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Find  $|\vec{a} \times \vec{b}|$ , if  
 $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$  and  $\vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
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Let the vectors  $\vec{a}$  and  $\vec{b}$  be such that

99

$|\vec{a}| = 3|\vec{b}| = \frac{\sqrt{2}}{3}$ , then  $\vec{a} \times \vec{b}$  is a unit vector, if the angle between  $\vec{a}$  and  $\vec{b}$  is?

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

Show that

$$\begin{aligned} & (\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) \\ &= 2(\vec{a} \times \vec{b}). \end{aligned}$$

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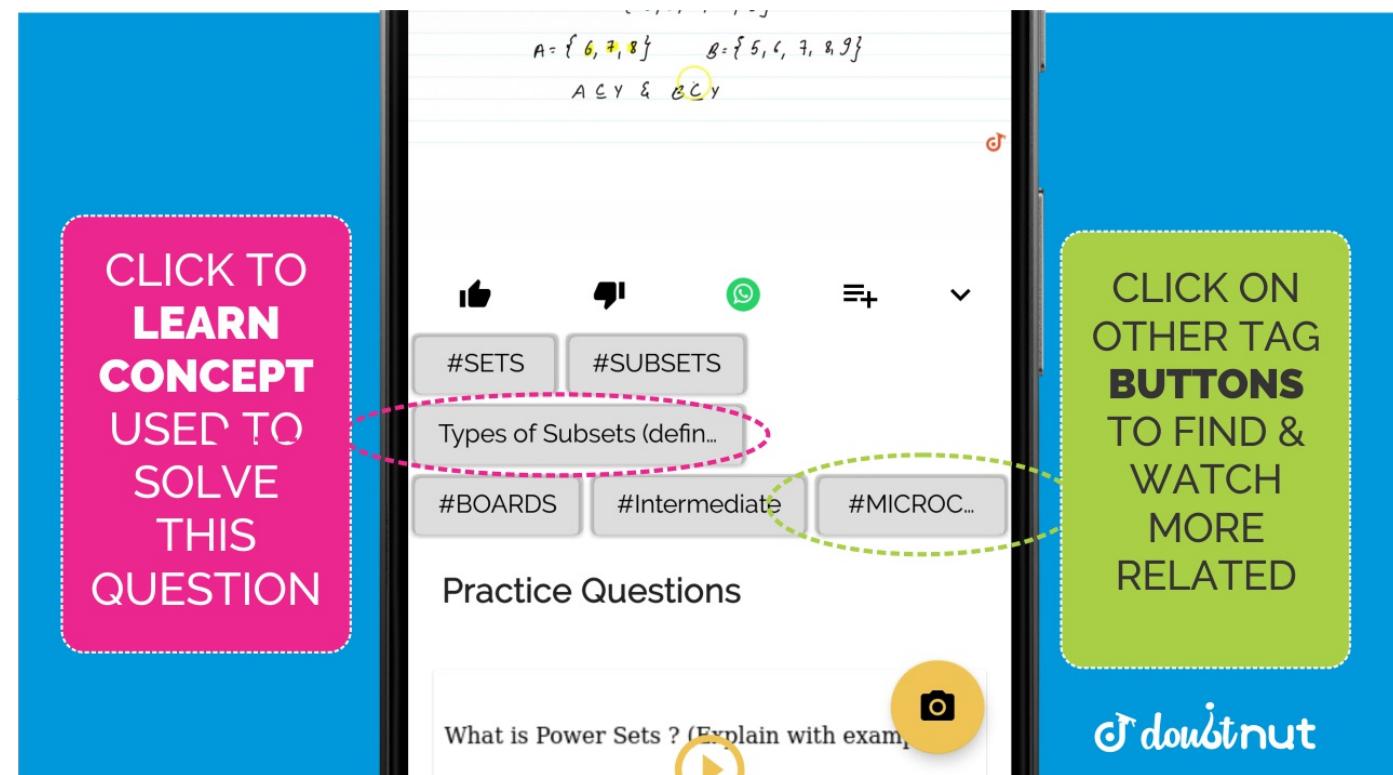
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Let

$$\begin{aligned} \vec{a} &= \hat{i} + 4\hat{j} + 2\hat{k}, \quad \vec{b} = 3\hat{i} \\ &\quad - 2\hat{j} + 7\hat{k} \text{ and } \vec{c} = 2\hat{i} - \hat{j} \\ &\quad + 4\hat{k}. \end{aligned}$$

Find a vector  $\vec{d}$  which is perpendicular to both  $\vec{a}$  and  $\vec{b}$  and  $\vec{c} \cdot \vec{d} = 15$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If  $A, B$  and  $C$  are the vertices of a triangle  $ABC$ , then prove sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

Using cross product of vectors, prove that  
 $\sin(A + B) = \sin A \cos B$   
+  $\cos A \sin B$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

Find a unit vector perpendicular to the plane determined by the points  
 $(1, -1, 2)$ ,  
 $(2, 0, -1)$  and  $(0, 2, 1)$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

If  $\vec{a}$  and  $\vec{b}$  are two vectors, then prove that

$$(\vec{a} \times \vec{b})^2$$

$$= \left| \vec{a} \cdot \vec{a} \cdot \vec{a} \cdot \vec{b} \cdot \vec{b} \cdot \vec{a} \cdot \vec{b} \cdot \vec{b} \right|$$

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

If  $|\vec{a}| = 2$ , then find the value of

$$|\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2$$

$$+ |\vec{a} \times \hat{k}|^2.$$

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

**GEOMETRY\_VECTOR**

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$$\begin{aligned}\vec{r} \times \vec{a} &= \vec{b} \times \vec{a}; \vec{r} \times \vec{b} \\ &= \vec{a} \times \vec{b}; \vec{a} \neq \vec{0}; \vec{b} \\ &\neq \vec{0}; \vec{a} \neq \lambda \vec{b}, \text{ and } \vec{a}\end{aligned}$$

is not perpendicular to  $\vec{b}$ , then find  $\vec{r}$  in terms of  $\vec{a}$  and  $\vec{b}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

$A, B, C$  and  $D$  are any four points in the space, then prove that

$$\left| \vec{AB} \times \vec{CD} + \vec{BC} \times \vec{AD} \right|$$

$$+ \left| \vec{CA} \times \vec{BD} \right| = 4$$

(area of  $ABC$ .)

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are the position vectors of the vertices  $A$ ,  $B$  and  $C$  respectively, of  $ABC$ , prove that the perpendicular distance of the vertex  $A$  from the base  $BC$  of

$$\frac{\left| \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} \right|}{\left| \vec{c} - \vec{b} \right|}$$

the triangle  $ABC$  is  $\frac{\left| \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} \right|}{\left| \vec{c} - \vec{b} \right|}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

Find the area of the triangle with vertices  
 $A(1, 1, 2)$ ,  
 $B(2, 3, 5)$  and  $C(1, 5, 5)$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

Find the area of the parallelogram whose adjacent sides are determined by the vectors

$$\vec{a} = \hat{i} - \hat{j} + 3\hat{k} \text{ and } \vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

Find the area a parallelogram whose diagonals are

$$\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k} \text{ and } \vec{b} = \hat{i} - 3\hat{j} + 4\hat{k}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

Let  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be three verctors such that

$$\vec{a} \neq 0, |\vec{a}| = |\vec{c}| = 1, |\vec{b}|$$

$$= 4 \text{ and } |\vec{b} \times \vec{c}| = \sqrt{15}. \text{ If } \vec{b} - 2\vec{c} = \lambda \vec{a}, \text{ then find the value of } \lambda$$

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

A rigid body is spinning about a fixed point (3,-2,-1) with an angular velocity of 4 rad/s, the axis of rotation being in the direction of (1,2,-2). Find the velocity of the particle at point (4,1,1).

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If

$$\vec{a} \times \vec{b} = \vec{c} \times \vec{d} \text{ and } \vec{a}$$

$$\times \vec{c} = \vec{b} \times \vec{d},$$

then show that  $\vec{a} - \vec{d}$ , is parallel to  $\vec{b} - \vec{c}$  provided  $\vec{a} \neq \vec{d}$  and  $\vec{b} \neq \vec{c}$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

Show by a numerical example and geometrically also that  $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$  does not imply  $\vec{b} = \vec{c}$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If  $\vec{a}, \vec{b}, \vec{c}$  and  $\vec{d}$  are the position vectors of the vertices of a cyclic quadrilateral  $ABCD$ , prove that

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$$\frac{\left| \vec{a} \times \vec{b} + \vec{b} \times \vec{d} + d \vec{x} \times \vec{a} \right|}{\left( \vec{b} - \vec{a} \right) \vec{d} - \vec{a}}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

The position vectors of the vertices of a quadrilateral with  $A$  as origin are  $B(\vec{b})$ ,  $D(\vec{d})$  and  $C(l\vec{b} + m\vec{d})$ .

Prove that the area of the quadrilateral is  $\frac{1}{2}(l+m)|\vec{b} \times \vec{d}|$ .

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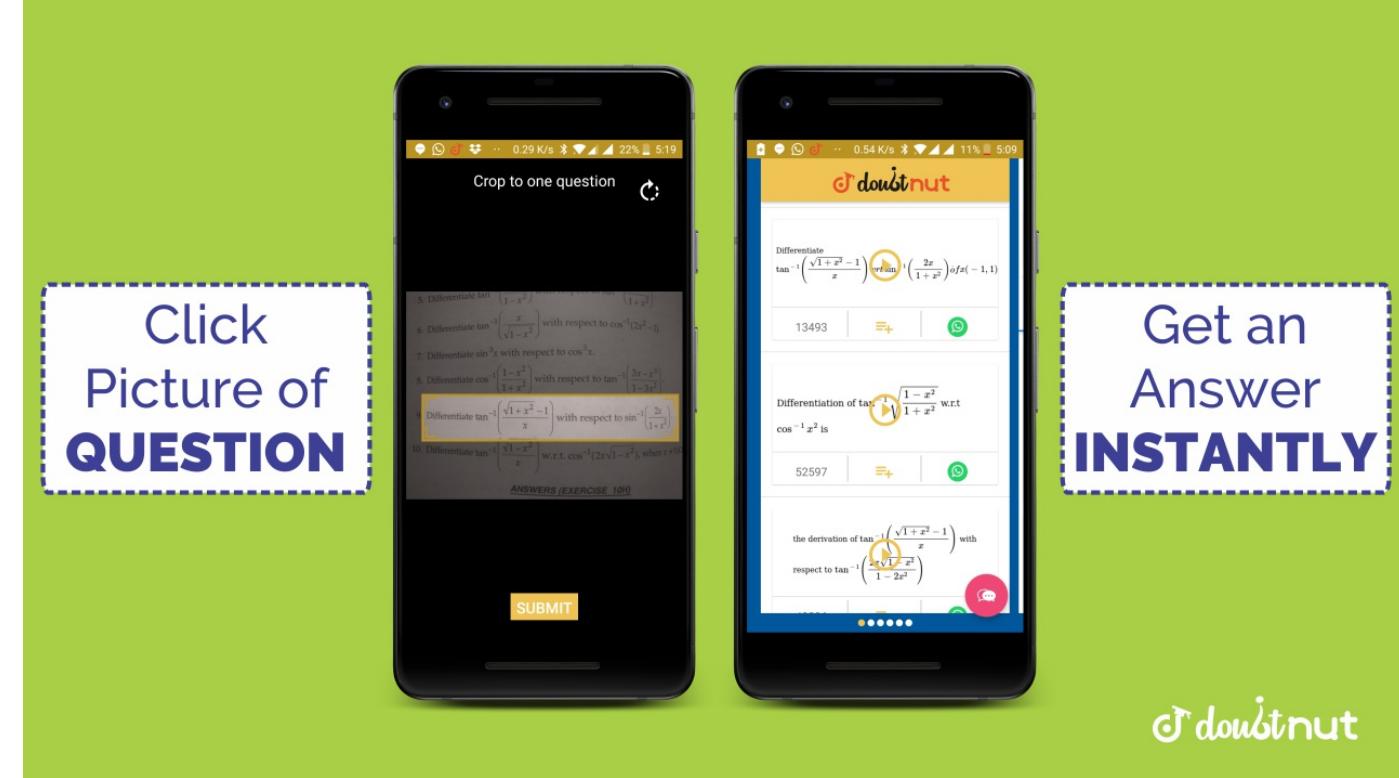
### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

Let  $\vec{a}$  and  $\vec{b}$  be unit vectors such that  $|\vec{a} + \vec{b}| = \sqrt{3}$ . Then find the value of

$$\left( 2\vec{a} + 5\vec{b} \right) \cdot 3\vec{a} + \vec{b} + \vec{a} \times \vec{b}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

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$u$  and  $v$  are two non-collinear unit vectors such that  $\left| \frac{\hat{u} + \hat{v}}{2} + \hat{u} \times \hat{v} \right| = 1$ . Prove that  $|\hat{u} \times \hat{v}| = \left| \frac{\hat{u} - \hat{v}}{2} \right|$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

In triangle  $ABC$ ,  $p, o \in tsD, E$  and  $F$  are taken on the sides  $BC, CA$  and  $AB$ , respectively, such that  $\frac{BD}{DC} = \frac{CE}{EA} = \frac{AF}{FB} = n$ . Prove that

– (DEF)

$$= \frac{n^2 - n + 1}{\left( (n+1)^2 \right)_{ABC}}.$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

Let  $A, B, C$  be points with position vectors

$$2\hat{i} - \hat{j} + \hat{k}, \hat{i} + 2\hat{j}$$

$$+ \hat{k}$$
 and  $2\hat{i} + \hat{j} + 2\hat{k}$

respectively. Find the shortest distance between point  $B$  and plane  $OAC$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

Let

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$\vec{a} = x\hat{i} + 12\hat{j} - \hat{k}$ ,  $\vec{b} = 2\hat{i} + 2x\hat{j} + \hat{k}$  and  $\vec{c} = \hat{i} + \hat{k}$ .  
 If the ordered set  $\left[ \begin{array}{ccc} \vec{b} & \vec{c} & \vec{a} \end{array} \right]$  is left handed, then find the values of  $x$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are three non-coplanar vectors, then find the value of

$$\frac{\vec{a} \cdot \vec{b} \times \vec{c}}{\vec{b} \cdot \vec{c} \times \vec{a}} + \frac{\vec{b} \cdot \vec{c} \times \vec{a}}{\vec{a} \cdot \vec{b} \times \vec{c}} + \frac{\vec{b} \times \vec{a}}{\vec{a} \cdot \vec{b} \times \vec{c}}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

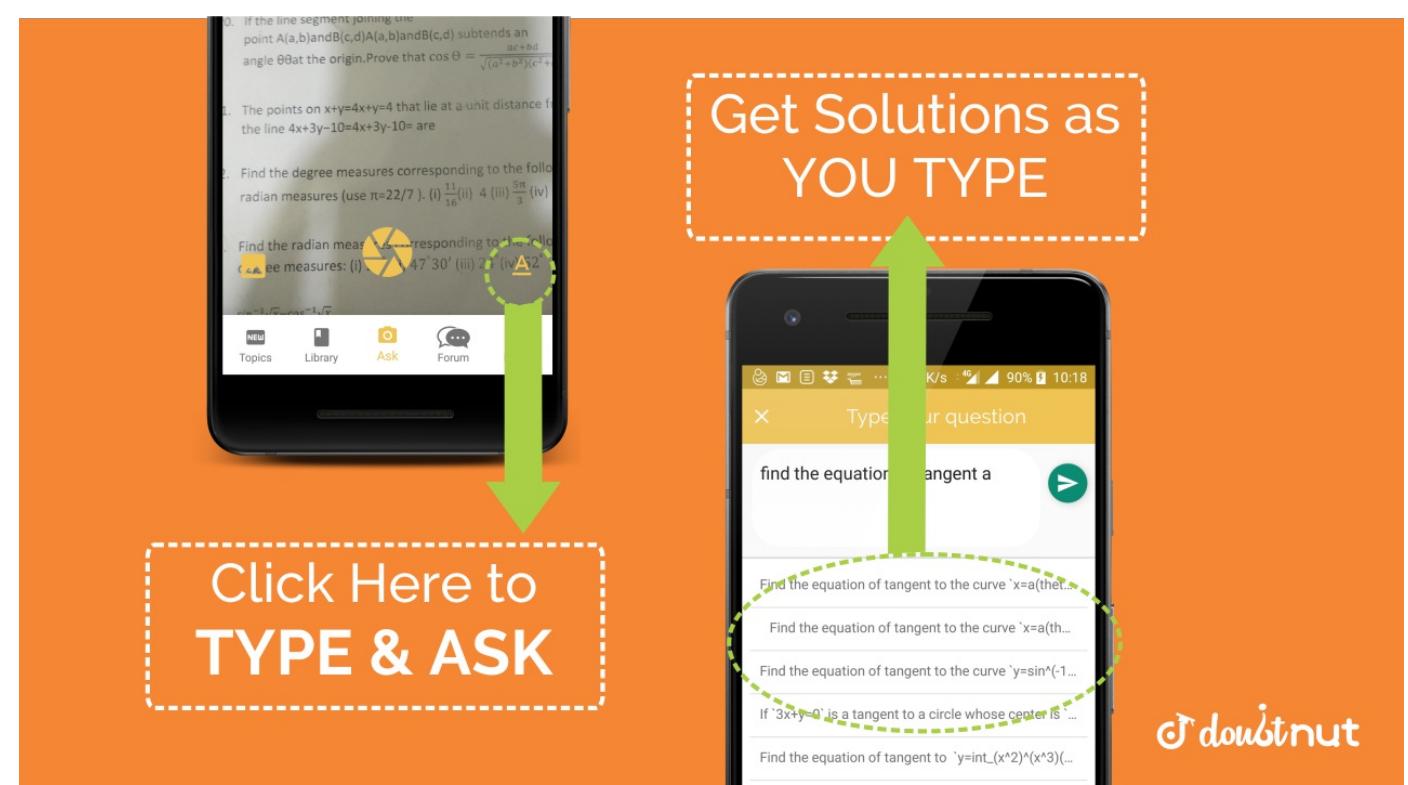
If the vectors

$$2\hat{i} - 3\hat{j}, \hat{i} + \hat{j} - \hat{k} \text{ and } 3\hat{i} - \hat{k}$$

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form three concurrent edges of a parallelepiped, then find the volume of the parallelepiped.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

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The position vectors of the four angular points of a tetrahedron are  $A(\hat{j} + 2\hat{k})$ ,  $B(3\hat{i} + \hat{k})$ ,  $C(4\hat{i} + 3\hat{j} + 6\hat{k})$  and  $D(2\hat{i} + 3\hat{j} + 2\hat{k})$ .

Find the volume of the tetrahedron  $ABCD$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

Let  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  be three unit vectors and  $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0$ . If the angle between  $\vec{b}$  and  $\vec{c}$  is  $\frac{\pi}{3}$ , then find the value of  $[\vec{a} \vec{b} \vec{c}]$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

Prove that

$$\begin{aligned} & [\vec{a} + \vec{b} \vec{b} + \vec{c} \vec{c} + \vec{a}] \\ &= 2 [\vec{a} \vec{b} \vec{c}]. \end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

Prove that

$$\begin{aligned} & [\vec{l} \vec{m} \vec{n}] [\vec{a} \vec{b} \vec{c}] \\ &= \\ & \left| \begin{array}{cccccccccc} \vec{l} & \vec{a} & \vec{l} & \vec{b} & \vec{l} & \vec{c} & \vec{m} & \vec{a} & \vec{m} & \vec{a} & \vec{m} & \vec{a} & \vec{n} & \vec{a} & \vec{n} & \vec{a} & \vec{n} & \vec{a} \\ \vec{l} & \vec{a} & \vec{l} & \vec{b} & \vec{l} & \vec{c} & \vec{m} & \vec{a} & \vec{m} & \vec{a} & \vec{m} & \vec{a} & \vec{n} & \vec{a} & \vec{n} & \vec{a} & \vec{n} & \vec{a} \end{array} \right| \end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If

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$$\begin{aligned}\vec{a} &= \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} - \hat{j} \\ &+ \hat{k}, \vec{c} = \hat{i} + 2\hat{j} - \hat{k}, \\ \text{then find the value of } &\left| \begin{array}{ccccccccc} \vec{a} & \vec{a} & \vec{a} & \vec{b} & \vec{a} & \vec{c} & \vec{b} & \vec{a} & \vec{b} \\ \vec{a} & \vec{a} & \vec{a} & \vec{b} & \vec{a} & \vec{c} & \vec{b} & \vec{a} & \vec{b} \\ \vec{a} & \vec{a} & \vec{a} & \vec{b} & \vec{a} & \vec{c} & \vec{b} & \vec{a} & \vec{b} \end{array} \right| \\ &\rightarrow \vec{a} \rightarrow \vec{a} \rightarrow \vec{a} \end{aligned}$$

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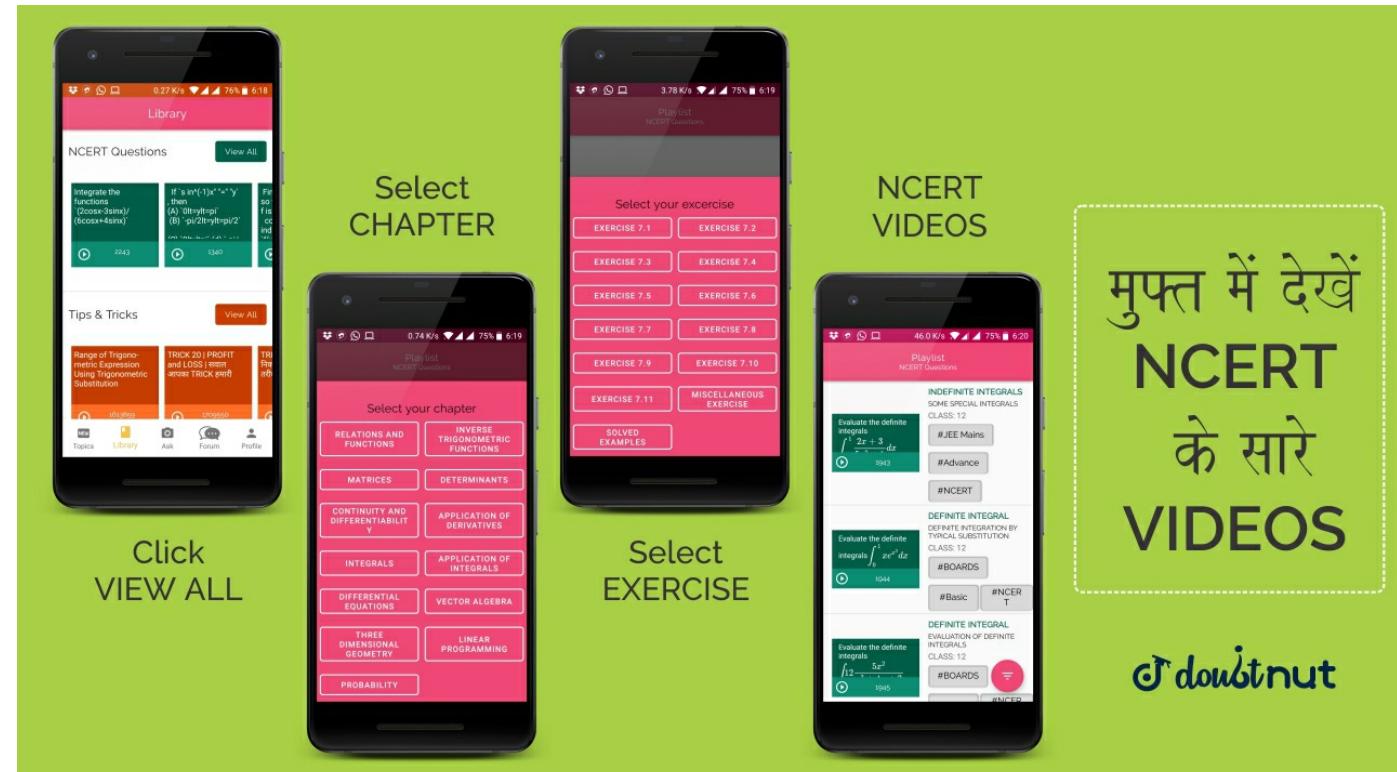
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

Find the value of  $a$  so that the volume of the parallelepiped formed by vectors  $\hat{i} + a\hat{j} + k, \hat{j} + a\hat{k}$  and  $a\hat{i} + \hat{k}$  becomes minimum.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  $\vec{u}, \vec{v}$  and  $\vec{w}$  are three non-coplanar vectors, then prove that  

$$(\vec{u} + \vec{v} - \vec{w}) \cdot (\vec{u} - \vec{v}) \times (\vec{v} - \vec{w})$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

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If  $\vec{a}$  and  $\vec{b}$  are two vectors such that  $|\vec{a} \times \vec{b}| = 2$ , then find the value of  $[\vec{a} \vec{b} \vec{a} \times \vec{b}]$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

Find the altitude of a parallelepiped whose three coterminous edges are vectors

$$\vec{A} = \hat{i} + \hat{j} + \hat{k}, \vec{B} = 2\hat{i}$$

$$+ 4\hat{j} - \hat{k} \text{ and } \vec{C} = \hat{i} + \hat{j}$$

$$+ 3\hat{k} \text{ with } \vec{A} \text{ and } \vec{B}$$

as the sides of the base of the parallelepiped.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  $[\vec{a} \vec{b} \vec{c}] = 2$ , then find the value of

$$[(\vec{a} + 2\vec{b} - \vec{c})(\vec{a} - \vec{b})](\vec{a} - \vec{b} - \vec{c}).$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are mutually perpendicular vectors and

$$\vec{a} = \alpha(\vec{a} \times \vec{b})$$

$$+ \beta(\vec{b} \times \vec{c})$$

$$+ \gamma(\vec{c} \times \vec{a}) \text{ and } [\vec{a} \vec{b} \vec{c}]$$

$$= 1,$$

then find the value of  $\alpha + \beta + \gamma$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

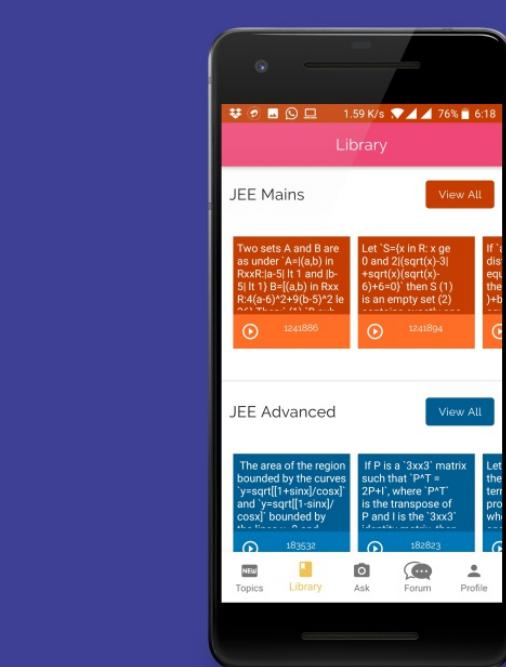
If  $a$ ,  $b$  and  $c$  are non-coplanar vector, then that prove

$$\left| \begin{pmatrix} \vec{a} & \vec{d} \\ \vec{b} & \vec{d} \\ \vec{c} & \vec{d} \end{pmatrix} \left( \vec{b} \times \vec{c} \right) \right| + \left| \begin{pmatrix} \vec{b} & \vec{d} \\ \vec{c} & \vec{d} \end{pmatrix} \left( \vec{c} \times \vec{a} \right) \right| + \left| \begin{pmatrix} \vec{c} & \vec{d} \\ \vec{a} & \vec{d} \end{pmatrix} \left( \vec{a} \times \vec{b} \right) \right|$$

is independent of  $d$ , where  $e$  is a unit vector.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

Prove that vectors

$$\vec{u} = (al + a_1l_1)\hat{i}$$

$$+ (am + a_1m_1)\hat{j}$$

$$+ (an + a_1n_1)\hat{k}$$

$$\vec{v} = (bl + b_1l_1)\hat{i}$$

$$+ (bm + b_1m_1)\hat{j}$$

$$+ (bn + b_1n_1)\hat{k}$$

$$\vec{w} = (bl + b_1l_1)\hat{i}$$

$$+ (bm + b_1m_1)\hat{j}$$

$$+ (bn + b_1n_1)\hat{k}$$

are coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

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Let  $G_1, G_2$  and  $G_3$  be the centroids of the triangular faces  $OBC, OCA$  and  $OAB$ , respectively, of a tetrahedron  $OABC$ . If  $V_1$  denotes the volume of the tetrahedron  $OABC$  and  $V_2$  that of the parallelepiped with  $OG_1, OG_2$  and  $OG_3$  as three concurrent edges, then prove that  $4V_1 = 9V_2$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

Prove that

$$\hat{i} \times (\vec{a} \times \hat{i}) \hat{j} \times (\vec{a} \times \hat{j}) \\ + \hat{k} \times (\vec{a} \times \hat{k}) = 2\vec{a}.$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\hat{i} \times [(\vec{a} - \hat{j}) \times \hat{i}] + \hat{j} \\ \times [(\vec{a} - \hat{k}) \times \hat{j}] + \hat{k} \\ \times [(\vec{a} - \hat{i}) \times \hat{k}] = 0,$$

then find vector  $\vec{a}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

Let  $\vec{a}, \vec{b}$ , and  $\vec{c}$  be any three vectors, then prove that

$$[\vec{a} \times \vec{b} \vec{b} \times \vec{c} \vec{c} \times \vec{a}] \\ = [\vec{a} \vec{b} \vec{c}]^2.$$

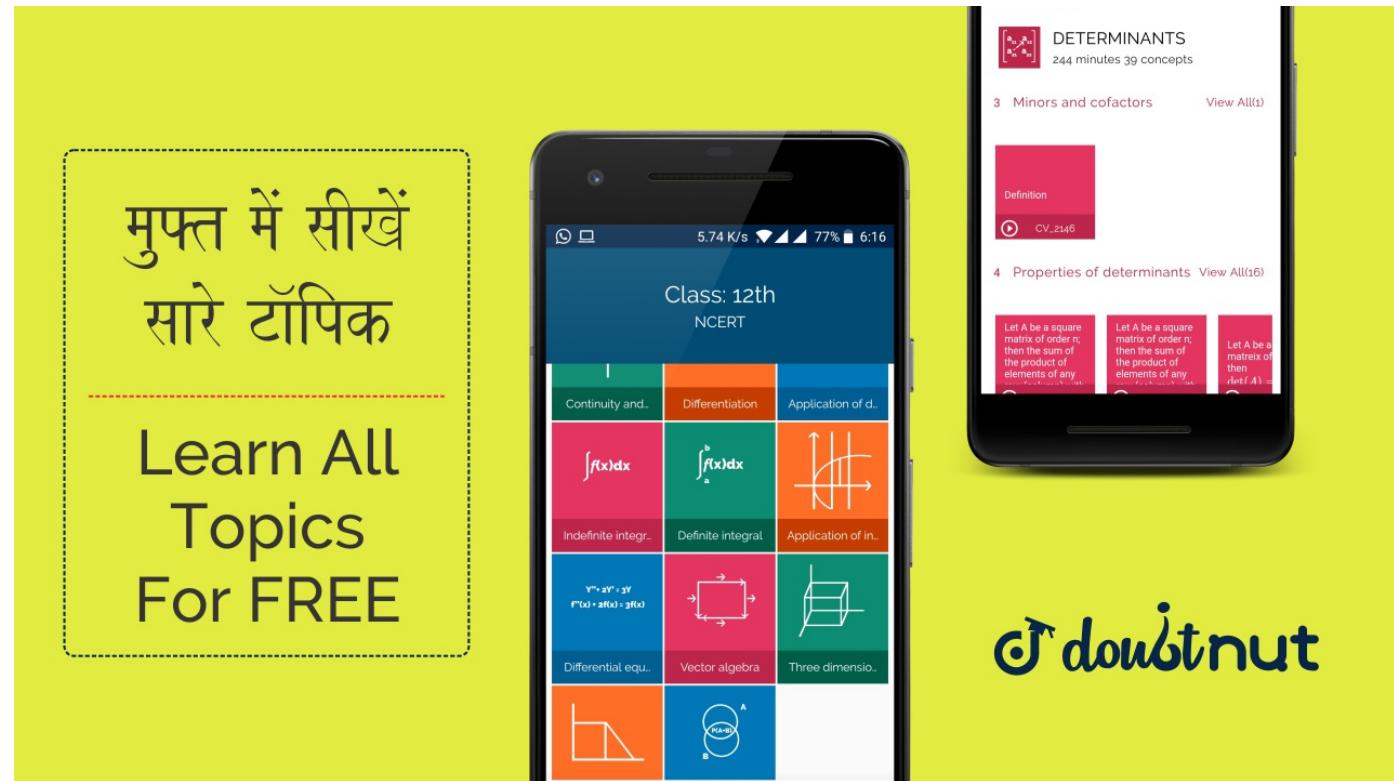
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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

For any four vectors, prove that

$$\begin{aligned}
 & \left( \vec{b} \times \vec{c} \right) \vec{a} \times \vec{d} \\
 & + \left( \vec{c} \times \vec{a} \right) \vec{b} \times \vec{d} \\
 & + \left( \vec{a} \times \vec{b} \right) \vec{c} \times \vec{d} = 0.
 \end{aligned}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  $\vec{b}$  and  $\vec{c}$  are two non-collinear vectors such that  $\vec{a} \perp (\vec{b} \times \vec{c})$ , then prove that  $(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{c})$  is equal to  $|\vec{a}|^2 (\vec{b} \cdot \vec{c})$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

Find the vector of length 3 unit which is perpendicular to  $\hat{i} + \hat{j} + \hat{k}$  and lies in the plane of  $\hat{i} + \hat{j} + \hat{k}$  and  $2\hat{k} - 3\hat{j}$ .

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are three non coplanar vectors, then prove that

$$\vec{d} = \frac{\vec{a} \cdot \vec{d}}{[\vec{a} \vec{b} \vec{c}]} (\vec{b} \times \vec{c})$$

$$+ \frac{\vec{b} \cdot \vec{d}}{[\vec{a} \vec{b} \vec{c}]} (\vec{c} \times \vec{a})$$

$$+ \frac{\vec{c} \cdot \vec{d}}{[\vec{a} \vec{b} \vec{c}]} (\vec{a} \times \vec{b})$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If  $\vec{b}$  is not perpendicular to  $\vec{c}$ , then find the vector  $\vec{r}$  satisfying the equation

$$\vec{r} \times \vec{b} = \vec{a} \times \vec{b} \text{ and } \vec{r} \cdot \vec{c} = 0.$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If  $\vec{a}$  and  $\vec{b}$  are two given vectors and  $k$  is any scalar, then find the vector  $\vec{r}$  satisfying  $\vec{r} \times \vec{a} + k\vec{r} = \vec{b}$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

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$$\begin{aligned}\vec{r} \cdot \vec{a} &= 0, \vec{r} \cdot \vec{b} \\ &= 1 \text{ and } \left[ \vec{r} \cdot \vec{a} \cdot \vec{b} \right] = 1, \vec{a} \cdot \vec{b} \\ &\neq 0, \left( \vec{a} \cdot \vec{b} \right)^2 \equiv |\vec{a}|^2 |\vec{b}|^2\end{aligned}$$

$$= 1,$$

then find  $\vec{r}$  in terms of  $\vec{a}$  and  $\vec{b}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If vector  $\vec{x}$  satisfying  $\vec{x} \times \vec{a} + \left( \vec{x} \cdot \vec{b} \right) \vec{c} = \vec{d}$  is given

$$\vec{x} = \lambda \vec{a} + \vec{a}$$

$$\times \frac{\vec{a} \times \left( \vec{d} - \lambda \vec{a} \right)}{\left( \vec{a} \cdot \vec{c} \right) |\vec{a}|^2}$$

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, then find the value of  $\lambda$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

$\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are three non-coplanar vectors and  $\vec{r}$  is any arbitrary vector. Prove

that

$$\begin{aligned} & \left[ \begin{smallmatrix} \vec{b} & \vec{c} & \vec{r} \end{smallmatrix} \right] \vec{a} + \left[ \begin{smallmatrix} \vec{c} & \vec{a} & \vec{r} \end{smallmatrix} \right] \vec{b} \\ & + \left[ \begin{smallmatrix} \vec{a} & \vec{b} & \vec{r} \end{smallmatrix} \right] \vec{c} \\ & = \left[ \begin{smallmatrix} \vec{a} & \vec{b} & \vec{c} \end{smallmatrix} \right] \vec{r}. \end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are non-coplanar unit vectors such that

$$\vec{a} \times (\vec{b} \times \vec{c})$$

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$$= \frac{\vec{b} + \vec{c}}{\sqrt{2}}, \vec{b} \text{ and } \vec{c}$$

are non-parallel, then prove that the angle between  $\vec{a}$  and  $\vec{b}$  is  $3\pi/4$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

Prove that

$$\vec{R}$$

$$+ \frac{\left[ \vec{R} \vec{\beta} \times (\vec{\beta} \times \vec{\alpha}) \right] \vec{\alpha}}{\left| \vec{\alpha} \times \vec{\beta} \right|^2}$$

$$+ \frac{\left[ \vec{R} \vec{\alpha} \times (\vec{\alpha} \times \vec{\beta}) \right] \vec{\beta}}{\left| \vec{\alpha} \times \vec{\beta} \right|^2}$$

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$$= \frac{\left[ \vec{R} \vec{\alpha} \vec{\beta} \right] (\vec{\alpha} \times \vec{\beta})}{\left| \vec{\alpha} \times \vec{\beta} \right|^2}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are three non-coplanar non-zero vectors, then prove that

$$\begin{aligned} & (\vec{a} \cdot \vec{a}) \vec{b} \times \vec{c} \\ & + (\vec{a} \cdot \vec{b}) \vec{c} \times \vec{a} \\ & + (\vec{a} \cdot \vec{c}) \vec{a} \times \vec{b} \\ & = [\vec{b} \vec{c} \vec{a}] \vec{a} \end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar  
Triple Product**

Find a set of vectors reciprocal to the set  
 $-\hat{i} + \hat{j} + \hat{k}, \hat{i} - \hat{j} + \hat{k}, \hat{i} + \hat{j} + \hat{k}$ .

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CLICK TO LEARN CONCEPT USED TO SOLVE THIS QUESTION

A = {6, 7, 8}      B = {5, 6, 7, 8, 9}  
A ⊂ Y & B ⊂ Y

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

Let

$$\vec{a}, \vec{b}, \text{ and } \vec{c} \text{ and } \vec{a}', \vec{b}', \vec{c}'$$

are reciprocal system of vectors, then prove that

$$\begin{aligned} & \vec{a}' \times \vec{b}' + \vec{b}' \times \vec{c}' \\ & + \vec{c}' \times \vec{a}' \\ & = \frac{\vec{a} + \vec{b} + \vec{c}}{[\vec{a} \vec{b} \vec{c}]} \end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If  $\vec{a}, \vec{b}, \text{ and } \vec{c}$  be three non-coplanar vector and  $a', b' \text{ and } c'$  constitute the reciprocal system of vectors, then prove that

$$\vec{r} = \left( \vec{r} \cdot \vec{a}' \right) \vec{a}$$

$$+ \left( \vec{r} \cdot \vec{b}' \right) \vec{b}$$

$$+ \left( \vec{r} \cdot \vec{c}' \right) \vec{c}$$

$$\vec{r} = \left( \vec{r} \cdot \vec{a}' \right) \vec{a}',$$

$$+ \left( \vec{r} \cdot \vec{b}' \right) \vec{b}',$$

$$+ \left( \vec{r} \cdot \vec{c}' \right) \vec{c}',$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

Find

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$$\left| \vec{a} \right| \text{ and } \left| \vec{b} \right|, \\ \text{if } (\vec{a} + \vec{b}) \cdot \vec{a} - \vec{b} = 8 \\ , \left| \vec{a} \right| = 8 \left| \vec{b} \right|.$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

Show that  $\left| \vec{a} \right| \left| \vec{b} \right| + \left| \vec{b} \right| \left| \vec{a} \right|$  is a perpendicular to  $\left| \vec{a} \right| \left| \vec{b} \right| - \left| \vec{b} \right| \left| \vec{a} \right|$ , for any two non-zero vectors  $\vec{a}$  and  $\vec{b}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  $\left| \vec{a} \right| = 3$ ,  $\left| \vec{b} \right| = 4$  and the angle between  $a$  and  $b$  is  $120^\circ$ , then find the value of  $\left| 4\vec{a} + 3\vec{b} \right|$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If the vectors  $A, B, C$  of a triangle  $ABC$  are  $(1, 2, 3)$ ,  $(-1, 0, 0)$ ,  $(0, 1, 2)$ , respectively then find  $\angle ABC$ .

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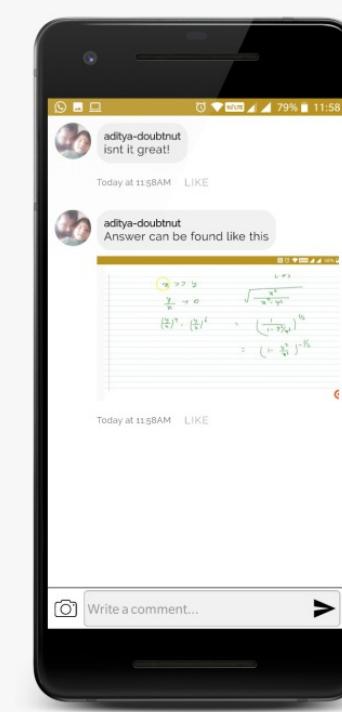
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

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Let  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be pairwise mutually perpendicular vectors, such that  $|\vec{a}| = 1$ ,  $|\vec{b}| = 2$ ,  $|\vec{c}| = 2$ . Then find the length of  $\vec{a} + \vec{b} + \vec{c}$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\vec{a} + \vec{b} + \vec{c} = 0, |\vec{a}| = 3,$$

$$|\vec{b}| = 5, |\vec{c}| = 7,$$

then find the angle between  $\vec{a}$  and  $\vec{b}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If the angel between unit vectors  $\vec{a}$  and  $\vec{b}$   $60^\circ$ , then find the value of  $|\vec{a} - \vec{b}|$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

Let

$$\hat{u} = \hat{i} + \hat{j}, \hat{v} = \hat{i} - \hat{j} \text{ and } \hat{w}$$

$$= \hat{i} + 2\hat{j} + 3\hat{k}$$

If  $\hat{n}$  is a unit vector such that  $\hat{u}\hat{n} = 0$  and  $\hat{v}\hat{n} = 0$ , then find the value of  $|\hat{w}\hat{n}|$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

$A, B, C, D$  are any four points, prove that

$$\begin{aligned} & \vec{A} \cdot \vec{B} \cdot \vec{C} \cdot \vec{D} + \vec{B} \cdot \vec{C} \cdot \vec{A} \cdot \vec{D} \\ & + \vec{C} \cdot \vec{A} \cdot \vec{B} \cdot \vec{D} = 0. \end{aligned}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

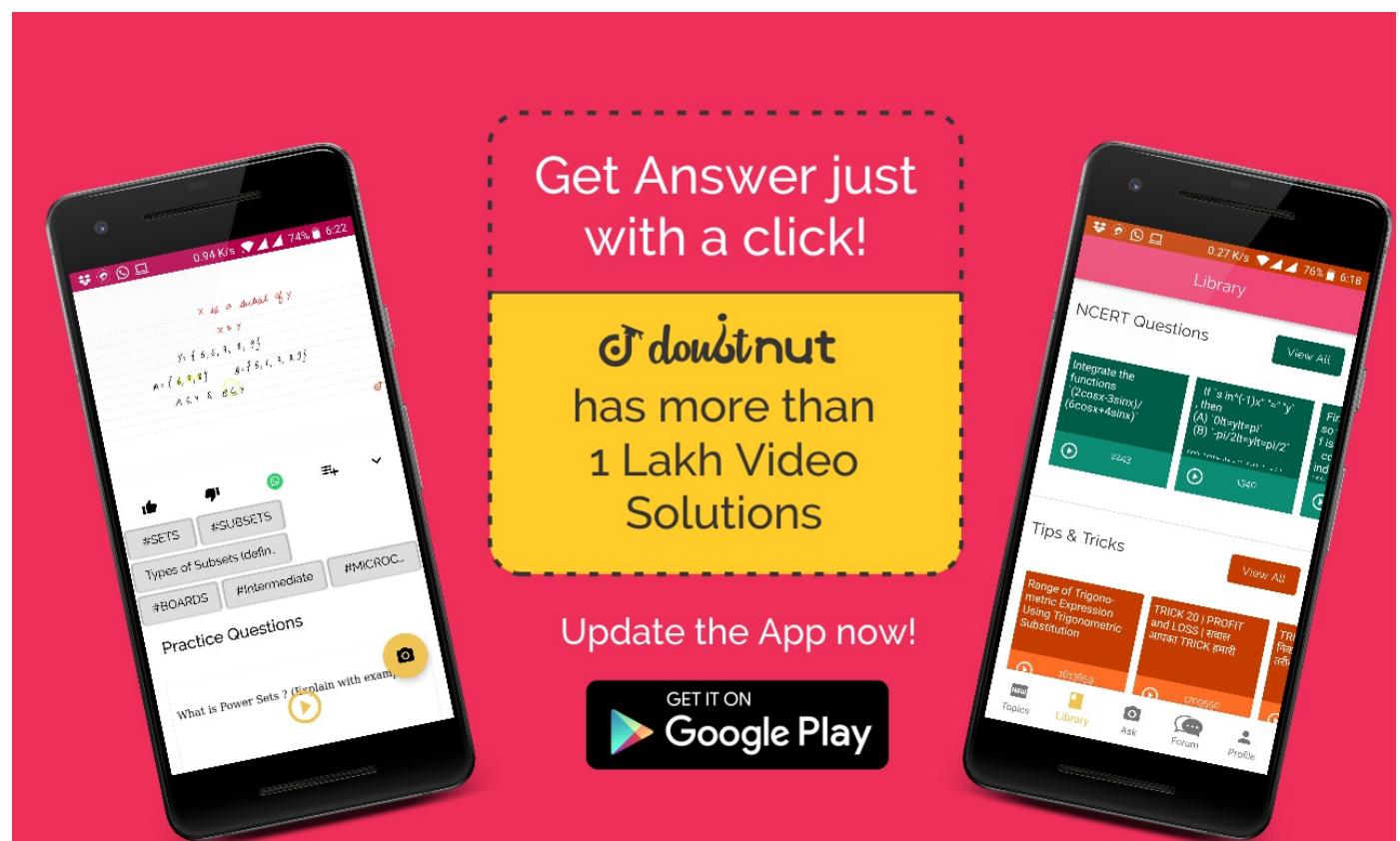
$P(1, 0, -1), Q(2, 0, -3),$

$R(-1, 2, 0)$  and  $S(-2, -1),$

then find the projection length of  $\vec{P}Q$  on  $\vec{RS}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If the vectors

$3\vec{p} + \vec{q}$ ;  $5\vec{p} - 3\vec{q}$  and  $2\vec{p} + \vec{q}$ ;  $4\vec{p} - 2\vec{q}$  are pairs of mutually perpendicular vectors, then find the angle between vectors  $\vec{p}$  and  $\vec{q}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

Let  $\vec{A}$  and  $\vec{B}$  be two non-parallel unit vectors in a plane. If  $(\alpha\vec{A} + \vec{B})$  bisects the internal angle between  $\vec{A}$  and  $\vec{B}$ , then find the value of  $\alpha$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

Let  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be unit vectors, such that

$$\vec{a} + \vec{b} + \vec{c} = \vec{x}, \vec{a} \cdot \vec{x}$$

$$= 1, \vec{b} \cdot \vec{x} = \frac{3}{2}, |\vec{x}| = 2.$$

Then find the angel between  $\vec{a}$  and  $\vec{x}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If  $\vec{a}$ , and  $\vec{b}$  are unit vectors , then find the greatest value of  $|\vec{a} + \vec{b}| + |\vec{a} - \vec{b}|$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

Constant forces

$$P_1 = \hat{i} + \hat{j} + \hat{k}, P_2 = -\hat{i} + 2\hat{j} - \hat{k}$$

act on a particle at a point  $A$ . Determine the work done when particle is displaced from position

$$A(4\hat{i} - 3\hat{j} - 2\hat{k})$$

$$\rightarrow B(6\hat{i} + \hat{j} - 3\hat{k}).$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If

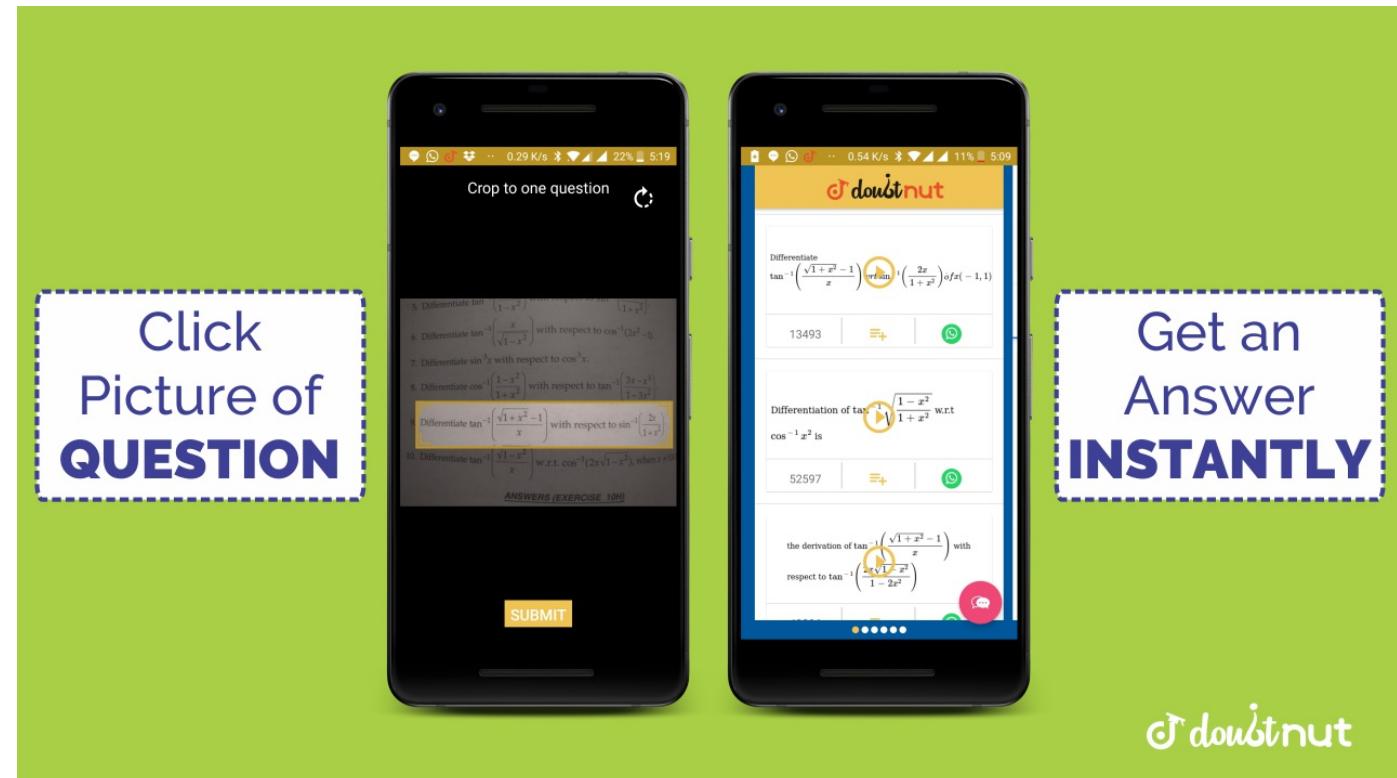
$$|\vec{a}| = 5, |\vec{a} - \vec{b}| = 8 \text{ and } |\vec{a} + \vec{b}| = 10$$

, then find  $|\vec{b}|$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If  $A, B, C, D$  are four distinct point in space such that  $AB$  is not perpendicular to  $CD$  and satisfies

$$\vec{A} \cdot \vec{B} \cdot \vec{C} \cdot \vec{D} = k \left( |\vec{A} \cdot \vec{D}|^2 \right.$$

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$$+ |\vec{B} \cdot \vec{C}|^2 - |\vec{A} \cdot \vec{C}|^2 \\ - |\vec{B} \cdot \vec{D}|^2 \left. \right),$$

then find the value of  $k$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If

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$$\begin{aligned}\vec{a} &= 2\hat{i} + 3\hat{j} - 5\hat{k}, \vec{b} \\ &= m\hat{i} + n\hat{j} + 12\hat{k} \text{ and } \vec{a} \\ &\times \vec{b} = \vec{0}, \\ \text{then find } (m, n).\end{aligned}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If  $|\vec{a}| = 2|\vec{b}| = 5$  and  $|\vec{a} \times \vec{b}| = 8$ , then find the value of  $\vec{a} \cdot \vec{b}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\vec{a} \times \vec{b} = \vec{b} \times \vec{c} \neq 0,$$

where  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$

are coplanar vectors, then for some scalar  $k$  prove that  $\vec{a} + \vec{c} = k\vec{b}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\vec{a} = 2\vec{i} + 3\vec{j} - \vec{k}, \vec{b} =$$

$$-\vec{i} + 2\vec{j} - 4\vec{k} \text{ and } \vec{c}$$

$$= \vec{i} + \vec{j} + \vec{k},$$

then find the value of  $(\vec{a} \times \vec{b}) \cdot \vec{c}$ .

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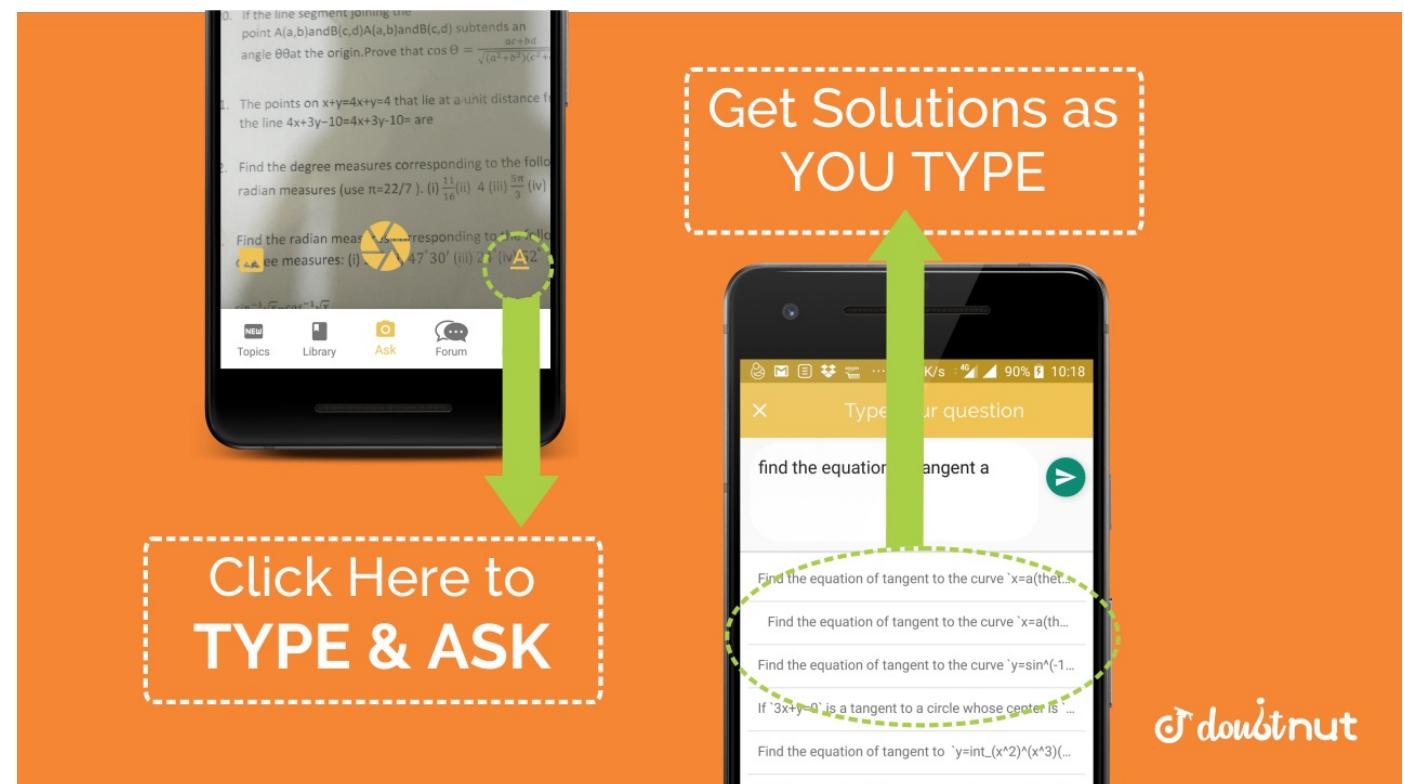
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If the vectors

$$\begin{aligned}\vec{c}, \vec{a} &= x\hat{i} + y\hat{j} + z\hat{k} \text{ and } \vec{b} \\ &= \hat{j}\end{aligned}$$

are such that  $\vec{a}$ ,  $\vec{c}$  and  $\vec{b}$  form a right-handed system, then find  $\vec{a} \cdot \vec{b}$ .



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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

Given that

$$\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}, \vec{a} \times \vec{b} = \vec{a} \\ \times \vec{c} \text{ and } \vec{a} \\ \text{is not a zero vector. Show that } \vec{b} = \vec{c}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

Show that

$$(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) \\ = 2\vec{a} \times \vec{b}$$

and give a geometrical interpretation of it.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If  $\vec{x}$  and  $\vec{y}$  are unit vectors and  $|\vec{z}| = \frac{2}{7}$  such that  $\vec{z} + \vec{z} \times \vec{x} = \vec{y}$ , then find the angle  $\theta$  between  $\vec{x}$  and  $\vec{z}$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

Prove that

$$\begin{aligned} & \left( \vec{a} \cdot \dot{\hat{i}} \right) \left( \vec{a} \times \hat{i} \right) \\ & + \left( \vec{a} \cdot \dot{\hat{j}} \right) \left( \vec{a} \times \hat{j} \right) \\ & + \left( \vec{a} \cdot \dot{\hat{k}} \right) \left( \vec{a} \times \hat{k} \right) = 0. \end{aligned}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

Let  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be three non-zero vectors such that

$$\vec{a} + \vec{b} + \vec{c} = 0 \text{ and } \lambda \vec{b}$$

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$$\begin{aligned} & \times \vec{a} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} \\ & = 0, \end{aligned}$$

then find the value of  $\lambda$

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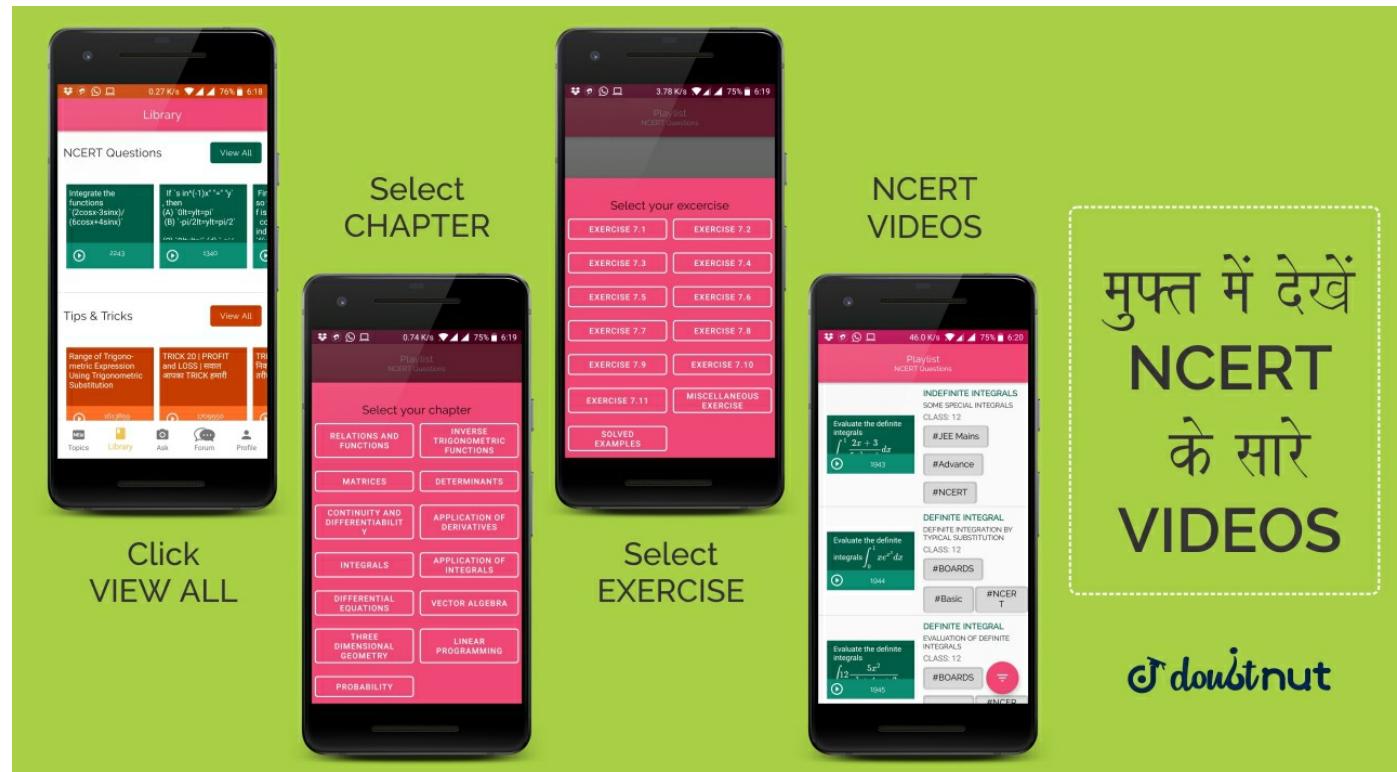
### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

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A particle has an angular speed of 3 rad/s and the axis of rotation passes through the points  $(1, 1, 2)$  and  $(1, 2, -2)$ . Find the velocity of the particle at point  $P(3, 6, 4)$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$\left( \vec{a} \times \vec{b} \right)^2 + \left( \vec{a} \cdot \vec{b} \right)^2$$

$$= 144 \text{ and } |\vec{a}| = 4,$$

then find the value of  $|\vec{b}|$ .

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3D

GEOMETRY\_VECTOR

**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

Given

$$|\vec{a}| = |\vec{b}| = 1 \text{ and } |\vec{a} + \vec{b}| = \sqrt{3}.$$

If  $\vec{c}$  is a vector such that

$$\vec{c} = \vec{a} - 2\vec{b}$$

$$= 3(\vec{a} \times \vec{b}),$$

then find the value of  $\vec{c} \cdot \vec{b}$

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

GEOMETRY\_VECTOR

Find the moment of  $\vec{F}$  about point (2, -1, 3), where force  $\vec{F} = 3\hat{i} + 2\hat{j} - 4\hat{k}$  is acting on point (1, -1, 2).

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

GEOMETRY\_VECTOR

If  $\vec{a}, \vec{b}, \vec{c}, \text{ and } \vec{d}$  are four non-coplanar unit vectors such that  $\vec{d}$  make equal angles with all the three vectors  $\vec{a}, \vec{b}$  and  $\vec{c}$ , then prove that

$$\begin{bmatrix} \vec{d} & \vec{a} & \vec{b} \end{bmatrix} = \begin{bmatrix} \vec{d} & \vec{c} & \vec{b} \end{bmatrix}$$

$$= \begin{bmatrix} \vec{d} & \vec{c} & \vec{a} \end{bmatrix}.$$

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

GEOMETRY\_VECTOR

Let

$$\begin{aligned}\vec{a} &= a_1\hat{i} + a_2\hat{j} + a_3\hat{k}, \vec{b} \\ &= b_1\hat{i} + b_2\hat{j} + b_3\hat{k} \text{ and } \vec{c} \\ &= c_1\hat{i} + c_2\hat{j} + c_3\hat{k}\end{aligned}$$

be three non-zero vectors such that  $\vec{c}$  is a unit vector perpendicular to both  $\vec{a}$  and  $\vec{b}$ . If the angle between  $a$  and  $b$  is  $\frac{\pi}{6}$ , then prove that

$$\begin{aligned}|a_1a_2a_3b_1b_2b_3c_1c_2c_3| \\ = \frac{1}{4}(a_{12} + a_{22} + a_{32})(b_{12} \\ + b_{22} + b_{32})\end{aligned}$$

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

**GEOMETRY\_VECTOR**

Prove that if  $[\vec{l} \vec{m} \vec{n}]$  are three non-coplanar vectors, then

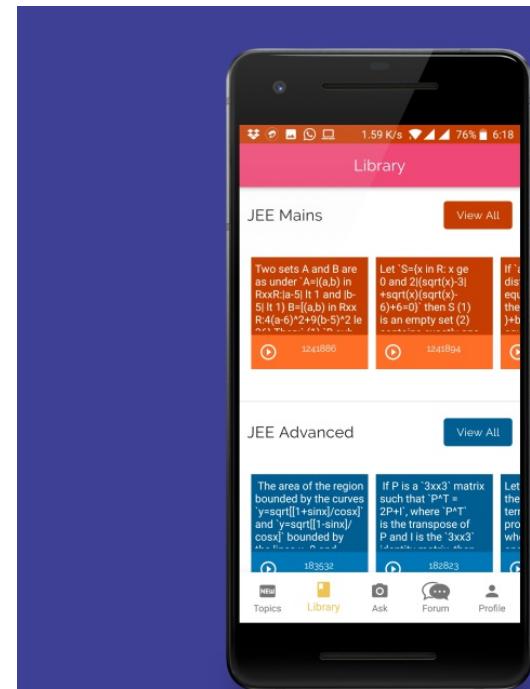
$$[\vec{l} \vec{m} \vec{n}] (\vec{a} \times \vec{b})$$

=

$$\begin{vmatrix} \vec{l} & \vec{a} & \vec{l} \\ \vec{l} & \vec{l} & \vec{b} \\ \vec{l} & \vec{m} & \vec{a} \\ \vec{a} & \vec{m} & \vec{b} \\ \vec{m} & \vec{b} & \vec{m} \\ \vec{b} & \vec{m} & \vec{n} \\ \vec{m} & \vec{n} & \vec{a} \\ \vec{a} & \vec{n} & \vec{b} \\ \vec{n} & \vec{b} & \vec{n} \end{vmatrix}$$

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

**GEOMETRY\_VECTOR**

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If the volume of a parallelepiped whose adjacent edges are  
 $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ ,  $\vec{b} = \hat{i} + \alpha\hat{j} + 2\hat{k}$   
 $+ \alpha\hat{k}$   
is 15, then find the value of  $\alpha$  if ( $\alpha > 0$ ).

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

**GEOMETRY\_VECTOR**

If

$$\vec{a} = \hat{i} + \hat{j} + \hat{k} \text{ and } \vec{b} = \hat{i} - 2\hat{j} + \hat{k},$$

then find vector  $\vec{c}$  such that  $\vec{a} \cdot \vec{c} = 2$  and  $\vec{a} \times \vec{c} = \vec{b}$ .

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

**GEOMETRY\_VECTOR**

If  $\vec{x} \cdot \vec{a} = 0$ ,  $\vec{x} \cdot \vec{b} = 0$  and  $\vec{x} \cdot \vec{c} = 0$  for some non-zero vector  $\vec{x}$ , then prove that  $[\vec{a} \vec{b} \vec{c}] = 0$ .

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

**GEOMETRY\_VECTOR**

If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are three vectors such that

$$\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} =$$

$$= \vec{a}, \vec{c} \times \vec{a} = \vec{b},$$

then prove that  $|\vec{a}| = |\vec{b}| = |\vec{c}|$ .

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

**GEOMETRY\_VECTOR**

If

$$\vec{a} = \vec{p} + \vec{q}, \vec{p} \times \vec{b}$$

$$= 0 \text{ and } \vec{q} \cdot \vec{b} = 0,$$

$$\text{then prove that } \frac{\vec{b} \times (\vec{a} \times \vec{b})}{\vec{b} \cdot \vec{b}} = \vec{q}.$$

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors

3D

GEOMETRY\_VECTOR

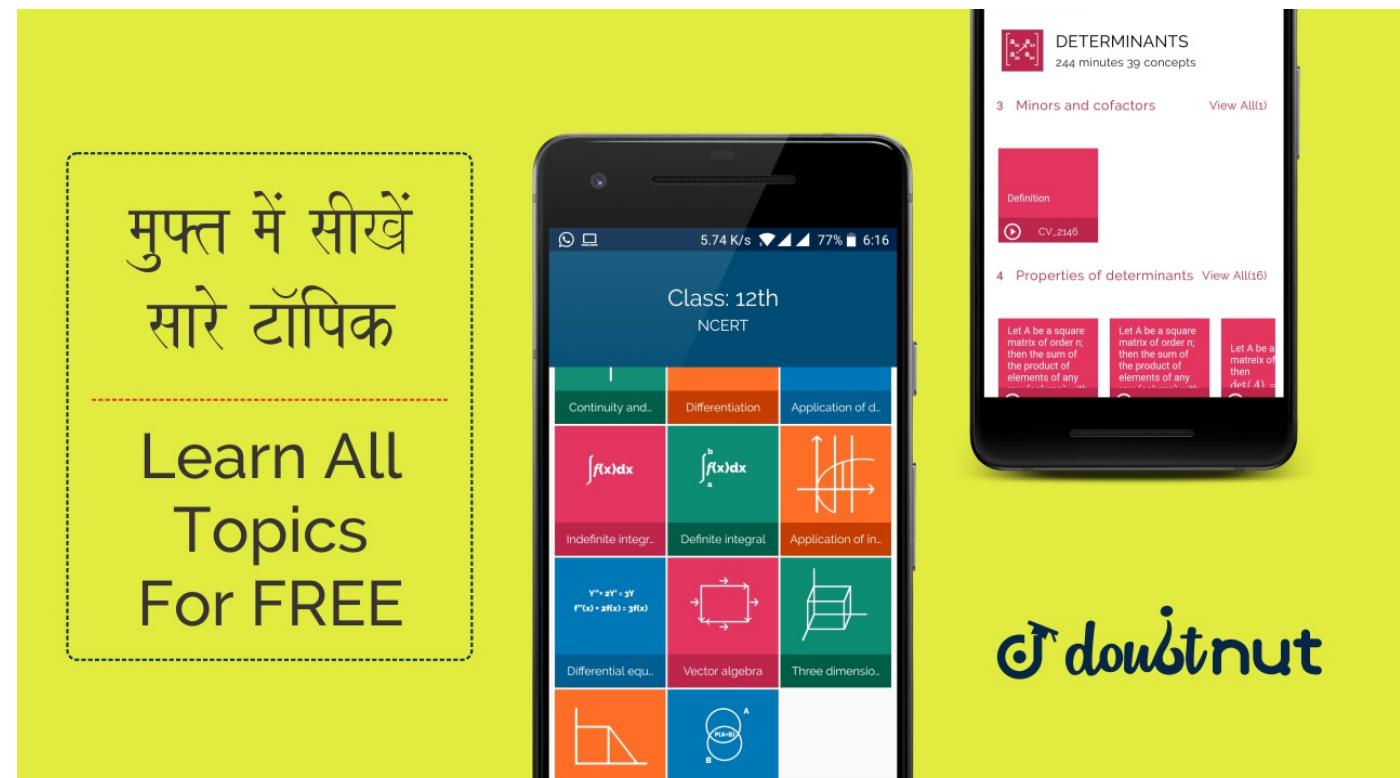
Prove that

$$\begin{aligned} & \left( \vec{a} \left( \vec{b} \times \hat{i} \right) \hat{i} \right. \\ & + \left. \left( \vec{a} \vec{b} \times \hat{j} \right) \hat{j} \right. \\ & + \left. \left( \vec{a} \vec{b} \times \hat{k} \right) \hat{k} \right) = \vec{a} \times \vec{b}. \end{aligned}$$

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors

3D

GEOMETRY\_VECTOR

For any four vectors,  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  and  $\vec{d}$  prove that

$$\begin{aligned} & \vec{a} \times \left( \vec{b} \times \left( \vec{c} \times \vec{d} \right) \right) \\ & = \left( \vec{b} \vec{d} \right) \left[ \vec{a} \vec{c} \vec{d} \right]. \end{aligned}$$

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If  $\vec{a}$ , and  $\vec{b}$  be two non-collinear unit vector such that  $\vec{a} \times (\vec{a} \times \vec{b}) = \frac{1}{2} \vec{b}$ , then find the angle between  $\vec{a}$ , and  $\vec{b}$ .

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Show that

$$(\vec{a} \times \vec{b}) \times \vec{c} = \vec{a}$$

$$\times (\vec{b} \times \vec{c})$$

if and only if  $\vec{a}$  and  $\vec{c}$  are collinear of  $(\vec{a} \times \vec{c}) \times \vec{b} = 0$ .

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If  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  be non-zero vectors such that no tow are collinear or

$$(\vec{a} \times \vec{b}) \times \vec{c}$$

$$= \frac{1}{3} |\vec{b}| |\vec{c}| |\vec{a}|.$$

If  $\theta$  is the acute angle between vectors  $\vec{b}$  and  $\vec{c}$ , then find the value of  $s \int h \eta$ .

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If  $\vec{p}$ ,  $\vec{q}$ ,  $\vec{r}$  denote vector  $\vec{b} \times \vec{c}$ ,  $\vec{c} \times \vec{a}$ ,  $\vec{a} \times \vec{b}$ , respectively, show that  $\vec{a}$  is parallel to  $\vec{q} \times \vec{r}$ ,  $\vec{b}$  is parallel  $\vec{r} \times \vec{p}$ ,  $\vec{c}$  is parallel to  $\vec{p} \times \vec{q}$ .

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Let  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  be non-coplanar vectors and let the equation  $\vec{a}'$ ,  $\vec{b}'$ ,  $\vec{c}'$ , are reciprocal system of vector  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$ , then prove that

$$\vec{a} \times \vec{a}' + \vec{b} \times \vec{b}' + \vec{c} \times \vec{c},$$

is a null vector.

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors

3D

GEOMETRY\_VECTOR

Given unit vectors  $\hat{m}$ ,  $\hat{n}$  and  $\hat{p}$  such that angle between  $\hat{m}$  and  $\hat{n}$  is  $\alpha$  and angle between  $\hat{p}$  and  $(\hat{m} \times \hat{n})$  is also  $\alpha$ , if  $[\hat{n} \hat{p} \hat{m}] = 1/4$ , then find the value of  $\alpha$ .

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors

3D

GEOMETRY\_VECTOR

$\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are three unit vectors and every two are inclined to each other at an angle  $\cos^{-1}(3/5)$ . If

$$\vec{a} \times \vec{b} = p \vec{a} + q \vec{b} + r \vec{c},$$

where  $p$ ,  $q$ ,  $r$  are scalars, then find the value of  $q$ .

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Miscellaneous

3D

GEOMETRY\_VECTOR

The position vectors of the vertices  $A$ ,  $B$ , and  $C$  of a triangle are  $\hat{i} + \hat{j}$ ,  $\hat{j} + \hat{k}$  and  $\hat{i} + \hat{k}$ , respectively. Find the unite vector  $\hat{r}$  lying in the plane of

*ABC* and perpendicular to  $IA$ , where  $I$  is the incentre of the triangle.

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Addition Of Vector**

AND

3D

**GEOMETRY\_VECTOR**

A ship is sailing towards the north at a speed of 1.25 m/s. The current is taking it towards the east at the rate of 1 m/s and a sailor is climbing a vertical pole on the ship at the rate of 0.5 m/s. Find the velocity of the sailor in space.

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Miscellaneous**

AND

3D

**GEOMETRY\_VECTOR**

Given four points  $P_1, P_2, P_3$  and  $P_4$  on the coordinate plane with origin  $O$  which satisfy the condition

$$\left( \overrightarrow{OP} \right)_{n-1} + \left( \overrightarrow{OP} \right)_{n+1} = \frac{3}{2} \overrightarrow{OP}_n$$

(i) If  $P_1$  and  $P_2$  lie on the curve  $xy=1$ , then prove that  $P_3$  does not lie on the curve (ii)  
If  $P_1, P_2, P_3$  lie on a circle  $x^2 + y^2 = 1$ , then prove that  $P_4$  also lies on this circle.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

$ABCD$  is a tetrahedron and  $O$  is any point. If the lines joining  $O$  to the vertices meet the opposite faces at  $P, Q, R$  and  $S$ , prove that

$$\frac{OP}{AP} + \frac{OQ}{BQ} + \frac{OR}{CR} + \frac{OS}{DS} = 1.$$

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A pyramid with vertex at point  $P$  has a regular hexagonal base  $ABCDEF$ . Positive vector of points A and B are  $\hat{i}$  and  $\hat{i} + 2\hat{j}$ . The centre of base has the position vector  $\hat{i} + \hat{j} + \sqrt{3}\hat{k}$ . Altitude drawn from  $P$  on the base meets the diagonal  $AD$  at point  $G$ . find the all possible position vectors of  $G$ . It is given that the volume of the pyramid is  $6\sqrt{3}$  cubic units and  $AP$  is 5 units.

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A straight line  $L$  cuts the lines  $AB$ ,  $AC$  and  $AD$  of a parallelogram  $ABCD$  at points  $B_1$ ,  $C_1$  and  $D_1$ , respectively. If

$$\left(\vec{AB}\right)_1, \lambda_1 \vec{AB}, \left(\vec{AD}\right)_1$$

$$= \lambda_2 \vec{AD} \text{ and } \left(\vec{AC}\right)_1$$

$$= \lambda_3 \vec{AC},$$

$$\text{then prove that } \frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}.$$

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The position vector of the points  $P$  and  $Q$  are  $5\hat{i} + 7\hat{j} - 2\hat{k}$  and  $-3\hat{i} + 3\hat{j} + 6\hat{k}$ , respectively. Vector  $\vec{A} = 3\hat{i} - \hat{j} + \hat{k}$  passes through point  $P$  and vector  $\vec{B} = -3\hat{i} + 2\hat{j} + 4\hat{k}$  passes through point  $Q$ . A third vector  $2\hat{i} + 7\hat{j} - 5\hat{k}$  intersects vectors  $A$  and  $B$ . Find the position vectors of points of intersection.

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Sow that

$$x_1\hat{i} + y_1\hat{j} + z_1\hat{k}, x_2\hat{i} + y_2\hat{j}$$

$$+ z_2\hat{k}, \text{ and } x_3\hat{i} + y_3\hat{j} + z_3\hat{k},$$

are non-coplanar if

$$|x_1| > |y_1| + |z_1|, |y_2| > |x_2|$$

$$+ |z_2| \text{ and } |z_3| > |x_3| + |y_3|$$

.

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If  $\vec{A}$  and  $\vec{B}$  are two vectors and  $k$  any scalar quantity greater than zero, then prove that

$$\left| \vec{A} + \vec{B} \right|^2 \leq (1 + k) \left| \vec{A} \right|^2 + \left( 1 + \frac{1}{k} \right) \left| \vec{B} \right|^2.$$

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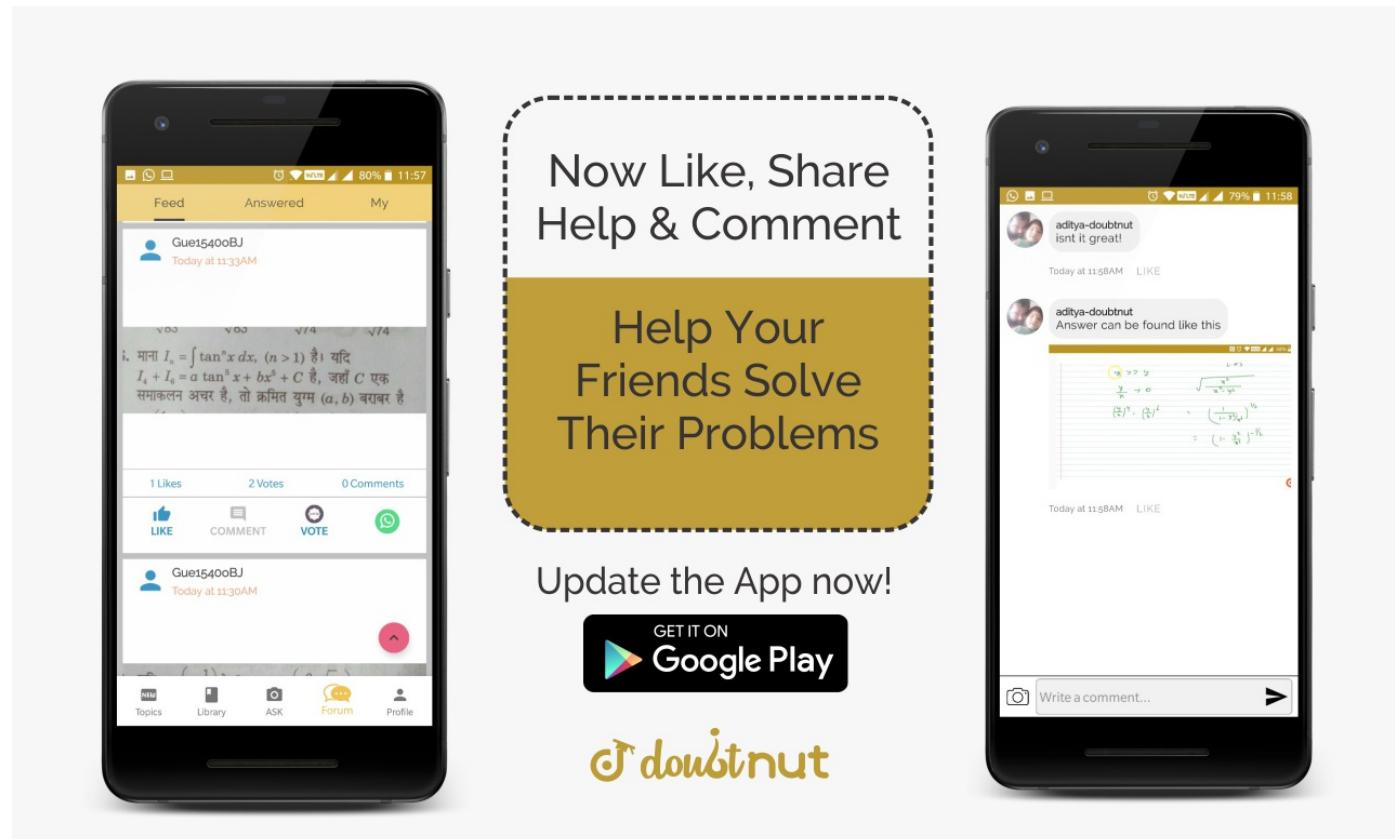
**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Consider the vectors

$$\begin{aligned} & \hat{i} + \cos(\beta - \alpha)\hat{j} \\ & + \cos(\gamma - \alpha)\hat{k}, \cos(\alpha - \beta)\hat{i} \\ & + \hat{j} + \cos(\gamma - \beta)\hat{k} \text{ and } \cos(\alpha - \gamma)\hat{i} + \cos(\beta - \gamma)\hat{k} + a\hat{k} \end{aligned}$$

where  $\alpha$ ,  $\beta$ , and  $\gamma$  are different angles. If these vectors are coplanar, show that  $a$  is independent of  $\alpha$ ,  $\beta$  and  $\gamma$

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Section Formula**

AND

3D

GEOMETRY\_VECTOR

In a triangle  $PQR$ ,  $S$  and  $T$  are points on  $QR$  and  $PR$ , respectively, such that  $QS = 3SR$  and  $PT = 4TR$ . Let  $M$  be the point of intersection of  $PS$  and  $QT$ . Determine the ratio  $QM : MT$  using the vector method.

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A boat moves in still water with a velocity which is  $k$  times less than the river flow velocity. Find the angle to the stream direction at which the boat should be rowed to minimize drifting.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If  $D, E$  and  $F$  are three points on the sides  $BC, CA$  and  $AB$ , respectively, of a triangle  $ABC$  such that the  $\frac{BD}{CD}, \frac{CE}{AE}, \frac{AF}{BF} = -1$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Types Of Vectors**

In a quadrilateral

$$PQRS, \vec{PQ} = \vec{a}, \vec{QR} = \vec{b},$$

$$\vec{SP} = \vec{a} - \vec{b}, M$$

is the midpoint of  $\vec{QR}$  and  $X$  is a point on  $SM$  such that  $SX = \frac{4}{5}SM$ . Prove that  $P, X$  and  $R$  are collinear.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Four non –zero vectors will always be a. linearly dependent  
independent c. either a or b

b. linearly independent d. none of these

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Let  $\vec{a}, \vec{b}$  and  $\vec{c}$  be three units vectors such that  $2\vec{a} + 4\vec{b} + 5\vec{c} = 0$ . Then which of the following statement is true? a.  $\vec{a}$  is parallel to  $\vec{b}$  b.  $\vec{a}$  is perpendicular to  $\vec{b}$  c.  $\vec{a}$  is neither parallel nor perpendicular to  $\vec{b}$  d. none of these

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space**

222

Let  $ABC$  be triangle, the position vectors of whose vertices are respectively  $\hat{i} + 2\hat{j} + 4\hat{k}$ ,  $-2\hat{i} + 2\hat{j} + \hat{k}$  and  $2\hat{i} + 4\hat{j} - 3\hat{k}$ . Then Delta  $ABC$  is a. isosceles b. equilateral c. right angled d. none of these

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Miscellaneous**

223

If  $|\vec{a} + \vec{b}| < |\vec{a} - \vec{b}|$ , then the angle between  $\vec{a}$  and  $\vec{b}$  can lie in the interval a.  $(\pi/2, \pi/2)$  b.  $(0, \pi)$  c.  $(\pi/2, 3\pi/2)$  d.  $(0, 2\pi)$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space**

224

If  $G$  is the centroid of triangle

$ABC$ , then  $\vec{G}A + \vec{G}B$

$+ \vec{G}C$

is equal to a.  $\vec{0}$  b.  $3\vec{G}A$  c.  $3\vec{G}B$  d.  $3\vec{G}C$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Addition Of Vector**

225

$ABCD$  parallelogram, and  $A_1$  and  $B_1$  are the midpoints of sides  $BC$  and  $CD$ , respectively. If  $\vec{A}_1 + \vec{A}B_1 = \lambda \vec{AC}$ , then  $\lambda$  is equal to a.  $\frac{1}{2}$  b. 1 c.  $\frac{3}{2}$  d. 2 e.  $\frac{2}{3}$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space**

The position vectors of the points  $P$  and  $Q$  with respect to the origin  $O$  are  $\vec{a} = \hat{i} + 3\hat{j} - 2\hat{k}$  and  $\vec{b} = 3\hat{i} - \hat{j} - 2\hat{k}$ , respectively. If  $M$  is a point on  $PQ$ , such that  $OM$  is the bisector of  $\angle POQ$ , then  $\vec{OM}$  is a.

- $2(\hat{i} - \hat{j} + \hat{k})$
- $2\hat{i} + \hat{j} - 2\hat{k}$
- $2(-\hat{i} + \hat{j} - \hat{k})$
- $2(\hat{i} + \hat{j} + \hat{k})$

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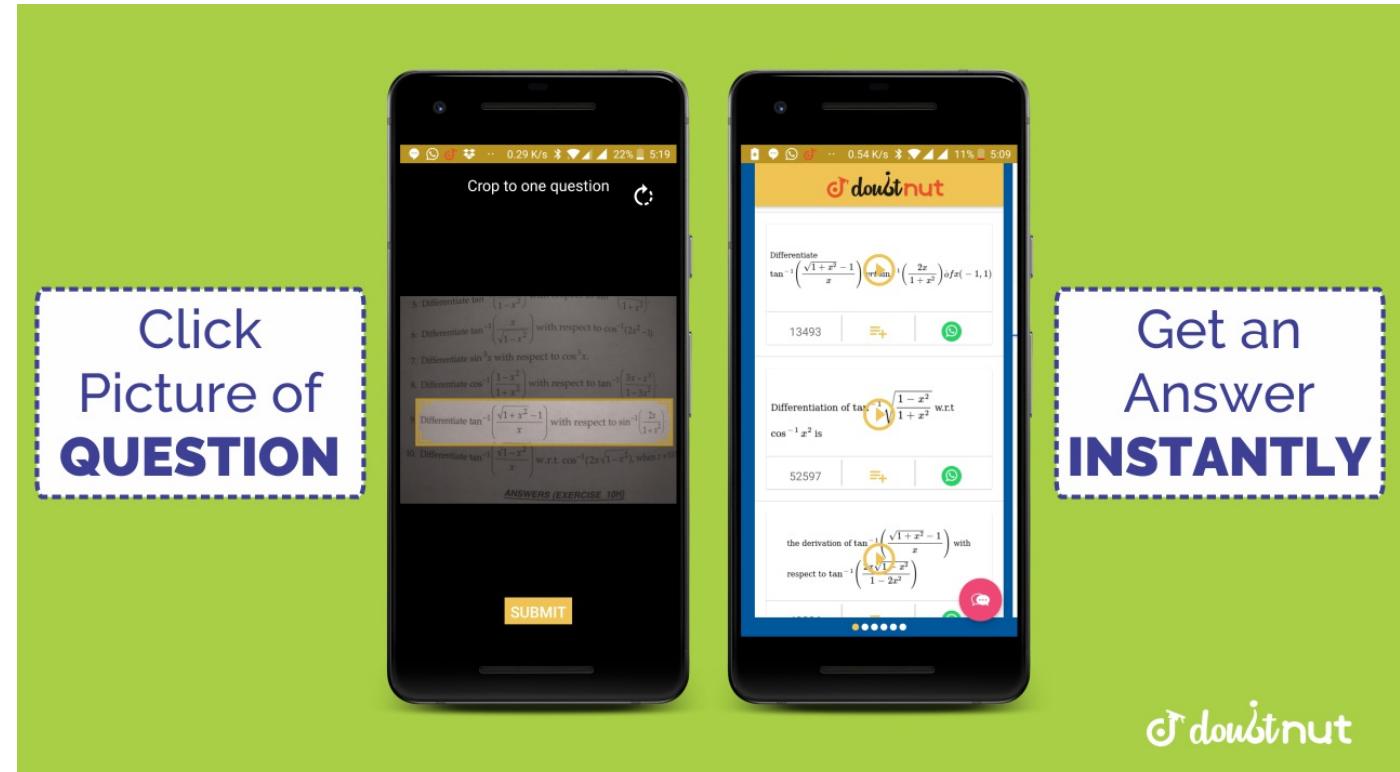
**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space**

$ABCD$  is a quadrilateral.  $E$  is the point of intersection of the line joining the midpoints of the opposite sides. If  $O$  is any point and  $\vec{OA} + \vec{OB} + \vec{OC} + \vec{OD} = x\vec{OE}$ , then  $x$  is equal to

- 3
- 9
- 7
- 4

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA>Addition Of Vector**

If vectors

$$\vec{AB} = -3\hat{i} + 4\hat{k} \text{ and } \vec{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$$

are the sides of a  $\Delta ABC$ , then the length of the median through  $A$  is

- $\sqrt{14}$
- $\sqrt{18}$
- $\sqrt{29}$
- $\sqrt{5}$

229

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

$A, B, C$  and  $D$  have position vectors  $\vec{a}, \vec{b}, \vec{c}$  and  $\vec{d}$ , respectively, such that  $\vec{a} - \vec{b} = 2(\vec{d} - \vec{c})$ . Then a.  $AB$  and  $CD$  bisect each other b.  $BD$  and  $AC$  bisect each other c.  $AB$  and  $CD$  trisect each other d.  $BD$  and  $AC$  trisect each other

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors**

If  $\vec{a}$  and  $\vec{b}$  are two unit vectors and  $\theta$  is the angle between them, then the unit vector along the angular bisector of  $\vec{a}$  and  $\vec{b}$  will be given by a.  $\frac{\vec{a} - \vec{b}}{\cos(\theta/2)}$  b.  $\frac{\vec{a} + \vec{b}}{2\cos(\theta/2)}$  c.  $\frac{\vec{a} - \vec{b}}{2\cos(\theta/2)}$  d. none of these

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Evolution Of Vector Concept**

Let us define the length of a vector

$$a\hat{i} + b\hat{j} + c\hat{k} \text{ as } |a| + |b| + |c|$$

This definition coincides with the usual definition of length of a vector  $a\hat{i} + b\hat{j} + c\hat{k}$  if and only if a.  $a = b = c = 0$  b. any two of  $a, b$ , and  $c$  are zero c. any one of  $a, b$ , and  $c$  is zero d.  $a + b + c = 0$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Given three vectors

$$\vec{a} = 6\hat{i} - 3\hat{j}, \vec{b} = 2\hat{i}$$

$$- 6\hat{j} \text{ and } \vec{c} = - 2\hat{i} + 21\hat{j}$$

such that  $\vec{\alpha} = \vec{a} + \vec{b} + \vec{c}$  Then the resolution of the vector  $\vec{\alpha}$  into components with respect to  $\vec{a}$  and  $\vec{b}$  is given by a.  $3\vec{a} - 2\vec{b}$  b.  $3\vec{b} - 2\vec{a}$  c.  $2\vec{a} - 3\vec{b}$  d.  $\vec{a} - 2\vec{b}$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear**

## Combination Linear Independence And Linear Dependence

233

If

$$\vec{\alpha} + \vec{\beta} + \vec{\gamma} = a \vec{\delta} \text{ and } \vec{\beta}$$

$$+ \vec{\gamma} + \vec{\delta} = b \vec{\alpha}, \vec{\alpha} \text{ and } \vec{\delta}$$

are non-collinear, then  $\vec{\alpha} + \vec{\beta} + \vec{\gamma} + \vec{\delta}$  equals a.  $a \vec{\alpha}$  b.  $b \vec{\delta}$  c. 0 d.  $(a+b) \vec{\gamma}$

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Addition Of Vector

AND

3D

GEOMETRY\_VECTOR

In triangle  $ABC$ ,  $\angle A = 30^\circ$ ,  $H$  is the orthocenter and  $D$  is the midpoint of  $BC$ . Segment  $HD$  is produced to  $T$  such that  $HD = DT$ . The length  $AT$  is equal to a.  $2BC$  b.  $3BC$  c.  $\frac{4}{2} BC$  d. none of these

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

Let  $\vec{r}_1, \vec{r}_2, \vec{r}_3, \dots, \vec{r}_n$  be the position vectors of points  $P_1, P_2, P_3, P_n$  relative to the origin  $O$ . If the vector equation

$$a_1 \vec{r}_1 + a_2 \vec{r}_2 + \dots + a_n \vec{r}_n$$

$$= 0$$

hold, then a similar equation will also hold w.r.t. to any other origin provided a.  $a_1 + a_2 + \dots + a_n = n$  b.  $a_1 + a_2 + \dots + a_n = 1$  c.  $a_1 + a_2 + \dots + a_n = 0$  d.  $a_1 = a_2 = a_3 = \dots = a_n = 0$

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Addition Of Vector

AND

3D

GEOMETRY\_VECTOR

Given three non-zero, non-coplanar vectors

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$\vec{a}$ ,  $\vec{b}$ , and  $\vec{r}_1 = p\vec{a}$

$+ q\vec{b} + \vec{c}$  and  $\vec{r}_2 = \vec{a}$

$+ p\vec{b} + q\vec{c}$

If the vectors  $\vec{r}_1$  and  $2\vec{r}_2$  and  $2\vec{r}_1 + \vec{r}_2$  are collinear, then  $(P, q)$  is a.  $(0, 0)$  b.  $(1, -1)$  c.  $(-1, 1)$  d.  $(1, 1)$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

If the vectors  $\vec{a}$  and  $\vec{b}$  are linearly independent satisfying

$$(\sqrt{3}\tan\theta + 1)\vec{a}$$

$$+ (\sqrt{3}\sec\theta - 2)\vec{b} = 0,$$

then the most general values of  $\theta$  are a.  $n\pi - \frac{\pi}{6}$ ,  $n \in \mathbb{Z}$  b.  $2n\pi \pm \frac{11\pi}{6}$ ,  $n \in \mathbb{Z}$  c.

$$n\pi \pm \frac{\pi}{6}, n \in \mathbb{Z}$$
 d.  $2n\pi + \frac{11\pi}{6}, n \in \mathbb{Z}$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Types Of Vectors

In a trapezium, vector  $\vec{BC} = \alpha\vec{AD}$ . We will then find that  $\vec{p} = \vec{AC} + \vec{BD}$  is collinear with  $\vec{AD}$ . If  $\vec{p} = \mu\vec{AD}$ , then which of the following is true? a.  $\mu = \alpha + 2$  b.  $\mu + \alpha = 2$  c.  $\alpha = \mu + 1$  d.  $\mu = \alpha + 1$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

Vectors

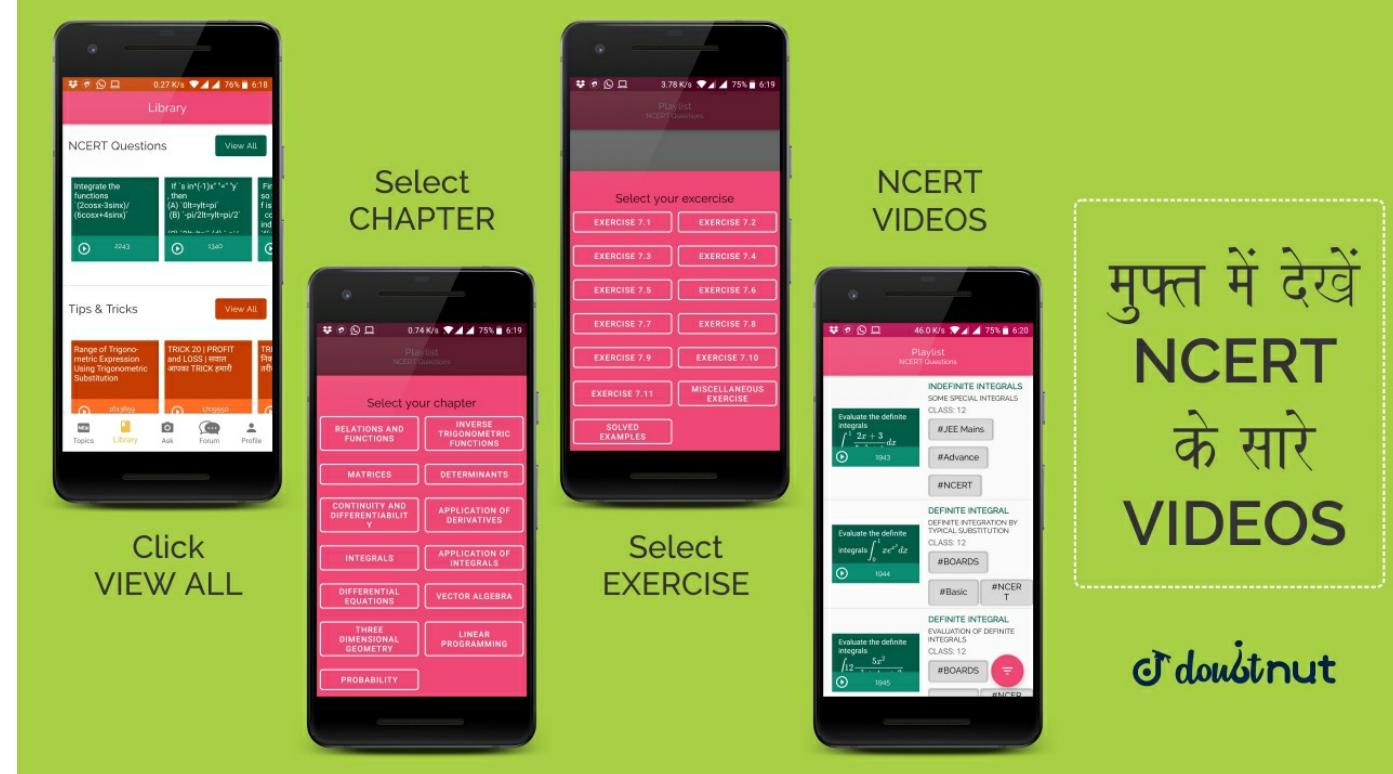
$$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i}$$

$$- \hat{j} + \hat{k}, \text{ and } \vec{c} = 3\hat{i} + \hat{j}$$

$$+ 4\hat{k},$$

are so placed that the end point of one vector is the starting point of the next vector. Then the vector are a. not coplanar b. coplanar but cannot form a triangle c. coplanar and form a triangle d. coplanar and can form a right angled triangle

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### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Multiplication Of A Vector By A Scalar

Vectors

$$\vec{a} = -4\hat{i} + 3\hat{k}; \vec{b} = 14\hat{i} + 2\hat{j} - 5\hat{k}$$

are laid off from one point. Vector  $\vec{d}$ , which is being laid off from the same point dividing the angle between vectors  $\vec{a}$  and  $\vec{b}$  in equal halves and having the magnitude  $\sqrt{6}$ , is a.  $\hat{i} + \hat{j} + 2\hat{k}$  b.  $\hat{i} - \hat{j} + 2\hat{k}$  c.  $\hat{i} + \hat{j} - 2\hat{k}$  d.  $2\hat{i} - \hat{j} - 2\hat{k}$

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### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA>Addition Of Vector

If  $\hat{i} - 3\hat{j} + 5\hat{k}$  bisects the angle between  $\hat{a}$  and  $-\hat{i} + 2\hat{j} + 2\hat{k}$ , where  $\hat{a}$

is a unit vector, then a.  $\hat{a} = \frac{1}{105}(41\hat{i} + 88\hat{j} - 40\hat{k})$  b.

$\hat{a} = \frac{1}{105}(41\hat{i} + 88\hat{j} + 40\hat{k})$  c.

$\hat{a} = \frac{1}{105}(-41\hat{i} + 88\hat{j} - 40\hat{k})$

d.  $\hat{a} = \frac{1}{105}(41\hat{i} - 88\hat{j} - 40\hat{k})$

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### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space

If

$$4\hat{i} + 7\hat{j} + 8\hat{k}, 2\hat{i} + 3\hat{j} + 24 \text{ and } 2\hat{i} + 5\hat{j} + 7\hat{k}$$

are the position vectors of the vertices  $A$ ,  $B$  and  $C$ , respectively, of triangle  $ABC$ , then the position vector of the point where the bisector of angle  $A$  meets  $BC$  is a.

a.  $\frac{2}{3}(-6\hat{i} - 8\hat{j} - \hat{k})$  b.  $\frac{2}{3}(6\hat{i} + 8\hat{j} + 6\hat{k})$  c.  $\frac{1}{3}(6\hat{i} + 13\hat{j} + 18\hat{k})$  d.

$\frac{1}{3}(5\hat{j} + 12\hat{k})$

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Miscellaneous**

AND

3D

**GEOMETRY\_VECTOR**

If  $\vec{b}$  is a vector whose initial point divides the join of  $5\hat{i}$  and  $5\hat{j}$  in the ratio  $k:1$  and whose terminal point is the origin and  $|\vec{b}| \leq \sqrt{37}$ , then  $k$  lies in the interval a.  $[-6, -1/6]$  b.  $(-\infty, -6] \cup [-1/6, \infty)$  c.  $[0, 6]$  d. none of these

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Find the value of  $\lambda$  so that the points  $P, Q, R$  and  $S$  on the sides  $OA, OB, OC$  and  $AB$ , respectively, of a regular tetrahedron  $OABC$  are coplanar. It is given that

$$\begin{aligned}\frac{\overrightarrow{OP}}{\overrightarrow{OA}} &= \frac{1}{3}, \quad \frac{\overrightarrow{OQ}}{\overrightarrow{OB}} = \frac{1}{2}, \quad \frac{\overrightarrow{OR}}{\overrightarrow{OC}} \\ &= \frac{1}{3} \text{ and } \frac{\overrightarrow{OS}}{\overrightarrow{AB}} = \lambda.\end{aligned}$$

- a.  $\lambda = \frac{1}{2}$  b.  $\lambda = -1$  c.  $\lambda = 0$  d. for no value of  $\lambda$

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space**

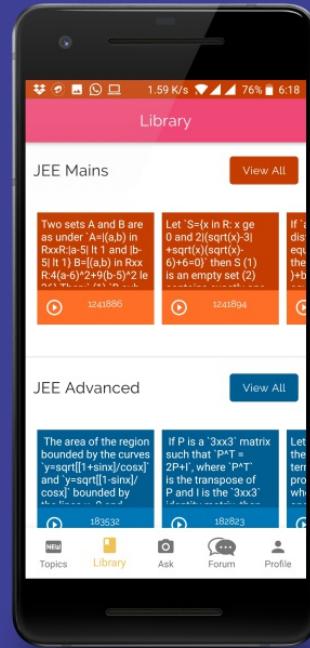
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**GEOMETRY\_VECTOR**

' $I$ ' is the incentre of triangle  $ABC$  whose corresponding sides are  $a, b, c$ , respectively.  $a\vec{IA} + b\vec{IB} + c\vec{IC}$  is always equal to a.  $\vec{0}$  b.  $(a+b+c)\vec{BC}$  c.  $(\vec{a} + \vec{b} + \vec{c})\vec{AC}$  d.  $(a+b+c)\vec{AB}$

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Miscellaneous**

**AND**

**3D**

**GEOMETRY\_VECTOR**

Let  $x^2 + 3y^2 = 3$  be the equation of an ellipse in the  $x - y$  plane.  $A$  and  $B$  are two points whose position vectors are  $-\sqrt{3}\hat{i}$  and  $-\sqrt{3}\hat{i} + 2\hat{k}$ . Then the position vector of a point  $P$  on the ellipse such that  $\angle APB = \pi/4$  is a.  $\pm \hat{j}$  b.  $\pm (\hat{i} + \hat{j})$  c.  $\pm \hat{i}$  d. none of these

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If  $\vec{x}$  and  $\vec{y}$  are two non-collinear vectors and  $ABC$  is a triangle with side lengths  $a, b$ , and  $c$  satisfying

$$(20a - 15b)\vec{x}$$

$$+ (15b - 12c)\vec{y}$$

$$+ (12c - 20a)(\vec{x} \times \vec{y})$$

$$= 0,$$

then triangle  $ABC$  is a. an acute-angled triangle b. an obtuse-angled triangle c. a right-angled triangle d. an isosceles triangle

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Evolution Of Vector Concept**

**3D**

**GEOMETRY\_VECTOR**

A uni-modular tangent vector on the curve

$$x = t^2 + 2, y = 4t - 5, z$$

$$= 2t^2 - 6t = 2$$

is a.  $\frac{1}{3}(2\hat{i} + 2\hat{j} + \hat{k})$  b.  $\frac{1}{3}(\hat{i} - \hat{j} - \hat{k})$  c.  $\frac{1}{6}(2\hat{i} + \hat{j} + \hat{k})$  d.  $\frac{2}{3}(\hat{i} + \hat{j} + \hat{k})$

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If  $\vec{x}$  and  $\vec{y}$  are two non-collinear vectors and a, b, and c represent the sides of a  $ABC$  satisfying

$$(a - b)\vec{x} + (b - c)\vec{y} \\ + (c - a)(\vec{x} \times \vec{y}) = 0,$$

then  $ABC$  is (where  $\vec{x} \times \vec{y}$  is perpendicular to the plane of  $x$  and  $y$ ) a. an acute-angled triangle b. an obtuse-angled triangle c. a right-angled triangle d. a scalene triangle

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Components Of A Vector**

250  $\vec{A}$  is a vector with direction cosines  $\cos \alpha, \cos \beta$  and  $\cos \gamma$ . Assuming the  $y - z$  plane as a mirror, the direction cosines of the reflected image of  $\vec{A}$  in the plane are a.  $\cos \alpha, \cos \beta, \cos \gamma$  b.  $\cos \alpha, -\cos \beta, \cos \gamma$  c.  $-\cos \alpha, \cos \beta, \cos \gamma$  d.  $-\cos \alpha, -\cos \beta, -\cos \gamma$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

The vectors

$$x\hat{i} + (x + 1)\hat{j} + (x + 2)\hat{k},$$

$$(x + 3)\hat{i} + (x + 4)\hat{j}$$

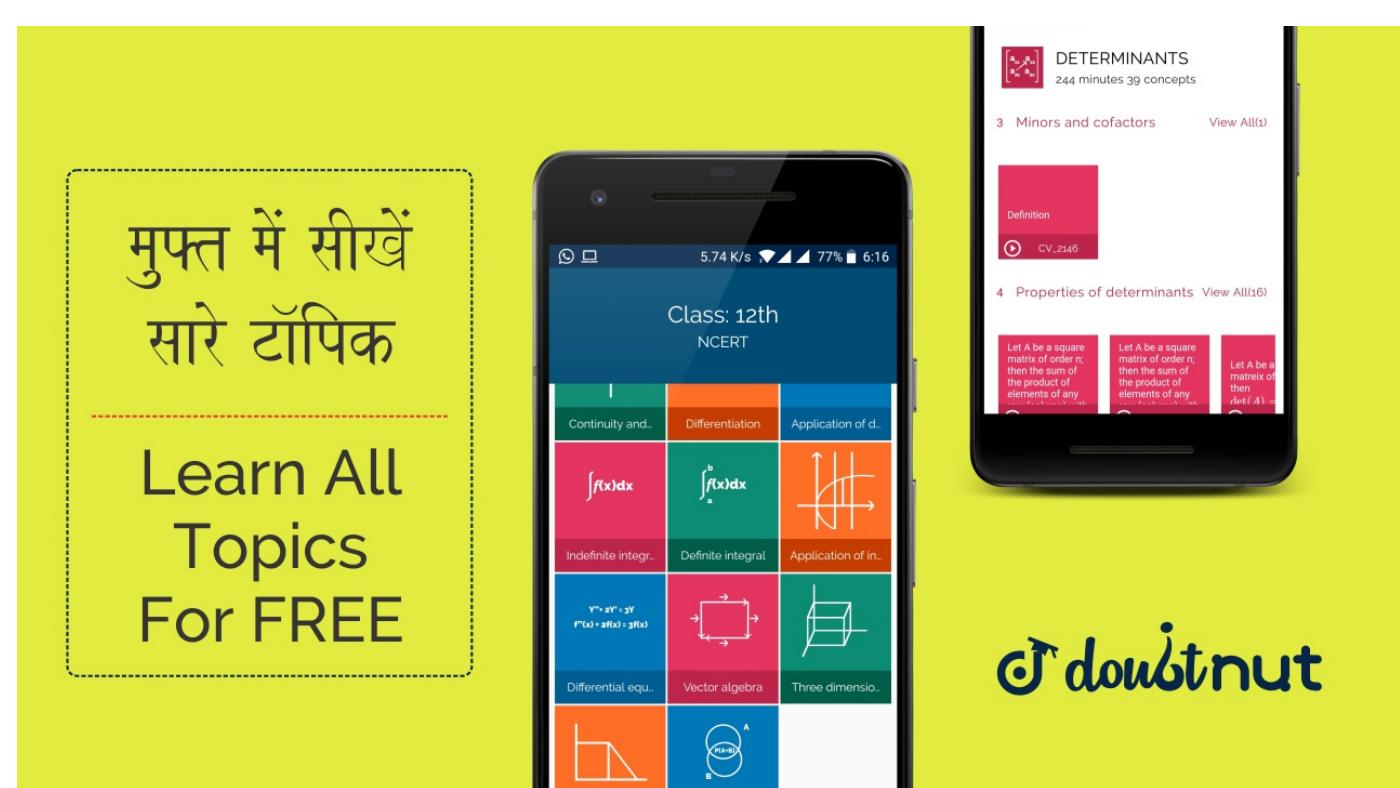
$$+ (x + 5)\hat{k}$$
 and  $(x + 6)\hat{i}$

$$+ (x + 7)\hat{j} + (x + 8)\hat{k}$$

are coplanar if  $x$  is equal to a. 1 b. -3 c. 4 d. 0

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The sides of a parallelogram are  $2\hat{i} + 4\hat{j} - 5\hat{k}$  and  $\hat{i} + 2\hat{j} + 3\hat{k}$ . The unit vector parallel to one of the diagonals is a.  $\frac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$  b.  $\frac{1}{7}(3\hat{i} - 6\hat{j} - 2\hat{k})$  c.  $\frac{1}{\sqrt{69}}(\hat{i} + 6\hat{j} + 8\hat{k})$  d.  $\frac{1}{\sqrt{69}}(-\hat{i} - 2\hat{j} + 8\hat{k})$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Components Of A Vector**

The vector  $\vec{a}$  has the components  $2p$  and  $1$  w.r.t. a rectangular Cartesian system. This system is rotated through a certain angle about the origin in the counterclockwise sense. If, with respect to a new system,  $\vec{a}$  has components  $(p+1)$  and  $1$ , then  $p$  is equal to a.  $-4$  b.  $-1/3$  c.  $1$  d.  $2$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Types Of Vectors**

If points  $\hat{i} + \hat{j}$ ,  $\hat{i} - \hat{j}$  and  $p\hat{i} + q\hat{j} + r\hat{k}$  are collinear, then a.  $p = 1$  b.  $r = 0$  c.  $qR$  d.  $q \neq 1$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are non-coplanar vectors and  $\lambda$  is a real number, then the vectors

$$\vec{a} + 2\vec{b} + 3\vec{c}, \lambda\vec{b}$$

$$+ \mu\vec{c} \text{ and } (2\lambda - 1)\vec{c}$$

are coplanar when a.  $\mu \in R$  b.  $\lambda = \frac{1}{2}$  c.  $\lambda = 0$  d. no value of  $\lambda$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Components Of A Vector**

If the resultant of three forces

$$\vec{F}_1 = p\hat{i} + 3\hat{j} - \hat{k}, \vec{F}_2$$

$$= 6\hat{i} - \hat{k} \text{ and } \vec{F}_3 = -5\hat{i}$$

$$+ \hat{j} + 2\hat{k}$$

acting on a particle has magnitude equal to 5 units, then the value of  $p$  is a.  $-6$  b.  $-4$  c.  $2$  d.  $4$

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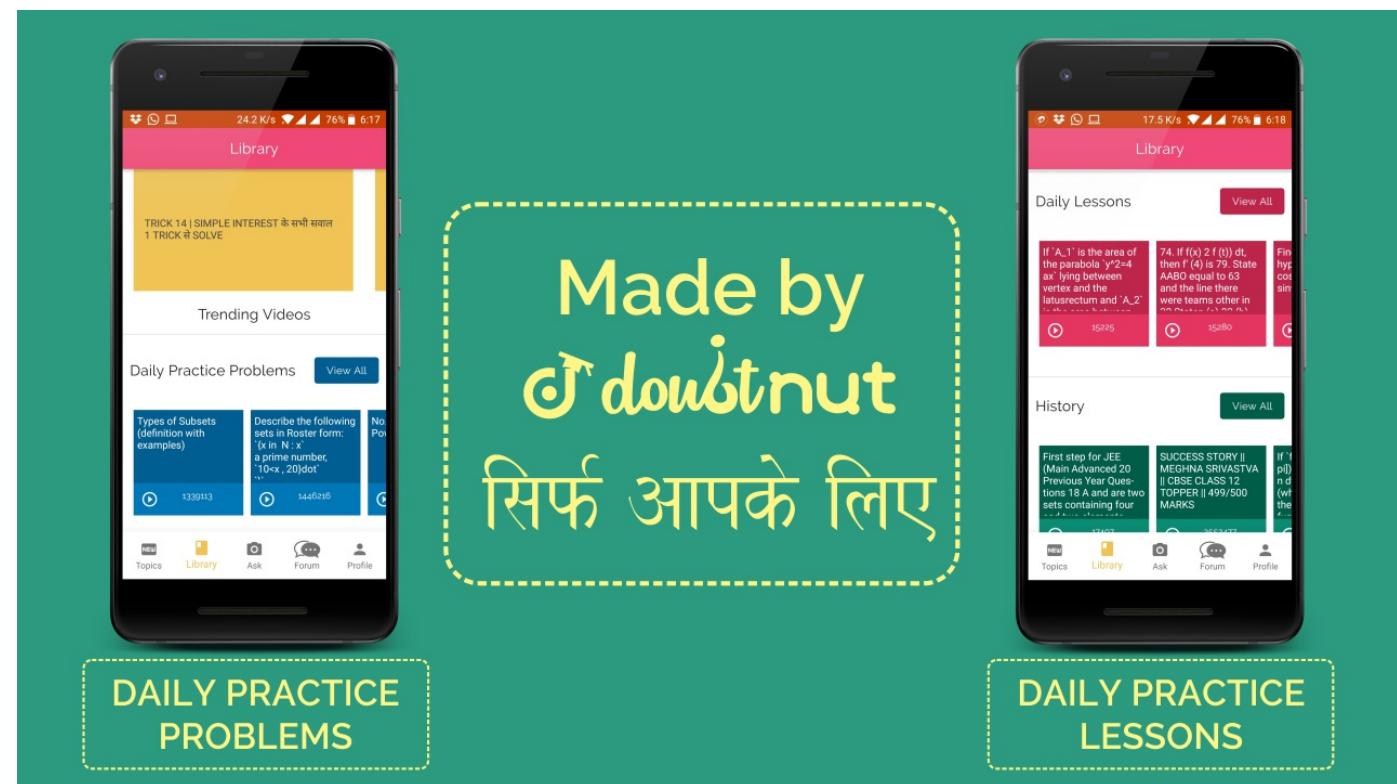
**GEOMETRY\_VECTOR**

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If the vectors  $\hat{i} - \hat{j}$ ,  $\hat{j} + \hat{k}$  and  $\vec{a}$  form a triangle, then  $\vec{a}$  may be a.  $-\hat{i} - \hat{k}$  b.  $\hat{i} - 2\hat{j} - \hat{k}$  c.  $2\hat{i} + \hat{j} + \hat{k}$  d.  $\hat{i} + \hat{k}$

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA>Evolution Of Vector Concept**

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**GEOMETRY\_VECTOR**

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The vector  $\hat{i} + x\hat{j} + 3\hat{k}$  is rotated through an angle  $\theta$  and doubled in magnitude, then it becomes  $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$ . Then value of  $x$  are - (a)  $-\frac{2}{3}$  (b)  $\frac{1}{3}$  (c)  $\frac{2}{3}$  (d) 2

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA>Linear Combination Linear Independence And Linear Dependence**

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$\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are three coplanar unit vectors such that  $\vec{a} + \vec{b} + \vec{c} = 0$ . If three vectors  $\vec{p}$ ,  $\vec{q}$ , and  $\vec{r}$  are parallel to  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$ , respectively, and have integral but different magnitudes, then among the following options,  $|\vec{p} + \vec{q} + \vec{r}|$  can take a value equal to a. 1 b. 0 c.  $\sqrt{3}$  d. 2

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA>Vector Along The Bisector Of Given Two Vectors**

If non-zero vectors  $\vec{a}$  and  $\vec{b}$  are equally inclined to coplanar vector  $\vec{c}$ , then  $\vec{c}$  can be a.

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$$\frac{|\vec{a}|}{|\vec{a}| + 2|\vec{b}|} \vec{a} \\ + \frac{|\vec{b}|}{|\vec{a}| + 2|\vec{b}|} \vec{b}$$

b.

$$\frac{|\vec{b}|}{|\vec{a}| + |\vec{b}|} \vec{a} \\ + \frac{|\vec{a}|}{|\vec{a}| + |\vec{b}|} \vec{b}$$

c.

$$\frac{|\vec{a}|}{|\vec{a}| + 2|\vec{b}|} \vec{a} \\ + \frac{|\vec{b}|}{|\vec{a}| + 2|\vec{b}|} \vec{b}$$

d.

$$\frac{|\vec{b}|}{2|\vec{a}| + |\vec{b}|} \vec{a} \\ + \frac{|\vec{a}|}{2|\vec{a}| + |\vec{b}|} \vec{b}$$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors

If

 $A(-4, 0, 3)$  and  $B(14, 2,$  $-5)$ ,

then which one of the following points lie on the bisector of the angle between  $\vec{OA}$  and  $\vec{OB}$  ( $O$  is the origin of reference)? a.  $(2, 2, 4)$  b.  $(2, 11, 5)$  c.  $(-3, -3, -6)$  d.  $(1, 1, 2)$

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## CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

In a four-dimensional space where unit vectors along the axes are  $\hat{i}, \hat{j}, \hat{k}$  and  $\hat{l}$ , and  $\vec{a}_1, \vec{a}_2, \vec{a}_3, \vec{a}_4$ ,

are four non-zero vectors such that no vector can be expressed as a linear combination of others and

$$\begin{aligned} & (\lambda - 1)(\vec{a}_1 - \vec{a}_2) \\ & + \mu(\vec{a}_2 + \vec{a}_3) \\ & + \gamma(\vec{a}_3 + \vec{a}_4 - 2\vec{a}_2) \\ & + \vec{a}_3 + \delta\vec{a}_4 = 0, \end{aligned}$$

then a.  $\lambda = 1$  b.  $\mu = -2/3$  c.  $\gamma = 2/3$  d.  $\delta = 1/3$

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## CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Coordinate Axes And Coordinate Planes In Three-Dimensional Space

Let  $ABC$  be a triangle, the position vectors of whose vertices are

$$7\hat{j} + 10\hat{k}, -\hat{i} + 6\hat{j} + 6\hat{k}$$

$$-4\hat{i} + 9\hat{j} + 6\hat{k}$$

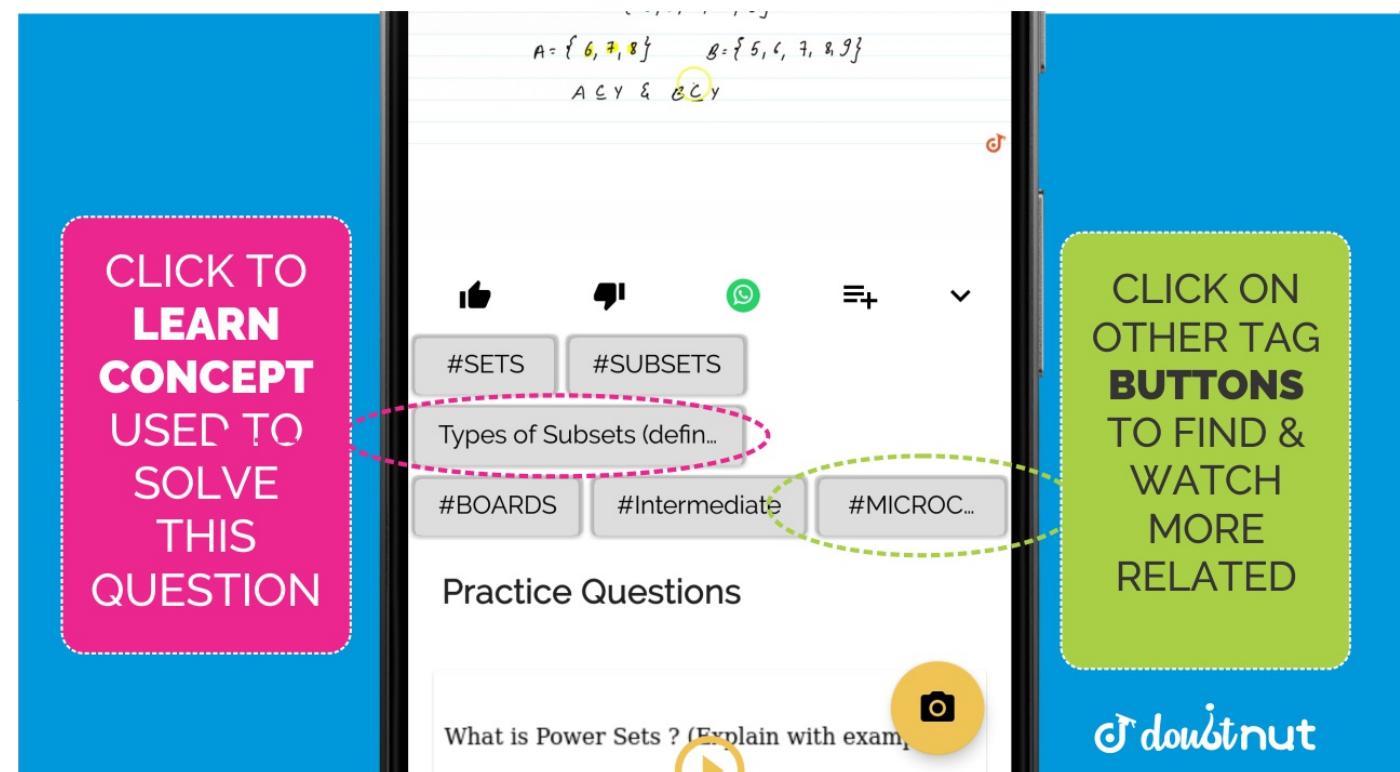
Then  $\Delta ABC$

a. isosceles b. equilateral c. right angled d. none of these

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## CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Coordinate Axes And Coordinate Planes In Three-Dimensional Space

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A vector has components  $p$  and 1 with respect to a rectangular Cartesian system. The axes are rotated through an angle  $\alpha$  about the origin the anticlockwise sense. Statement 1: IF the vector has component  $p + 2$  and 1 with respect to the new system, then  $p = -1$ . Statement 2: Magnitude of the original vector and new vector remains the same.

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#### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Types Of Vectors

Statement 1: if three points  $P, Q$  and  $R$  have position vectors  $\vec{a}, \vec{b}$ , and  $\vec{c}$ , respectively, and  $2\vec{a} + 3\vec{b} - 5\vec{c} = 0$ , then the points  $P, Q$ , and  $R$  must be collinear. Statement 2: If for three points  $A, B$ , and  $C$ ,  $\vec{AB} = \lambda \vec{AC}$ , then points  $A, B$ , and  $C$  must be collinear.

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#### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Along The Bisector Of Given Two Vectors

Statement 1: If  $\vec{u}$  and  $\vec{v}$  are unit vectors inclined at an angle  $\alpha$  and  $\vec{x}$  is a unit vector bisecting the angle between them, then

$$\vec{x} = \left( \frac{\vec{u} + \vec{v}}{\sqrt{2 \sin(\alpha/2)}} \right)$$

$$/ (2 \sin(\alpha/2)).$$

Statement 2: If Delta  $ABC$  is an isosceles triangle with  $AB = AC = 1$ , then the vector representing the bisector of angle  $A$  is given by  $\vec{AD} = \left( \frac{\vec{AB} + \vec{AC}}{2} \right) / 2$ .

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#### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Components Of A Vector

Statement 1: If  $\cos \alpha, \cos \beta$ , and  $\cos \gamma$  are the direction cosines of any line segment, then

$$\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$$

Statement 2: If  $\cos \alpha, \cos \beta$ , and  $\cos \gamma$  are the direction cosines of any line segment, then

$$\cos 2\alpha + \cos 2\beta + \cos 2\gamma = 1$$

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#### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Components Of A Vector

Statement 1: The direction cosines of one of the angular bisectors of two intersecting lines having direction cosines as  $l_1, m_1, n_1$  and  $l_2, m_2, n_2$  are proportional to  $l_1 + l_2, m_1 + m_2, n_1 + n_2$ . Statement 2: The angle between the two intersection

lines having direction cosines as  $l_1, m_1, n_1$  and  $l_2, m_2, n_2$  is given by  
 $\cos \theta = l_1 l_2 + m_1 m_2 + n_1 n_2$ .

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Addition Of Vector

AND

3D

### GEOMETRY\_VECTOR

Statement 1: In

$$\text{Delta } ABC, \vec{AB} + \vec{BC}$$

$$+ \vec{CA} = 0$$

Statement 2: If

$$\vec{OA} = \vec{a}, \vec{OB} = \vec{b},$$

$$\text{then } \vec{AB} = \vec{a} + \vec{b}$$

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Components Of A Vector

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3D

### GEOMETRY\_VECTOR

Statement 1:  $\vec{a} = 3\vec{i} + p\vec{j} + 3\vec{k}$  and  $\vec{b} = 2\vec{i} + 3\vec{j} + q\vec{k}$  are parallel vectors if  $p = 9/2$  and  $q = 2$ . Statement 2: if

$$\vec{a} = a_1 \vec{i} + a_2 \vec{j}$$

$$+ a_3 \vec{k} \text{ and } \vec{b} = b_1 \vec{i} + b_2 \vec{j}$$

$$+ b_3 \vec{k}$$

are parallel, then  $\frac{a_1}{b_1} = \frac{a_2}{b_2} = \frac{a_3}{b_3}$ .

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### CENGAGE\_MATHS\_VECTORS

AND

3D

### GEOMETRY\_VECTOR

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**ALGEBRA\_Components Of A Vector**

Statement 1: If  $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ , then  $\vec{a}$  and  $\vec{b}$  are perpendicular to each other. Statement 2: If the diagonal of a parallelogram are equal magnitude, then the parallelogram is a rectangle.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Statement 1: Let  $A(\vec{a}), B(\vec{b})$  and  $C(\vec{c})$  be three points such that

$$\vec{a} = 2\hat{i} + \hat{k}, \vec{b} = 3\hat{i} - \hat{j}$$

$$+ 3\hat{k} \text{ and } \vec{c} = -\hat{i} + 7\hat{j}$$

$$- 5\hat{k}.$$

Then  $OABC$  is a tetrahedron. Statement 2: Let  $A(\vec{a}), B(\vec{b})$  and  $C(\vec{c})$  be three points such that vectors  $\vec{a}, \vec{b}$  and  $\vec{c}$  are non-coplanar. Then  $OABC$  is a tetrahedron where  $O$  is the origin.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

Statement 1: Let  $\vec{a}, \vec{b}, \vec{c}$  and  $\vec{d}$  be the position vectors of four points  $A, B, C$  and  $D$  and

$$3\vec{a} - 2\vec{b} + 5\vec{c} - 6\vec{d} = 0$$

. Then points  $A, B, C$ , and  $D$  are coplanar. Statement 2: Three non-zero, linearly dependent coinitial vector  $(\vec{P}Q, \vec{PR} \text{ and } \vec{PS})$  are coplanar. Then

$$\vec{P}Q = \lambda \vec{PR} + \mu \vec{PS},$$

where  $\lambda$  and  $\mu$  are scalars.

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Addition Of Vector**

AND

3D

**GEOMETRY\_VECTOR**

Statement 1:

$$|\vec{a}| = 3, |\vec{b}|$$

$$= 4 \text{ and } |\vec{a} + \vec{b}| = 5,$$

$$\text{then } |\vec{a} - \vec{b}| = 5.$$

Statement 2: The length of the diagonals of a rectangle is the same.

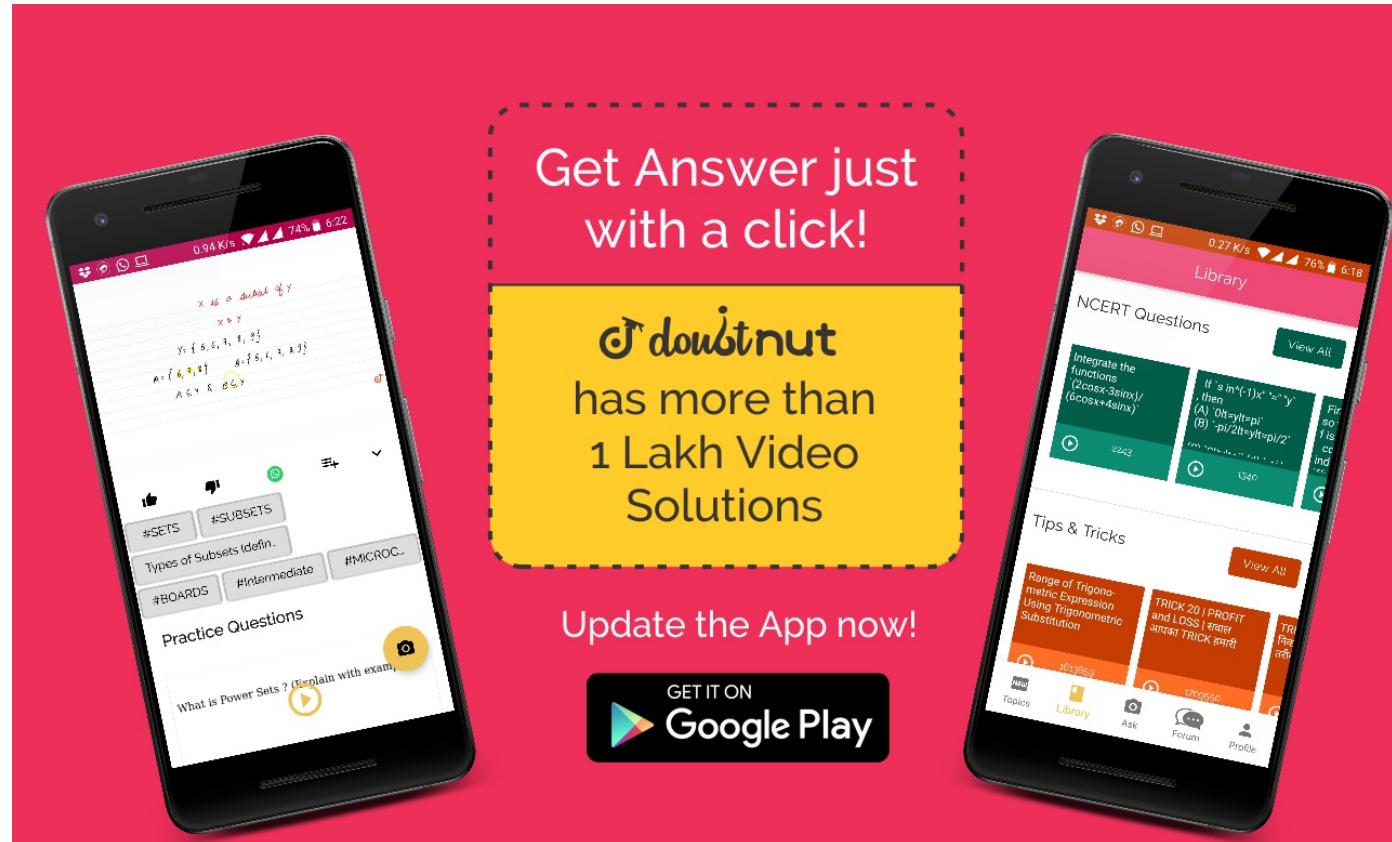
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Types Of Vectors

Column I, Column II Collinear vectors, p.  $\vec{a}$  Coinitial vectors, q.  $\vec{b}$  Equal vectors, r.  $\vec{c}$  Unlike vectors (same intitial point), s.  $\vec{d}$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

$a$  and  $b$  form the consecutive sides of a regular hexagon  $ABCDEF$ . Column I, Column II If  $\vec{C}D = x\vec{a} + y\vec{b}$ , then, p.  $x = -2$  If  $\vec{C}E = x\vec{a} + y\vec{b}$ , then, q.  $x = -1$  If  $\vec{A}E = x\vec{a} + y\vec{b}$ , then, r.  $y = 1$   $\vec{A}D = -x\vec{b}$ , then, s.  $y = 2$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

The position vectors of the vertices  $A$ ,  $B$  and  $C$  of a triangle are three unit vectors  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$ , respectively. A vector  $\vec{d}$  is such that  $\vec{a} = \lambda \vec{b} + \mu \vec{c}$ .

Then triangle  $ABC$  is a. acute angled b. obtuse angled c. right angled d. none of these

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**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Components Of A Vector**

AND

3D

**GEOMETRY\_VECTOR**

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If the resultant of three forces

$$\begin{aligned}\vec{F}_1 &= p\hat{i} + 3\hat{j} - \hat{k}, \vec{F}_2 \\ &= 6\hat{i} - \hat{k} \text{ and } \vec{F}_3 = -5\hat{i} \\ &\quad + \hat{j} + 2\hat{k}\end{aligned}$$

acting on a particle has magnitude equal to 5 units, then the value of  $p$  is a. -6 b. -4 c. 2 d. 4[Watch Free Video Solution on Doubtnut](#)**CENGAGE\_MATHS\_VECTORS  
ALGEBRA\_Miscellaneous**

AND

3D

**GEOMETRY\_VECTOR**

279

Let  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be unit vectors such that  $\vec{a} + \vec{b} - \vec{c} = 0$ . If the area of triangle formed by vectors  $\vec{a}$  and  $\vec{b}$  is  $A$ , then what is the value of  $4A^2$ ?[Watch Free Video Solution on Doubtnut](#)**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Joining Two Points**

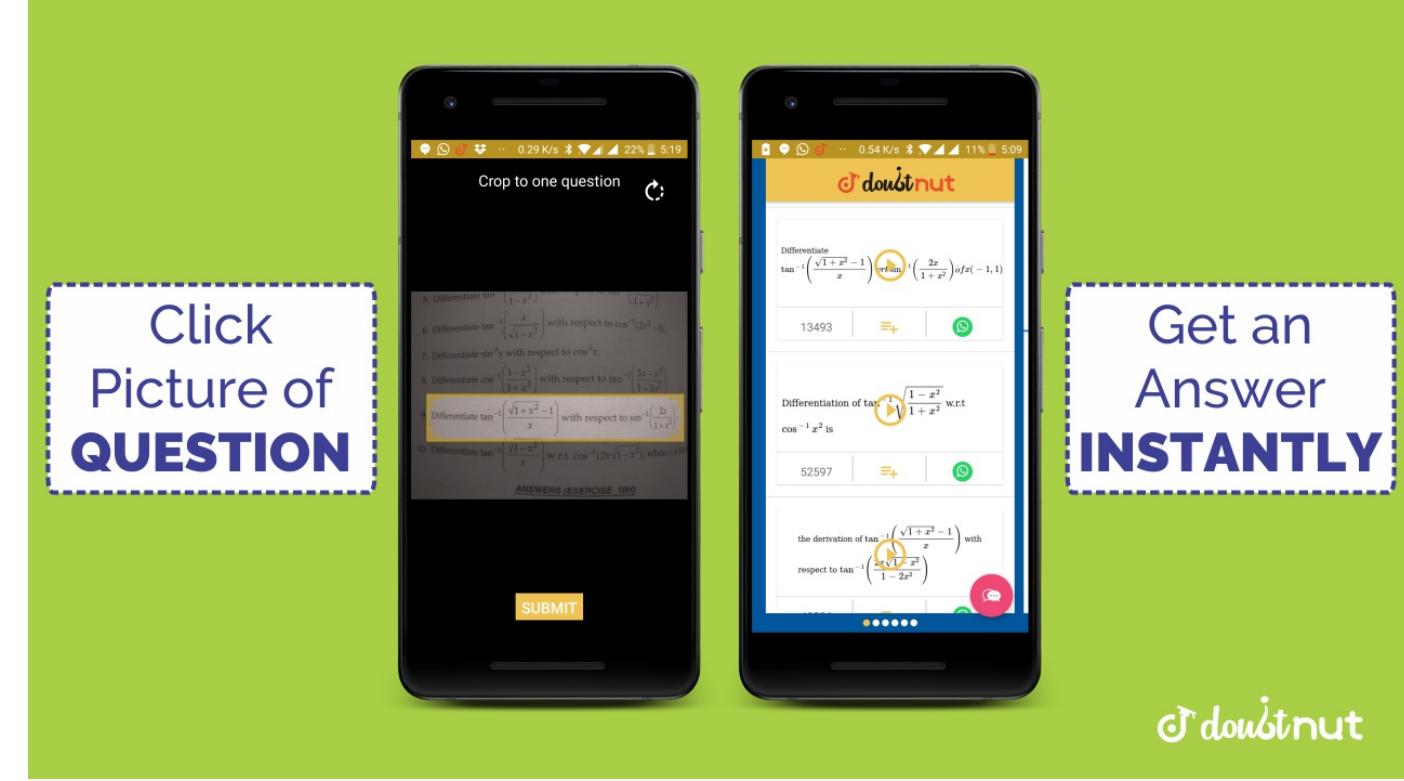
280

Find the least positive integral value of  $x$  for which the angle between vectors  $\vec{a} = x\hat{i} - 3\hat{j} - \hat{k}$  and  $\vec{b} = 2x\hat{i} + x\hat{j} - \hat{k}$  is acute.[Watch Free Video Solution on Doubtnut](#)**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear  
Combination Linear Independence And Linear Dependence**

If vectors

$$\begin{aligned}\vec{a} &= \hat{i} + 2\hat{j} - \hat{k}, \vec{b} = 2\hat{i} \\ &\quad - \hat{j} + \hat{k} \text{ and } \vec{c} = \lambda\hat{i} \\ &\quad + \hat{j} + 2\hat{k}\end{aligned}$$

are coplanar, then find the value of  $(\lambda - 4)$ .[Watch Free Video Solution on Doubtnut](#)



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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space**

Find the values of  $\lambda$  such that

$$\begin{aligned} & x, y, z \neq (0, 0, 0) \text{ and } (\hat{i} + \hat{j} \\ & + 3\hat{k})x + (3\hat{i} - 3\hat{j} + \hat{k})y \\ & + (-4\hat{i} + 5\hat{j})z \\ & = \lambda(\hat{x}\hat{i} + \hat{y}\hat{j} + \hat{z}\hat{k}) \end{aligned}$$

, where  $\hat{i}, \hat{j}, \hat{k}$  are unit vector along coordinate axes.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Coordinate Axes And Coordinate Planes In Three- Dimensional Space**

A vector has component  $A_1, A_2$  and  $A_3$  in a right -handed rectangular Cartesian coordinate system  $OXYZ$ . The coordinate system is rotated about the x-axis through an angel  $\pi/2$ . Find the component of  $A$  in the new coordinate system in terms of  $A_1, A_2$ , and  $A_3$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

The position vectors of the point  $A, B, C$  and  $D$  are  $3\hat{i} - 2\hat{j}$

$$\begin{aligned} & -\hat{k}, 2\hat{i} + 3\hat{j} - 4\hat{k}, -\hat{i} + \hat{j} \\ & + 2\hat{k} \end{aligned}$$

and  $4\hat{i} + 5\hat{j} + \lambda\hat{k}$ , respectively. If the points  $A, B, C$  and  $D$  lie on a plane, find the value of  $\lambda$ .

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	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Section Formula</b>	AND	3D	<b>GEOMETRY_VECTOR</b>
285	<p>Let <math>OACB</math> be a parallelogram with <math>O</math> at the origin and <math>OC</math> a diagonal. Let <math>D</math> be the midpoint of <math>OA</math>. Using vector methods prove that <math>BD</math> and <math>CO</math> intersect in the same ratio. Determine this ratio.</p> <p>► <a href="#">Watch Free Video Solution on Doubtnut</a></p>			
286	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA_Section Formula</b></p> <p>In a triangle <math>ABC</math>, <math>D</math> and <math>E</math> are points on <math>BC</math> and <math>AC</math>, respectively, such that <math>BD = 2DC</math> and <math>AE = 3EC</math>. Let <math>P</math> be the point of intersection of <math>AD</math> and <math>BE</math>. Find <math>BP/PE</math> using the vector method.</p> <p>► <a href="#">Watch Free Video Solution on Doubtnut</a></p>	AND	3D	<b>GEOMETRY_VECTOR</b>
287	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA_Addition Of Vector</b></p> <p>Prove, by vector method or otherwise, that the point of intersection of the diagonals of a trapezium lies on the line passing through the midpoint of the parallel sides (you may assume that the trapezium is not a parallelogram).</p> <p>► <a href="#">Watch Free Video Solution on Doubtnut</a></p>	AND	3D	<b>GEOMETRY_VECTOR</b>



	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Section Formula</b>	AND	3D	<b>GEOMETRY_VECTOR</b>
288	<p>Show, by vector methods, that the angular bisectors of a triangle are concurrent and find an expression for the position vector of the point of concurrency in terms of the position vectors of the vertices.</p>			

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Miscellaneous**

Let

$$\vec{A}(t) = f_1(t)\hat{i} + f_2(t)\hat{j} \text{ and}$$

$$\vec{B}(t) = g_1(t)\hat{i} + g_2(t)\hat{j}$$

$$+ g_3(t)\hat{j}, t \in [0, 1],$$

$$f_1, f_2, g_1, g_2$$

289

are continuous functions. If  $\vec{A}(t)$  and  $\vec{B}(t)$  are non-zero vectors for all  $t$  and  $\vec{A}(0) = 2\hat{i} + 3\hat{j}$ ,

$$\vec{A}(1) = 6\hat{i} + 2\hat{j}, \vec{B}(0) = 3\hat{i}$$

$$+ 2\hat{i} \text{ and } \vec{B}(1) = 2\hat{j} + 6\hat{j}$$

Then, show that  $\vec{A}(t)$  and  $\vec{B}(t)$  are parallel for some  $t$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Section Formula**

290

In a  $\triangle OAB$ , E is the mid point of OB and D is the point on AB such that  $AD:DB = 2:1$ . If OD and AE intersect at P then determine the ratio of  $OP:PD$  using vector methods

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

291

If  $\vec{a}, \vec{b}$  are two non-collinear vectors, prove that the points with position vectors  $\vec{a} + \vec{b}, \vec{a} - \vec{b}$  and  $\vec{a} + \lambda \vec{b}$  are collinear for all real values of  $\lambda$ .

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Types Of Vectors**

292

The points with position vectors  $60\hat{i} + 3\hat{j}, 40\hat{i} - 8\hat{j}, a\hat{i} - 52\hat{j}$  are collinear if a.  $a = -40$  b.  $a = 40$  c.  $a = 20$  d. none of these

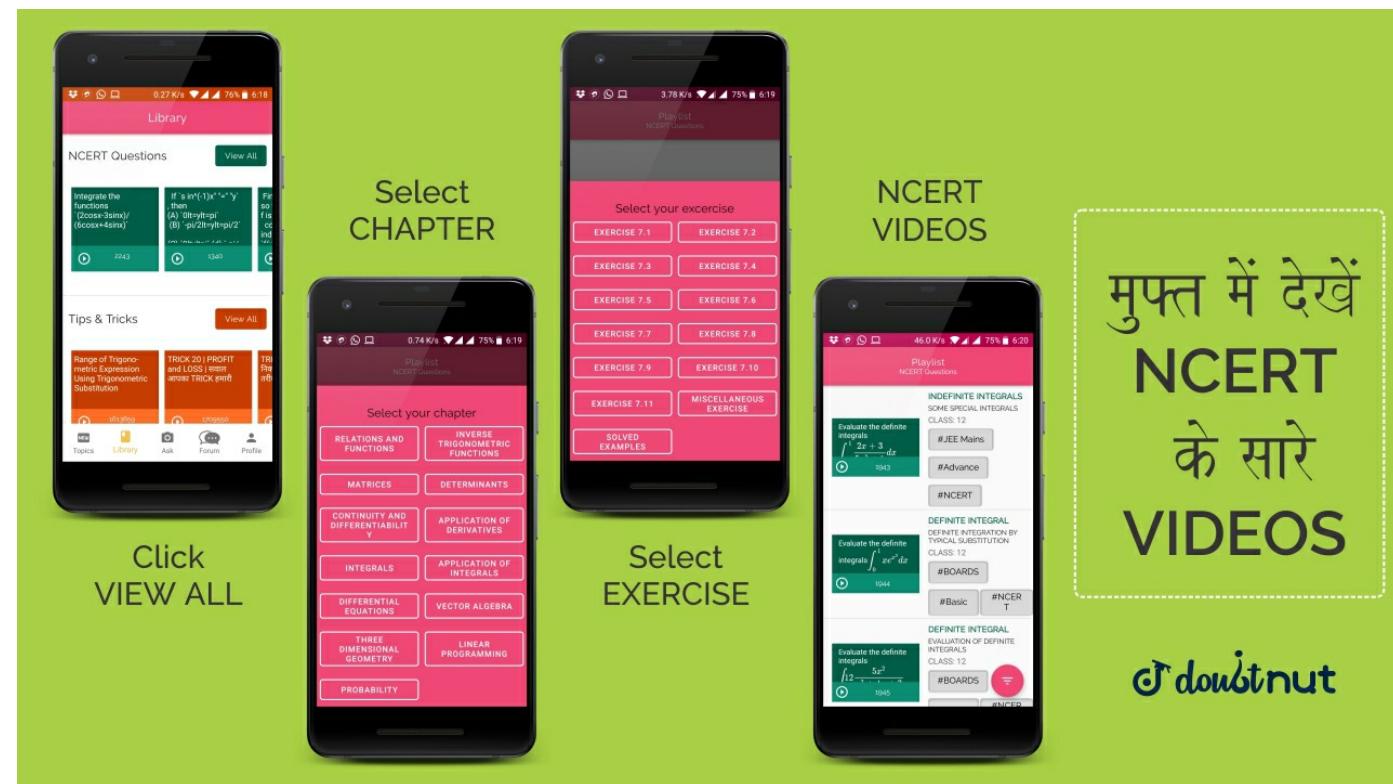
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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence**

If the vectors

$\vec{\alpha} = a\hat{i} + a\hat{j} + c\hat{k}$ ,  $\vec{\beta} = \hat{i} + \hat{k}$  and  $\vec{\gamma} = c\hat{i} + c\hat{j} + b\hat{k}$  are coplanar, then prove that  $c$  is the geometric mean of  $a$  and  $b$ .

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

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  $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}$  depends on only  $x$  (b) only  $y$  Neither  $x$  nor  $y$  (d) both  $x$  and  $y$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Coordinate Axes And Coordinate Planes In Three-Dimensional Space

Let  $\alpha, \beta$  and  $\gamma$  be distinct real numbers. The points whose position vector's are  $\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$ ;  $\beta\hat{i} + \gamma\hat{j}$  +  $\alpha\hat{k}$  and  $\gamma\hat{i} + \alpha\hat{j} + \beta\hat{k}$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

296

The number of distinct real values of  $\lambda$ , for which the vectors  
 $\lambda^2\hat{i} + \hat{j} + k, \hat{i} - \lambda^2\hat{j}$   
 $+ \hat{k}$  and  $\hat{i} + \hat{j} - \lambda^2\hat{k}$   
are coplanar is a. zero b. one c. two d. three

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

If

$$\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 4\hat{i}$$

$$+ 3\hat{j} + 4\hat{k}$$

and  $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$  are linearly dependent vectors &  $|\vec{c}| = \sqrt{3}$ , then ordered pair  $(\alpha, \beta)$  is (a) (1, 1) (b) (1, -1) (c) (-1, 1) (d) (-1, -1)

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

Consider the set of eight vector

$$V = \left\{ a\hat{i} + b\hat{j} + c\hat{k}; a, b, c \in \{-1, 1\} \right\}.$$

Three non-coplanar vectors can be chosen from  $V$  is  $2^p$  ways. Then  $p$  is \_\_\_\_\_.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

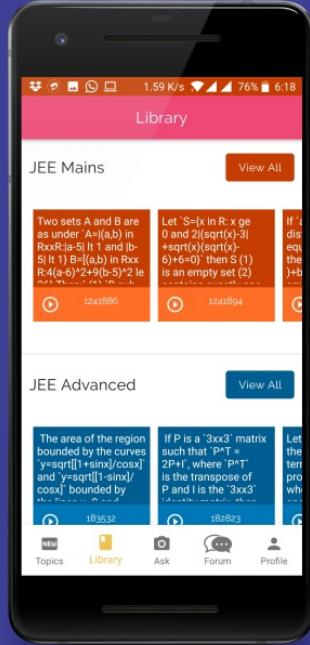
, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

303

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

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, etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

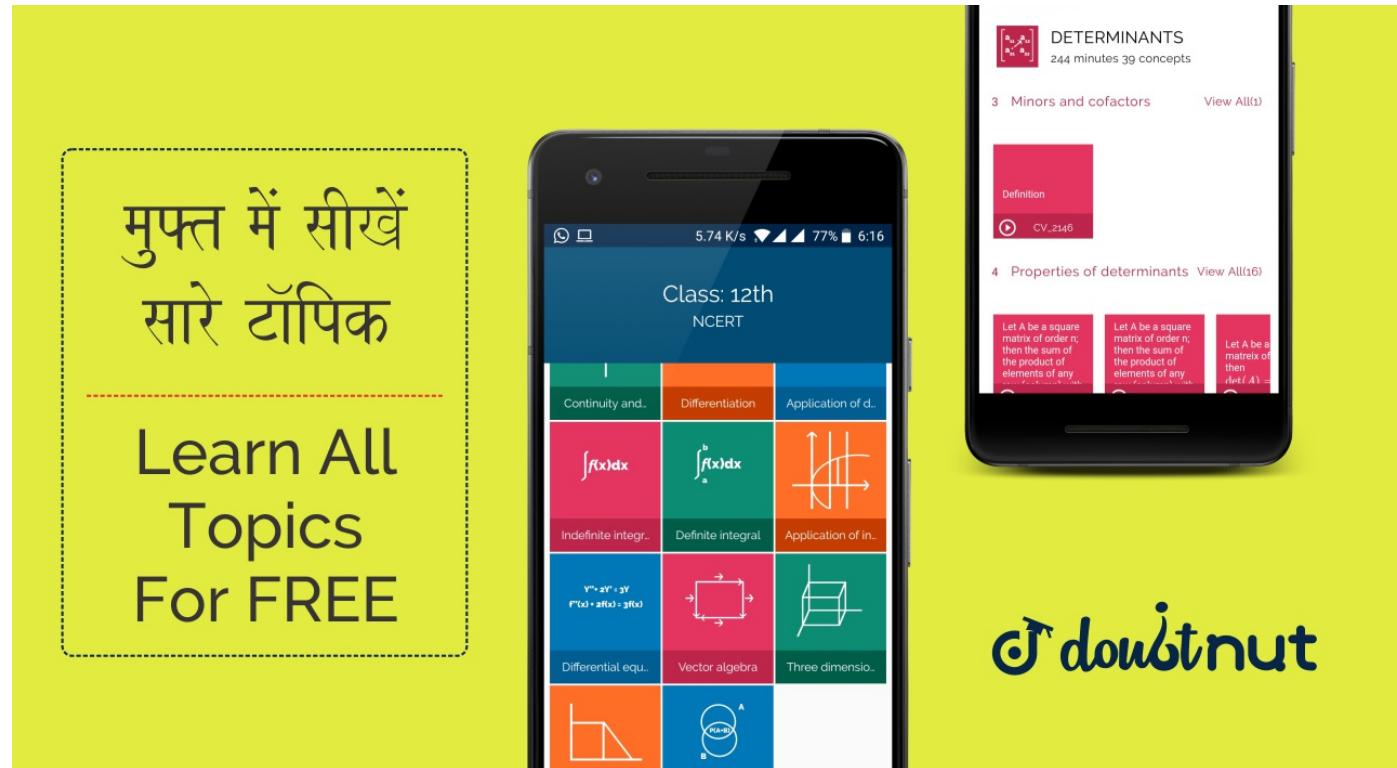
$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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309

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If  

$$|(a - x)^2(a - y)^2(a - z)^2(b - x)^2(b - y)^2(b - z)^2(c - x)^2(c - y)^2(c - a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$|(a - x)^2(a - y)^2(a - z)^2(b - x)^2(b - y)^2(b - z)^2(c - x)^2(c - y)^2(c - a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

313

, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If



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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

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$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

323

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Applications Of Dot (Scalar) Product

3D

GEOMETRY\_VECTOR

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\begin{aligned} & \vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} \\ &= a^2 \hat{i} + a \hat{j} + \hat{k} \end{aligned}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\begin{aligned} & \vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} \\ &= a^2 \hat{i} + a \hat{j} + \hat{k} \end{aligned}$$

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$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\begin{aligned} & \vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} \\ &= a^2 \hat{i} + a \hat{j} + \hat{k} \end{aligned}$$

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$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

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$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

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, etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**GEOMETRY\_VECTOR**

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product**

If

**GEOMETRY\_VECTOR**

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$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product

### GEOMETRY\_VECTOR

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

335

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

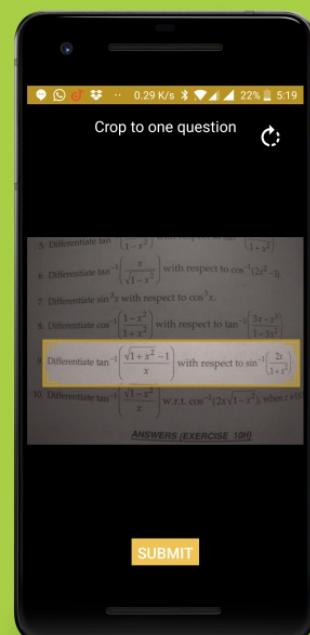
$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\begin{aligned}|(a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2| = 0\end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Dot (Scalar) Product**

If

$$\begin{aligned}|(a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2| = 0\end{aligned}$$

and vectors

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$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If

$$\begin{aligned}|(a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2| = 0\end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Linear Combination Linear Independence And Linear Dependence

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

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$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Applications Of Dot (Scalar) Product

AND

3D

GEOMETRY\_VECTOR

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

343

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

344

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

345

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

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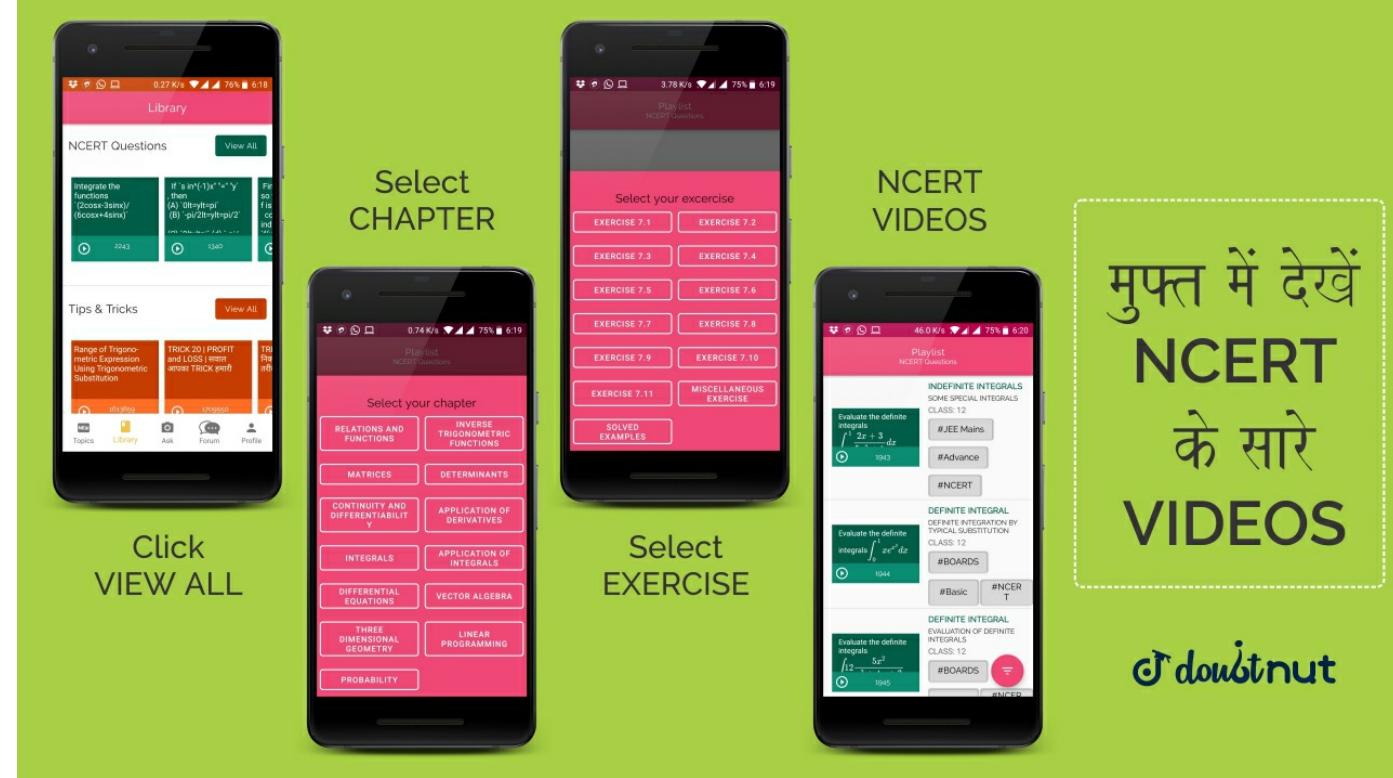
, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### GEOMETRY\_VECTOR

### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

349

, etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

352

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a \hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x \hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

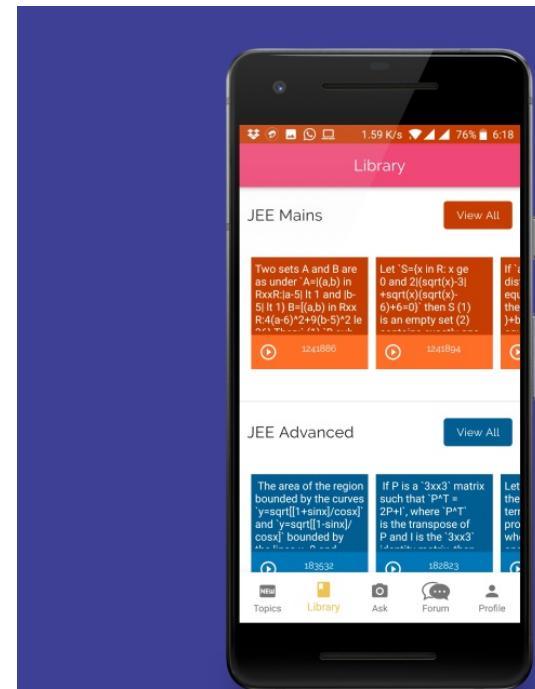
$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Miscellaneous

If

354

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$$\begin{aligned} & \vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} \\ & = a^2 \hat{i} + a \hat{j} + \hat{k} \end{aligned}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$$\begin{aligned} & \vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} \\ & = a^2 \hat{i} + a \hat{j} + \hat{k} \end{aligned}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$$\begin{aligned} & \vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} \\ & = a^2 \hat{i} + a \hat{j} + \hat{k} \end{aligned}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

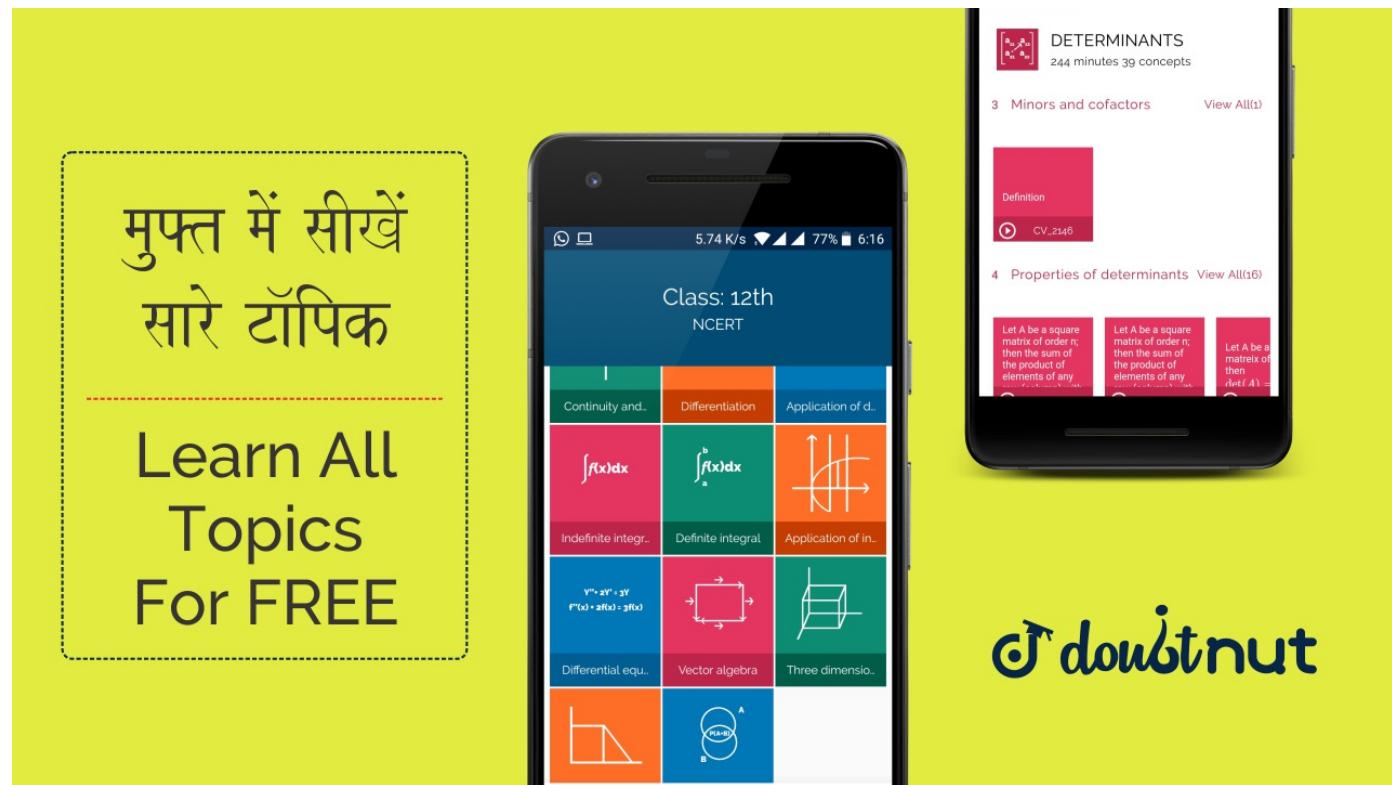
$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Applications Of Dot (Scalar) Product</b>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
357	<p>If</p> $\left  (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right  = 0$ <p>and vectors</p> <p><math>\vec{A}, \vec{B}, \text{ and } \vec{C}</math>, where <math>\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}</math>, etc, are non-coplanar, then prove that vectors <math>\vec{X}, \vec{Y} \text{ and } \vec{Z}</math>, where <math>\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}</math>, etc. may be coplanar.</p>			
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358	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b></p> <p>If</p> $\left  (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right  = 0$ <p>and vectors</p> <p><math>\vec{A}, \vec{B}, \text{ and } \vec{C}</math>, where <math>\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}</math>, etc, are non-coplanar, then prove that vectors <math>\vec{X}, \vec{Y} \text{ and } \vec{Z}</math>, where <math>\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}</math>, etc. may be coplanar.</p>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
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359	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b></p> <p>If</p> $\left  (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right  = 0$ <p>and vectors</p> <p><math>\vec{A}, \vec{B}, \text{ and } \vec{C}</math>, where <math>\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}</math>, etc, are non-coplanar, then prove that vectors</p>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

### GEOMETRY\_VECTOR

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$$\begin{aligned} & \vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} \\ & = a^2 \hat{i} + a \hat{j} + \hat{k} \end{aligned}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

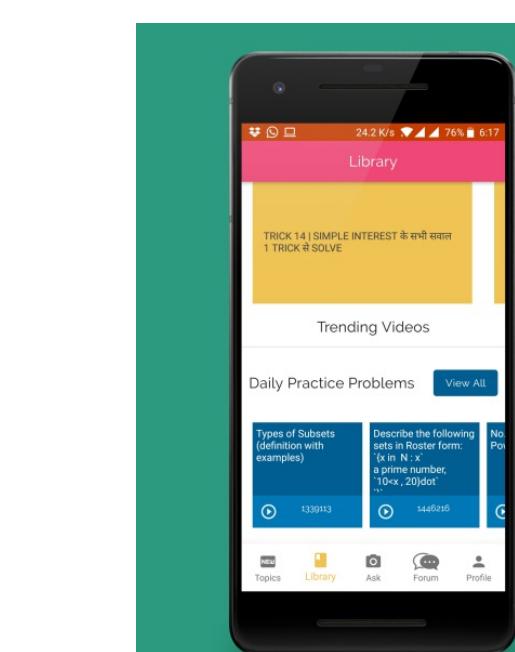
, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

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$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

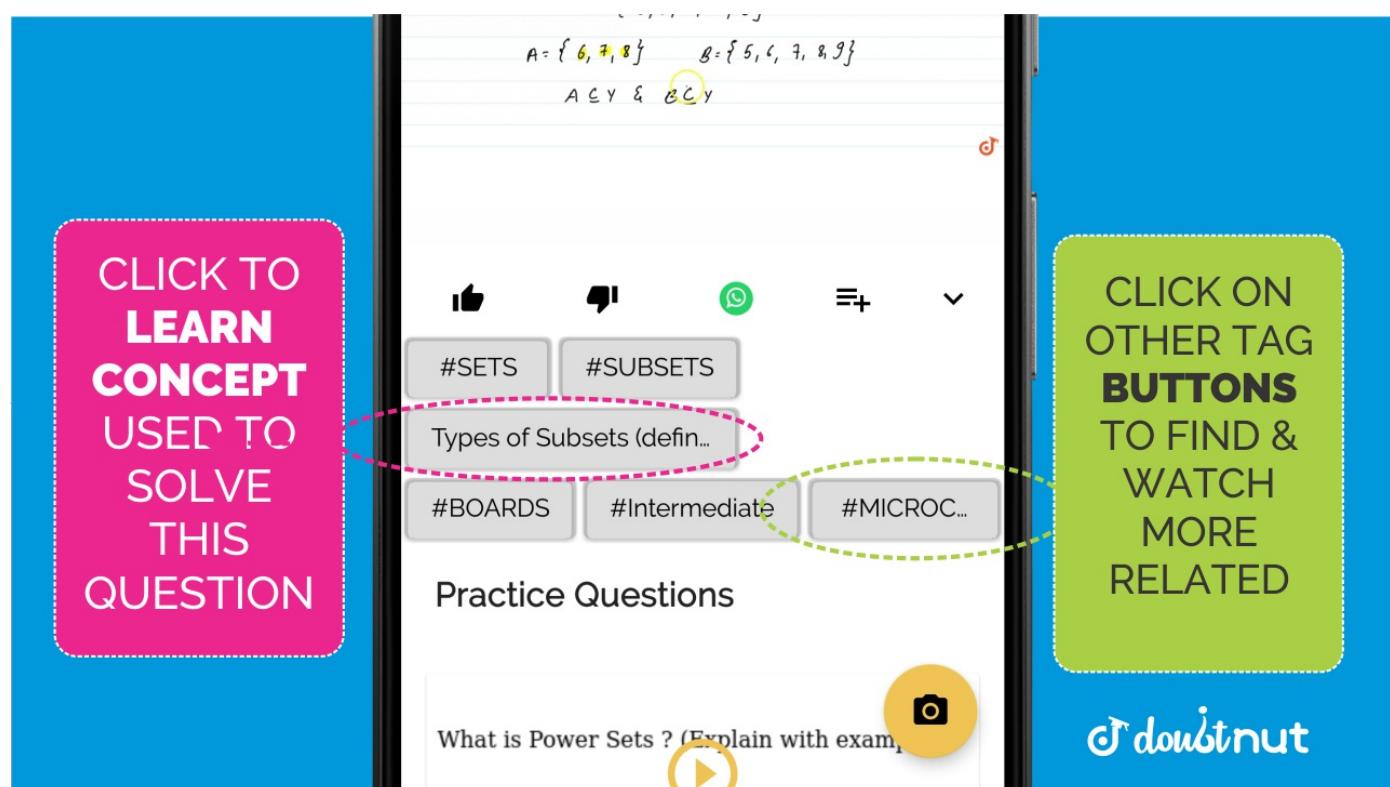
, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

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If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

374

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

375

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

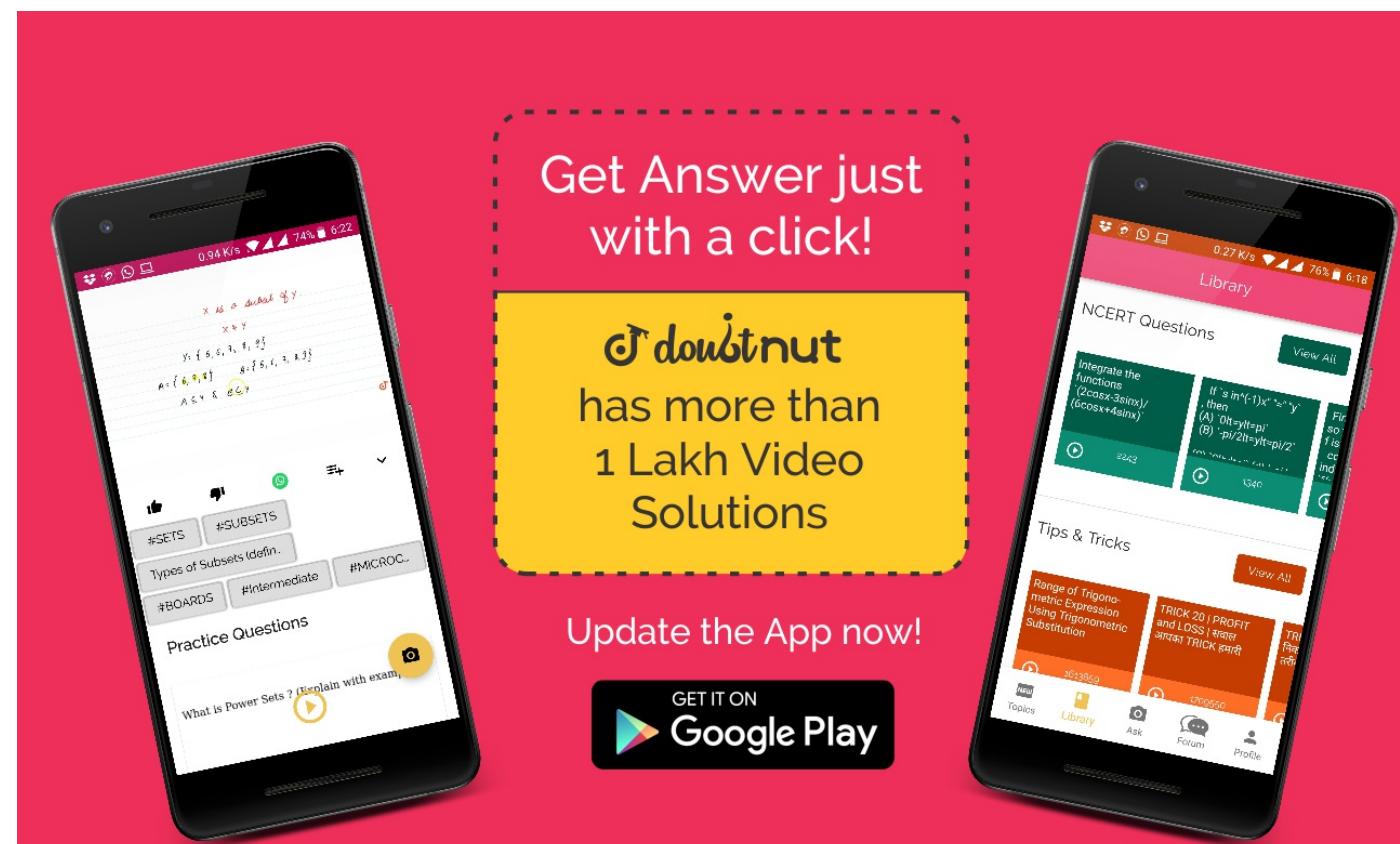
$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\begin{vmatrix} (a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2 \end{vmatrix} = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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Triple Produt**

If

$$\begin{vmatrix} (a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2 \end{vmatrix} = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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[Watch Free Video Solution on Doubtnut](#)**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

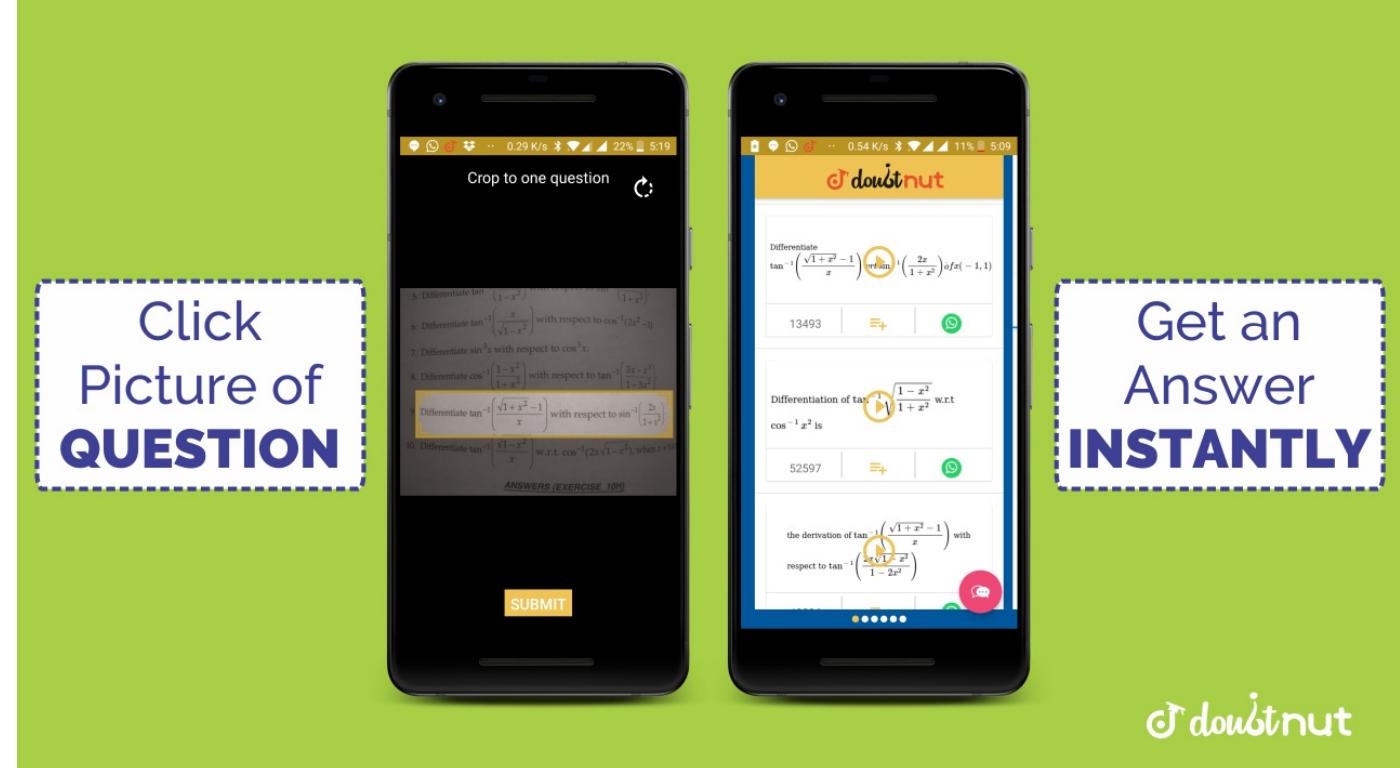
$$\begin{vmatrix} (a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2 \end{vmatrix} = 0$$

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and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

391

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

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$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$\begin{aligned} & \left| (a-x)^2(a-y)^2(a-z)^2(b \right. \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2 \left. \right| = 0 \end{aligned}$$

396

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

GEOMETRY\_VECTOR

397

If

$$\begin{aligned} & \left| (a-x)^2(a-y)^2(a-z)^2(b \right. \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2 \left. \right| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\begin{aligned} & \left| (a-x)^2(a-y)^2(a-z)^2(b \right. \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2 \left. \right| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

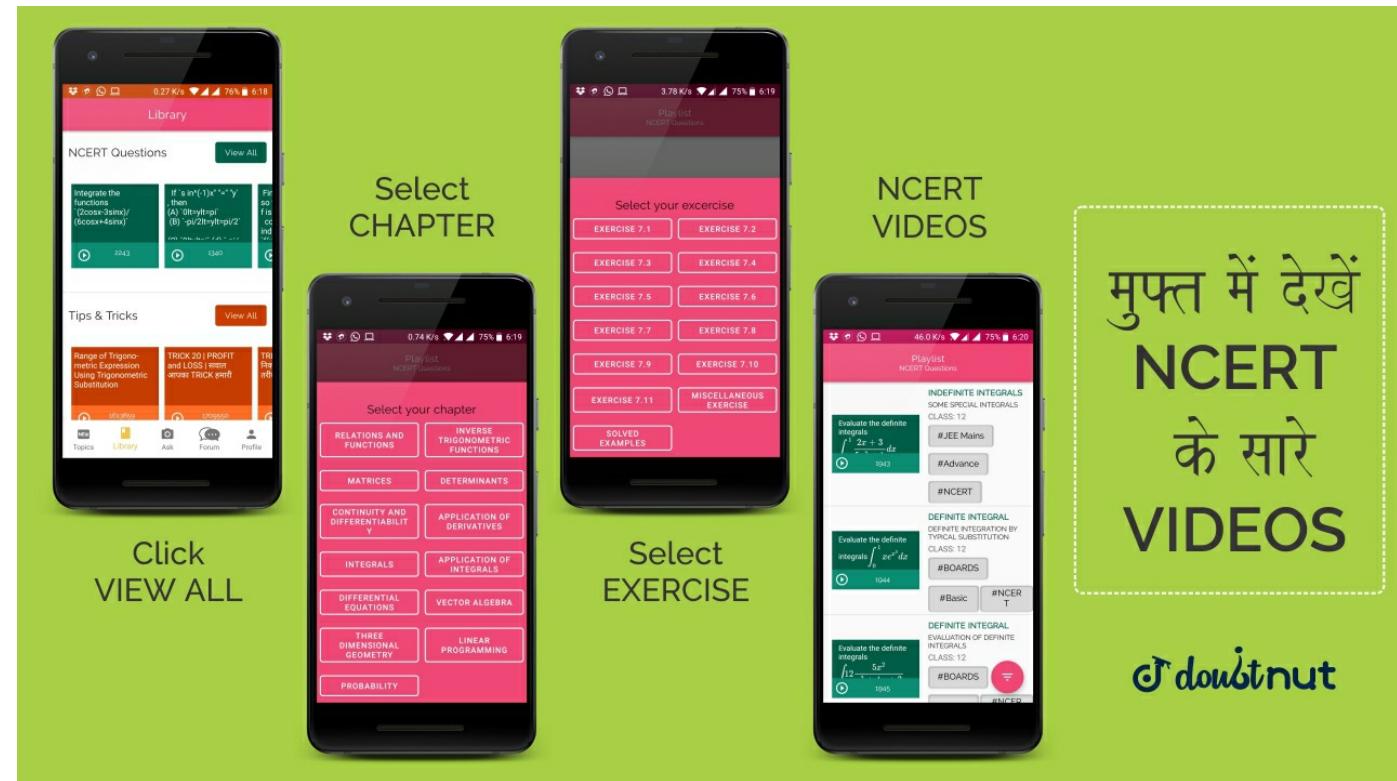
If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If  $|(a - x)^2(a - y)^2(a - z)^2(b - x)^2(b - y)^2(b - z)^2(c - x)^2(c - y)^2(c - z)^2| = 0$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

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$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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404

### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If  
 $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If  
 $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

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406

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

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, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

3D

**GEOMETRY\_VECTOR**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### **CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors**

**3D**

**GEOMETRY\_VECTOR**

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

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, etc. may be coplanar.

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### **CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Applications Of Dot (Scalar) Product**

**3D**

**GEOMETRY\_VECTOR**

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

408

409

	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b>	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
410	<p>If</p> $ (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2  = 0$ <p>and vectors</p> $\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors $\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.			
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411	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b></p> <p>If</p> $ (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2  = 0$ <p>and vectors</p> $\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors $\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>
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	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA_Miscellaneous</b></p> <p>If</p> $ (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2  = 0$	<b>AND</b>	<b>3D</b>	<b>GEOMETRY_VECTOR</b>

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

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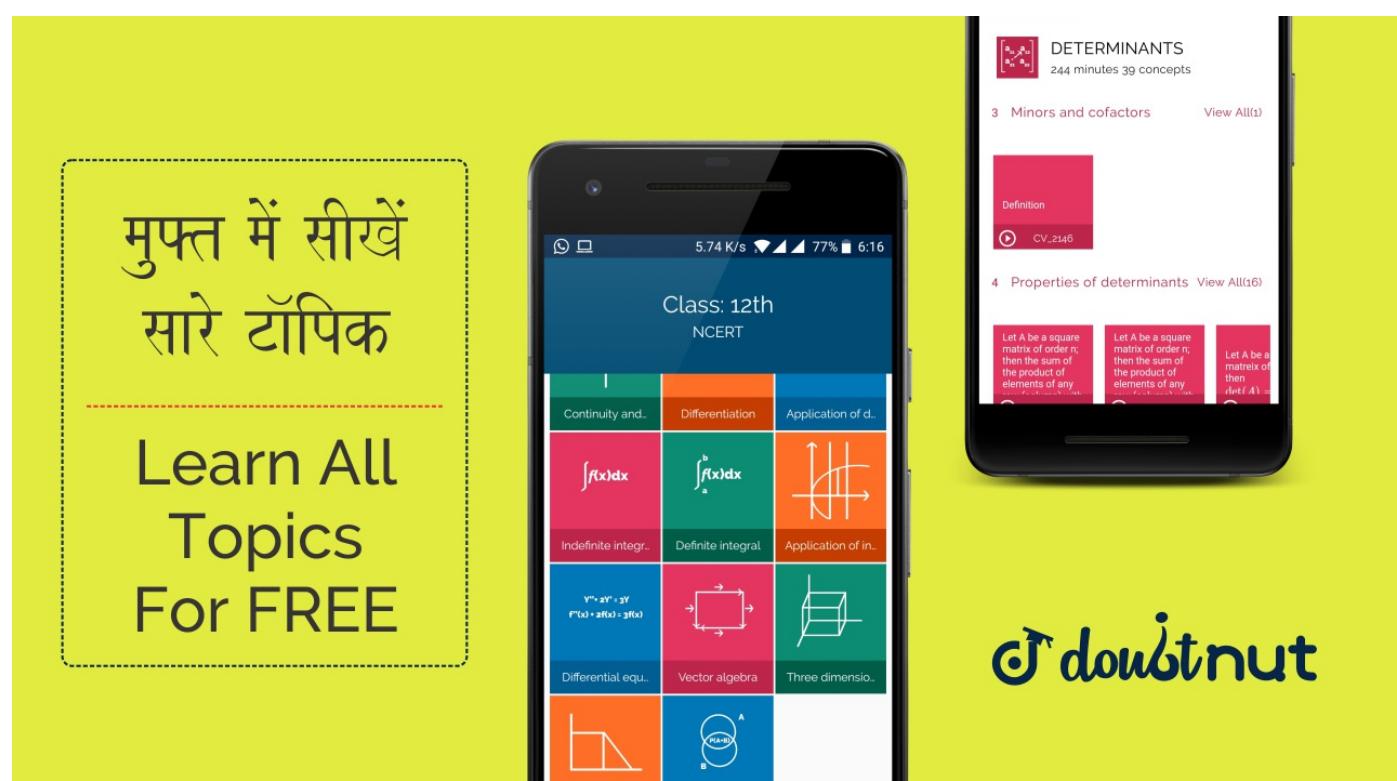
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$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

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 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

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$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
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 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
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, etc. may be coplanar.



### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

If  

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and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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421

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

422

If  
$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

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, etc, are non-coplanar, then prove that vectors

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$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If  
$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

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and vectors

424

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a \hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x \hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

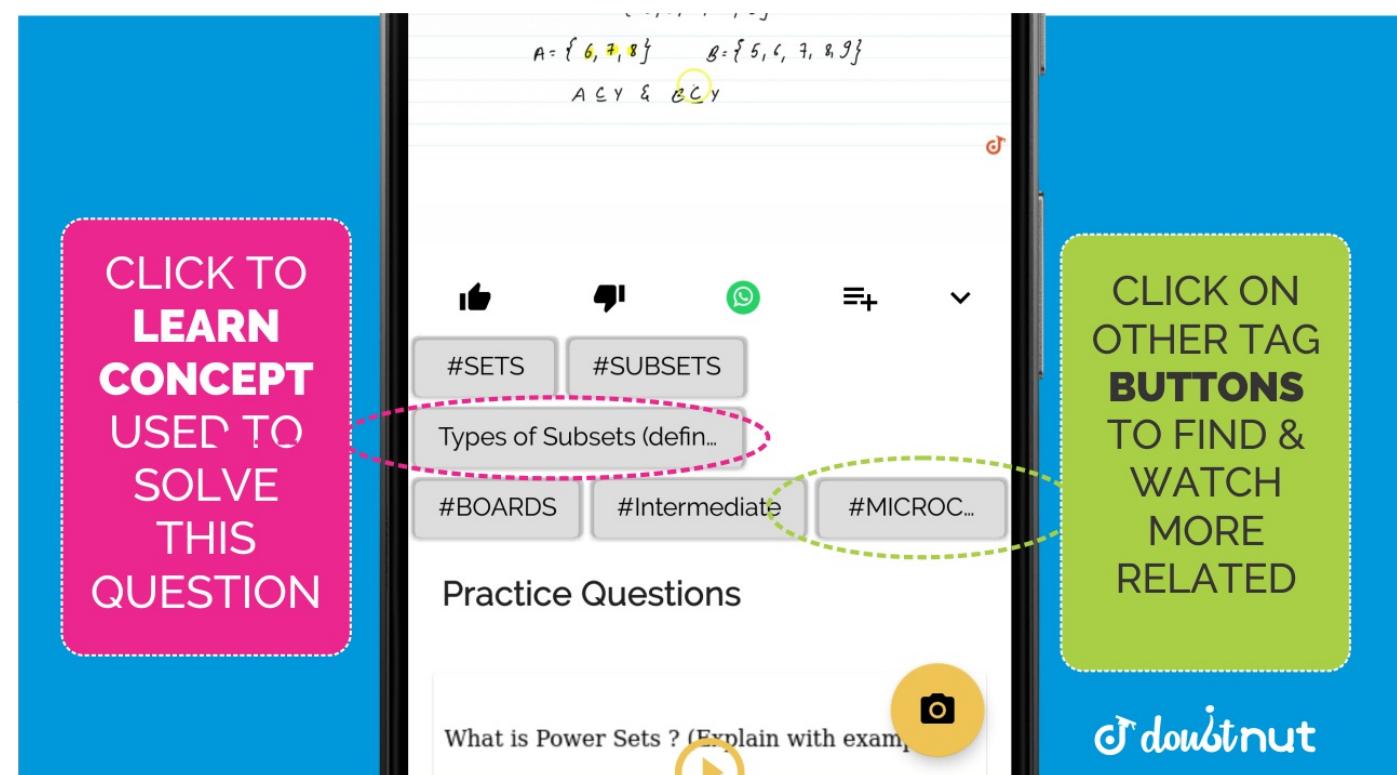
425

If  $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a \hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x \hat{j} + \hat{k}$ , etc. may be coplanar.

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If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Applications Of Dot (Scalar) Product

3D

### GEOMETRY\_VECTOR

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

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$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

431

### GEOMETRY\_VECTOR

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

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$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A}$

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$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

433

$| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 | = 0$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

If  
 $| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 | = 0$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\begin{vmatrix} (a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2 \end{vmatrix} = 0$$

and vectors

 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$ 

$= a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$ 

$= x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If

$$\begin{vmatrix} (a-x)^2(a-y)^2(a-z)^2(b \\ -x)^2(b-y)^2(b-z)^2(c \\ -x)^2(c-y)^2(c-a)^2 \end{vmatrix} = 0$$

and vectors

 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$ 

$= a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

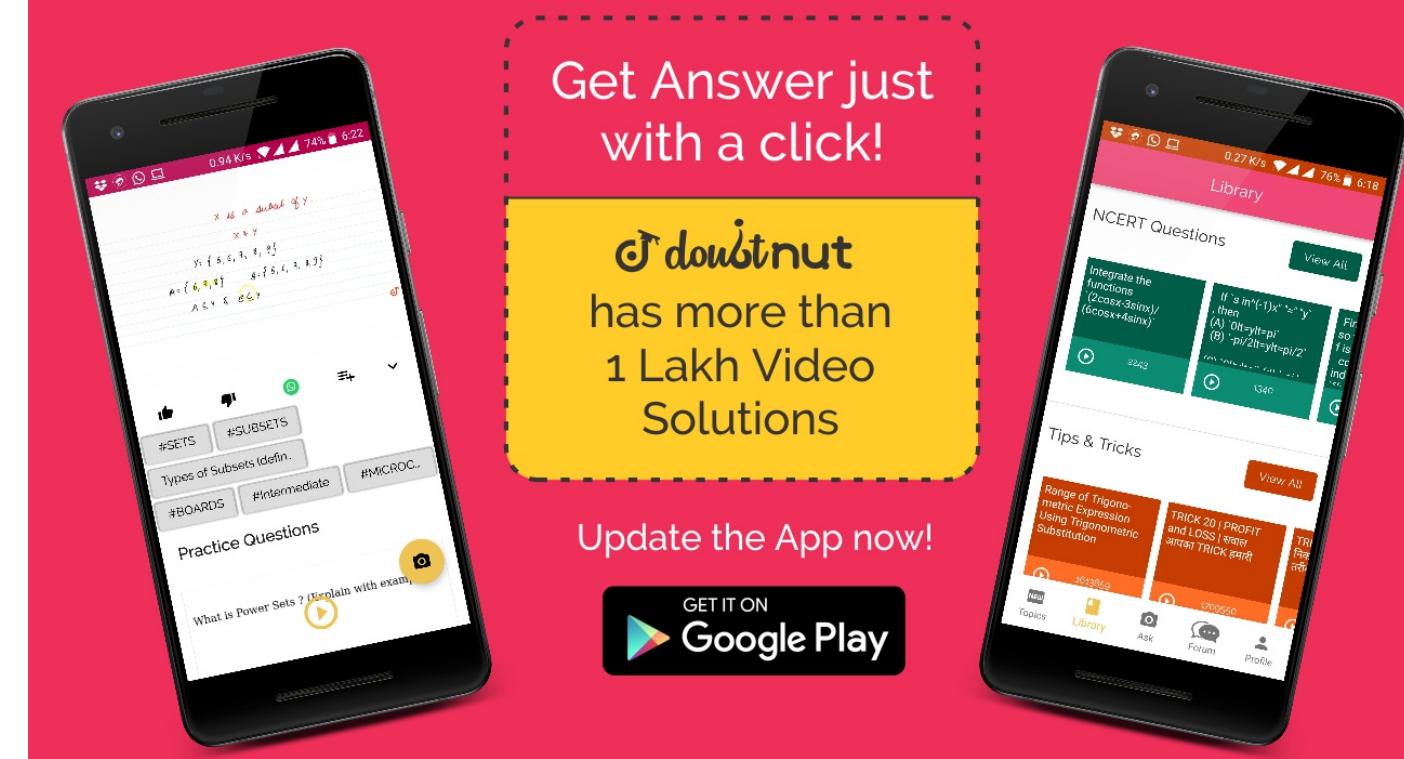
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$ 

$= x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

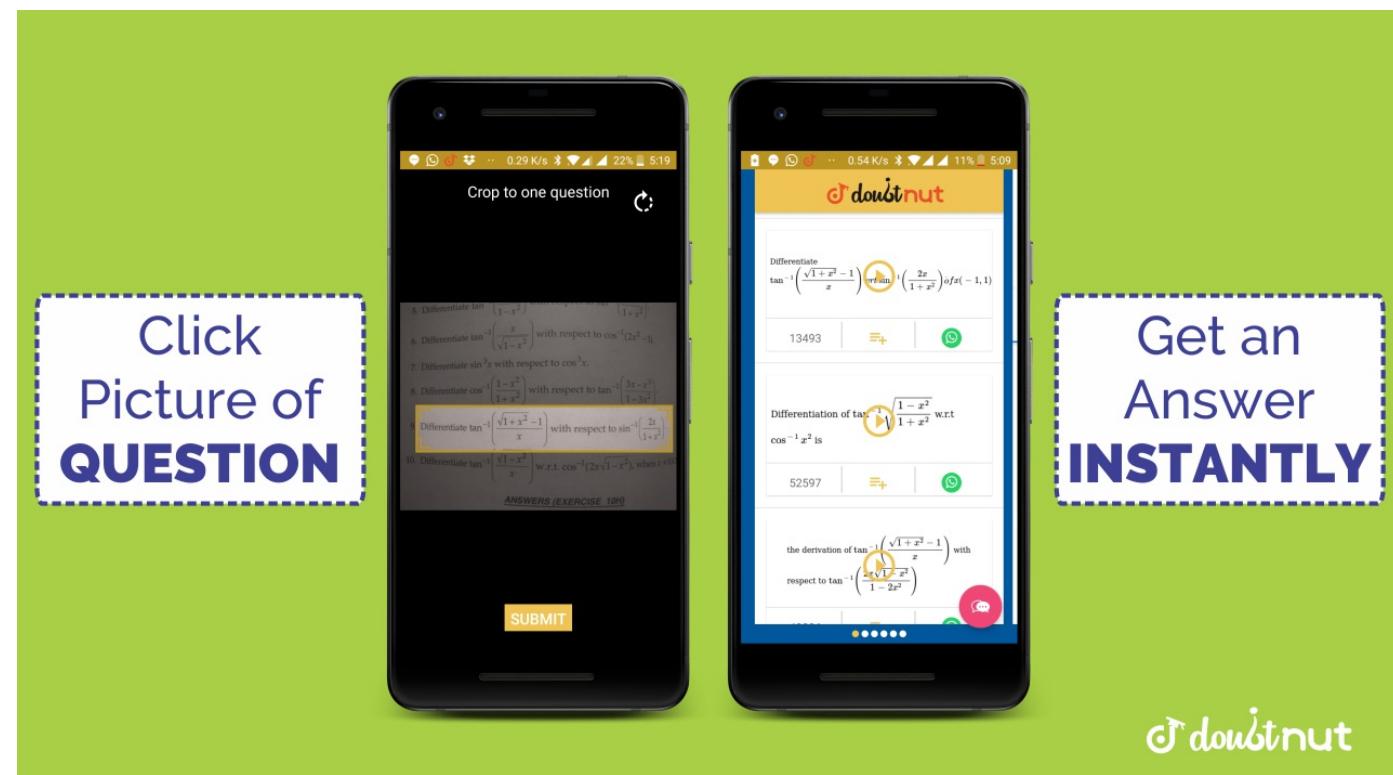
$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

444

, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x \hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

### GEOMETRY\_VECTOR

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$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Dot (Scalar) Product

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

448

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x \hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

451

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

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$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

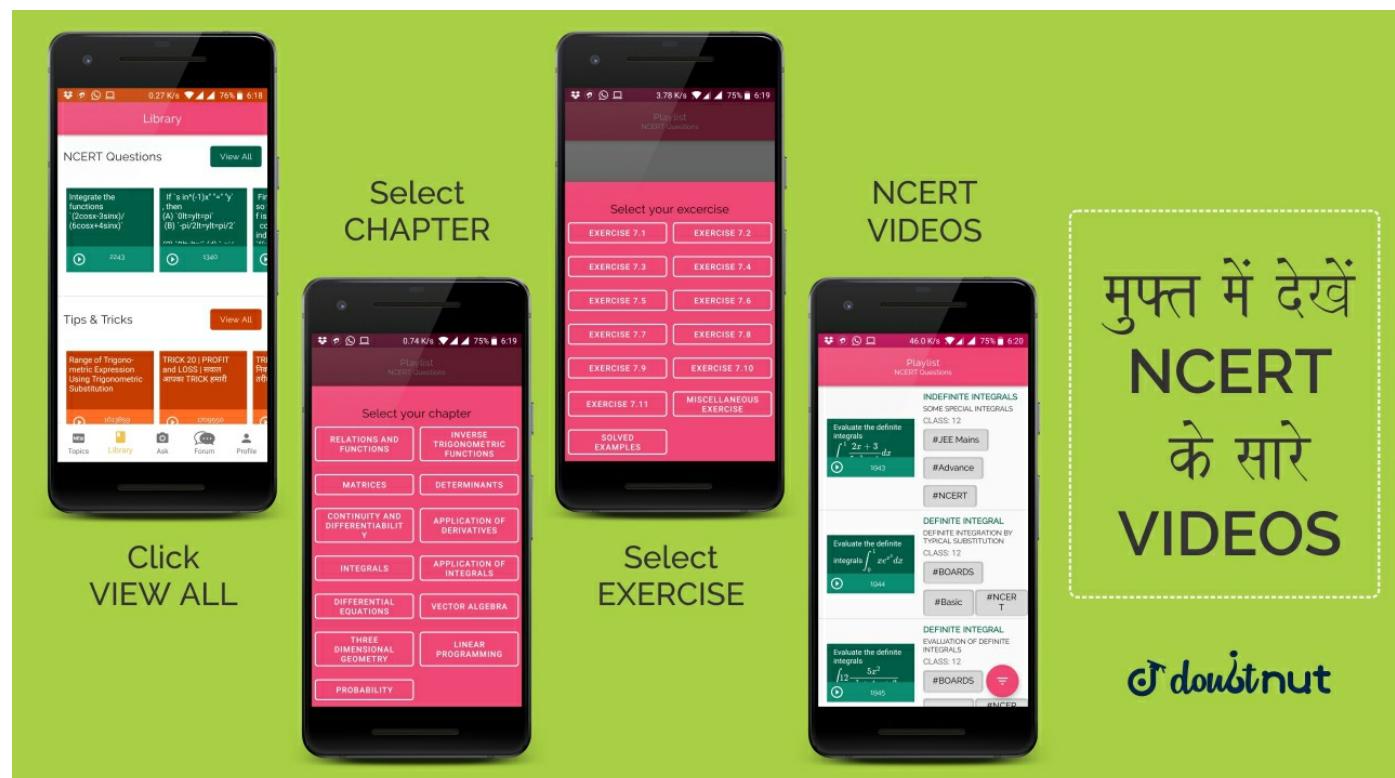
, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

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If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If  

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

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$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

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If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Applications Of Dot (Scalar) Product

AND

3D

### GEOMETRY\_VECTOR

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

463

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Miscellaneous

AND

3D

GEOMETRY\_VECTOR

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

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$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

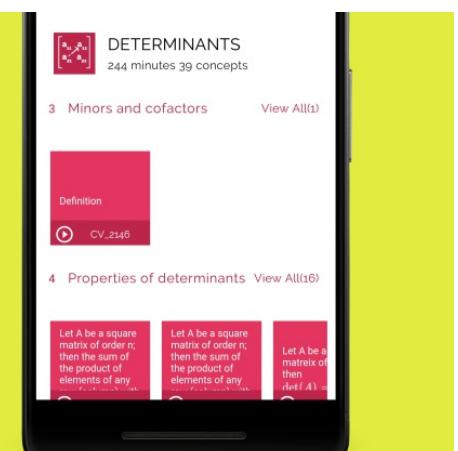
$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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469

### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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470

### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

473

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a \hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x \hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

### GEOMETRY\_VECTOR

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$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

GEOMETRY\_VECTOR

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

478

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product

### GEOMETRY\_VECTOR

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

479

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
Triple Produt**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

### GEOMETRY\_VECTOR

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

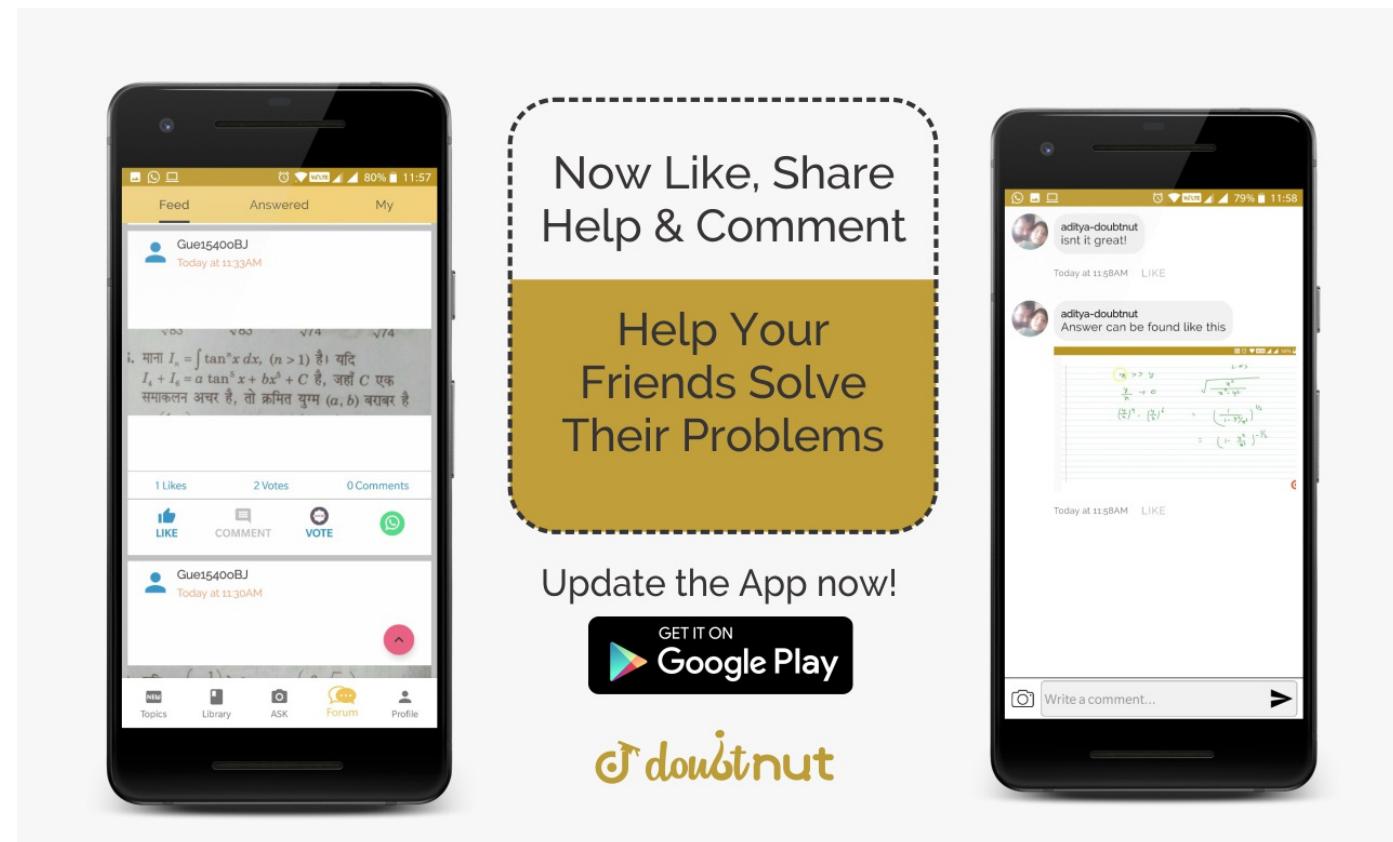
, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

487

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Applications Of Dot (Scalar) Product

3D

GEOMETRY\_VECTOR

488

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

489

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
 and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
 , etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
 , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

490

[Watch Free Video Solution on Doubtnut](#)**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

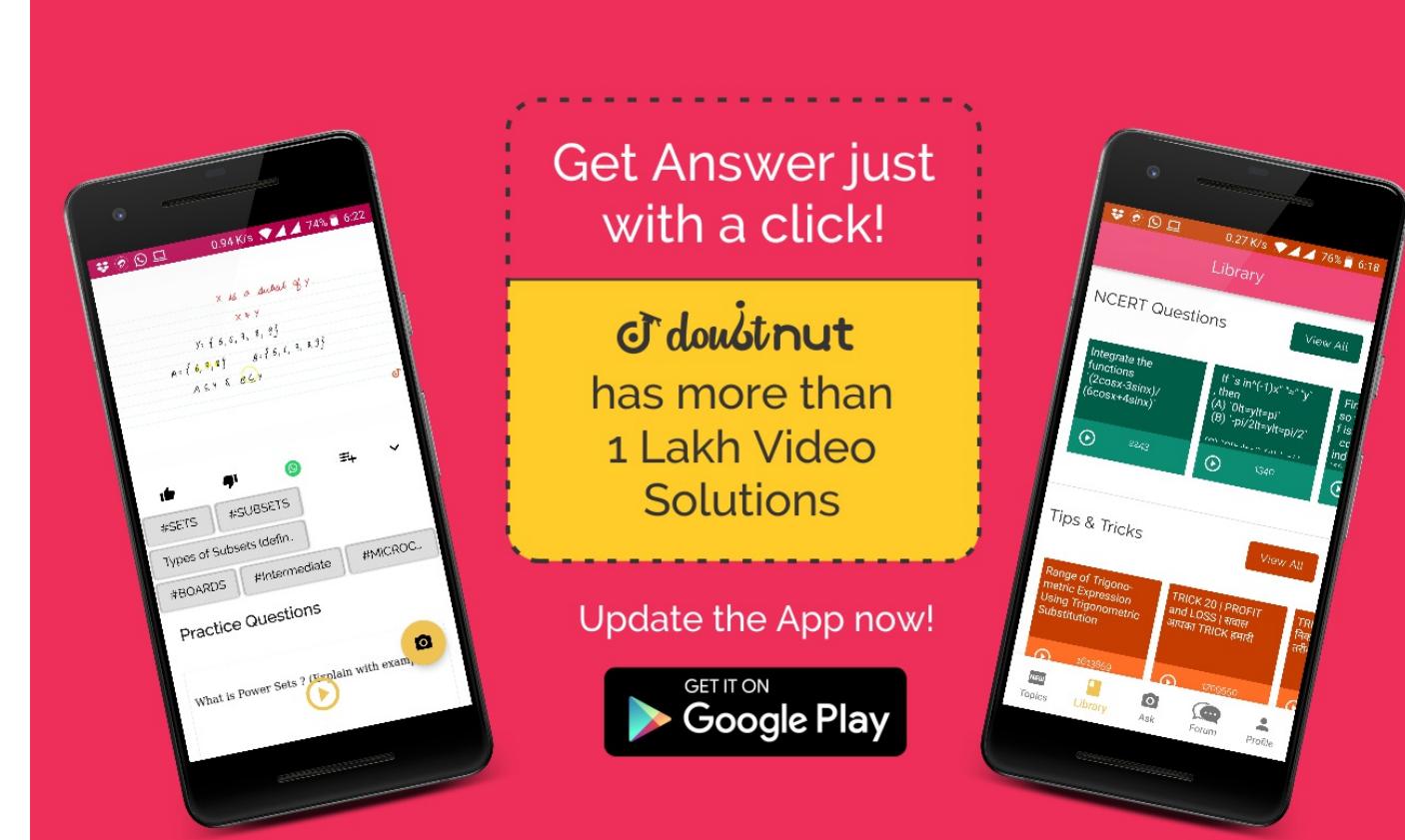
$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Miscellaneous

AND

3D

GEOMETRY\_VECTOR

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS ALGEBRA\_Applications Of Dot (Scalar) Product

AND

3D

GEOMETRY\_VECTOR

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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	<b>CENGAGE_MATHS_VECTORS ALGEBRA_Applications Of Dot (Scalar) Product</b>	<b>AND 3D</b>	<b>GEOMETRY_VECTOR</b>
494	<p>If</p> $ (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2  = 0$ <p>and vectors</p> $\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ <p>, etc, are non-coplanar, then prove that vectors</p> $\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ <p>, etc. may be coplanar.</p>		
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495	<p><b>CENGAGE_MATHS_VECTORS AND 3D GEOMETRY_VECTOR ALGEBRA_Vector (Or Cross) Product Of Two Vectors</b></p> <p>If</p> $ (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2  = 0$ <p>and vectors</p> $\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ <p>, etc, are non-coplanar, then prove that vectors</p> $\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ <p>, etc. may be coplanar.</p>		
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496	<p><b>CENGAGE_MATHS_VECTORS ALGEBRA_Applications Of Dot (Scalar) Product</b></p> <p>If</p> $ (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2  = 0$ <p>and vectors</p> $\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$	<b>3D</b>	<b>GEOMETRY_VECTOR</b>

, etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

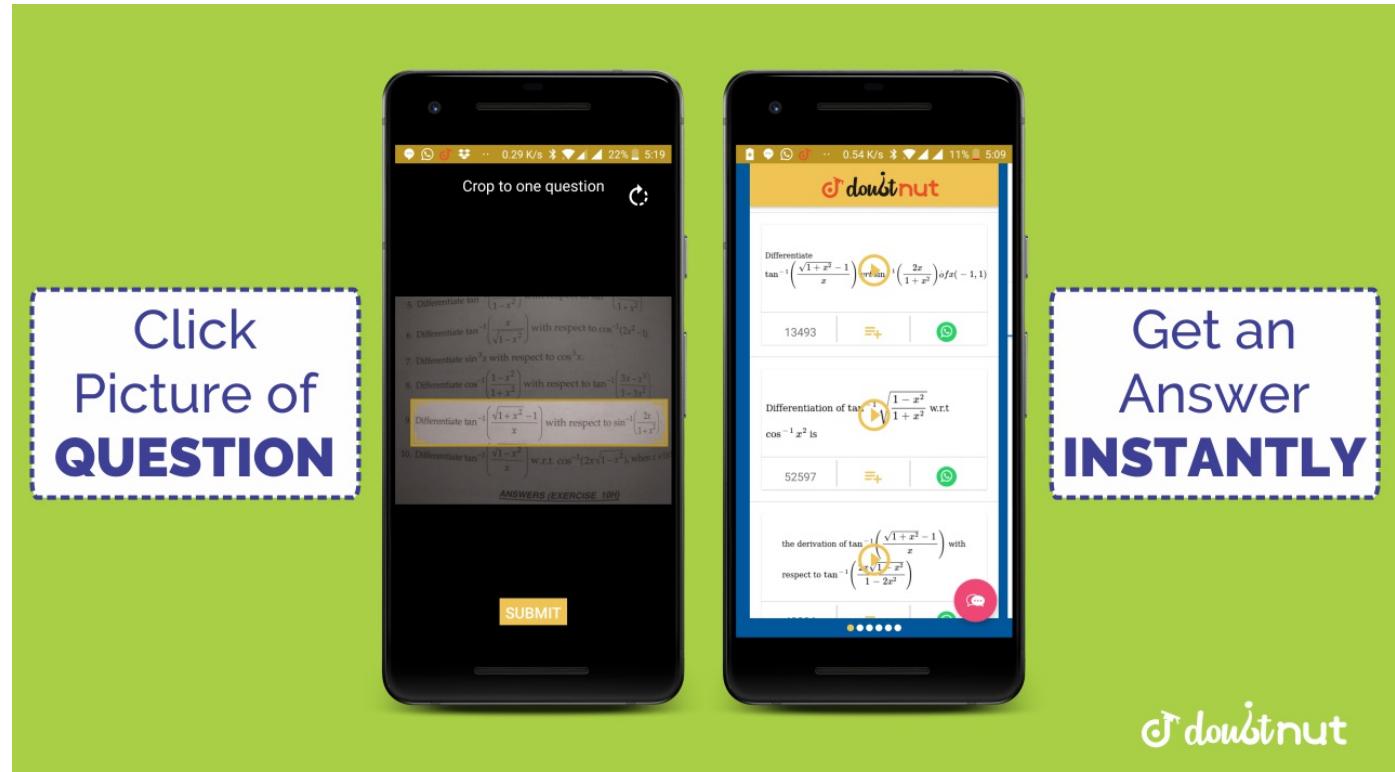
$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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पढ़ना हुआ आसान



### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

498

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

501

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  
 $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  
 $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.



### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

506

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR  
ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

507

**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector  
(Or Cross) Product Of Two Vectors**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

508

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2 \hat{i} + a \hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2 \hat{i} + x \hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

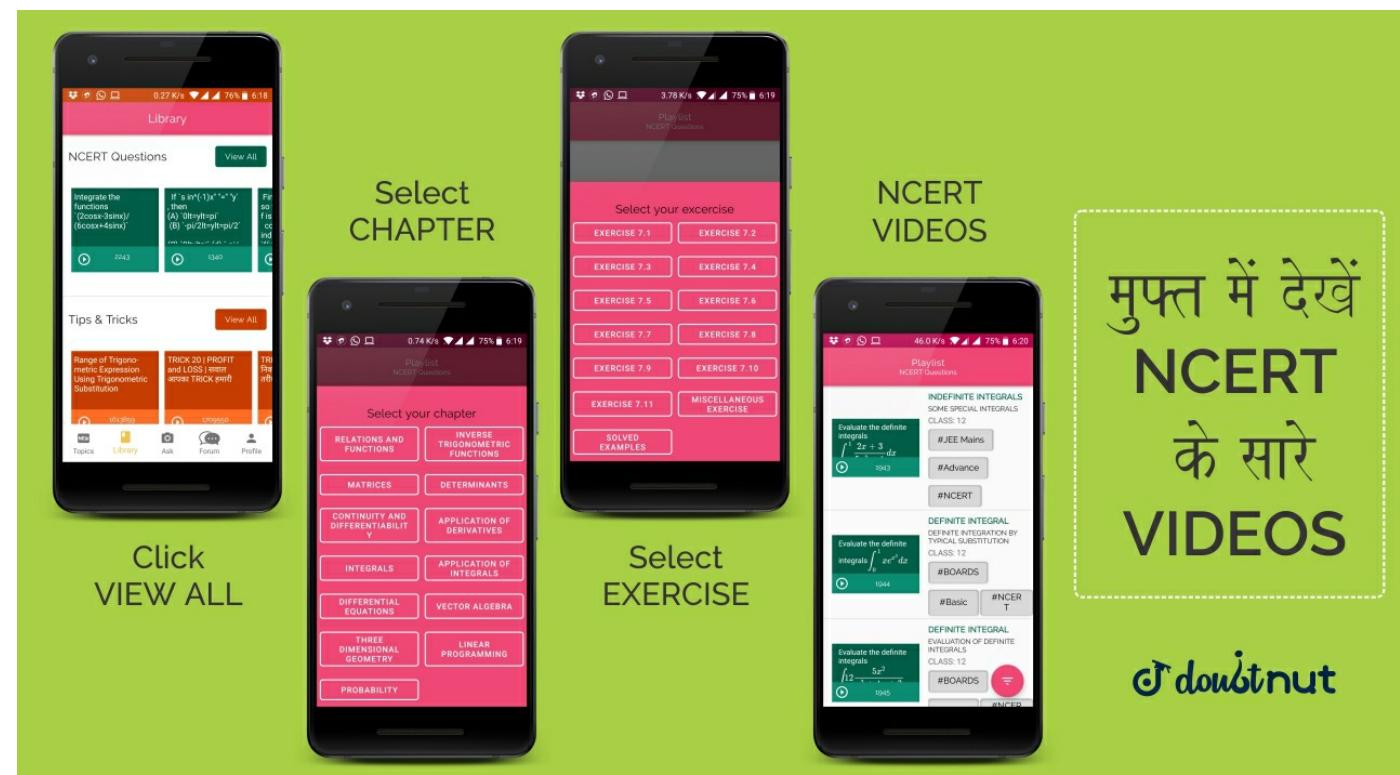
$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

510

$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If  $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If  $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

514

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

515

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If  
 $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If  
 $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Produt

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2\hat{i} + a\hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2\hat{i} + x\hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$$\vec{A}, \vec{B}, \text{ and } \vec{C}, \text{ where } \vec{A}$$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$$\vec{X}, \vec{Y} \text{ and } \vec{Z}, \text{ where } \vec{X}$$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

524

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product**

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

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$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$= x^2 \hat{i} + x \hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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, etc, are non-coplanar, then prove that vectors

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

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$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND ALGEBRA\_Reciprocal System Of Vectors

3D

GEOMETRY\_VECTOR

If  $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

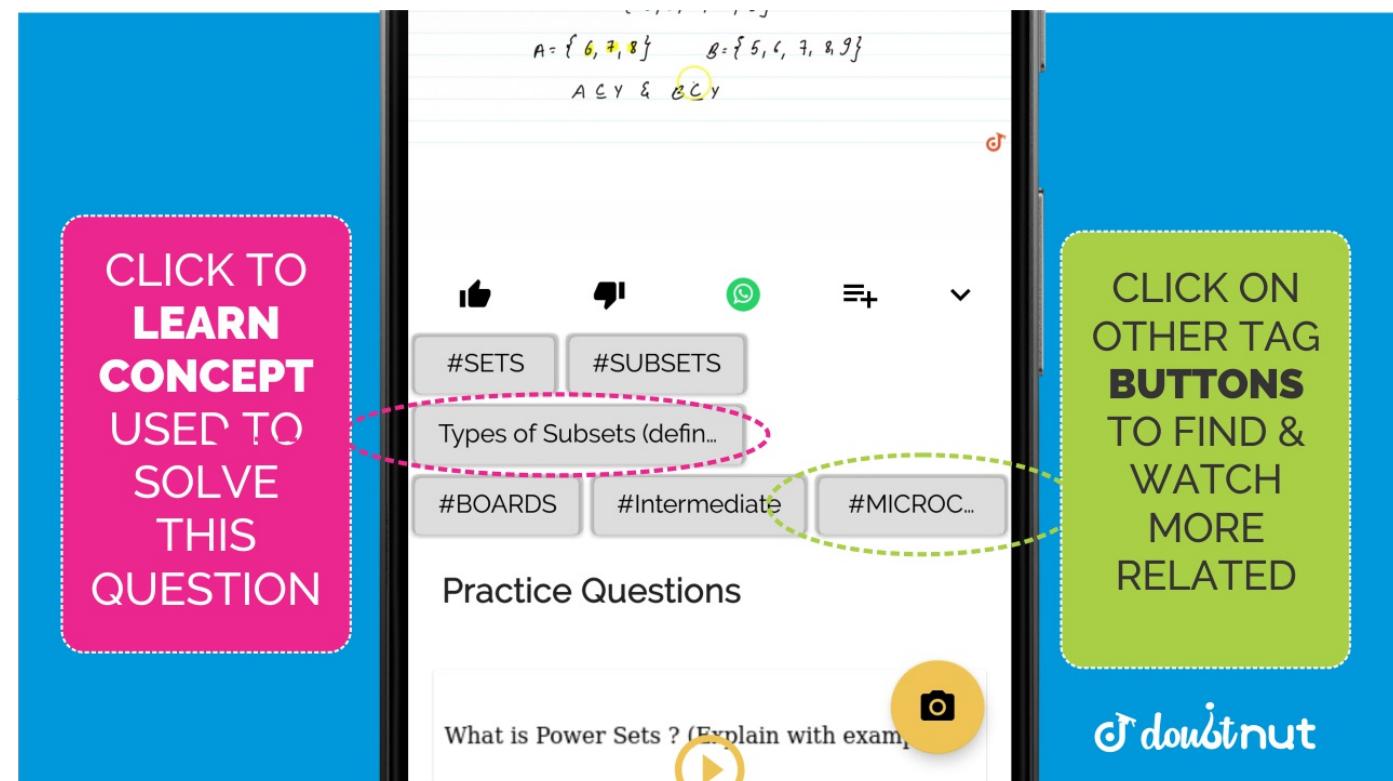
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If  $|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$

and vectors  $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.



### CENGAGE\_MATHS\_VECTORS AND 3D ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

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$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar

### Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}$ ,  $\vec{B}$ , and  $\vec{C}$ , where  $\vec{A}$

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, etc, are non-coplanar, then prove that vectors

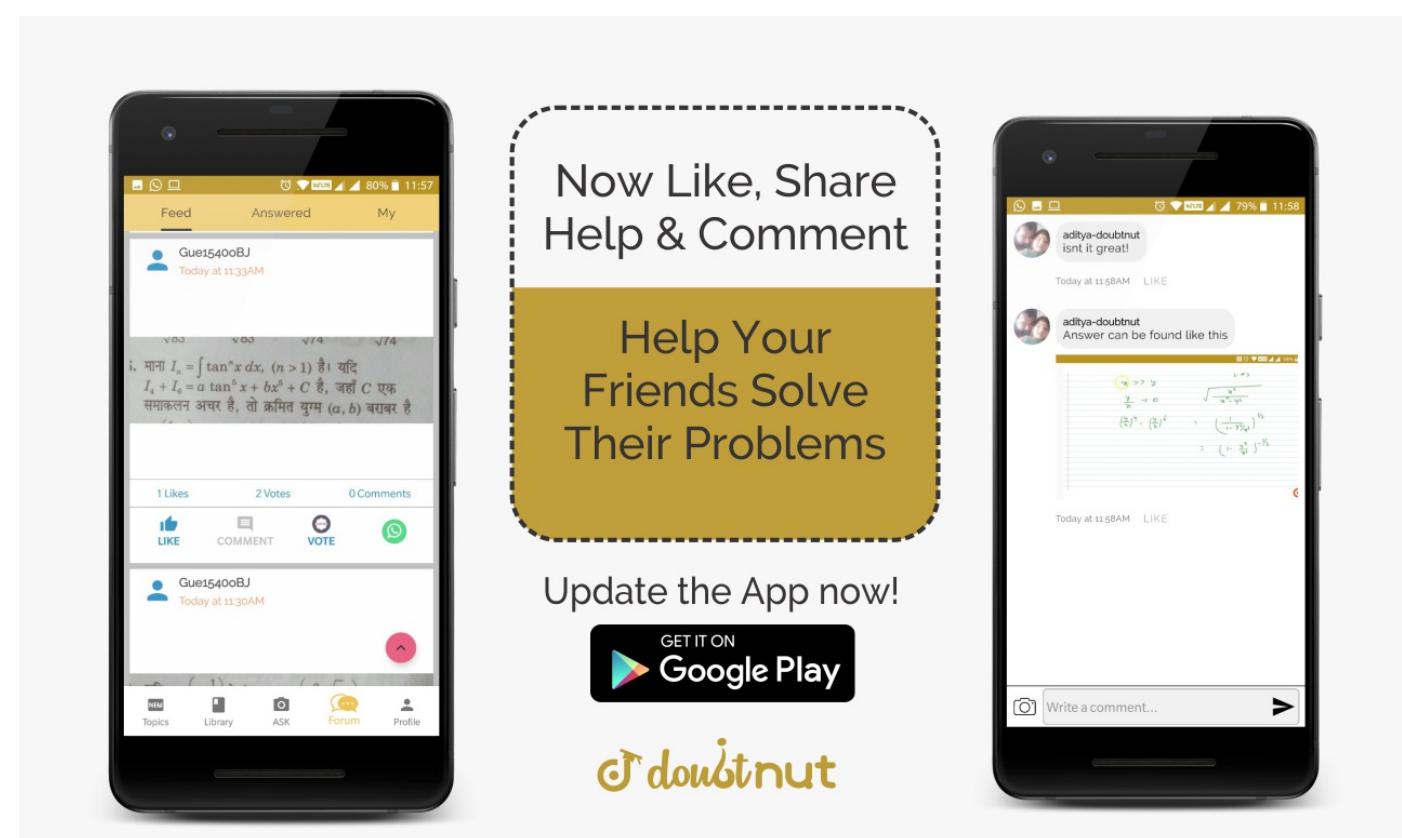
$\vec{X}$ ,  $\vec{Y}$  and  $\vec{Z}$ , where  $\vec{X}$

$$= x^2 \hat{i} + x \hat{j} + \hat{k}$$

, etc. may be coplanar.

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If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

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, etc. may be coplanar.

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

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and vectors

$\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A}$

$$= a^2 \hat{i} + a \hat{j} + \hat{k}$$

, etc, are non-coplanar, then prove that vectors

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**CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product**

If

$$\left| (a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2 \right| = 0$$

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, etc, are non-coplanar, then prove that vectors  
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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

, etc, are non-coplanar, then prove that vectors

$\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$

, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Applications Of Dot (Scalar) Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B}$ , and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$

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, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

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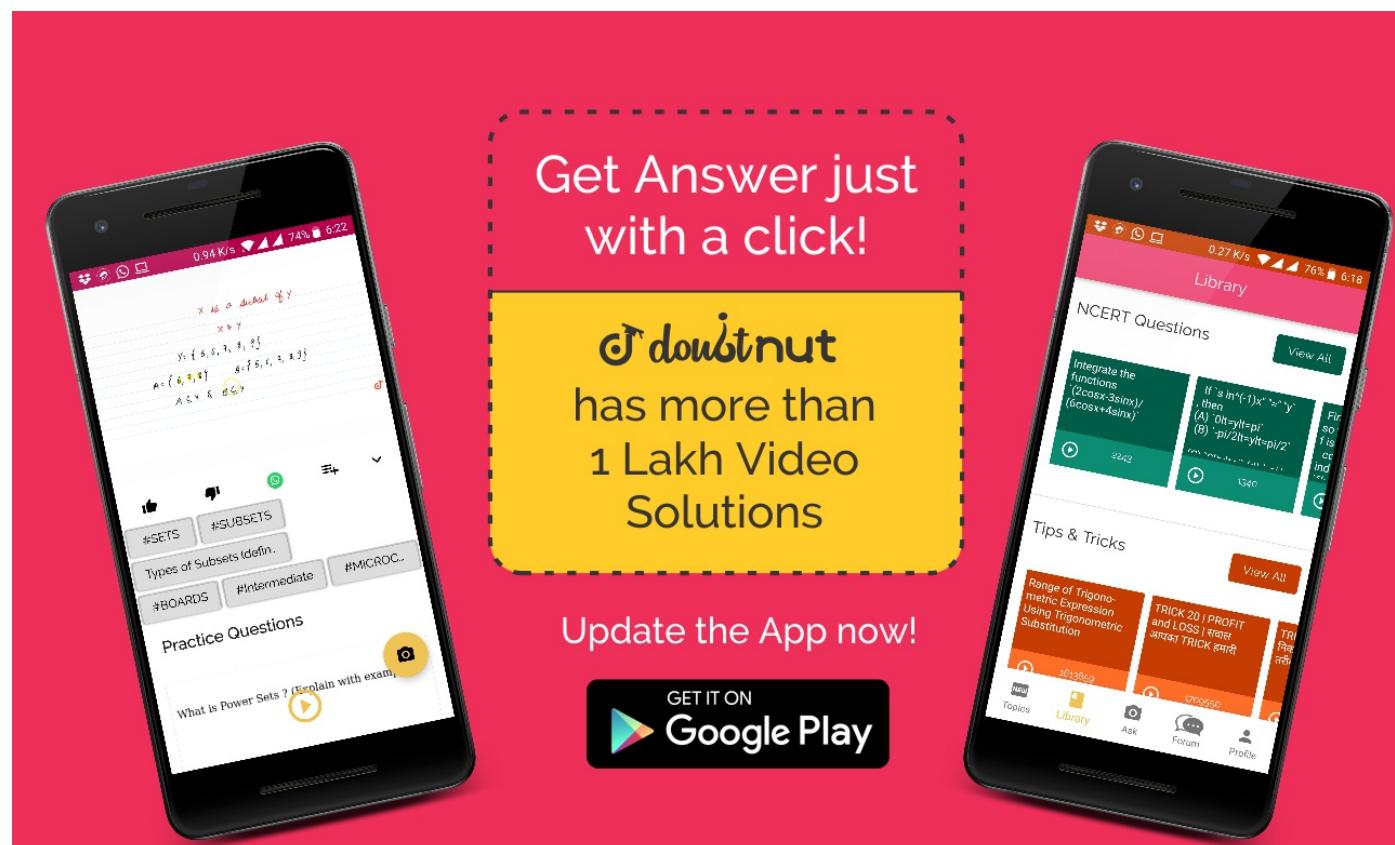
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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$\begin{aligned} & |(a-x)^2(a-y)^2(a-z)^2(b \\ & -x)^2(b-y)^2(b-z)^2(c \\ & -x)^2(c-y)^2(c-a)^2| = 0 \end{aligned}$$

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$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Scalar Triple Product

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

If

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$

and vectors

$\vec{A}, \vec{B},$  and  $\vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$ , etc, are non-coplanar, then prove that vectors  $\vec{X}, \vec{Y}$  and  $\vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$ , etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector (Or Cross) Product Of Two Vectors

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If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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### CENGAGE\_MATHS\_VECTORS AND 3D GEOMETRY\_VECTOR ALGEBRA\_Vector Triple Product

If  

$$|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-a)^2| = 0$$
  
and vectors  
 $\vec{A}, \vec{B}, \text{ and } \vec{C}$ , where  $\vec{A} = a^2\hat{i} + a\hat{j} + \hat{k}$   
, etc, are non-coplanar, then prove that vectors  
 $\vec{X}, \vec{Y} \text{ and } \vec{Z}$ , where  $\vec{X} = x^2\hat{i} + x\hat{j} + \hat{k}$   
, etc. may be coplanar.

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