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CHAPTER 10

VECTORS

POINTS TO REMEMBER

- A quantity that has magnitude as well as direction is called a *vector*. It is denoted by a directed line segment.
- Two or more vectors which are parallel to same line are called *collinear vectors*.
- *Position vector* of a point *P*(*a, b, c*) w.r.t. origin (0, 0, 0) is denoted by *OP*, where $\overrightarrow{OP} = a\hat{i} + b\hat{j} + c\hat{k}$ and $|\overrightarrow{OP}| = \sqrt{a}$ \overrightarrow{OP} where $\overrightarrow{=}$ \wedge \wedge \wedge \wedge \rightarrow $\overrightarrow{?}$ $\sqrt{2}$ $\sqrt{2}$ $\sqrt{2}$
- , where 2 2 2 *OP ai b j ck a b c* and . *OP* **CHAPTER 10**
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as magnitude as well as direction is called a vector. It

directed line segment.

for s which are parallel to same line are called *collinear*

f a point $P(a, b, c)$ w.r.t. orig If $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$ be any two points in space, then **POINTS TO REMEMBER**
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A quantity that has magnitude as well as direction is called a *vector*. It

s denoted by a directed line segment.

Two or more vectors which are parallel to same line are calle $\overrightarrow{AB} = (x_2 - x_1)\hat{i} + (y_2 - y_1)\hat{j} + (z_2 - z_1)\hat{k}$ and **POINTS TO REMEMBER**
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A quantity that has magnitude as well as direction is called a *vector*. It is denoted by a directed line segment.

Two or more vectors which are parallel to same line are calle **CHAPTER 10**
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point $P(a, b, c)$ w.r.t. origin $(0, 0, 0)$ is de $|\overrightarrow{AB}| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}.$ **IO REMEMBER**

ide as well as direction is called a *vector*. It

are parallel to same line are called *collinear*
 $(2a, b, c)$ w.r.t. origin $(0, 0, 0)$ is denoted by
 $+c\hat{k}$ and $|\overline{OP}| = \sqrt{a^2 + b^2 + c^2}$.
 y_2 , z_2) **POINTS TO REMEMBER**

by that has magnitude as well as direction is called a *vector*. It

and by a directed line segment.

more vectors which are parallel to same line are called *collinear*

vector of a point $P(a, b, c)$ **POINTS TO REMEMBER**

• A quantity that has magnitude as well as direction is called a *vector*. It

is denoted by a directed line segment.

• Two or more vectors which are parallel to same line are called *collinear*
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is denoted by a directed line segment.
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Position vector of a point $P(a, b, c)$ w.r.t. origin $(0, 0, 0)$ is de vector. It
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s. and . *a a* • Position vector of a point $P(a, b, c)$ w.r.t. origin (0, 0, 0) is denoted by
 \overrightarrow{OP} , where $\overrightarrow{OP} = a\hat{i} + b\hat{j} + c\hat{k}$ and $|\overrightarrow{OP}| = \sqrt{a^2 + b^2 + c^2}$.

• If $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$ be any two points in space, are two collinear textors, then $\vec{a} = |\vec{a}| \hat{a}$, where \hat{a} is denoted by
 $\vec{OP} = a\hat{i} + b\hat{j} + c\hat{k}$ and $|\vec{OP}| = \sqrt{a^2 + b^2 + c^2}$.
 z_1) and $B(x_2, y_2, z_2)$ be any two points in space, then
 $x_1\hat{j} + (y_2 - y_1)\hat{j} + ($ $\sqrt{1000}$, 0, 0) is denoted by
 $\sqrt{a^2 + b^2 + c^2}$.

D points in space, then

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 $\sqrt{z^2 - z_1^2}$.

gnitude and direction by

en their sum $\vec{a} + \vec{b}$ is

side of triangle taken in

ddition of vectors.

is a vector col
- If two vectors \overrightarrow{a} and \overrightarrow{b} are represented in magnitude and direction by the two sides of a triangle taken in order, then their sum $\vec{a} + \vec{b}$ is represented in magnitude and direction by third side of triangle taken in opposite order. This is called triangle *law of addition of vectors.*
- If \overrightarrow{a} is any vector and λ is a scalar, then $\lambda \overrightarrow{a}$ is a vector collinear with \vec{a} and $|\vec{a}| = |\vec{a}| |\vec{a}|$.
- scalar.
- Any vector \overrightarrow{a} can be written as $\overrightarrow{a} = \overrightarrow{a} \cdot \overrightarrow{a}$, where \overrightarrow{a} is a unit vector in the direction of \overrightarrow{a} .

If \overrightarrow{a} and \overrightarrow{b} be the position vectors of points *A* and *B*, and *C* is any point which divides AB in ratio m : n internally then position vector a \overline{AB} in ratio m : n internally then position vector \vec{c} of point **Example 18 and** \vec{b} **be the position vectors of points** *A* **and** *B***, and** *C* **is any point
which divides** \overline{AB} **in ratio** *m* **:** *n* **internally then position vector** \vec{c} **of point
***C* **is given as \vec{c} = \frac{m\vec{b} + n\vec{a 40** \bigcap compared \bigcap and \bigcap compared \bigcap and B , and C is any point \overline{AB} in ratio $m : n$ internally then position vector \overline{c} of point $\overline{C} = \frac{m\overline{b} + n\overline{a}}{m + n}$. If C divides \overline{AB} in ratio **40** \cap community and *B*, and *B*, and *C* is any point

ratio *m* : *n* internally then position vector \vec{c} of point
 $\frac{n\vec{b} + n\vec{a}}{m + n}$. If *C* divides \overrightarrow{AB} in ratio *m* : *n* externally,
 m and by $\vec{$ $\frac{m b + n a}{m + n}$. If *C* divides \overrightarrow{AB} in ratio *m* : *n* externally, \overrightarrow{a} in ratio *m* : *n* externally, **4.0** O. COM

be the position vectors of points *A* and *B*, and *C* is any point
 \overline{AB} in ratio *m* : *n* internally then position vector \overline{c} of point
 $\overline{c} = \frac{m\overline{b} + n\overline{a}}{m + n}$. If *C* divides \overline{AB} i **4000.** COM
 and \vec{b} be the position vectors of points *A* and *B*, and *C* is any point

divides \overline{AB} in ratio *m* : *n* internally then position vector \vec{c} of point

given as $\vec{c} = \frac{m\vec{b} + n\vec{a}}{m + n}$. **4000.** COM
 be the position vectors of points *A* **and** *B***, and** *C* **is any point

s** \overline{AB} in ratio *m* : *n* internally then position vector \overline{c} of point
 m $\overline{B} = \frac{m\overline{b} + n\overline{a}}{m + n}$. If *C* divides $\$ **40** \bigcap , $C \odot M$
 40 If \vec{a} and \vec{b} be the position vectors of points *A* and *B*, and *C* is any point

which divides \overrightarrow{AB} in ratio *m* : *n* internally then position vector \vec{c} of point
 C is give *Propertionally then position vector* \vec{c} *of point***
** *internally then position vector* \vec{c} *of point***
** *F**c* **divides** \overline{AB} **in ratio** *m* **:** *n* **externally,
** $\vec{r} = a\hat{i} + b\hat{j} + c\hat{k}$ **with positive direction
** *int* If \vec{a} and \vec{b} be the position vectors of points *A* and *B*, and *C* is any point
which divides \overrightarrow{AB} in ratio *m* : *n* internally then position vector \vec{c} of point
C is given as $\vec{C} = \frac{m\vec{b} + n\vec{a}}$ *r r <i>r <i>r r r <i>r <i>r r <i>r <i><i>r <i>r <i><i>r <i>r <i>f <i>r* • If \vec{a} and \vec{b} be the position vectors of points *A* and *B*, and *C* is any point

which divides \overline{AB} in ratio *m* : *n* internally then position vector \vec{c} of point
 C is given as $\vec{C} = \frac{m\vec{b} +$ ctors of points *A* and *B*, and *C* is any point
 n internally then position vector \vec{c} of point

If *C* divides \overline{AB} in ratio $m : n$ externally,

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 $+ b\hat{j} + c\hat{k}$ with positive direction

ngles and cosines of these angles
 y denoted as and *b* be the position vectors of points A and *b*, and *b* is any point
which divides \overline{AB} in ratio *m* : *n* internally then position vector \overline{c} of point
C is given as $\overline{C} = \frac{m\overline{b} + n\overline{a}}{m + n}$. If *C* and \vec{b} be the position vectors of points A and B, and C is any point

ch divides \overline{AB} in ratio m : n internally then position vector \vec{c} of point

s given as $\vec{C} = \frac{mb + na}{m + n}$. If C divides \overline{AB} in rati where \vec{v} is the angle between \vec{a} and \vec{b} and \vec{c} is any point

ratio $m : n$ internally then position vector \vec{c} of point
 $\vec{v} + n\vec{a}$. If C divides \overrightarrow{AB} in ratio $m : n$ externally,

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 $I = \cos \alpha$, *m* = cos β,

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ed direction ratios.

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a, a, a, which divides \overrightarrow{AB} in ratio $m : n$ internally then position vector \overrightarrow{c} of point
 C is given as $\overrightarrow{C} = \frac{m\overrightarrow{b} + na}{m + n}$. If *C* divides \overrightarrow{AB} in ratio $m : n$ externally,

then $\overrightarrow{C} = \frac{m\overrightarrow{b} - n\overrightarrow{a}}{m - n}$

then $\vec{C} = \frac{mb - na}{m - n}$.

The angles α , β and γ made by $\vec{r} = a\hat{i} + b\hat{j} + c\hat{k}$ with positive direction of x, *y* and *z*-axis are called direction angles and cosines of these angles are called *direction cosines* of \vec{r} usually denoted as $l = \cos \alpha$, $m = \cos \beta$, $n = \cos \gamma$. *C* is given as $\overline{C} = \frac{m\dot{b} + n\dot{a}}{m + n}$, if *C* divides \overline{AB} in ratio *m* : *n* externally,

then $\overline{C} = \frac{m\dot{b} - n\dot{a}}{m - n}$.

The angles a , β and γ made by $\overline{r} = a\dot{i} + b\dot{j} + c\dot{k}$ with positive *a a i l j j k k ^a* , so 1. $\frac{\partial \vec{a}}{\partial \vec{n}}$.
 $\frac{\partial \vec{a}}{\partial \vec{n}}$.
 $\frac{\partial \vec{a}}{\partial \vec{n}}$.
 $\frac{\partial \vec{a}}{\partial \vec{n}}$.
 $\frac{\partial \vec{a}}{\partial \vec{n}}$ and $\frac{\partial \vec{a}}{\partial \vec{n}}$ is $\frac{\partial \vec{a}}{\partial \vec{n}}$ and $\frac{\partial \vec{a}}{\partial \vec{n}}$ and $\frac{\partial \vec{a}}{\partial \vec{n}}$ and $\frac{\partial \vec{a}}{\partial \vec{n}}$ and $\frac{\partial \vec{a}}$ **Then** $C = \frac{1}{m} - n$.
 The angles α , β and γ made by $\vec{r} = a\hat{i} + b\hat{j} + c\hat{k}$ with positive direction of x, y and z-axis are called direction angles and cosines of these angles are called direction cosines of The angles α , β and γ made by $\vec{r} = a\hat{i} + b\hat{j} + c\hat{k}$ with positive direction

of x, y and z-axis are called direction angles and cosines of these angles

are called *direction cosines* of \vec{r} usually denot d direction angles and cosines of these angles

of \vec{r} usually denoted as $l = \cos \alpha$, $m = \cos \beta$,
 $= \frac{c}{|\vec{r}|}$ and $\vec{F} + m^2 + n^2 = 1$.

trivinal to *l*, *m*, *n* are called direction ratios.

rs \vec{a} and \vec{b} is train are called direction anyles and cosines of these anyles

teriori cosines of \vec{r} usually denoted as $l = \cos \alpha$, $m = \cos \beta$,
 $m = \frac{b}{|\vec{r}|}$, $n = \frac{c}{|\vec{r}|}$ and $\beta + m^2 + n^2 = 1$.

a, b, c proportional to l, m, n are

Also
$$
I = \frac{a}{|\vec{r}|}
$$
, $m = \frac{b}{|\vec{r}|}$, $n = \frac{c}{|\vec{r}|}$ and $f + m^2 + n^2 = 1$.

- The numbers *a, b, c* proportional to *l, m, n* are called *direction ratios*.
- Scalar product of two vectors \vec{a} and \vec{b} is denoted as $\vec{a}.\vec{b}$ and is defined as $\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$, where θ is the angle between \vec{a} and \vec{b} ($0 \le \theta \le \pi$). $m = \frac{b}{|\vec{r}|}, n = \frac{c}{|\vec{r}|}$ and $\vec{F} + m^2 + n^2 = 1$.
 a, b, c proportional to *l, m, n* are called *direction ratios.*

of two vectors \vec{a} and \vec{b} is denoted as $\vec{a}.\vec{b}$ and is defined
 $|\cos \theta|$, where θ i *a*, *b*, *c* proportional to *l*, *m*, *n* are called *direction ratios.*
 t of two vectors \vec{a} and \vec{b} is denoted as $\vec{a}.\vec{b}$ and is defined
 $|\vec{b}| \cos \theta$, where θ is the angle between \vec{a} and \vec{b} $n = \frac{c}{|r|}$ and $\beta + m^2 + n^2 = 1$.

oportional to *l, m, n* are called direction ratios.

ctors \vec{a} and \vec{b} is denoted as $\vec{a}.\vec{b}$ and is defined

nere θ is the angle between \vec{a} and \vec{b} ($0 \le \theta \le \pi$ $\frac{1}{|I|}$, $m = \frac{1}{|I|}$, $n = \frac{1}{|I|}$ and $P + m^2 + n^2 = 1$.

It is an and \overline{I} is denoted as $\overline{a} \overline{b}$ and is defined
 $|I| \overline{b}| \cos \theta$, where θ is the angle between \overline{a} and \overline{b} ($0 \le \theta \le \pi$).

It i *a a b*, *c* proportional to *l*, *m*, *n* are called *direction ratios.*
 act of two vectors \vec{a} and \vec{b} is denoted as $\vec{a}.\vec{b}$ and is defined $|\vec{b}| \cos \theta$, where θ is the angle between \vec{a} and $\$ d as $\vec{a}.\vec{b}$ and is defined

en \vec{a} and \vec{b} (0 $\leq \theta \leq \pi$).
 $\vec{i} \cdot \vec{b} = \vec{b} \cdot \vec{a}$.
 $\vec{j} \cdot \vec{k}$, then

n vector of
 \vec{a} and \vec{b} is denoted as

were θ is the angle
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\vec{a} \cdot \vec{b} = 0 \Leftrightarrow \vec{a} = \vec{0}, \vec{b} = \vec{0}
$$
 or $\vec{a} \perp \vec{b}$.

$$
\bullet \quad \vec{a} \cdot \vec{a} = |\vec{a}|^2 \text{, so } \hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1.
$$

- $= a_1 a_2 + b_1 b_2 + c_1 c_2$. **as** $\overline{a} \overline{b} = |\overline{a}||\overline{b}| \cos \theta$, where θ is the angle between \overline{a} and \overline{b} ($0 \le \theta \le \pi$).
 C *Cross product* of two vectors is commutative *i.e.* $\hat{a} \cdot \overline{b} = \overline{b} \cdot \overline{a}$.
 C $\overline{a} \cdot \overline{b} = 0$ *Dot product* of two vectors is commutative *i.e.* $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$.
 $\vec{a} \cdot \vec{b} = 0 \Leftrightarrow \vec{a} = \vec{0}, \vec{b} = \vec{0} \text{ or } \vec{a} \perp \vec{b}$.
 $\vec{a} \cdot \vec{a} = |\vec{a}|^2$, so $\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1$.

If $\vec{a$ Scalar product of two vectors a and b is derived as a.b and is defined

as $\vec{a}.\vec{b} = |\vec{a}||\vec{b}| \cos \theta$, where θ is the angle between \vec{a} and \vec{b} ($0 \le \theta \le \pi$).

Dot product of two vectors is commutative *i.e.* oduct of two vectors is commutative *i.e.* $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$.
 $= 0 \Leftrightarrow \vec{a} = \vec{0}, \vec{b} = \vec{0}$ or $\vec{a} \perp \vec{b}$.
 $= |\vec{a}|^2$, so $\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1$.
 $a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$ and $\vec{b} = b_$
- Projection of \vec{a} on $\vec{b} = \left|\frac{a \cdot b}{\frac{a}{\cdots}}\right|$ and projection vector *b* $=$ $\frac{a+b}{1}$ and projection vector of

$$
\vec{a} \text{ along } \vec{b} = \left(\frac{(\vec{a} \cdot \vec{b})}{|\vec{b}|} \right) \hat{b}.
$$

Cross product or vector product of two vectors \vec{a} and \vec{b} is denoted as *a a* and *b* is denoted as *a.b* and is defined
 θ is the angle between \vec{a} and \vec{b} ($0 \le \theta \le \pi$).

is commutative *i.e.* $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$.

or $\vec{a} \perp \vec{b}$.
 $\vec{b} = \hat{k} \cdot \hat{k} = 1$.
 $\vec{b} = b_1$

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 a and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both

such that \vec{a}, \vec{b} and \hat{n} form a right handed system.

boduct of two vectors is not commutative i.e., $\vec{a} \times \vec{b} \neq \$ between \vec{a} and \vec{b} ($0 \le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both \vec{a} and \vec{b} such that \vec{a} , \vec{b} and \hat{n} form a right handed system.

- **40 1 a** and **b** \overline{b} ($0 \le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both \overline{a} and \overline{b} such that \overline{a} , \overline{b} *and* \hat{n} form a right handed system.
Cross product of two vectors is not **4000.** COM
 between \vec{a} and \vec{b} ($0 \le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both
 \vec{a} and \vec{b} such that \vec{a} , \vec{b} and \hat{n} form a right handed system.

Cross product of two vecto **400.** COM

between \vec{a} and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both
 \vec{a} and \vec{b} such that \vec{a} , \vec{b} and \hat{n} form a right handed system.

Cross product of two vectors **4 0** 1 0 compared \vec{a} and \vec{b} ($0 \le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both
such that \vec{a} , \vec{b} and \hat{n} form a right handed system.
oduct of two vectors is not commutative i.e., \vec{a} **Example 19 A** \overrightarrow{A} **C** \overrightarrow{OA} **C** \overrightarrow{OA} **a a** \overrightarrow{A} **b a a** \overrightarrow{A} **b a** rpendicular to both
system.
 $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$, **400.** COM

between \vec{a} and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both
 \vec{a} and \vec{b} such that \vec{a} , \vec{b} and \hat{n} form a right handed system.

Cross product of two vectors **40** \bigcap com

een \vec{a} and \vec{b} ($0 \le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both

d \vec{b} such that \vec{a} , \vec{b} and \hat{n} form a right handed system.

ss product of two vectors is not commut **a** b obtween \vec{a} and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both
 a and \vec{b} such that $\overline{\vec{a} \cdot \vec{b}}$ and \hat{n} form a right handed system.

• Cross product of two vectors is not **400**. COM

between \vec{a} and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both
 \vec{a} and \vec{b} such that $\overline{\vec{a} \cdot \vec{b}}$ and \hat{n} form a right handed system.

Cross product of two vectors *i i j j k k o* . *i j k j k i k i j j i k k j i i k j* , , and – , , **between** \vec{a} and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both
 \vec{a} and \vec{b} such that $\vec{a} \cdot \vec{b}$ and \hat{n} form a right handed system.

• Cross product of two vectors is not com **b** iveen \vec{a} and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both

and \vec{b} such that $\overline{\vec{a} \cdot \vec{b}}$ and \hat{n} form a right handed system.

boss product of two vectors is not commutative $\le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both
 \vec{a} , \vec{b} and \hat{n} form a right handed system.

vectors is not commutative i.e., $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$,
 \vec{a}).
 \vec{c} , $\vec{b} = \vec{o}$ or $\le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both
 i i, *b* and \hat{n} form a right handed system.

vectors is not commutative i.e., $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$,
 $\cdot \vec{a}$).
 $\vec{b} \cdot \vec{a}$
 $\vec{b} \cdot \vec{$ *a* and *b* $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both

such that \overline{a} , \overline{b} and \hat{n} form a right handed system.

duct of two vectors is not commutative i.e., $\overline{a} \times \overline{b} \neq \overline{b} \times \overline{$ $\vec{a} \cdot \vec{b} \le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both
 $\vec{a} \cdot \vec{b}$ and \hat{n} form a right handed system.
 $\vec{b} \times \vec{a}$ \vec{b} \vec{b} \vec{c} \vec{b} \vec{c} \vec{b} \vec{c} \vec{b} \vec{c} $\vec{$ and \vec{b} ($0 \le \theta \le \pi$) and \hat{n} is a unit vector perpendicular to both

uch that \vec{a} , \vec{b} and \hat{n} form a right handed system.

uct of two vectors is not commutative i.e., $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$,
 $\$ \vec{a} and \vec{b} $(0 \le \theta \le \pi)$ and \hat{n} is a unit vector perpendicular to both
 \vec{b} such that \vec{a} , \vec{b} and \hat{n} form a right handed system.
 $\vec{b} = -(\vec{b} \times \vec{a})$.
 $\vec{b} = -(\vec{b} \times \vec{a})$.
 $\vec{b} = \vec{b} \$ Unit vector is in the commutative i.e., $\overline{a \times b} \neq \overline{b \times a}$,

but $\overline{a \times b} = -(\overline{b \times a})$.
 $\overline{a \times b} = \overline{b} \Leftrightarrow \overline{a} = \overline{0}, \overline{b} = \overline{0} \text{ or } \overline{a} \parallel \overline{b}$.

4 $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = \overline{0}.$

4 $\hat{i} \$ e., $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$,
 $\times \hat{j} = -\hat{i}, \hat{i} \times \hat{k} = -\hat{j}$
 \hat{k} , then
 $\left(\frac{(\vec{a} \times \vec{b})}{|\vec{a} \times \vec{b}|} \right)$.

adjacent sides are ve i.e., $\overrightarrow{a} \times \overrightarrow{b} \neq \overrightarrow{b} \times \overrightarrow{a}$,
 $\hat{k}, \hat{k} \times \hat{j} = -\hat{i}, \hat{i} \times \hat{k} = -\hat{j}$
 $+ b_3 \hat{k}$, then
 $= \pm \left(\frac{(\overrightarrow{a} \times \overrightarrow{b})}{|\overrightarrow{a} \times \overrightarrow{b}|} \right).$

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diagonals are \overrightarrow{a} and \overrightarrow{b} . siperion
clude to both
 $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$,
 $\vec{i} = -\hat{i}, \vec{j} \times \hat{k} = -\hat{j}$
then
 $\vec{a} \times \vec{b}$)
 $\vec{a} \times \vec{b}$)
djacent sides are orm a right handed system.

t commutative i.e., $\overrightarrow{a} \times \overrightarrow{b} \neq \overrightarrow{b} \times \overrightarrow{a}$,
 \overrightarrow{n} \overrightarrow{a} \overrightarrow{b} .
 \overrightarrow{a} \overrightarrow{a} \overrightarrow{b} .
 \overrightarrow{a} \overrightarrow{a} \overrightarrow{b} .
 \overrightarrow{b}
 \overrightarrow{a} \overrightarrow{a} \overrightarrow{b} \overrightarrow{a} $\overrightarrow{$ $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$,
 $\hat{i} = -\hat{i}, \hat{i} \times \hat{k} = -\hat{j}$

then
 $\vec{a} \times \vec{b}$)
 $\vec{a} \times \vec{b}$)

djacent sides are
-
- $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = \overrightarrow{0}$.

•
$$
\hat{i} \times \hat{j} = \hat{k}
$$
, $\hat{j} \times \hat{k} = \hat{i}$, $\hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times i = -\hat{k}$, $\hat{k} \times \hat{j} = -\hat{i}$, $\hat{i} \times \hat{k} = -\hat{j}$

• If
$$
\overrightarrow{a} = a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}
$$
 and $\overrightarrow{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$, then

$$
\overrightarrow{a} \times \overrightarrow{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}
$$

 $\overrightarrow{0}$, $\overrightarrow{b} = \overrightarrow{0}$ or \overrightarrow{a} || \overrightarrow{b} .
 $\hat{k} = \overrightarrow{0}$.
 $\hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times i = -\hat{k}$, $\hat{k} \times \hat{j} = -\hat{i}$, $\hat{i} \times \hat{k} = -\hat{j}$
 $\frac{3}{43}\hat{k}$ and $\overrightarrow{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$, then
 \overrightarrow{a} , $\overrightarrow{b$ **a** \times **b** $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{0} \Leftrightarrow \overrightarrow{a} = \overrightarrow{0}$, $\overrightarrow{b} = \overrightarrow{0}$ or $\overrightarrow{a} \parallel \overrightarrow{b}$.
 a $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = \overrightarrow{0}$.
 a $\hat{i} \times \hat{j} = \hat{k}, \hat{j} \times \hat{k} = \hat{i}, \hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times \hat{i} = -\hat{k}, \hat{k} \times$ Cross product of two vectors is not commutative i.e., $a \times b \neq b \times a$,

with $\overrightarrow{a} \times \overrightarrow{b} = -(\overrightarrow{b} \times \overrightarrow{a})$.
 $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{0} \Leftrightarrow \overrightarrow{a} = \overrightarrow{0}$, $\overrightarrow{b} = \overrightarrow{0}$ or \overrightarrow{a} || \overrightarrow{b} .
 $\overrightarrow{x} \hat{i} = \hat{j} \times \hat{j} = \hat{k}$ but $a \times b = -(b \times a)$.
 $a \times b = \overline{0} \Leftrightarrow \overline{a} = \overline{0}$, $\overline{b} = \overline{0}$ or $\overline{a} \parallel \overline{b}$.
 $\hat{i} \times \hat{j} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = \overline{0}$.
 $\hat{i} \times \hat{j} = \hat{k}$, $\hat{j} \times \hat{k} = \hat{i}$, $\hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times \hat{i} = -\hat{k}$, $\hat{k} \$ $\hat{l} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = \overline{o}$.
 $\hat{j} = \hat{k}, \hat{j} \times \hat{k} = \hat{i}, \hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times \hat{i} = -\hat{k}, \hat{k} \times \hat{j} = -\hat{i}, \hat{j} \times \hat{k} = -\hat{j}$
 $\overline{a} = a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$ and $\overline{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$, then
 $\overline{a} \times$ $\hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = \overline{0}.$
 $\hat{j} = \hat{k}, \hat{j} \times \hat{k} = \hat{i}, \hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times \hat{i} = -\hat{k}, \hat{k} \times \hat{j} = -\hat{i}, \hat{j} \times \hat{k} = -\hat{j}$
 $\vec{a} = a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$ and $\overline{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$, then
 $\overline{a} \times \$ $\hat{i} = \hat{k} \times \hat{k} = \vec{0}$.
 $\times \hat{k} = \hat{i}, \hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times \hat{i} = -\hat{k}, \hat{k} \times \hat{j} = -\hat{i}, \hat{i} \times \hat{k} = -\hat{j}$
 $\times \hat{k} = \hat{i}, \hat{k} \times \hat{i} = \hat{j}$ and $\vec{b} = b_i \hat{i} + b_2 \hat{j} + b_3 \hat{k}$, then
 $\therefore \overline{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2$ • If $\vec{a} = a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$ and $\vec{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$, then
 $\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$

• Unit vector perpendicular to both \vec{a} and $\vec{b} = \pm \left(\frac{(\vec{a} \times \vec{b$ *c* $\hat{j} = \hat{k}$, $\hat{j} \times \hat{k} = \hat{i}$, $\hat{k} \times \hat{i} = \hat{j}$ and $\hat{j} \times \hat{i} = -\hat{k}$, $\hat{k} \times \hat{j} = -\hat{i}$, $\hat{i} \times \hat{k} = -\hat{j}$
 $\vec{a} = a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$ and $\vec{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$, then
 $\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j$

- $a \times b \neq b \times a$,
 $= -\hat{i}, \hat{i} \times \hat{k} = -\hat{j}$
then
 $\frac{\vec{a} \times \vec{b}}{\left| \vec{a} \times \vec{b} \right|}$.
Ijacent sides are $\|\vec{a} \times \vec{b}\|$ is the *area of parallelogram* whose adjacent sides are $(a_2 \hat{i} + a_3 \hat{k} \text{ and } \overrightarrow{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$, then
 $\overrightarrow{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$

erpendicular to both \overrightarrow{a} and $\overrightarrow{b} = \pm \left(\frac{\overrightarrow{a} \times \overrightarrow{b}}{\overrightarrow{a} \times \overrightarrow{b}} \right)$.
 \overrightarrow{b} the *ar*
- \bullet $\frac{1}{2}$ | a \times 1 $2¹$ and and a parameter gram
-

$$
= \frac{1}{2} \left| \overrightarrow{a} \times \overrightarrow{b} \right| = \frac{1}{2} \left| \overrightarrow{b} \times \overrightarrow{c} \right| = \frac{1}{2} \left| \overrightarrow{c} \times \overrightarrow{a} \right|.
$$

 $\vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$
 $\times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$
 \Rightarrow **perpendicular to both** \vec{a} and $\vec{b} = \pm \left(\frac{(\vec{a} \times \vec{b})}{|\vec{a} \times \vec{b}|} \right)$.
 \therefore is t $\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$
 a b c a² c b c a² c a² c b c a² c a² c b c a² c a² c a² c a² c a² c a² c a $\vec{a} \times \vec{b} = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$

• Unit vector perpendicular to both \vec{a} and $\vec{b} = \pm \left(\frac{(\vec{a} \times \vec{b})}{|\vec{a} \times \vec{b}|} \right)$.

• $\left| \vec{a} \times \vec{b} \right|$ is the *area of parallelogram* whose adjacent side $\frac{d}{d} \overline{b} = \pm \left(\frac{(\overline{a} \times \overline{b})}{|\overline{a} \times \overline{b}|} \right).$
 m whose adjacent sides are

there diagonals are \overline{a} and \overline{b} .

area of the triangle.
 $\boxed{c \times \overline{a}}$.
 \overline{a} , \overline{b} and \overline{c} is defined as it vector perpendicular to both \overline{a} and $\overline{b} = \pm \left(\frac{(\overline{a} \times \overline{b})}{|\overline{a} \times \overline{b}|} \right)$.
 $\overline{x} \times \overline{b}$ is the *area of parallelogram* whose adjacent sides are

and \overline{b} .
 $\overline{a} \times \overline{b}$ is the area of par *a* \times *b* $=$ $\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$

Unit vector perpendicular to both \overline{a} and $\overline{b} = \pm \left(\frac{(\overrightarrow{a} \times \overrightarrow{b})}{|\overrightarrow{a} \times \overrightarrow{b}|} \right)$.
 $\boxed{a} \times \overline{b}$ is the *area* of *parallelogram* whose adjacent s

- Geometrically, absolute value of scalar triple product $\boxed{a \ b \ c}$ represents
volume of a parallelepiped whose coterminous edges are \boxed{a} , \boxed{b} and \boxed{c} .

 $\boxed{a \ b \ c}$ and \boxed{c} are coplanar $\Leftrightarrow \boxed{a \ b \ c}$ = 0
 Geometrically, absolute value of scalar triple product $\left[\begin{array}{cc} \overline{a} & \overline{b} & \overline{c} \end{array}\right]$ represents
volume of a parallelepiped whose coterminous edges are \overline{a} , \overline{b} and \overline{c} .
 \overline{a} , \overline{b} and $\overline{$ **4 0** \bigcap *c c* \bigcap *c c* \bigcap
 a decometrically, absolute value of scalar triple product $\bigg[a \ b \ c \bigg]$ represents

volume of a parallelepiped whose coterminous edges are $a, b \text{ and } c$.
 a $\bigg[a \ b \ c \bigg] = \bigg[$ **4 0** \bigcap comercially, absolute value of scalar triple product $\left[\overline{a} \overline{b} \overline{c}\right]$ represents
volume of a parallelepiped whose coterminous edges are \overline{a} , \overline{b} and \overline{c} .
 \overline{a} , \overline{b} and \overline{c} *a a b c a b c a b c a b c a b and c a b* \hat{a} *<i>b c a b c a b c a b c a b c a b c a b c a b c a b c a b c a b c a b c a b c a b c a b c*
-
-
- **4.0** C.C.M
 4.0 C.C.M
 6 Geometrically, absolute value of scalar triple product $\left[\begin{array}{cc} \frac{a}{a} & \frac{b}{b-a} \end{array}\right]$ represents

volume of a parallelepiped whose coterminous edges are $\frac{c}{a}$, $\frac{c}{b}$ and $\frac{c}{c}$ **a a a c** *a* **c** *a a* • Geometrically, absolute value of scalar triple product $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}$ represents
volume of a parallelepiped whose coterminous edges are $\overline{\vec{a}}$, $\overline{\vec{b}}$ and $\overline{\vec{c}}$.
• $\overline{\vec{a}}$, $\overline{\vec{b}}$ an ally, absolute value of scalar triple product $\left[\begin{array}{ccc} \overrightarrow{a} & \overrightarrow{b} & \overrightarrow{c} \end{array}\right]$ represents
parallelepiped whose coterminous edges are $\left[\begin{array}{ccc} \overrightarrow{a} & \overrightarrow{b} & \overrightarrow{a} \end{array}\right]$
 $\frac{\overrightarrow{a}}{\overrightarrow{a}}$ are coplanar $\Leftrightarrow \left[\begin{array}{ccc$ Geometrically, absolute value of scalar triple product $\left[\begin{array}{cc} \overline{a} & \overline{b} & \overline{c} \end{array}\right]$ represents
volume of a parallelepiped whose coterminous edges are \overline{a} , \overline{b} and \overline{c} .
 \overline{a} , \overline{b} and $\overline{$ Using the product $\boxed{a \ b \ c}$ represents

whose coterminous edges are $\boxed{a \ b \ c}$ represents

anar $\Leftrightarrow \boxed{a \ b \ c} = 0$
 $= \boxed{c \ a \ b}$
 \boxed{b}
 $\boxed{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$ &
 \boxed{b}
 $\boxed{a_2 \ a_3}$
 $\boxed{b_2 \ b_3}$
 $\boxed{c$ *a a i a j a k b b i b j b k* **c** contains the space of scalar triple product $\left[\begin{array}{ccc} \overline{a} & \overline{b} & \overline{c} \end{array}\right]$ represents
 c i c and \overline{c} are coplanar \Leftrightarrow $\left[\begin{array}{ccc} \overline{a} & \overline{b} & \overline{c} \end{array}\right]$ and \overline{c} .
 b and \overline{c} are coplan Finally, absolute value of scalar triple product $\left[\begin{array}{cc} \vec{a} & \vec{b} & \vec{c} \end{array}\right]$ represents

of a parallelepiped whose coterminous edges are $\overline{\vec{a}}$, $\overline{\vec{b}}$ and $\overline{\vec{c}}$.

and $\overline{\vec{c}}$ are coplanar \Leftrightarrow crically, absolute value of scalar triple product $\overline{a} \overline{b} \overline{c}$ represents

of a parallelepiped whose coterminous edges are \overline{a} , \overline{b} and \overline{c} .

and \overline{c} are coplanar $\Leftrightarrow [\overline{a} \ \overline{b} \ \overline{c}] = 0$
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 a
 a
 b and c are coplanar \Leftrightarrow $\boxed{a \ b \ c} = 0$
 b and c are coplanar \Leftrightarrow $\boxed{a \ b \ c} = 0$
 b c $\boxed{a \ b \ c} = \boxed{b \ c \ a}$
 a
 a $= a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$, $\boxed{b \ c \ b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$ &
 c metrically, absolute value of scalar triple product $\left[\begin{array}{ccc} \overline{a} & \overline{b} & \overline{c} \end{array}\right]$ represents

me of a parallelepiped whose coterminous edges are \overline{a} , \overline{b} and \overline{c} .
 \overline{b} and \overline{c} are coplana value of scalar triple product $\boxed{a \ b \ c}$ represents

ed whose coterminous edges are \boxed{a} , \boxed{b} and \boxed{c} .

planar $\Leftrightarrow \boxed{a \ b \ c}$ = 0
 $\boxed{c \ a \ b}$
 $\begin{bmatrix} \vec{r} & \vec{r} \\ \vec{r} & \vec{r} \end{bmatrix}$
 $\begin{bmatrix} \vec{r} & \vec{r} \\ \vec{r}$ ed whose coterminous edges are \overline{a} , \overline{b} and \overline{c} .

planar $\Leftrightarrow [\overline{a} \ \overline{b} \ \overline{c}] = 0$
 $\overline{c} = [\overline{c} \ \overline{a} \ \overline{b}]$
 \hat{A} , $\overline{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$ &
 \hat{A} , then
 $\begin{vmatrix} 4 & a_2 & a_3 \\ 4 & b_2 & b_$ Trically, absolute value of scalar triple product $\boxed{a \ b \ c}$ represents

and \boxed{c} are coplanar $\Leftrightarrow \boxed{a \ b \ c}$ = 0
 \boxed{c} and \boxed{c} are coplanar $\Leftrightarrow \boxed{a \ b \ c}$ = 0
 \boxed{c} and \boxed{c} are coplanar $\Leftrightarrow \boxed{a \ b \ c}$ cally, absolute value of scalar triple product $\boxed{a \ b \ c}$ represents
 f a parallelepiped whose coterminous edges are \boxed{a} , \boxed{b} and \boxed{c} .
 nd \boxed{c} are coplanar $\Leftrightarrow \boxed{a \ b \ c}$ = 0
 $\boxed{1}$ = $\boxed{b \ c \ a}$ = *a* and \overline{c} are coplanar \Leftrightarrow \overline{a} b \overline{c} and \overline{c} are coplanar \Leftrightarrow \overline{a} b \overline{b} and \overline{c} .
 \overline{a} and \overline{c} are coplanar \Leftrightarrow \overline{a} b \overline{b} = 0
 \overline{a} = \overline{b} \overline{c} *c* value of scalar triple product \overline{a} *b* \overline{c} represents

coplanar \Leftrightarrow \overline{a} *b* \overline{c} \overline{c} = 0

coplanar \Leftrightarrow \overline{a} *b* \overline{c} = 0
 \overline{a} \overline{b} = \overline{c} \overline{a} *b* \overline{c}
 $\overline{$ 1. If $\vec{a} = a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$, $\vec{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$ &
 $\vec{c} = c_1 \hat{i} + c_2 \hat{j} + c_3 \hat{k}$, then
 $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix} = \begin{bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & a_3 \\ c_1 & c_2 & c_3 \end{bmatrix}$

1. The scalar triple produc which $\hat{i} + b_2 \hat{j} + b_3 \hat{k}$ &
tors is zero if any two of them are
QUESTIONS (1 MARK)
d components of a vector \overline{a} of
 \overline{a} of \overline{b} with the direction of x-axis.
where $\overline{x} = \hat{i} - 2\hat{j} + 2\hat{k}$?
ram whose s *x* + $b_3 \hat{k}$ &
IONS (1 MARK)
IONS (1 MARK)
pnents of a vector \overline{a} of
the direction of x-axis.
 $\overline{x} = \hat{i} - 2\hat{j} + 2\hat{k}$?
ose sides are given by • If $\vec{a} = a_1 \vec{i} + a_2 \vec{j} + a_3 \vec{k}$, $\vec{b} = b_1 \vec{i} + b_2 \vec{j} + b_3 \vec{k}$ &
 $\vec{c} = c_1 \vec{i} + c_2 \vec{j} + c_3 \vec{k}$, then
 $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix} = \begin{bmatrix} a_1 & a_2 & a_3 \ b_1 & b_2 & b_3 \ c_1 & c_2 & c_3 \end{bmatrix}$

• The scalar triple product $a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}$, $\vec{b} = b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k}$ &
 $\overline{a} + \hat{b} + \hat{c}_2 \hat{j} + c_3 \hat{k}$, then
 $\overline{a} + \overline{b} + \overline{c} = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$
 x triple product of three vectors is zero if **EXECT ARE INTERT ARE ARE AREA CONDUCTERED**
 EXECUTE: $\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$
 EXECT SHORT ANSWER TYPE QUESTIONS (1 MARK)

1. What are the horizontal and vertical components of a vector $\overline{$ $\vec{c} = c_1 \hat{i} + c_2 \hat{j} + c_3 \hat{k}$, then
 $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix} = \begin{bmatrix} a_1 & a_2 & a_3 \ b_1 & b_2 & b_3 \ c_1 & c_2 & c_3 \end{bmatrix}$

the scalar triple product of three vectors is zero if any two of them are
 RY SHORT ANSWER TYPE QUES EXECUTE: $\begin{vmatrix} \frac{1}{2} & \frac{$
- The scalar triple product of three vectors is zero if any two of them are same or collinear.

VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)

- 1. What are the horizontal and vertical components of a vector *a* of magnitude 5 making an angle of 150° with the direction of *x*-axis.
-
-
-
- 5. What is the angle between \overrightarrow{a} and \overrightarrow{b} , If
- $|c_1 \quad c_2 \quad c_3|$

ar triple product of three vectors is zero if any two of them are

collinear.
 IORT ANSWER TYPE QUESTIONS (1 MARK)

e the horizontal and vertical components of a vector $\frac{1}{a}$ of
 $a \in B$ such that [$\vec{a} \cdot \vec{b} \cdot \vec{c}$] = $\begin{vmatrix} x_1 & x_2 & x_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$

lar triple product of three vectors is zero if any two of them are

r collinear.
 HORT ANSWER TYPE QUESTIONS (1 MARK)

re the horizontal and v 6. Write a unit vector which makes an angle of $\frac{\pi}{4}$ with x-axis and $\frac{\pi}{3}$ with *z*-axis and an acute angle with *y*-axis.
- 7. If *A* is the point (4, 5) and vector *AB* <u>and the community of the community</u> has components 2 and 6 along *x*-axis and *y*-axis respectively then write point *B*.

- 8. What is the point of trisection of *PQ* nearer to *P* if positions of *P* and *Q* **400.** COM
What is the point of trisection of PQ nearer to P if positions of P and Q
are $3\hat{i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?
Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose and 9 8 10 *i j k* respectively? 9. What is the point of trisection of *PQ* nearer to *P* if positions of *P* and *Q* are $3\hat{i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?
9. Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, wh 11. What is the point of trisection of *PQ* nearer to *P* if positions of *P* and *Q*
are $3\hat{i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?
9. Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, w **h** and \hat{k} respectively?
 $\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is

vector equiangular with co-ordinate
 $\hat{i} - 6\hat{j} + 2\hat{k}$ makes with the x-axis?

both the vectors
 $2\hat{k}$. 4 (D) \bigcap C.com

the point of trisection of *PQ* nearer to *P* if positions of *P* and *Q*

3) – 4 \hat{k} and $\hat{9i} + 8j - 10\hat{k}$ respectively?

e vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is 13. What is the point of trisection of *PQ* nearer to *P* if positions of *P* and *Q*

are $3\hat{i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?

9. Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, mearer to P if positions of P and Q
 \vec{a} respectively?
 $+ 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is

vector equiangular with co-ordinate
 $\hat{i} - 6\hat{j} + 2\hat{k}$ makes with the x-axis?

both the vectors
 $2\hat{k}$.
 $\hat{i} - \hat{j$ The set of P and Q

ith co-ordinate

ith the x-axis?
 $\hat{i} + \hat{j}$?

of $|\vec{a} + \vec{b}|$?

endicular to
- 10 units.
- 10. What are the direction cosines of a vector equiangular with co-ordinate axes?
-
- 12. Write a unit vector perpendicular to both the vectors
-

14. If
$$
|\overrightarrow{a}| = 2
$$
, $|\overrightarrow{b}| = 2\sqrt{3}$ and $\overrightarrow{a} \perp \overrightarrow{b}$, what is the value of $|\overrightarrow{a} + \overrightarrow{b}|$?

- 14. What is the point of trisection of PQ nearer to P if positions of P and Q

are $3\hat{i} + 3\hat{j} 4\hat{k}$ and $3\hat{i} + 8\hat{j} 10\hat{k}$ respectively?

19. Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose at is the point of trisection of PQ nearer to P if positions of P and Q
 $\hat{3i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?

ite the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is

u ection of *PQ* nearer to *P* if positions of *P* and *Q*
 $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?

lirection of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is

cosines of a vector equiangular with co-ordinate

the vector $3\hat$ are to *P* if positions of *P* and *Q*
espectively?
 $3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is
tor equiangular with co-ordinate
 $6\hat{j} + 2\hat{k}$ makes with the x-axis?
h the vectors
 \hat{j} on the vector $\hat{i} + \hat{j}$?
what is the of P and Q

nagnitude is

co-ordinate

the x-axis?
 \hat{j} ?
 $\vec{a} + \vec{b}$?

dicular to 15. What is the point of trisection of *PQ* nearer to *P* if positions of *P* and *Q*
are $3\hat{i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?
9. Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, w What is the point of trisection of *PQ* nearer to *P* if positions of *P* and *Q*

if $\cos 3i + 3j - 4k$ and $9i + 8j - 10k$ respectively?

Wite the vector in the direction of $2i + 3j + 2\sqrt{3}k$, whose magnitude is

0 units.

W What is the point of trisection of PQ nearer to P if positions of P and Q
are $3\hat{i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?
Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude 19. Write the vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is

10. What are the direction cosines of a vector equiangular with co-ordinate

11. What is the angle which the vector $3\hat{i} - 6\hat{j} + 2\$ 3) $-4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively?
vector in the direction of $2\hat{i} + 3\hat{j} + 2\sqrt{3}\hat{k}$, whose magnitude is
the direction cosines of a vector equiangular with co-ordinate
e angle which the vector $3\hat{i} -$ 2 $\sqrt{3}\hat{k}$, whose magnitude is
equiangular with co-ordinate
- 2 \hat{k} makes with the x-axis?
where the vectors
on the vector $\hat{i} + \hat{j}$?
t is the value of $|\vec{a} + \vec{b}|$?
 $4\hat{k}$ is perpendicular to
and $2|\vec{b}| = |\vec{a}|$?
whose magnitude is

uular with co-ordinate

akes with the x-axis?

rs

vector $\hat{i} + \hat{j}$?

value of $|\vec{a} + \vec{b}|$?

perpendicular to
 $|\vec{b}| = |\vec{a}|$?
 $|\vec{b}| = |\vec{a} + \vec{b}|$?
 $|\vec{a}| = |\vec{a}| + |\vec{b}|$?
 $|\vec{a}| = |\vec{a}| + |\vec{b}| + 4\hat{k}$ tor equiangular with co-ordinate
 $6\hat{j} + 2\hat{k}$ makes with the x-axis?
 \hat{j} on the vectors
 \hat{j} on the vector $\hat{i} + \hat{j}$?

what is the value of $|\vec{a} + \vec{b}|$?
 $\hat{j} + 4\hat{k}$ is perpendicular to

3 and $2|\vec{b}| = |\vec{a$ 2 $\sqrt{3}\hat{k}$, whose magnitude is
quiangular with co-ordinate
2 \hat{k} makes with the x-axis?
vectors
n the vector $\hat{i} + \hat{j}$?
is the value of $|\vec{a} + \vec{b}|$?
 \hat{k} is perpendicular to
and $2|\vec{b}| = |\vec{a}|$?
 $\vec{a} - \vec{b}| = |\vec{a}$ 18. What are the direction cosines of a vector equiangular with co-ordinate

axes?

11. What is the angle which the vector $3\hat{i} - 6\hat{j} + 2\hat{k}$ makes with the x-axis?

12. Write a unit vector perpendicular to both the ve 11. What is the area of a parallelogram of a parallelogram whose diagonals are given by vectors $3\hat{i} - 2\hat{j} + \hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$.

13. What is the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$ perpendicular to both the vectors

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

ion of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$?
 $2\sqrt{3}$ and $\overline{a} \perp \overline{b}$, what is the value of $|\overline{a} + \overline{b}|$?

of λ , $\overline{a} = \lambda \hat{i} + \hat{j} +$ vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$?
 $\vec{a} \perp \vec{b}$, what is the value of $|\vec{a} + \vec{b}|$?
 $\vec{a} = \lambda \hat{i} + \hat{j} + 4\hat{k}$ is perpendicular to
 $\vec{a} - \vec{b}$ = 3 and $2|\vec{b}| = |\vec{a}|$?
 \vec{i} and \vec{b} , if $|\vec{a} \vec{a} = 2\sqrt{3}$ and $\vec{a} \perp \vec{b}$, what is the value of $|\vec{a} + \vec{b}|$?

alue of λ , $\vec{a} = \lambda \hat{i} + \hat{j} + 4\hat{k}$ is perpendicular to
 $\pm 3\hat{k}$?

if $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = 3$ and $2|\vec{b}| = |\vec{a}|$?

gle between \vec{a} on the vector $\hat{i} + \hat{j}$?

hat is the value of $|\vec{a} + \vec{b}|$?

+ 4 \hat{k} is perpendicular to

3 and $2|\vec{b}| = |\vec{a}|$?

if $|\vec{a} - \vec{b}| = |\vec{a} + \vec{b}|$?

j + 4 \hat{k} and $\vec{AC} = \hat{i} + \hat{j} + 4\hat{k}$.

diagonals are given by vector *i* $\left| \frac{a}{c} \right| = \frac{b}{c} \sqrt{b^2 - 2c}$ and $\frac{a}{d} \pm b$, what is the value of $\left| \frac{a}{d} + \frac{b}{d} \right|$.
 i $\left| \frac{a}{d} \right|$, if $\left(\frac{a}{d} + \frac{b}{b} \right)$. $\left(\frac{a}{d} - \frac{b}{b} \right) = 3$ and $2\left| \frac{b}{b} \right| = \left| \frac{a}{d} \right|$?

And of λ , $\overline{a} = \lambda \hat{i} + \hat{j} + 4\hat{k}$ is perpendicular to
 \overline{b}). $(\overline{a} - \overline{b}) = 3$ and $2|\overline{b}| = |\overline{a}|$?

tween \overline{a} and \overline{b} , if $|\overline{a} - \overline{b}| = |\overline{a} + \overline{b}|$?

ABCD, $\overline{AB} = 2\hat{i} - \hat{j} + 4\hat{k}$ and $\overline{AC} =$
-
- 17. What is the angle between *a* and *b*, if $|a b| = |a + b|$? \longrightarrow \longrightarrow \longrightarrow \longrightarrow \longrightarrow \longrightarrow and *b*, if $|a - b| = |a + b|$? \rightarrow , \rightarrow \rightarrow \rightarrow \rightarrow
- What is the length of side *BC* ?
-
- 20. Find $x \mid$ if for a unit vector $a, (x a)$ \overrightarrow{x} if for a unit vector \hat{a} , $(\overrightarrow{x} - \hat{a}) \cdot (\overrightarrow{x} + \hat{a}) = 12$.
- 21. If *a* and b are two unit vectors and $a + b$ <u>and the company of th</u> ors and $a + b$ is also a unit vector \rightarrow then what is the angle between \overline{a} and \overline{b} ?
- 22. If \hat{i} , \hat{j} , \hat{k} are the usual three mutually perpendicular unit vectors then $\overline{D} = 2\hat{i} + 6\hat{j} + 3\hat{k}$?

What is $|\overline{a}|$, if $(\overline{a} + \overline{b}) \cdot (\overline{a} - \overline{b}) = 3$ and $2|\overline{b}| = |\overline{a}|$?

What is the angle between \overline{a} and \overline{b} , if $|\overline{a} - \overline{b}| = |\overline{a} + \overline{b}|$?

In a parallelogram ABCD, $\$ 3 and $2|\overline{b}| = |\overline{a}|?$

if $|\overline{a} - \overline{b}| = |\overline{a} + \overline{b}|?$
 $\hat{j} + 4\hat{k}$ and $\overline{AC} = \hat{i} + \hat{j} + 4\hat{k}$.

e diagonals are given by vectors
 $\begin{aligned} \n\frac{\partial}{\partial x} + \hat{a} &= 12. \n\end{aligned}$
 $\overline{a} + \overline{b}$ is also a unit vector
 and $2|\overline{b}| = |\overline{a}|?$
 $|\overline{a} - \overline{b}| = |\overline{a} + \overline{b}|?$
 $-4\hat{k}$ and $\overline{AC} = \hat{i} + \hat{j} + 4\hat{k}$.

agonals are given by vectors
 $\overline{x} + \hat{a} = 12$.
 $+ \overline{b}$ is also a unit vector
 \overline{x}
 $\overline{x} \cdot \overline{y} = |\overline{x} \times \overline{y}|?$
- 23. What is the angle between x and y if $x \cdot y = |x \times y|$ \rightarrow and \rightarrow and \rightarrow and \rightarrow and *y* if $x \cdot y = |x \times y|$? \longrightarrow , \longrightarrow \longrightarrow \longrightarrow \longrightarrow \longrightarrow \longrightarrow

- 24. Write a unit vector in *xy*-plane, making an angle of 30° with the +ve direction of *x*–axis.
- **40** 1. COM

The a unit vector in xy-plane, making an angle of 30° with the +ve

ection of x-axis.
 a, \overline{b} and \overline{c} are unit vectors with $\overline{a} + \overline{b} + \overline{c} = \overline{0}$, then what

the value of $\overline{a} \cdot \overline{b} + \$ 25. If \vec{a} , \vec{b} and \vec{c} are unit vectors with $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then what
- **400**.com

24. Write a unit vector in xy-plane, making an angle of 30° with the +ve

direction of x-axis.

25. If \overline{a} , \overline{b} and \overline{c} are unit vectors with $\overline{a} + \overline{b} + \overline{c} = \overline{0}$, then what

is the valu **400.** COM

are unit vectors with $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then what
 $\vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$

b contribution is perpendicular

de unit vectors such that $(\vec{a} + 2\vec{b})$ is perpendicular

then what is the angl Write a unit vector in *xy*-plane, making an angle of 30° with the +ve
direction of *x*-axis.
If \vec{a} , \vec{b} and \vec{c} are unit vectors with $\vec{a} + \vec{b} + \vec{c} = 0$, then what
is the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec$ **400.** COM

comment of the set of 30° with the +ve

xis.
 \overrightarrow{c} are unit vectors with $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = \overrightarrow{0}$, then what
 $\overrightarrow{a} \cdot \overrightarrow{b} + \overrightarrow{b} \cdot \overrightarrow{c} + \overrightarrow{c} \cdot \overrightarrow{a}$?

are unit vectors such that $(\overrightarrow{a} + 2\overrightarrow{$ 26. If *a* and *b* are unit vectors such that $(a + 2)$ **400.** CCM

containstand that the sum of the sum of the sum of the sum of the sum of
 $\frac{a}{a}$ are unit vectors with $\frac{a}{a} + \frac{b}{b} + \frac{c}{c} = 0$, then what
 $\frac{a}{a} \cdot \frac{b}{b} + \frac{b}{b} \cdot \frac{c}{c} + \frac{c}{c} \cdot \frac{a}{a}$?

are uni M

angle of 30° with the +ve
 $\overline{b} + \overline{c} = \overline{0}$, then what
 $\overline{a} + 2\overline{b}$) is perpendicular

tween \overline{a} and \overline{b} ?
 SS (4 MARKS) is perpendicular **40** \cap community exception of *x*-axis.

the 4 unit vector in *xy*-plane, making an angle of 30° with the +ve

direction of *x*-axis.

If \overline{a} , \overline{b} and \overline{c} are unit vectors with $\overline{a} + \overline{b} + \overline{c} = \overline{$ **4000.com**
 a unit vector in xy-plane, making an angle of 30° with the +ve

tion of x-axis.
 b and \overline{c} are unit vectors with $\overline{a} + \overline{b} + \overline{c} = 0$, then what

value of \overline{a} . $\overline{b} + \overline{b}$. $\overline{c} + \overline{c$ then what is the angle between *a* and *b* ? unit vector in xy-plane, making an angle of 30° with the +ve

of x-axis.
 \overrightarrow{a} and \overrightarrow{c} are unit vectors with $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = \overrightarrow{0}$, then what

alue of $\overrightarrow{a} \cdot \overrightarrow{b} + \overrightarrow{b} \cdot \overrightarrow{c} + \overrightarrow{c} \cdot \overrightarrow{a}$?

or

SHORT ANSWER TYPE QUESTIONS (4 MARKS)

27. If ABCDEF is a regular hexagon then using triangle law of addition prove that :

O being the centre of hexagon.

- unit vector in xy-plane, making an angle of 30° with the +ve

of x-axis.
 $A = 4B$ A \overline{B} are unit vectors with $\overline{a} + \overline{b} + \overline{c} = 0$, then what
 $A = 4B$ are unit vectors such that $(\overline{a} + 2\overline{b})$ is perpendicula 28. Points *L, M, N* divides the sides *BC, CA, AB* of a *ABC* in the ratios Write a unit vector in *xy*-plane, making an angle of 30° with the +ve

If \overline{a} , \overline{b} and \overline{c} are unit vectors with $\overline{a} + \overline{b} + \overline{c} = \overline{0}$, then what

is the value of \overline{a} . $\overline{b} + \overline{b}$. \overline{c} an angle of 30° with the +ve
 $\frac{a}{a} + \frac{b}{b} + \frac{c}{c} = 0$, then what
 $\frac{a}{a}$?

at $(\frac{a}{a} + 2\frac{b}{b})$ is perpendicular

between $\frac{a}{a}$ and $\frac{b}{b}$?
 IONS (4 MARKS)

ng triangle law of addition prove
 $\frac{a}{b}$
 1 : 4, 3 : 2, 3 : 7 respectively. Prove that \overline{AL} + \overline{BM} + \overline{CM} is a vector parallel to *CK* $\overrightarrow{0}$. The opposition of the state $\overrightarrow{0}$ where *K* divides *AB* in ratio 1 : 3.
- 29. The scalar product of vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum *i* \overline{c} if \overline{a} ?

ors such that $(\overline{a} + 2\overline{b})$ is perpendicular

is the angle between \overline{a} and is the value of \overline{a} . $\overline{b} + \overline{b}$. $\overline{c} + \overline{c}$. \overline{a} ?

If \overline{a} and \overline{b} are unit vectors such that $(\overline{a} + 2\overline{b})$ is perpendicular

to $(5\overline{a} - 4\overline{b})$, then what is the angle between $\overline{a$ value of λ .
- **SHORT ANSWER TYPE QUESTIONS (4 MARKS)**

27. If ABCDEF is a regular hexagon then using triangle law of addition prove

that :
 $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3 \overline{AD} = 6 \overline{AO}$
 \overline{OD} being the centre of hexagon.
 a and \overline{B} of \overline{B} are unit vectors such that $($ a + 2 b) is perpenducted to $(5\overline{a} - 4\overline{b})$, then what is the angle between \overline{a} and \overline{b} ?
 SHORT ANSWER TYPE QUESTIONS (4 MARKS)

If ABCDEF is a regu 30. \vec{a} , \vec{b} and \vec{c} are three mutually perpendicular vectors of equal **SHORT ANSWER TYPE QUESTIONS (4 MARKS)**

If ABCDEF is a regular hexagon then using triangle law of addition prove

that :
 $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3 \overline{AD} = 6 \overline{AO}$
 \overline{OB} D being the centre of hexagon.

P **PE QUESTIONS (4 MARKS)**
 PE QUESTIONS (4 MARKS)

agon then using triangle law of addition prove
 $+\overline{AE} + \overline{AF} = 3\overline{AD} = 6\overline{AO}$

gon.

sides BC, CA, AB of a $\triangle ABC$ in the ratios

y. Prove that $\overline{AL} + \overline{BM} + \overline{CM}$ magnitude. Show that $\vec{a} + \vec{b} + \vec{c}$ makes equal angles with *f* ABCDEF is a regular hexagon then using triangle law of addition prove

ant :
 $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3 \overline{AD} = 6 \overline{AO}$

D being the centre of hexagon.

Points *L*, *M*, *N* divides the sides *BC*, *CA*, **SHORT ANSWER TYPE QUESTIONS (4 MARKS)**

f ABCDEF is a regular hexagon then using triangle law of addition prove

that :
 $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3 \overline{AD} = 6 \overline{AO}$
 \overline{OB} being the centre of hexagon.

Poin \overrightarrow{a} , \overrightarrow{b} and \overrightarrow{c} with each angle as $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$. using triangle law of addition prove
 $+\overline{AF} = 3\overline{AD} = 6\overline{AO}$
 \therefore , CA, AB of a $\triangle ABC$ in the ratios

nat $\overline{AL} + \overline{BM} + \overline{CN}$ is a vector

in ratio 1 : 3.
 \hat{k} with a unit vector along the sum
 $+ 2\hat{j} + 3\hat{k}$ $3²$ triangle law of addition prove
 $\vec{L} = 3 \overline{AD} = 6 \overline{AO}$
 $AB \text{ of a } \triangle ABC$ in the ratios
 $\vec{L} + \overline{BM} + \overline{CN}$ is a vector

io 1 : 3.

a unit vector along the sum
 $+ 3\hat{k}$ is equal to 1. Find the

endicular vectors of equ $\overrightarrow{AB} = 3 \overrightarrow{AD} = 6 \overrightarrow{AO}$
 $\overrightarrow{AB} = 6 \overrightarrow{AO}$
 $\overrightarrow{BA} = \overrightarrow{CM} + \overrightarrow{ON}$ is a vector
 $\overrightarrow{AB} = 3\hat{k}$ is equal to 1. Find the

endicular vectors of equal

makes equal $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3\overline{AD} = 6\overline{AO}$
 \overline{OB} being the centre of hexagon.

28. Points *L*, *M*, *N* divides the sides *BC*, *CA*, *AB* of a $\triangle ABC$ in the ratios

1: 4, 3: 2, 3: 7 respectively. Prove tha **EXECUTE:** It is a regular liexagon uneriosing transformation prove

then $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3 \overline{AD} = 6 \overline{AO}$

being the centre of hexagon.

its L, M, N divides the sides BC, CA, AB of a AABC in the rat $AB + AC + AD + AE + AF = 3 AD = 6 AO$

O being the centre of hexagon.

Points L, M, N divides the sides BC, CA, AB of a $\triangle ABC$ in the ratios

1: 4, 3: 2, 3: 7 respectively. Prove that $AL + BM + CN$ is a vector

baratlel to CK where K divides AB on.

on.

on.

on.

on.

Prove that $\overline{AL} + \overline{BM} + \overline{CN}$ is a vector

rides AB in ratio 1 : 3.
 $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum

and $\hat{\lambda} \hat{i} + 2 \hat{j} + 3 \hat{k}$ is equal to 1. Find the

mutually perpendi $\overline{AB} = 3 \overline{AD} = 6 \overline{AO}$
 \overline{AB} of a $\triangle ABC$ in the ratios
 $\overline{L} + \overline{BM} + \overline{CM}$ is a vector

tio 1 : 3.

n a unit vector along the sum

+ $3\hat{k}$ is equal to 1. Find the

endicular vectors of equal

makes equal angl 28. Points L, M, N divides the sides *BC*, *CA*, *AB* of a *AABC* in the ratios

1: 4, 3: 2, 3: 7 respectively. Prove that $AL + BM + CN$ is a vector

parallel to \overrightarrow{CK} where K divides *AB* in ratio 1: 3.

29. The scalar prod 2respectively. Prove that $\overline{AL} + \overline{BM} + \overline{CN}$ is a vector
 \overline{K} where K divides AB in ratio 1 : 3.

coduct of vector $\hat{j} + \hat{j} + \hat{k}$ with a unit vector along the sum

such $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda \hat{i} + 2\hat{j} +$ A, AB of a $\triangle ABC$ in the ratios
 $\overline{AL} + \overline{BM} + \overline{CN}$ is a vector

ratio 1 : 3.

with a unit vector along the sum
 $\hat{J} + 3\hat{k}$ is equal to 1. Find the

prependicular vectors of equal
 \overline{r} makes equal angles with
 parallel to CK where K divides AB in ratio 1 : 3.

The scalar product of vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum

of the vectors $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda \hat{i} + 2\hat{j} + 3\hat{k}$ is equal to 1. Find the

v 3 : 2, 3 : 7 respectively. Prove that $\overline{AL} + \overline{BM} + \overline{CM}$ is a vector

lel to \overline{CK} where K divides AB in ratio 1 : 3.

scalar product of vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum

e vectors $2\hat{i} + 4$
- \rightarrow 1. The set of the in the form of where β_1 is parallel to α and β_2 is perper \rightarrow \rightarrow \rightarrow \rightarrow is perpendicular $\frac{1}{\alpha}$. $\frac{1}{\alpha}$.
- 32. If \vec{a} , \vec{b} , \vec{c} are three vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then prove

- 33. If $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the angle
between $|\vec{a}|$ and $|\vec{b}|$.
34. Let $\vec{a} = \hat{i} \hat{j}$, $\vec{b} = 3\hat{j} \hat{k}$ and $\vec{c} = 7\hat{i} \hat{k}$, find a vector \vec{a} which
is p 33. If $|\overrightarrow{a}| = 3, |\overrightarrow{b}| = 5, |\overrightarrow{c}| = 7$ and $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = \overrightarrow{0}$, find the angle **400.** \overline{O} \overline{O} and \overline{B} and \overline{B} and \overline{C} and \overline{a} and \overline{b} .

Let $\overline{a} = \hat{i} - \hat{j}$, $\overline{b} = 3\hat{j} - \hat{k}$ and $\overline{c} = 7\hat{i} - \hat{k}$, find a vector \overline{d} which

is perpendicular to \overline{a} 33. If $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the angle
between \vec{a} and \vec{b} .
34. Let $\vec{a} = \hat{i} - \hat{j}$, $\vec{b} = 3\hat{j} - \hat{k}$ and $\vec{c} = 7\hat{i} - \hat{k}$, find a vector \vec{d} which
is p **f**
 f \overline{b} \overline{b} = 5, \overline{c} = 7 and \overline{a} + \overline{b} + \overline{c} = $\overline{0}$, find the angle
 f a and \overline{b} .
 $\hat{i} - \hat{j}$, \overline{b} = 3 $\hat{j} - \hat{k}$ and \overline{c} = $\hat{7} \hat{i} - \hat{k}$, find a vector \overline{d} If $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the angle
between \vec{a} and \vec{b} .
Let $\vec{a} = \hat{i} - \hat{j}$, $\vec{b} = 3\hat{j} - \hat{k}$ and $\vec{c} = 7\hat{i} - \hat{k}$, find a vector \vec{a} which
is perpendic $\mathbf{A} \cdot \overline{C}$ = 7 and $\overline{a} + \overline{b} + \overline{c} = \overline{0}$, find the angle
 \overline{a}

= $3\hat{j} - \hat{k}$ and $\overline{c} = 7\hat{i} - \hat{k}$, find a vector \overline{d} which
 \overline{a} and \overline{b} and \overline{c} . $\overline{d} = 1$.
 $\overline{c} = \hat{j} - \hat{k}$ $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the angle

tween \vec{a} and \vec{b} .
 $\vec{a} = \hat{i} - \hat{j}$, $\vec{b} = 3\hat{j} - \hat{k}$ and $\vec{c} = 7\hat{i} - \hat{k}$, find a vector \vec{d} which

perpendicular to
-
- *b* satisfying the equation $a \times b =$ \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow
- 33. If $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the angle
between \vec{a} and \vec{b} .
34. Let $\vec{a} = \hat{i} \hat{j}$, $\vec{b} = 3\hat{j} \hat{k}$ and $\vec{c} = 7\hat{i} \hat{k}$, find a vector \vec{d} which
is p satisfying the equation *a b c a b* , . 3. 36. Find a unit vector perpendicular to plane *ABC,* when position vectors of *A* \boxed{a} \boxed{a} \boxed{a} \boxed{a} \boxed{b} \boxed{c} \boxed{c} \boxed{c} \boxed{c} \boxed{a} \boxed{a} \boxed{b} \boxed{c} \boxed{c} \boxed{c} \boxed{a} \boxed{a} \boxed{b} \boxed{c} \boxed{c} \boxed{f} \boxed{a} \boxed{a} \boxed{a} \boxed{c} \boxed{c} \boxed{f} *i* $\left| \frac{1}{2} \right| = 5$, $\left| \frac{1}{2} \right| = 7$ and $\overline{a} + \overline{b} + \overline{c} = \overline{0}$, find the angle \overline{a} . $\overline{b} = 3\hat{j} - \hat{k}$ and $\overline{c} = 7\hat{i} - \hat{k}$, find a vector \overrightarrow{a} which \overline{a} and \overrightarrow{b} and \overrightarrow{c} . $\overrightarrow{a$ 33. If $|\overline{a}| = 3$, $|\overline{b}| = 5$, $|\overline{c}| = 7$ and $\overline{a} + \overline{b} + \overline{c} = \overline{0}$, find the angle
between \overline{a} and \overline{b} .
34. Let $\overline{a} = \overline{i} - \overline{j}$, $\overline{b} = 3\overline{j} - \overline{k}$ and $\overline{c} = 7\overline{i} - \overline{k}$, find a vector \vec{b} .
 $\vec{a} = 3\hat{j} - \hat{k}$ and $\vec{b} = 7\hat{i} - \hat{k}$, find a vector \vec{d} which
 \vec{a} and \vec{b} and $\vec{c} \cdot \vec{d} = 1$.
 $\vec{c} = \hat{j} - \hat{k}$ are the given vectors then find a vector

equation $\vec{a} \times \vec{b} = \vec{c}$, $\$ $\boxed{|\overline{b}|} = 5, |\overline{c}| = 7$ and $\overline{a} + \overline{b} + \overline{c} = \overline{0}$, find the angle
 \boxed{a} and \overline{b} .
 $\boxed{b} = \frac{3}{2} - \overline{k}$ and $\overline{c} = 7\hat{i} - \hat{k}$, find a vector \overline{d} which
 \boxed{c} i.e. \overline{a} and \overline{b} and \overline 33. If $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the angle
between \vec{a} and \vec{b} .
34. Let $\vec{a} = \hat{i} - \hat{j}$, $\vec{b} = 3\hat{j} - \hat{k}$ and $\vec{c} = 7\hat{i} - \hat{k}$, find a vector \vec{d} which
is p sin . 2 2 *a b* $\vec{a} \cdot \vec{b} = \vec{r}$, find a vector \vec{d} which
 $\vec{d} = 1$.

ven vectors then find a vector
 \vec{r} , $\vec{a} \cdot \vec{b} = 3$.

ABC, when position vectors of

and $4\hat{i} - 3\hat{j} + \hat{k}$ respectively.
 $\leq |\vec{a}| + |\vec{b}|$.
 $\hat{k}|^2$ = 0, find the angle

and a vector \overrightarrow{d} which

and a vector
 \overrightarrow{b} = 3.

an position vectors of
 $\hat{i} + \hat{k}$ respectively.
 \overrightarrow{b}
 \overrightarrow{a}

be that :
 $\frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}}$. **a** a vector \overrightarrow{d} which

ors then find a vector
 $\overrightarrow{b} = 3$.
 a position vectors of
 $\hat{i} + \hat{k}$ respectively.
 \overrightarrow{b}
 han prove that :
 $\frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}}$.
 $\frac{\hat{a} - \hat{b}}{2}$.
 $\overrightarrow{a} - \overrightarrow{b} = \frac{\hat{a}$. $\overline{b} = 3$.

hen position vectors of
 $3\hat{j} + \hat{k}$ respectively.
 $+ |\overline{b}|$.

than prove that :
 $|\frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}}|$.
 $2\hat{b}^2 - (\overline{a} \cdot \overline{b})^2$.
 $(x - 2)\hat{j} - \hat{k}$. If \overline{c}
-
- 38. Evaluate $(\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2$.
-

(i)
$$
\sin \frac{\theta}{2} = \frac{1}{2} |\hat{a} - \hat{b}|
$$
 (ii) $\tan \frac{\theta}{2} = \left| \frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}} \right|$

40. For any two vectors, show that $|\vec{a} \times \vec{b}| = \sqrt{a^2b^2 - (\vec{a} \cdot \vec{b})^2}$.

- *a* $\overline{c} = 7\hat{i} \hat{k}$, find a vector \overline{d} which
 a c $\overline{c} \cdot \overline{d} = 1$.
 re the given vectors then find a vector
 $\overline{b} = \overline{c}$, $\overline{a} \cdot \overline{b} = 3$.
 a \overline{a} o plane *ABC*, when position vectors of
 41. $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + 2\hat{j}$ and $\vec{c} = x\hat{i} + (x - 2)\hat{j} - \hat{k}$, If \vec{c} $\frac{a}{a} = \hat{i} + \hat{j} + \hat{k}, \ \overline{c} = \hat{j} - \hat{k}$ are the given vectors then find a vector
 \overline{D} satisfying the equation $\overline{a} \times \overline{b} = \overline{c}$; \overline{a} , $\overline{b} = 3$.
 \overline{a} in \overline{b} a antit vector perpendicular to pl s perpendicular to \overline{a} and \overline{b} and \overline{c} . $\overline{d} = 1$.
 $f(\overline{a}) = \hat{i} + \hat{j} + \hat{k}$, $\overline{c} = \hat{j} - \hat{k}$ are the given vectors then find a vector
 \overline{D} satisfying the equation $\overline{a} \times \overline{b} = \overline{c}$, $\overline{a$ If $\overline{a} = \hat{i} + \hat{j} + \hat{k}$, $\overline{c} = \hat{j} - \hat{k}$ are the given vectors then find a vector
 \overline{D} satisfying the equation $\overline{a} \times \overline{D} = \overline{c}$, $\overline{a} \cdot \overline{D} = 3$.

Find a unit vector perpendicular to plane ABC, when lies in the plane of \overrightarrow{a} and \overrightarrow{b} , then find the value of x.
- 42. Prove that angle between any two diagonals of *a* cube is $\cos^{-1} \left(\frac{1}{2} \right)$. $3⁷$
- on vectors of
spectively.
 $\frac{1}{\sqrt{b}}$
 $\frac{1}{\sqrt{c}}$
 $-\hat{k}$. If $\frac{1}{\sqrt{c}}$
 $\cos^{-1}(\frac{1}{3})$.
 $= 0$ and the
 $\times \hat{c}$. ectors of
tively.
and :
 $\frac{1}{\sqrt{6}}$
 $\frac{1}{\sqrt{6}}$
 $\frac{-1}{\sqrt{6}}$
and the
 $\frac{1}{\sqrt{6}}$. vely.
 $\frac{1}{2}$.
 $\frac{1}{2}$.
 $\left(\frac{1}{3}\right)$.
 $\frac{1}{3}$.
Its with 4, B, C are $3\hat{i} - \hat{j} + 2\hat{k}$, $\hat{i} - \hat{j} - 3\hat{k}$ and $4\hat{i} - 3\hat{j} + \hat{k}$ respectively.

37. For any two vector, show that $|\vec{a} + \vec{b}| \le |\vec{a}| + |\vec{b}|$.

38. Evaluate $(\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{k})^2$.

39. If angle between \hat{b} and \hat{c} is $\frac{\pi}{6}$, then prove that $\hat{a} = \pm 2(\hat{b} \times \hat{c})$.
- Evaluate $(\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2$.

If \hat{a} and \hat{b} are unit vector inclined at an angle θ than prove that :

(i) $\sin \frac{\theta}{2} = \frac{1}{2} |\hat{a} \hat{b}|$.

(ii) $\tan \frac{\theta}{2} = |\frac{\hat{a} \hat{b}}{\hat{a} + \hat{b}}|$.
 $|\vec{a} + \vec{b}| \leq |\vec{a}| + |\vec{b}|.$
 $\frac{2}{2} + (\vec{a} \times \hat{k})^2.$

ined at an angle θ than prove that :

(ii) $\tan \frac{\theta}{2} = \left| \frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}} \right|.$
 $|\vec{a} \times \vec{b}| = \sqrt{a^2b^2 - (\vec{a} \cdot \vec{b})^2}.$
 $2\hat{j}$ and $\vec{c} = x\hat{i} + (x - 2)\hat$ 44. Prove that the normal vector to the plane containing three points with If a and b are unit vector inclined at an angle θ than prove that :

(i) $\sin \frac{\theta}{2} = \frac{1}{2} |\hat{a} - \hat{b}|$.

(ii) $\tan \frac{\theta}{2} = \left| \frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}} \right|$.

For any two vectors, show that $|\vec{a} \times \vec{b}| = \sqrt{a^2b^2 - (\vec{a} \cdot$ + $(\vec{a} \times \vec{I})$ + $(\vec{a} \times \vec{k})$.

vector inclined at an angle θ than prove that :
 $-\hat{b}$. (ii) $\tan \frac{\theta}{2} = \left| \frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}} \right|$.
 \therefore show that $|\vec{a} \times \vec{b}| = \sqrt{a^2b^2 - (\vec{a} \cdot \vec{b})^2}$.
 $= \hat{i} - \hat{j} + 2\$ position vectors \vec{a} , \vec{b} and \vec{c} lies in the direction of vector *f* \hat{a} and \hat{b} are unit vector inclined at an angle 0 than prove that :

(i) $\sin \frac{\theta}{2} = \frac{1}{2} |\hat{a} - \hat{b}|$.

(ii) $\tan \frac{\theta}{2} = |\frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}}|$.

For any two vectors, show that $|\vec{a} \times \vec{b}| = \sqrt{a^2b^2 - (\vec$

- 40 **1.** COM
45. If \overline{a} , \overline{b} , \overline{c} are position vectors of the vertices *A*, *B*, *C* of a triangle
ABC then show that the area of
 $\triangle ABC$ is $\frac{1}{2}|\overline{a} \times \overline{b} + \overline{b} \times \overline{c} + \overline{c} \times \overline{a}|$.
46. If \overline 45. If \vec{a} , \vec{b} , \vec{c} are position vectors of the vertices *A, B, C* of a triangle *ABC* then show that the area of $\triangle ABC$ is $\frac{1}{2}$ $\left| \overrightarrow{a} \times \overrightarrow{b} + \overrightarrow{b} \times \overrightarrow{c} + \overrightarrow{c} \times \overrightarrow{a} \right|.$ **4000.** COM
 E a, **b**, **c** are position vectors of the vertices A, B, C of a triangle
 ABC is $\frac{1}{2}$ $\begin{vmatrix} \overline{a} & \overline{x} & \overline{b} + \overline{b} & \overline{x} & \overline{c} + \overline{c} & \overline{x} \\ 0 & \overline{a} & \overline{a} & \overline{b} + \overline{b} & \overline{x} & \overline{c} + \overline{c$ **400.** COM
 a are position vectors of the vertices A, B, C of a triangle

then show that the area of
 $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$.
 $\vec{c} \times \vec{a}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{a}$, then prove that

parallel 46. If \vec{a} , \vec{b} , \vec{c} are position vectors of the vertices *A*, *B*, *C* of a triangle
 ABC is $\frac{1}{2}|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.

46. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{$ $\frac{40}{10}$. COM
 $\frac{1}{2}$ $\frac{1}{a}$, $\frac{1}{b}$, $\frac{1}{c}$ are position vectors of the vertices *A*, *B*, *C* of a triangle

ABC is $\frac{1}{2}$ $\frac{1}{a} \times \frac{1}{b} + \frac{1}{b} \times \frac{1}{c} + \frac{1}{c} \times \frac{1}{a}$.
 $\frac{1}{a} \times \frac{1}{b} = \frac{1}{$ **400.** COM
 6 \vec{c} are position vectors of the vertices *A*, *B*, *C* of a triangle

then show that the area of
 $\frac{1}{2}|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.
 $\vec{c} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, **4000.com**

on vectors of the vertices *A*, *B*, *C* of a triangle

show that the area of
 $\overline{b} \times \overline{c} + \overline{c} \times \overline{a}$.

Ind $\overline{a} \times \overline{c} = \overline{b} \times \overline{d}$, then prove that
 $\overline{b} - \overline{c}$ provided $\overline{a} \neq \overline{d}$ **p**.com

s of the vertices *A*, *B*, *C* of a triangle

that the area of
 $\frac{1}{c} \times \frac{1}{a}$.
 $\frac{1}{c} = \frac{1}{b} \times \frac{1}{a}$, then prove that

provided $\frac{1}{a} \neq \frac{1}{a}$ and $\frac{1}{b} \neq \frac{1}{c}$.

th vectors $\hat{i} + \hat{j} - 3\hat$ vertices A, B, C of a triangle
the area of
 \vec{a} .
 $\times \vec{a}$, then prove that
 $\vec{a} \neq \vec{a}$ and $\vec{b} \neq \vec{c}$.
rs $\hat{i} + \hat{j} - 3\hat{k}$, $\hat{i} + 3\hat{j} - 2\hat{k}$
ly. Find the vectors. A, *B*, *C* of a triangle
area of
en prove that
and $\overline{b} \neq \overline{c}$.
 $\hat{i} - 3\hat{k}, \hat{i} + 3\hat{j} - 2\hat{k}$
he vectors.
that $\overline{a} + \overline{b}$ and 44. The *i* \vec{B} , \vec{C} are position vectors of the vertices *A*, *B*, *C* of a triangle
 ABC is $\frac{1}{2} |\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.

44. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{a}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, **a**nd \overline{a} , \overline{b} , \overline{c} are position vectors of the vertices *A*, *B*, *C* of a triangle

ABC then show that the area of
 $\triangle ABC$ is $\frac{1}{2} | \overline{a} \times \overline{b} + \overline{b} \times \overline{c} + \overline{c} \times \overline{a} |$.

If $\overline{a} \times \overline{b} = \over$ 45. If \vec{a} , \vec{b} , \vec{c} are position vectors of the vertices *A*, *B*, *C* of a triangle
 ABC is $\frac{1}{2}|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.

46. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{a}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{$ **a b a c a c c a c** If \overline{a} , \overline{b} , \overline{c} are position vectors of the vertices *A*, *B*, *C* of a triangle
 a ABC is $\frac{1}{2}|\overline{a} \times \overline{b} + \overline{b} \times \overline{c} + \overline{c} \times \overline{a}|$.
 f $\overline{a} \times \overline{b} = \overline{c} \times \overline{d}$ and $\overline{a} \times \overline{c} =$ 45. If \vec{a} , \vec{b} , \vec{c} are position vectors of the vertices *A*, *B*, *C* of a triangle

ABC then show that the area of

ABC is $\frac{1}{2} | \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} |$.

46. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{$ \overline{b} , \overline{c} , \overline{a} are position vectors of the vertices *A*, *B*, *C* of a triangle

then show that the area of
 \overline{c} is $\frac{1}{2}|\overline{a} \times \overline{b} + \overline{b} \times \overline{c} + \overline{c} \times \overline{a}|$.
 \overline{x} $\overline{b} = \overline{c} \times \overline{d}$ be position vectors of the vertices A, B, C of a triangle

show that the area of
 $\overline{b} + \overline{b} \times \overline{c} + \overline{c} \times \overline{a}$.
 $\times \overrightarrow{d}$ and $\overrightarrow{a} \times \overrightarrow{c} = \overrightarrow{b} \times \overrightarrow{d}$, then prove that

allel to $\overrightarrow{b} - \overrightarrow{c}$ provided *a*, *b*, *c* are position vectors of the vertices *A*, *B*, *C* of a triangle
 BC then show that the area of
 ABC is $\frac{1}{2} |\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.
 $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{$ $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$
 $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$.
 $\vec{c} \times \vec{a}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{a}$, then prove that

parallel to $\vec{b} - \vec{c}$ provided $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$. 45. $\vec{a} \cdot \vec{a} \cdot \vec{D} \cdot \vec{c}$ are position vectors of the vertices *A*, *B*, *C* of a triangle
 ABC is $\frac{1}{2} |\vec{a} \times \vec{D} + \vec{D} \times \vec{c} + \vec{c} \times \vec{a}|$.

46. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{$
-
-
-
-
-
- **and** *a* b, c are position vectors of the vertices *A*, *B*, *C* of a triangle then show that the area of $\triangle ABC$ is $\frac{1}{2}|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.

If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \$ AABC is $\frac{1}{2} |\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.

46. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, then prove that
 $\vec{a} - \vec{d}$ is parallel to $\vec{b} - \vec{c}$ provided $\vec{a} \neq \vec{d}$ and \vec{b} $\overline{c} = \overline{c} \times \overline{d}$ and $\overline{a} \times \overline{c} = \overline{b} \times \overline{d}$, then prove that

sparallel to $\overline{b} - \overline{c}$ provided $\overline{a} \neq \overline{d}$ and $\overline{b} \neq \overline{c}$.

Let of a vector with vectors $\hat{i} + \hat{j} - 3\hat{k}$, $\hat{i} + 3\hat{j} -$ AABC is $\frac{1}{2} |\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|$.
 $\frac{1}{4} |\vec{a} \times \vec{b}| = |\vec{c} \times \vec{d}|$ and $\vec{a} \times \vec{c} = |\vec{b} \times \vec{d}|$, then prove that
 $\vec{a} - \vec{d}$ is parallel to $\vec{b} - \vec{c}$ provided $\vec{a} \neq \vec{d}$ and \vec{b} x a and $a \times c = b \times a$, then prove that

rallel to $\overline{b} - \overline{c}$ provided $\overline{a} \neq \overline{d}$ and $\overline{b} \neq \overline{c}$.

of a vector with vectors $\hat{i} + \hat{j} - 3\hat{k}$, $\hat{i} + 3\hat{j} - 2\hat{k}$
 \hat{k} is 0, 5 and 8 respectively. Find $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, then prove that
 $-\vec{c}$ provided $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$.

In with vectors $\hat{i} + \hat{j} - 3\hat{k}$, $\hat{i} + 3\hat{j} - 2\hat{k}$
 $-\hat{j} - \lambda \hat{k}$, find λ such that $\vec{a} + \vec{b}$ and
 \vec{a} $\vec{a} \times \vec{b} = \vec{c}$. Prove that \vec{a}, \vec{b} and \vec{c} are mutually perpendicular to If $a \times b = c \times d$ and $a \times c = b \times d$, then prove that
 $\overline{a} - \overline{d}$ is parallel to $\overline{b} - \overline{c}$ provided $\overline{a} \neq \overline{d}$ and $\overline{b} \neq \overline{c}$.

Dot product of a vector with vectors $\hat{i} + \hat{j} - 3\hat{k}$, $\hat{i} + 3\hat{j} - 2\hat$ 47. Dot product of a vector with vectors $\hat{i} + \hat{j} - 3\hat{k}$, $\hat{i} + 3\hat{j} - 2\hat{k}$

and $2\hat{i} + \hat{j} + 4\hat{k}$ is 0, 5 and 8 respectively. Find the vectors.

48. If $\vec{a} = 5\hat{i} - \hat{j} + 7\hat{k}$, $\hat{b} = \hat{i} - \hat{j} - \hat{k}$, find λ and $z_1 + y_1 + x_2 - y_1 + z_3 - z_4$, and 3 be probably that $\frac{1}{a} = \frac{1}{b}$, $\frac{1}{a} = \frac{1}{b}$ and $\frac{1}{a} = \frac{1}{b}$ are orthogonal.

Let $\frac{1}{a}$ and $\frac{1}{b}$ be vectors such that $\left| \frac{1}{a} \right| = \left| \frac{b}{c} \right| = \left| \frac{a}{c} - \frac$ 49. Let \vec{a} and \vec{b} be vectors such that $|\vec{a}| = |\vec{b}| = |\vec{a} - \vec{b}| = 1$,

then find $|\vec{a} + \vec{b}|$.

50. If $|\vec{a}| = 2$, $|\vec{b}| = 5$ and $\vec{a} \times \vec{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, find the value of
 $\vec{a} \cdot \vec{b}$.

51. \vec{a} *a* i \overline{a} i \overline{a} i \overline{a} i \overline{a} i \overline{a} i \overline{b} i \overline{a} i \overline{a} i \overline{b} i \overline{a} i \overline{a} i \overline{b} i \overline{c} i \overline{a} and \overline{b} i \overline{c} i \overline{a} and \overline{c} are mutually pe Let a and b be vectors such that $|a| = |b| = |a - b| = 1$,

then find $|\overline{a} + \overline{b}|$.

If $|\overline{a}| = 2$, $|\overline{b}| = 5$ and $\overline{a} \times \overline{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, find the value of
 $\overline{a} \cdot \overline{b}$.
 $\overline{a} \cdot \overline{b}$, \overline{c} are t 50. If $|\overline{a}| = 2$, $|\overline{b}| = 5$ and $\overline{a} \times \overline{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, find the value of $\overline{a} \cdot \overline{b}$.

51. \overline{a} , \overline{b} , \overline{c} are three vectors such that $\overline{b} \times \overline{c} = \overline{a}$ and $\overline{a} \times \overline{b} = \overline{c}$
-
-
-
- 55. Show that the four points (–1, 4, –3), (3, 2, –5) (–3, 8, –5) and (–3, 2, 1) are coplanar.
-

$$
\begin{bmatrix} \overrightarrow{a} + \overrightarrow{b} & \overrightarrow{b} + \overrightarrow{c} & \overrightarrow{c} + \overrightarrow{a} \end{bmatrix} = 2 \begin{bmatrix} \overrightarrow{a} & \overrightarrow{b} & \overrightarrow{c} \end{bmatrix}
$$

 $\boxed{\vec{a} + \vec{b}}$ $\boxed{\vec{b} + \vec{c}}$ $\boxed{\vec{c} + \vec{a}}$ = 2 $\boxed{\vec{a} \ \vec{b} \ \vec{c}}$
three vectors $\boxed{\vec{a}, \ \vec{b}}$ and $\boxed{\vec{c}}$, prove that $\boxed{\vec{a} - \vec{b}, \ \vec{b} - \vec{c}}$
 $\boxed{-\vec{a}}$ are coplanar. $\frac{40}{0}$.com
 $\frac{a}{a} + \frac{b}{b} + \frac{c}{c}$ $\frac{c}{c} + \frac{c}{a} = 2[\frac{a}{a} \quad \frac{b}{b} \quad \frac{c}{c}]$

three vectors $\frac{a}{a}$, $\frac{b}{b}$ and $\frac{c}{c}$, prove that $\frac{a}{a} - \frac{b}{b}$, $\frac{c}{b} - \frac{c}{c}$
 ANSWERS 400. COM
 $\begin{bmatrix} \overline{a} + \overline{b} & \overline{b} + \overline{c} & \overline{c} + \overline{a} \end{bmatrix} = 2 \begin{bmatrix} \overline{a} & \overline{b} & \overline{c} \end{bmatrix}$

57. For any three vectors \overline{a} , \overline{b} and \overline{c} , prove that $\overline{a} - \overline{b}$, $\overline{b} - \overline{c}$

and $\overline{c} - \$ **40** $\begin{bmatrix} 0 & 0 \end{bmatrix}$ $\begin{bmatrix} 0 & \overline{c} & \overline{c} + \overline{a} \end{bmatrix} = 2 \begin{bmatrix} \overline{a} & \overline{b} & \overline{c} \end{bmatrix}$
 a, \overline{b} and \overline{c} , prove that $\overline{a} - \overline{b}$, $\overline{b} - \overline{c}$
 ANSWERS and \overrightarrow{c} – \overrightarrow{a} are coplanar. **a** are coplanar.
 c and \overline{c} are coplanar.
 c are coplanar.

ANSWERS

20. $\sqrt{13}$ 21. $\frac{2\pi}{3}$ 2π 3 and 2010 π 22. -1 23. $\frac{1}{4}$ π 20. $\sqrt{13}$

21. $\frac{2\pi}{3}$

22. -1

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

24. $\frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}$

25. $-\frac{3}{2}$

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

29. $\lambda = 1$ 4 **i i** $\sqrt{3}$
 1 21. $\frac{2\pi}{3}$
 1 23. $\frac{\pi}{4}$
 25. $-\frac{3}{2}$
 25. $-\frac{3}{2}$
 1 25. $-\frac{3}{2}$ **40** 1 C.COM

21. $\frac{2\pi}{3}$

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25. $-\frac{3}{2}$ 3 2 and 2 25. $-\frac{3}{2}$ 26. $\frac{\pi}{3}$ π 29. $\lambda = 1$ 20. $\sqrt{13}$

21. $\frac{2\pi}{3}$

22. -1

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

24. $\frac{\sqrt{3}}{2}i + \frac{1}{2}j$

25. $-\frac{3}{2}$

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

29. $\lambda = 1$

31. $\overline{\beta} = (\frac{3}{2}i - \frac{1}{2}i) + (\frac{1}{2}i + \frac{3}{2}j - 3k)$.

33. 60°

34. $\frac{1}{4}i + \frac{1}{4}j + \frac{3}{4}$ 20. $\sqrt{13}$

21. $\frac{2\pi}{3}$

22. -1

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

24. $\frac{\sqrt{3}}{2}i + \frac{1}{2}j$

25. $-\frac{3}{2}$

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

29. $\lambda = 1$

31. $\overline{\beta} = \left(\frac{3}{2}i - \frac{1}{2}j\right) + \left(\frac{1}{2}i + \frac{3}{2}j - 3\hat{k}\right)$.

33. 60°

34. $\frac{1}{4}\hat{i} + \frac{1$ 2 $\frac{\pi}{3}$
 $-\frac{3}{2}$
 $-\frac{3}{2}$
 $\frac{1}{4}$ $\hat{i} + \frac{1}{4}$ $\hat{j} + \frac{3}{4}$ \hat{k} .
 $\frac{-1}{\sqrt{165}}$ $(10\hat{i} + 7\hat{j} - 4\hat{k})$. 22. -1

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

24. $\frac{\sqrt{3}}{2}i + \frac{1}{2}i$

25. $-\frac{3}{2}$

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

29. $\lambda = 1$

31. $\overline{\beta} = \left(\frac{3}{2}i - \frac{1}{2}i\right) + \left(\frac{1}{2}i + \frac{3}{2}i - 3\hat{k}\right)$.

33. 60°

34. $\frac{1}{4}i + \frac{1}{4}i + \frac{3}{4}\hat{k}$.

35. $\frac{5}{3}i +$ 1

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 $\frac{\sqrt{3}}{2}i + \frac{1}{2}i$

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 $\frac{\pi}{3}$
 $\frac{\pi}{3}$
 $\frac{\pi}{3}$
 $\frac{3}{2}i + \frac{1}{2}i$
 $\frac{1}{2}i + \frac{3}{2}i - 3k$

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 $\frac{3}{2}$
 $\hat{i} + \frac{1}{4} \hat{j} + \frac{3}{4} \hat{k}$.
 $\frac{-1}{165} (10\hat{i} + 7\hat{j} - 4\hat{k})$.
 $= -2$
 $\frac{1}{173}$. $\frac{3}{2}$
 $\hat{i} + \frac{1}{4}\hat{j} + \frac{3}{4}\hat{k}$.
 $\frac{-1}{165} (10\hat{i} + 7\hat{j} - 4\hat{k}).$
 $= -2$
 $\sqrt{73}$ $+\frac{3}{4}\hat{k}$.
 $\hat{i} + 7\hat{j} - 4\hat{k}$. 38. $2|\vec{a}|^2$ 41. x = 41. $x = -2$ 47. $\hat{i} + 2\hat{j} + \hat{k}$ $\frac{\pi}{3}$
 $\hat{\beta} = \left(\frac{3}{2}\hat{i} - \frac{1}{2}\hat{j}\right) + \left(\frac{1}{2}\hat{i} + \frac{3}{2}\hat{j} - 3\hat{k}\right).$

30°

34. $\frac{1}{4}\hat{i} + \frac{1}{4}\hat{j} + \frac{3}{4}\hat{k}.$
 $\frac{5}{3}\hat{i} + \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}.$

36. $\frac{-1}{\sqrt{165}}\left(10\hat{i} + 7\hat{j} - 4\hat{k}\right).$

2 $|\vec{a}|^2$

41. 25. $-\frac{3}{2}$
 $\frac{\pi}{3}$
 $\lambda = 1$
 $\overline{\beta} = \left(\frac{3}{2}\hat{i} - \frac{1}{2}\hat{j}\right) + \left(\frac{1}{2}\hat{i} + \frac{3}{2}\hat{j} - 3\hat{k}\right).$

30°

34. $\frac{1}{4}\hat{i} + \frac{1}{4}\hat{j} + \frac{3}{4}\hat{k}.$

36. $\frac{-1}{\sqrt{165}}(10\hat{i} + 7\hat{j} - 4\hat{k}).$

2| \overline{a} | \hat{i}

2| \overline{a} |49. $\sqrt{3}$ 50. $\frac{91}{10}$ 91 10 52. 4 53. 37 $54. \quad \lambda = 1$

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