VECTORS

Scalar → Magnitude

Vector → Magnitude, Direction

Scalar quantity
⇒ Work
⇒ Speed
⇒ Distance

Vector quantity
⇒ Force
⇒ Velocity
⇒ Displacement.

Representation of Vector

length = Magnitude

$|A| = 4$ unit (Magnitude)

$\vec{A} = 4$ unit south (Direction).

Types of Vector

1. Equal and unequal.
2. Parallel and antiparallel.
3. Collinear.
4. Concurrent.
5. Coplanar.
6. Zero
7. Unit.

⇒ Equal and unequal vector
For two vectors to be similar $\vec{A}$ and $\vec{B}$ should have equal magnitude and have same direction.

$$\underbrace{\vec{V_1} = 5 m/sec \text{ East} \qquad \vec{V_2} = 5 m/sec \text{ West}}_{\text{Unequal vectors}}$$

Unequal vectors.

⇒ Parallel Vector
- Same direction
- $\theta = 0°$

⇒ Antiparallel Vector
- Opposite direction
- $\theta = 180°$

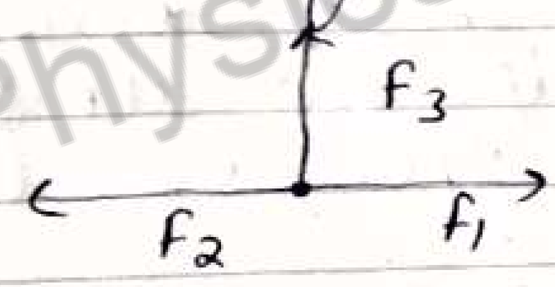
⇒ Colinear.
In a same line.

→ → →

⇒ Coplanar (In a single plane)

* 2 vectors are always coplanar.
* 3 vectors may be coplanar or may be not. (They may lie or may not lie on a similar plane).

⇒ Concurrent Vector
* Forces (Acting at same point)



⇒ Zero vector
whose magnitude is 0. and direction is arbitrary. (It can take any direction).

⇒ Unit Vector [($\hat{A}$)]

$\hat{x}$ in x-direction, $\hat{y}$ in y-direction

Magnitude = 1

* It gives direction

$$\hat{A} = \frac{\vec{A}}{|A|} = \frac{A_x\hat{i} + A_y\hat{j} + A_z\hat{k}}{\sqrt{(A_x)^2 + (A_y)^2 + (A_z)^2}}$$

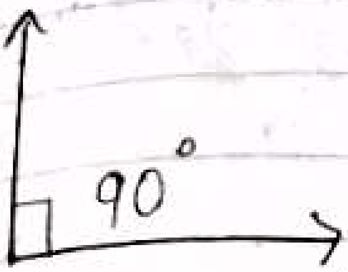
Parallel shift of vector.

We can shift a vector, as it should be parallel shift and the shift should be on the same body

If a force of 10N is applied on a body, it can be shift parallel on the same body.

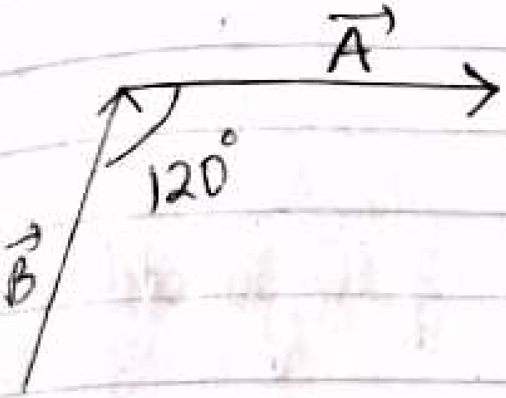
Angles between two vectors (Tail to tail or head to head)

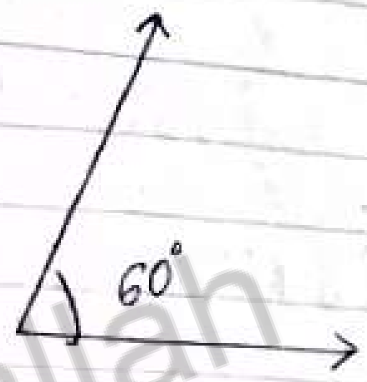
1.



$\theta = 90°$

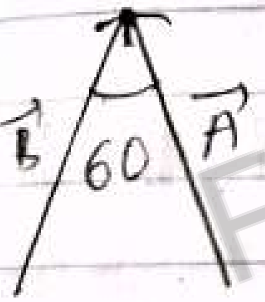
2.





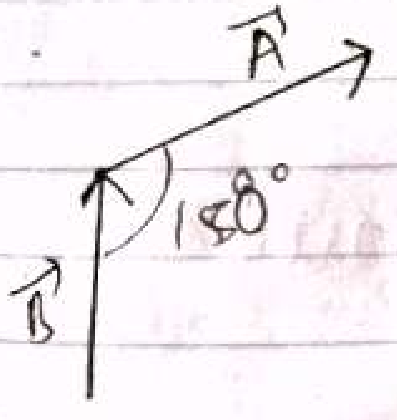
(Parallel shift)

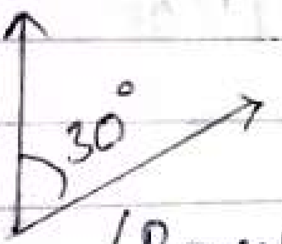
3.



$\theta = 60°$

4.

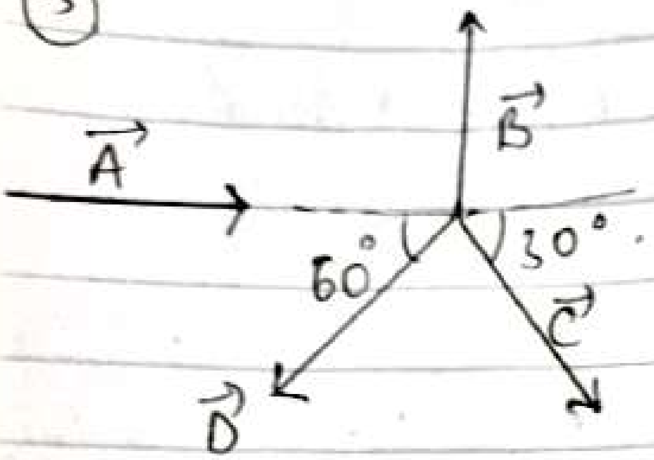


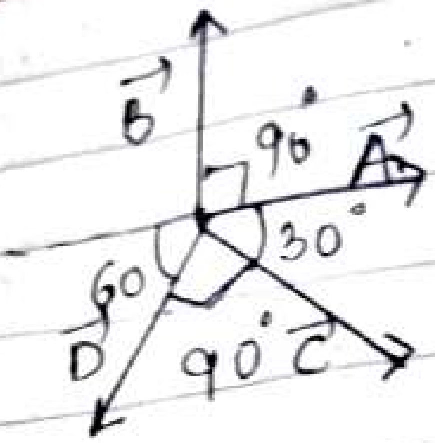


$\theta = 30°$

(Parallel shift

⑤





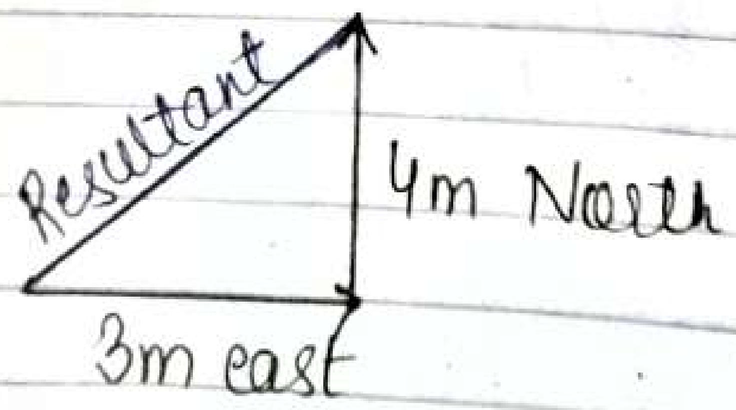
(Tail to Tail)

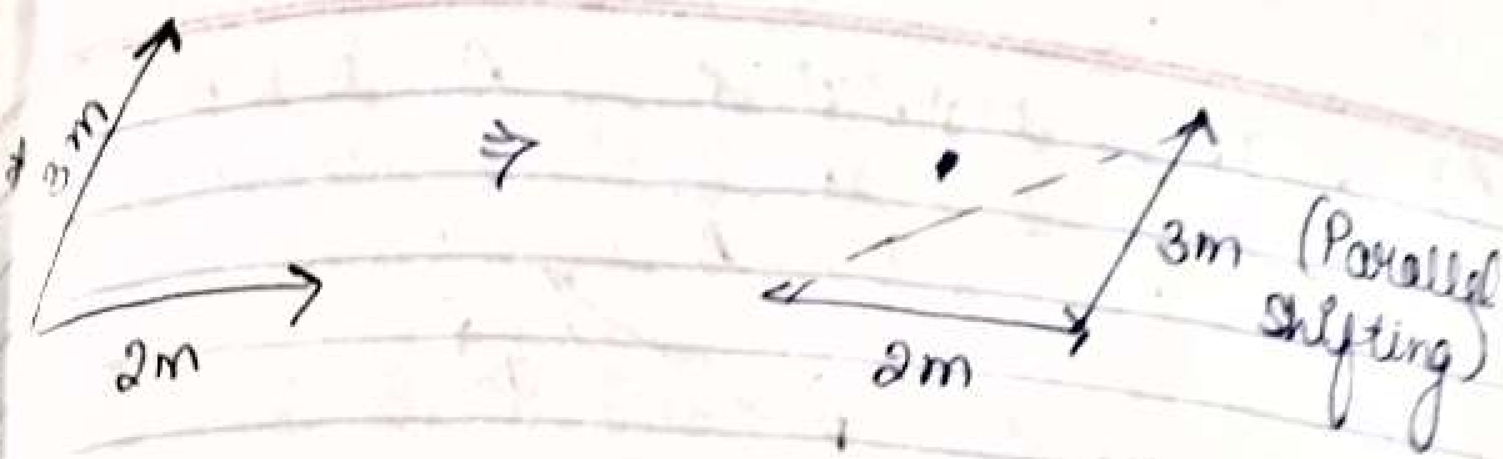
$(0 \leq \theta° \leq 180)$

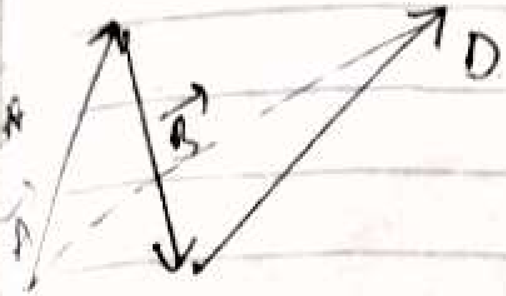
Smaller angle will be preferred.

Addition AND SUBTRACTION.

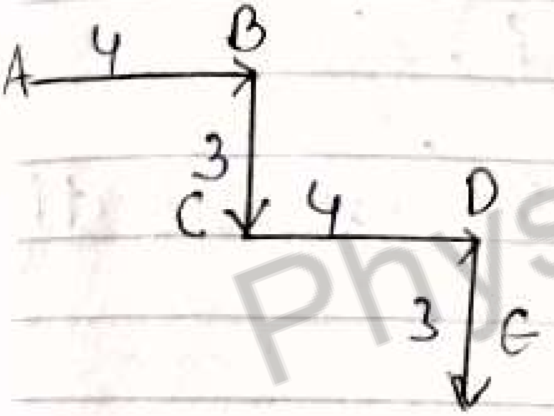
(Head-Tail Method)



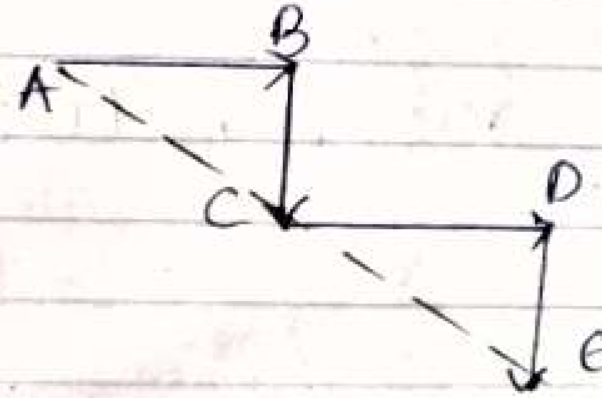




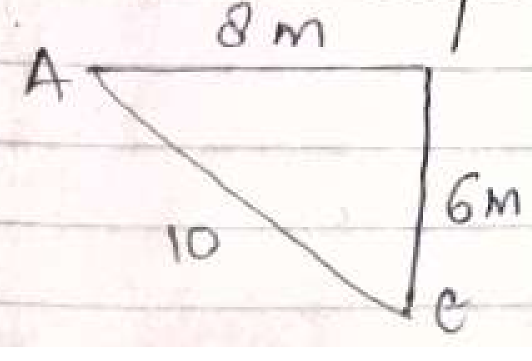
Resultant = Displacement = Ist vector tail + last vector head



Displacement = ?

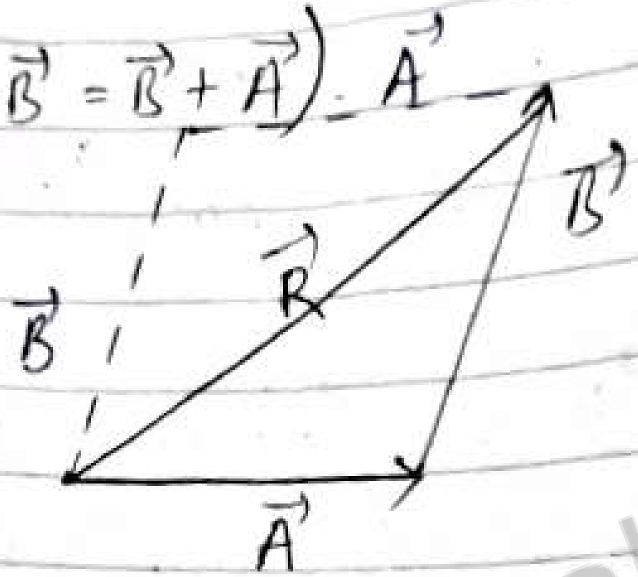


Displacement AE.



Is Vector Commutative $(\vec{A}+\vec{B}=\vec{B}+\vec{A})$

$\Rightarrow (\vec{A}+\vec{B}=\vec{B}+\vec{A})$



We know that,

$$\vec{A}+\vec{B}=\vec{R} \quad -(i)$$

$$\vec{B}+\vec{A}=\vec{R} \quad -(ii)$$ (Parallel shifting)

So, $\vec{A}+\vec{B}=\vec{B}+\vec{A}$

Hence vectors are commutative

⇒ Vectors can not be added as all scalar quantities are added.

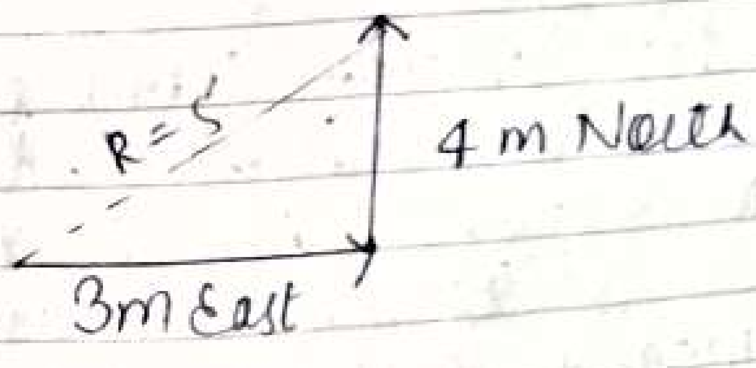
VECTOR ADDITION.

1. Head-Tail Method.
2. Parallelogram Law.
3. Triangle Law.

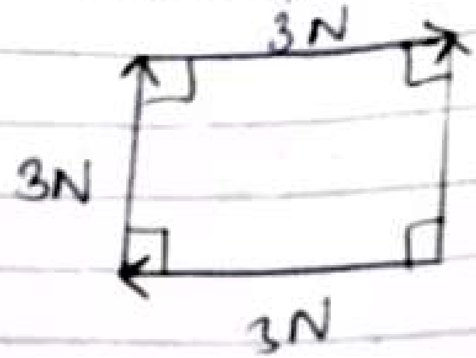
1. Head-tail method

Join tail of next vector with Head of previous vector

3m East + 4m North = R



⇒ Add 3 vectors
3N West, 3N North, 3N East



Resultant

$\vec{R} = 3\ [90^\circ]$

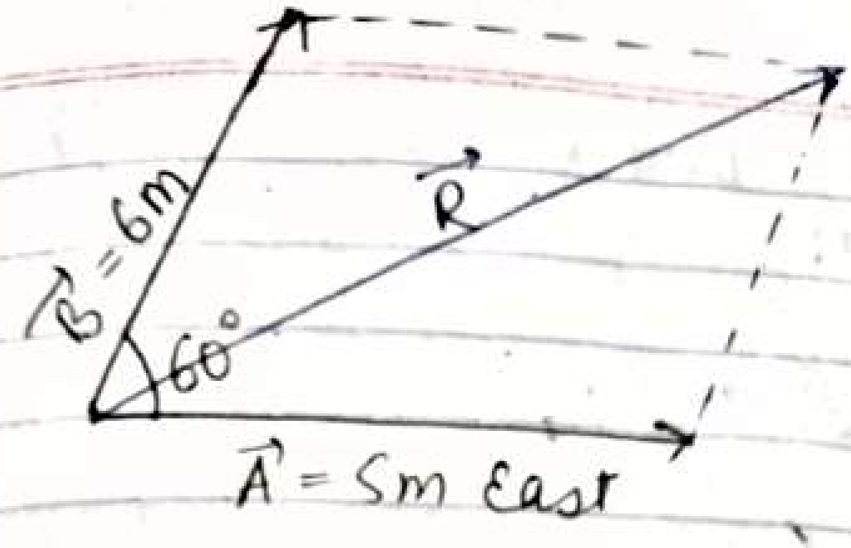
→ 5m east then 5m at 60' from east

This law fails here

<u>Parallelogram Law</u>

It allows us to add any kind of vector

⇒ Join two vectors from tail to tail as the two adjacent sides of parallelogram. , $\vec{A} = 5$ East ,
$\vec{B}$, 6m , 60° from East .
(Imagine complete ||gm)



$\vec{R}$ = diagonal of llgm from common point.

$\vec{R} = \vec{A} + \vec{B}$.

$R^2 = A^2 + B^2 + 2AB\cos\theta$. (Magnitude)

θ = angle between 2 vectors

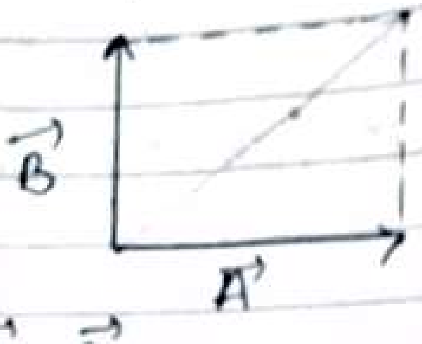
$R^2 = 5^2 + 6^2 + 2 \times 5 \times 6 \times \frac{1}{2}$

$R^2 = 25 + 36 + 30$.

$R = 9$.

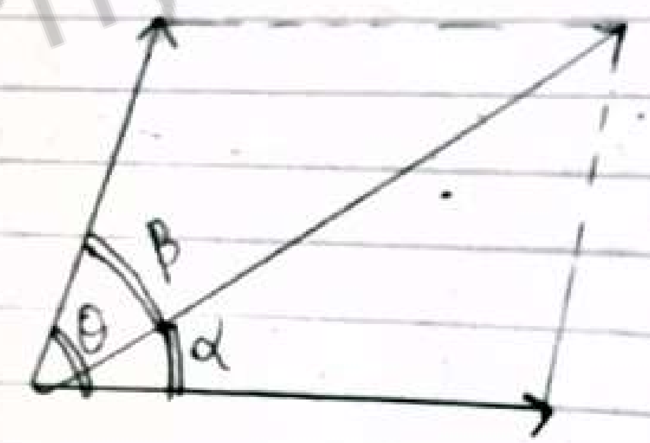
Quest- Add two vectors 6 units, 8 units at 90°

$\vec{A} = 6$, $\vec{B} = 8$, $\theta = 90°$



$\vec{R} = \vec{A} + \vec{B}$

$R^2 = A^2 + B^2 + 2AB\cos\theta$
$R^2 = 36 + 64 + 2 \times 6 \times 8 \times 0$
$R = \pm 10$



$$\tan\alpha = \frac{B\sin\theta}{A + B\cos\theta}.$$

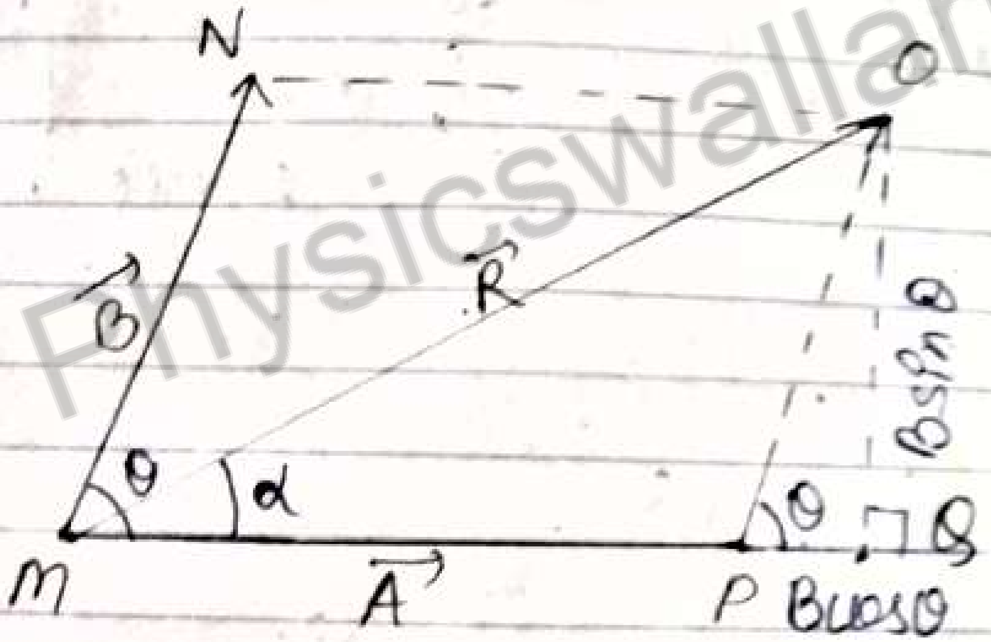
(Direction of resultant)

$\tan\beta = \frac{A\sin\theta}{B + A\cos\theta}$ $(\beta = \theta - \alpha)$

$\vec{R}$ direction is from vector $\vec{A}$ (α)

$\vec{R}$ direction from $\vec{B}$ (β)

Derive $R^2 = A^2 + B^2 + 2AB\cos\theta$



Parallelogram's pair of opp sides is parallel and equal (||).

ΔPOQ

$\cos\theta = \frac{B}{H}$

$$\cos\theta = \frac{PQ}{PO}$$

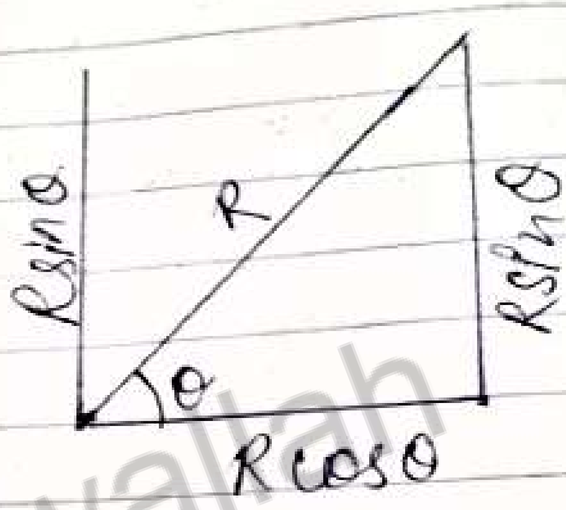
$$PQ = PO\cos\theta$$

$$\boxed{PQ = B\cos\theta}$$

$$\sin\theta = \frac{P}{H}$$

$$\sin\theta = \frac{OQ}{PO} = \frac{OQ}{B}$$

$$\boxed{OQ = B\sin\theta}$$



In ΔOQM

$$(OM)^2 = (OQ)^2 + (MQ)^2$$

$$R^2 = (B\sin\theta)^2 + (A + B\cos\theta)^2$$

$$R^2 = B^2\sin^2\theta + A^2 + B^2\cos^2\theta + 2AB\cos\theta$$

$$R^2 = A^2 + B^2\sin^2\theta + B^2\cos^2\theta + 2AB\cos\theta$$

$$R^2 = A^2 + B^2(\sin^2\theta + \cos^2\theta) + 2AB\cos\theta$$

$$\boxed{R^2 = A^2 + B^2 + 2AB\cos\theta}$$

Direction of Resultant

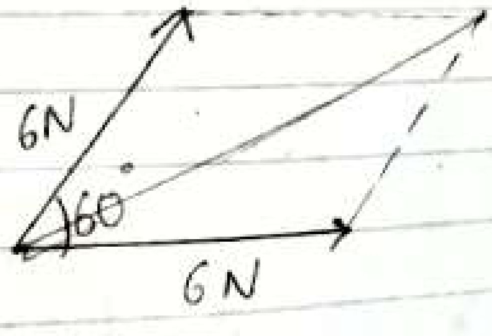
In ΔOQM

$\tan\alpha = \frac{P}{B}$

$\tan\alpha = \frac{OQ}{MQ} = \frac{B\sin\theta}{A+B\cos\theta}$

$$\boxed{\tan\alpha = \frac{B\sin\theta}{A+B\cos\theta}}$$

Ques6- Two forces of magnitude 6N each at a point as shown. Find the resultant.



$R^2 = A^2 + B^2 + 2AB\cos\theta$

$R^2 = 36 + 36 + 2 \times 36 \cos 60^\circ$

$R^2 = 108$

$R = 6\sqrt{3}$

$\tan\alpha = \frac{B\sin\theta}{A + B\cos\theta}$

$\tan\alpha = \frac{1}{\sqrt{3}}, \alpha = 30°$

{ If 2 vectors are equal in magnitude the resultant will pass through the angle between them }

Ques6 - Two vectors of equal magnitude are added to give resultant, which is of same magnitude as the 2 vectors. Find the angle between them.

$R = A = B = x$

$R^2 = A^2 + B^2 + 2AB\cos\theta$

$x^2 = x^2 + x^2 + 2x^2\cos\theta$

$-x^2 = 2x^2\cos\theta$

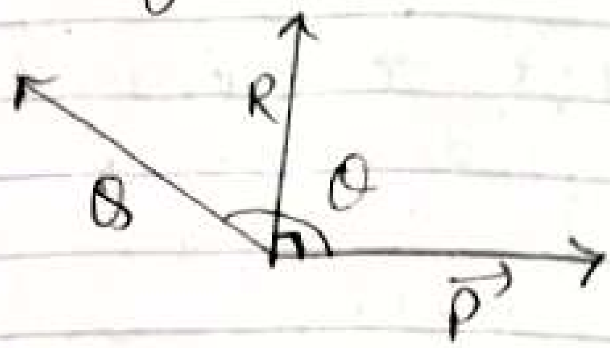
$\cos\theta = \frac{-x^2}{2x^2} = \frac{-1}{2}$

$\cos\theta = \frac{-1}{2}$

$\boxed{\theta = 120°}$

Ques6 - Two vectors P (smaller one) & Q as a sum of 18 and there resultant is 12. The resultant is

⊥ to smaller of two vector. Find the value of P & Q and angle between them.



$P + Q = 18$

$P' + Q' = 12$

$R^2 = A^2 + B^2 + 2AB\cos\theta$

$12^2 = P^2 + Q^2 + 2PQ\cos\theta$.

$12^2 = P^2 + Q^2 + 2P(-P)$

$12^2 = P^2 + Q^2 - 2P^2$.

$12^2 = Q^2 - P^2$

$(Q-P)(Q+P) = 144$

$Q-P(18) = 144$

$Q - P = 8$

$P + Q = 18$

$2Q = 26, \boxed{Q = 13}$.

$12^2 = 13^2 - P^2$

$\boxed{P = 5}$

$\tan\alpha = \dfrac{B\sin\theta}{A + B\cos\theta}$.

$\tan 90^\circ = \dfrac{Q\sin\theta}{P + Q\cos\theta}$.

$P + Q\cos\theta = 0$

$Q\cos\theta = -P$.

$Q\cos\theta = -5$

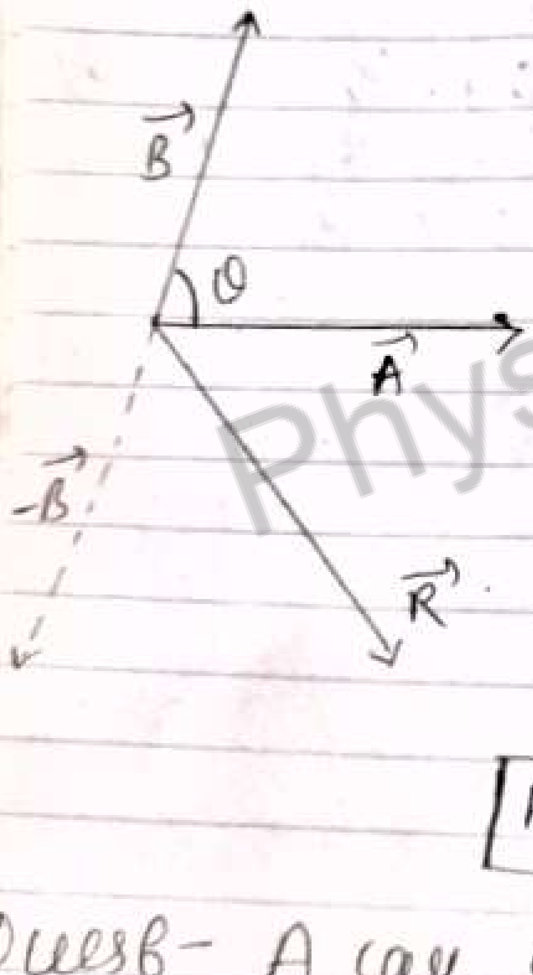
$\boxed{\cos\theta = \dfrac{-5}{13}}$.

Subtraction of vector

(Means negative of vector (opp in direction

⇒ Vectors can only be added.

⇒ $\vec{A} - \vec{B}$ (×)
⇒ $\vec{A} + (-\vec{B})$ (✓)



$\vec{R} = \vec{A} + (-\vec{B})$

angle $= (180 - \theta)$

$R^2 = A^2 + B^2 + 2AB\cos\theta$

$R^2 = A^2 + B^2 + 2AB\cos(180-\theta)$

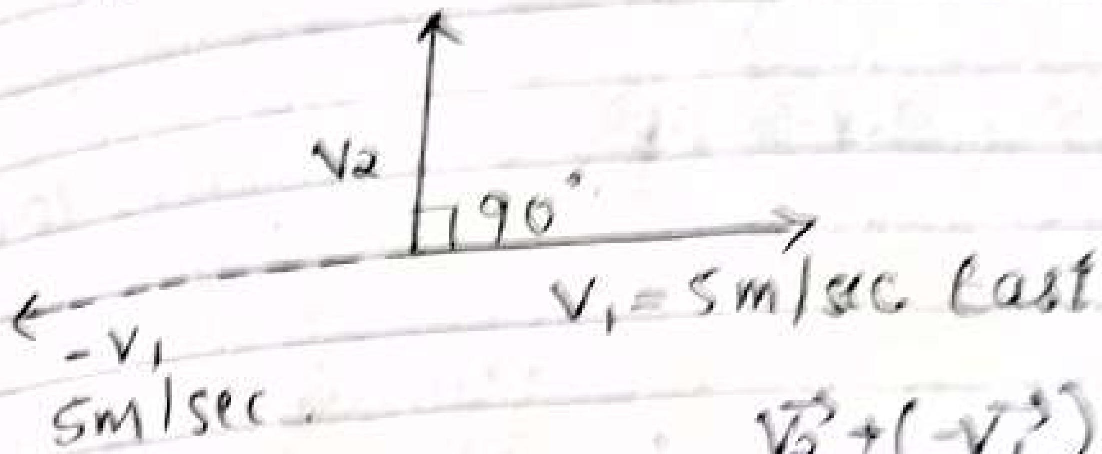
$R^2 = A^2 + B^2 + 2AB(-\cos\theta)$

$\cos(180-\theta) = -\cos\theta$

$$\boxed{R^2 = A^2 + B^2 - 2AB\cos\theta}$$

Ques6- A car runs at 5m/sec East, takes a sharp turn to North and continues at 5m/sec. Find the change in velocity of car.

Δv = change in velocity $\Rightarrow \vec{v_2} - \vec{v_1}$

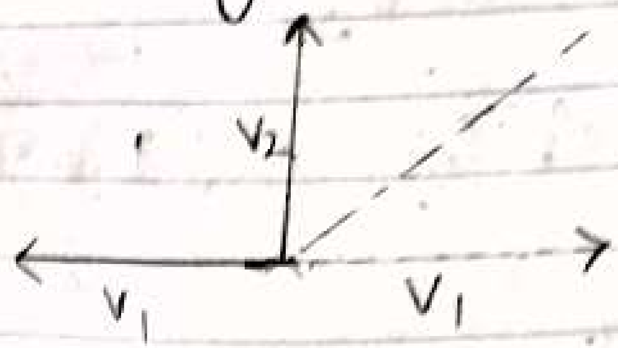


$\vec{v_2} + (-\vec{v_1})$

$R^2 = A^2 + B^2 - 2AB\cos 90°$

$[R = 5\sqrt{2}]$ North west.

Ques 8 - A car running at 10m/sec (west) takes a sharp turn towards north and continues at 10m/sec. If it takes 2 sec in turning. Find acc of car.



$$\vec{a} = \frac{\vec{v_2} - \vec{v_1}}{t}$$

$R^2 = A^2 + B^2 - 2AB\cos\theta$
$R^2 = 200 - 200 \times 0$
$R = 10\sqrt{2}$ NE

$a = \frac{\Delta V}{t} = \frac{10\sqrt{2}}{2} = 5\sqrt{2}$ NE m/sec^2.

Ques6- A plane moving with velocity V turns by 'θ' angle & its speed remains 'v'. find the change in velocity of plane.

$\vec{V_2} - \vec{V_1}$

Ans:- $(R)^2 = A^2 + B^2 - 2AB\cos\theta$
$(R)^2 = V^2 + V^2 - 2V \times V\cos\theta$.
$(R)^2 = 2V^2 - 2V^2\cos\theta$
$(R)^2 = 2V^2(1 - \cos\theta)$
$(R)^2 = 2V^2 \cdot 2\sin^2\theta/2$.

$(R)^2 = 4V^2\sin^2\theta/2$

$\left\{ 1 - \cos\theta = 2\sin^2\theta/2 \right\}$

$R = 2V\sin\theta/2$.

Ques- The difference of 2 unit vectors is a unit vector. find the angle between 2 vectors.

$\vec{A} = 1$, $\vec{B} = 1$, $R = 1$

$R^2 = A^2 + B^2 - 2AB\cos\theta$.

$1^2 = 1^2 + 1^2 - 2\cos\theta$

$\cos\theta = \frac{1}{2}$

$\theta = 60^\circ$.

Ques- The sum and difference are equal in magnitude. Find the angle b/w vectors

$|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$.

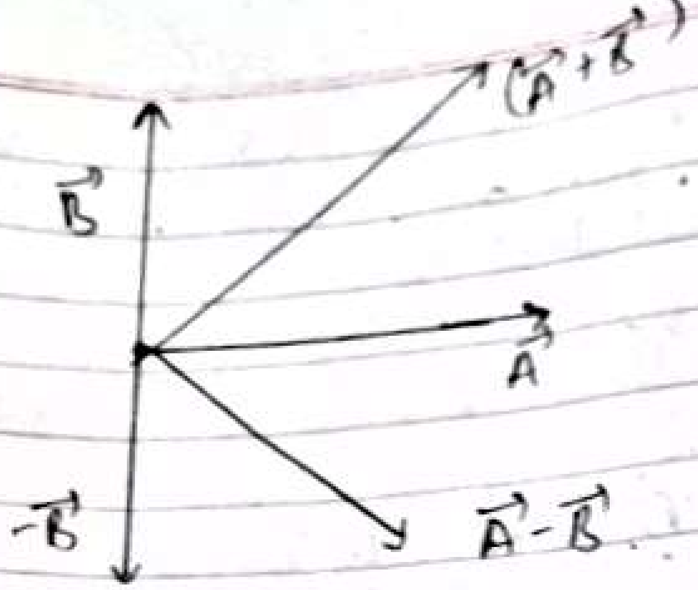
Let $|\vec{A} + \vec{B}|^2 = |\vec{A} - \vec{B}|^2$.

$A^2 + B^2 + 2AB\cos\theta = A^2 + B^2 - 2AB\cos\theta$.

$4AB\cos\theta = 0$.

$\cos\theta = 0$

$\theta = 90^\circ$.



Ques 6 – 3 vectors $\vec{A}+\vec{B}+\vec{C}=0$, if $|\vec{A}|=12$, $|B|=5$, $|C|=13$.
Find angle between $\vec{A}$ and $\vec{B}$.

$$|\vec{A}+\vec{B}|^2 = |(-C)|^2$$

$$A^2+B^2+2AB\cos\theta = C^2$$
$$144+25+120\cos\theta = 169$$
$$\cos\theta = 0$$
$$\theta = 90^\circ$$

⇒ We have 2 vectors 3 & 4, Their resultant cannot be
(a) 2
(b) 6
✓(c) 8
(d) 4

Max value of any vector

$R = |A + B|$

Min value of any vector

$R = |A - B|$

Date ___/___/______ Page No. ______

Multiplication of Vector

① Scalar × Vector
② Vector × Vector = Scalar
③ Vector × Vector = Vector

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

Cartesian form

$3\vec{A} = 6\hat{i} - 3\hat{j} + 3\hat{k}$

Vector × Vector = Scalar

$\vec{A} = 2\hat{i} - \hat{j} + \hat{k}$
$\vec{B} = 3\hat{i} + 4\hat{j} + 2\hat{k}$

$\vec{A} \cdot \vec{B} = C$ (3, 4, 5 . .)

$\Downarrow$ (dot product) $\downarrow$ Scalar

V × V = V

$\vec{A} \times \vec{B} = \vec{C}$ (vector product)

$\Downarrow$

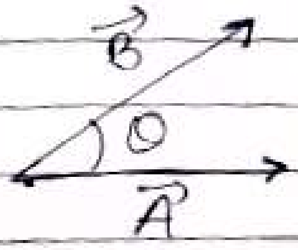
(cross product)

(22) * If the angle between A & B are greater than 90°, the dot product will be -ve (Vectors ~~with~~ length will always be +ve)

Dot Product

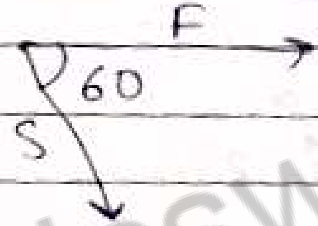
$\vec{A} \cdot \vec{B} = C$.

Work $= \vec{F} \cdot \vec{S}$



$\vec{A} \cdot \vec{B} = |A| \times |B| \times \cos\theta$.

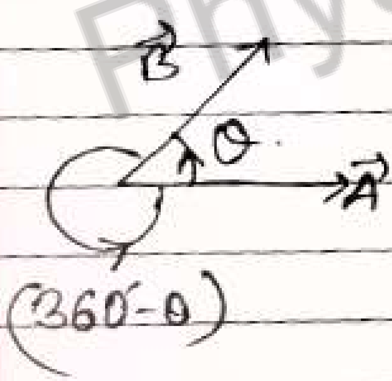
$\vec{F} = 10N$ $\quad \vec{S} = 5m$



Work $= \vec{F} \cdot \vec{S}$

Work $= 25J$

$\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$.



(A से B angle)

$\vec{A} \cdot \vec{B} = |A| |B| \cos\theta$.

$\vec{B} \cdot \vec{A} = |B| |A| \cos(360-\theta)$

(B से A angle)

$\cos(360-\theta) = \cos\theta$

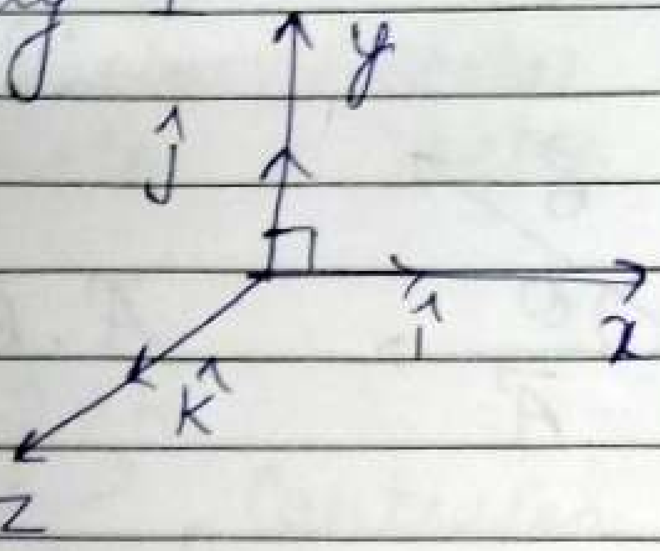
* If $\vec{A} \perp \vec{B}$ $\quad \theta = 90°$

$\vec{A} \cdot \vec{B} = |A| |B| \cos 90°$

$\vec{A} \cdot \vec{B} = 0$

Orthogonal unit vectors

mutually ⊥



$\hat{i}$ = whose mag is 1 and is in the direction of x.

similarly $\hat{j}$ & $\hat{k}$.

$\hat{i}.\hat{j} = 0$; $\hat{i}.\hat{i} = 1$

$\hat{i}.\hat{k} = 0$; $\hat{j}.\hat{j} = 1$

$\hat{j}.\hat{k} = 0$; $\hat{k}.\hat{k} = 1$

$\hat{i}.\hat{i} = |\hat{i}||\hat{i}| \cos 0°$

$\Rightarrow 1.$

Date __/__/____ Page No.: ______

Quest- $\vec{A} = 2\hat{i} + 3\hat{j}$
$\vec{B} = 4\hat{i} + 5\hat{j}$

find $\vec{A}.\vec{B}$.

$\Rightarrow (2\hat{i} + 3\hat{j}).(4\hat{i} + 5\hat{j})$

$\Rightarrow 8(1) + 15(1)$

$\vec{A}.\vec{B} \Rightarrow 23$

$\vec{A}.\vec{B} = A_xB_x + A_yB_y + A_zB_z$
$\Rightarrow 2\times4 + (3\times5) + 0\times0$
$\Rightarrow 23$

Quest- Find, if
$\vec{A} = 2\hat{i} + \hat{j} + \hat{k}$
$\vec{B} = \hat{i} - \hat{j} + 3\hat{k}$

$\vec{A}.\vec{B} = 2 - 1 + 3$
$\vec{A}.\vec{B} \Rightarrow 5$

Quest- If a vector $(2\hat{i} + 3\hat{j} + 8\hat{k})$ is $\perp$ to the vector $4\hat{i} - 4\hat{j} + a\hat{k}$, then the value of a is.

$\vec{A}.\vec{B} = 0 \quad (\perp)$

$0 = 8 - 12 + 8a$

$0 = -4 + 8a$

$4 = 8a$

$a = \frac{1}{2}$

8-

Angle between two vectors

$\vec{A} \cdot \vec{B} = |A||B| \cos\theta$

$$\boxed{\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|A||B|}}$$

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

$\vec{B} = \hat{i} - \hat{j}$

$\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|A||B|}$

$\vec{A} \cdot \vec{B} = (2 + 1)$

$\Rightarrow 3$

$|A||B| = \sqrt{A_x^2 + A_y^2 + A_z^2} \sqrt{B_x^2 + B_y^2 + A_z^2}$

Date __/__/__ Page No.: ____

$\Rightarrow \sqrt{4+1+1}\ \sqrt{1+1}$

$\Rightarrow \sqrt{6}\ \sqrt{2}$

$\Rightarrow \sqrt{12}$

2	12
2	6
3	3
	1

$$\boxed{\cos\theta = \frac{3}{2\sqrt{3}}}$$

Quest- $\vec{P} = 2\hat{i} + \hat{j} - \hat{k}$, find θ

$\vec{Q} = \hat{i} - \hat{j}$

$$\cos\theta = \frac{2-1}{\sqrt{6}\,\sqrt{2}}$$

$$\cos\theta \Rightarrow \frac{1}{2\sqrt{3}}.$$

Quest $\vec{R} = \hat{i} + \hat{j}$ (find θ).

$\vec{S} = \hat{i} - \hat{j}$.

$$\cos\theta = \frac{1-1}{\sqrt{2}\,\sqrt{2}} \Rightarrow \frac{0}{\sqrt{4}} \Rightarrow \frac{0}{2} = 0$$

Quest- Find the angle that $\vec{A} = \hat{i} + \hat{j}$ makes with x axes.

$\vec{A} = \hat{i} + \hat{j}$

$\vec{B} = \hat{i}$ (any vector along x-axes) can be $2\hat{i}, 0.5\hat{i}$ ... anything

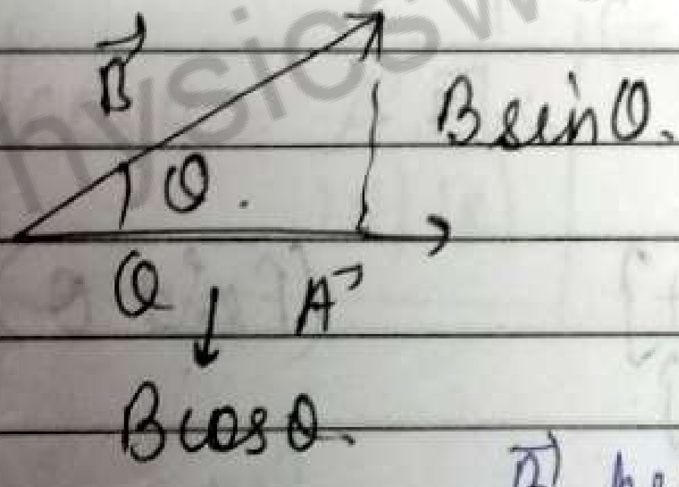
$\cos\theta = \frac{\vec{A}\,\vec{B}}{|A|\,|B|}$

$\cos\theta \Rightarrow \frac{1 \times 1 \times 0}{\sqrt{2}\,\sqrt{1}}$

$\cos\theta \Rightarrow \frac{1}{\sqrt{2}}$

$$\boxed{\theta = 45^\circ}$$

$\vec{A}\cdot\vec{B} = |A|\,|B|\cos\theta$



$\vec{B}$ projectection on $\vec{A}$

$B\cos\theta$ is along $\vec{A}$.

$\vec{A}\cdot\vec{B} = |\vec{A}|\,(|\vec{B}|\cos\theta)$.

Cross / Vector Product

$\vec{A} \times \vec{B} = \vec{C}$ vector

$\overrightarrow{\text{Torque}}$/ moment of force. $= \vec{F} \times$ displacement

(This is $\perp$ to $\vec{A}$ & $\vec{B}$)

$\vec{A} \times \vec{B} = \boxed{|A||B|\sin\theta.}\ \hat{n}$

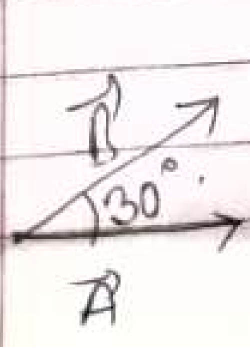
direction

To give direction to vectors we use unit vector

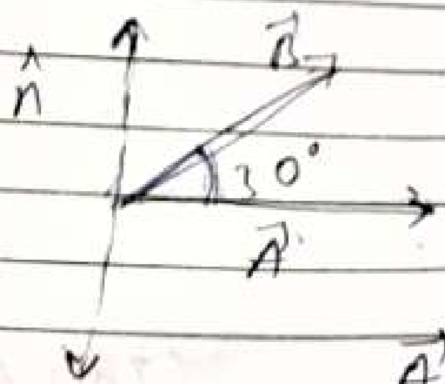
$\vec{C} \perp \vec{A}$
$\vec{C} \perp \vec{B}$.

Quest.⇒ $\vec{A} = 5$, $\vec{B} = 2$, $\theta = 30^\circ$ find $\vec{A} \times \vec{B} = |A||B|\sin\theta$
$\vec{B} \times \vec{A} =$

$\vec{A} \times \vec{B} = 5$
$\vec{B} \times \vec{A} = |B||A|\sin\theta. = 5$



$\vec{A}\times\vec{B} \neq \vec{B}\times\vec{A}$



(Right hand thumb rule)

$\vec{A}\times\vec{B}$ = while curling from $\vec{A}$ to $\vec{B}$ using R.H. Thumb rule the thumb is upward so the $\hat{n}$ will be upward.

$\vec{B}\times\vec{A}$ = while curling from $\vec{B}$ to $\vec{A}$ using R.H. Thumb rule the thumb will be downwards

(as ~~we~~ we will take the smaller angle between the vectors).

$\vec{A}\times\vec{B}$ = 5 upwards

$\vec{B}\times\vec{A}$ = 5 downwards

so, $\vec{A}\times\vec{B} \neq \vec{B}\times\vec{A}$

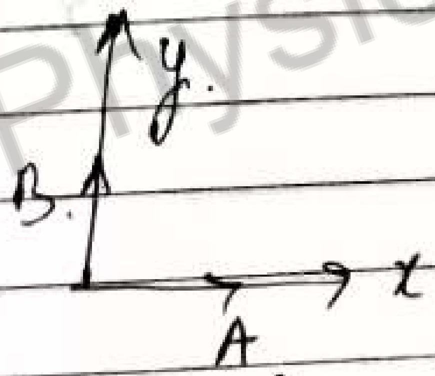
Date __/__/____ Page No.: _____

OR Screw Rule.

(Add both the vector tail to tail; move the screw from $\vec{A}$ to $\vec{B}$, so the direction is upwards)

and move the screw from $\vec{B}$ to $\vec{A}$ so the screw will go downwards.

commutative rule is not valid for cross product.

Quest→ 

$\vec{A} \times \vec{B}$

what will be the direction of $\vec{A} \times \vec{B}$

upwards (outwards)

$\vec{B} \times \vec{A}$ (Inwards) downwards.

Orthogonal unit vector:

$\hat i \times \hat j = \hat k$

$\hat j \times \hat k = \hat i$

~~$\hat k \times \hat i =$~~

$\hat i$

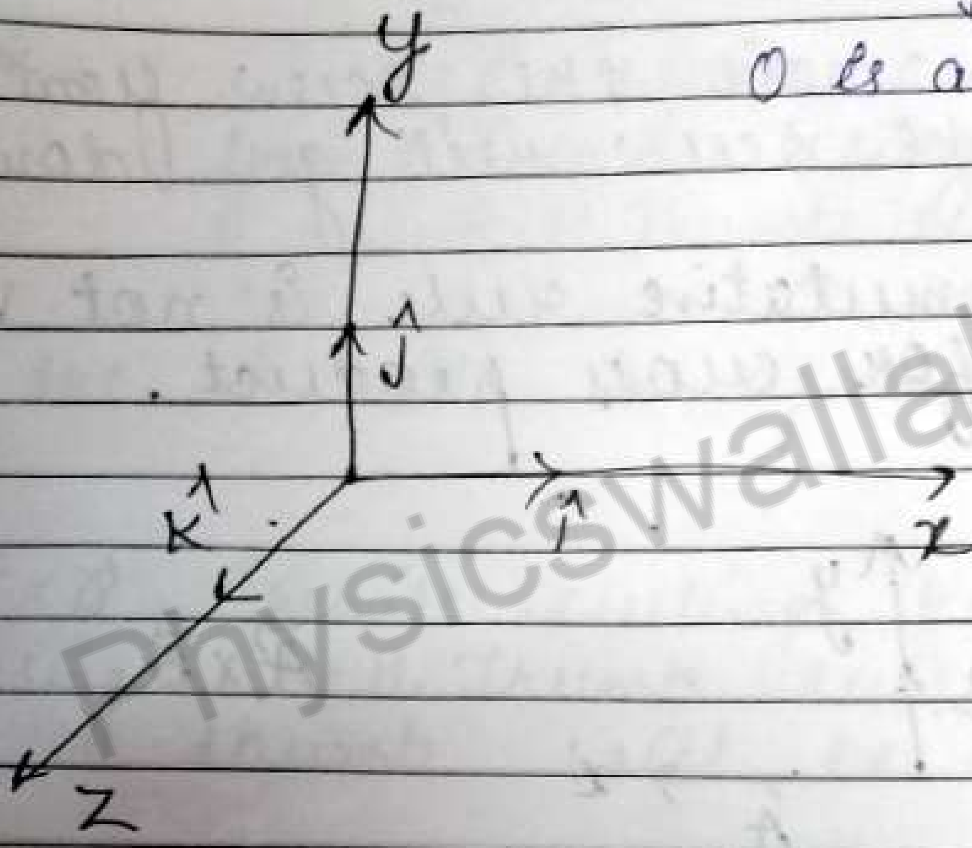
$\hat i \times \hat i = |\hat i||\hat i| \sin 0 = \vec 0$

$\hat j \times \hat j = |\hat j||\hat j| \sin 0 = \vec 0$

$\hat k \times \hat k = \vec 0$

$\Downarrow \quad \vec 0$

0 is a vector



$\hat i \times \hat j = |\hat i||\hat j| \sin 90^\circ$

$\Rightarrow 1 \, \hat n \longrightarrow$ (unit vector outwards).

$\Rightarrow \hat k$.

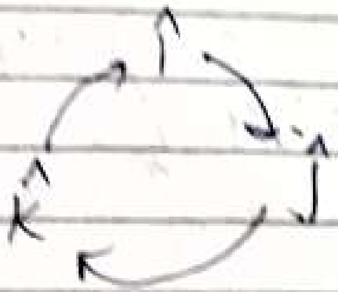
$\hat k \times \hat i = \hat j$

Date ________ Page No.: ________

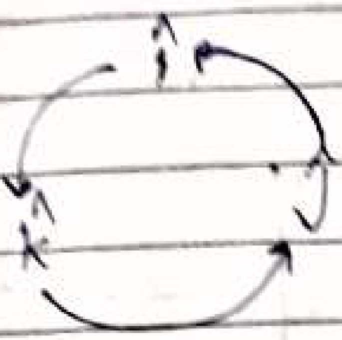
$\hat{j} \times \hat{i} = -\hat{k}$

$\hat{k} \times \hat{j} = -\hat{i}$

$\hat{i} \times \hat{k} = -\hat{j}$



Clockwise = +ve



anticlockwise = -ve

Quest $\vec{A} = 5\hat{i}$

$\vec{B} = 2\hat{k}$

$\vec{A} \times \vec{B} = 5\hat{i} \times 2\hat{k}$

$= -10\hat{j}$

$\vec{B} \times \vec{A} = 10\hat{j}$

$$\boxed{\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}}$$

Quest- $\vec{A} = 2\hat{i} + 3\hat{j} + 4\hat{k}$.
$\vec{B} = 3\hat{i} + 2\hat{j} + 3\hat{k}$.

$$\vec{A} \times \vec{B} = 6(0) + 4\hat{k} + 6(-\hat{j})$$
$$9(-\hat{k}) + 6(0) + 9\hat{i}$$
$$12\hat{j} + 8(-\hat{i}) + 12(0)$$

$$\vec{A} \times \vec{B} = \hat{i} + 6\hat{j} - 5\hat{k}$$

Short cut.

	$\hat{i}$	$\hat{j}$	$\hat{k}$
A	2	3	4
B	3	2	3

$$\vec{A} \times \vec{B} = \hat{i}(9-8) - \hat{j}(6-12) + \hat{k}(4-9)$$

$$\vec{A} \times \vec{B} = 1\hat{i} - (-6)\hat{j} + (-5\hat{k})$$

$$\boxed{\vec{A} \times \vec{B} = \hat{i} + 6\hat{j} - 5\hat{k}}$$

Quest- Find the mag. of $\vec{A} \times \vec{B}$ if $A = 2\hat{i} + \hat{j} - \hat{k}$

and $B = 6\hat{i} + 3\hat{j} - 3\hat{k}$

Date __/__/__ Page No.: ____

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 1 & -1 \\ 6 & 3 & -3 \end{vmatrix}$$

$\Rightarrow \hat{i}(-3+3) - \hat{j}(-6+6) + \hat{k}(6-6)$

$\Rightarrow \hat{i}(0) - \hat{j}(0) + \hat{k}(0)$

$\Rightarrow 0$

$|\vec{A} \times \vec{B}| = \sqrt{A_x^2 + A_y^2 + A_z^2}$

Mag 6 - If $\vec{A} \times \vec{B} = (3\hat{i} + 2\hat{j} + 4\hat{k})$

$|\vec{A} \times \vec{B}| = \sqrt{3^2 + 2^2 + 4^2}$ (Mag)

Date __/__/__ Page No.: ____

* If $\vec{A} \times \vec{B} = 0$

Either $A = 0$ or $B = 0$

or

$|A||B| \sin\theta = 0$

$\sin\theta = 0$

$\theta = 0^\circ$

$\vec{A} \cdot \vec{B} = 0$

$\theta = \perp$ or 90°

$\vec{A} \times \vec{B} = 0$

$\theta = 0^\circ$

Quest- $|\vec{A}| = 5$ (Mag)

$|B| = 6$.

$|\vec{A} \times \vec{B}| = 15$ (Mag)

find angle btw A & B

$|\vec{A} \times \vec{B}| = |A| |B| \sin\theta$.

$15 = 5 \times 6 \sin\theta$

$\sin\theta = \frac{1}{2}$, $\theta = 30^\circ$ and 150°

Find angle between $\vec{A}$ & $\vec{B}$.

$|\vec{A}\times\vec{B}| = |A.B|$

$|A||B|\sin\theta = |A||B|\cos\theta$.

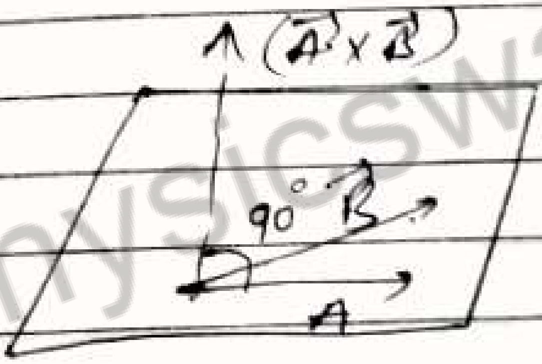
$\frac{\sin\theta}{\cos\theta} = 1$

$\tan\theta = 1$

$\boxed{\theta = 45^\circ}$ or $\frac{\pi}{4}$ $\pi \to 180^\circ$

$A.(\vec{A}\times\vec{B}) = ?$

$\vec{A}.(\vec{A}\times\vec{B})$



$\vec{A}.(\vec{A}\times\vec{B}) = 0$

$(\perp)$ to $(\vec{A}\times\vec{B})$.

If $\vec{A}.\vec{B}=0$

$\vec{A}.\vec{C}=0$

then $\vec{A}$ is $\parallel$ to

(a) $\vec{C}$ (c) $\vec{B}\times\vec{C}$

(b) $\vec{B}$ (d) $B.C$

* Vectors are which follows ||gm law

Page No.:

Date / /

Unit Vectors

eg:- current is not vector,

⇒ Magnitude = 1

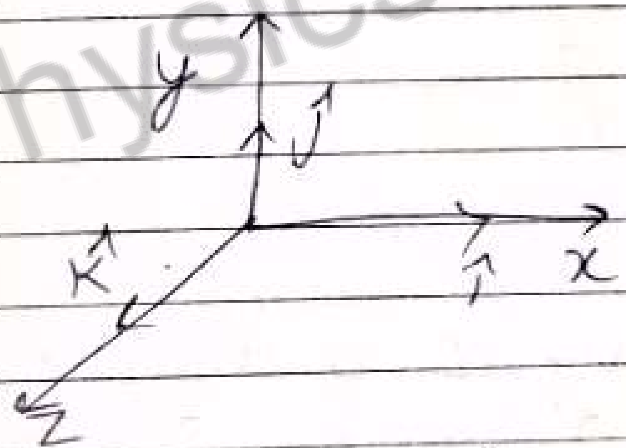
➤ It gives direction.

$\vec{A}$ = Magnitude × direction

$\vec{A} = |A| \times \hat{A}$

$\hat{A} = \dfrac{\vec{A}}{|A|}$

Orthogonal unit vector



Ques:- A force 10 N is in x direction. Represent it in vector form

$\vec{F} = 10\hat{i}$

$\boxed{\vec{F} = 10\hat{i}}$