$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^2(x)\,dx$$

$$\cos(2x) = 1 - 2\sin^2 x$$

$$\sin^2 x = \frac{1-\cos(2x)}{2}$$

$$\int \frac{1-\cos(2x)}{2}\,dx$$

$$= \int \frac{1}{2}\,dx - \frac{1}{2}\int \cos(2x)\,dx$$

$$= \left[\frac{1}{2}x - \frac{1}{2}\left[\frac{1}{2}\sin(2x)\right]\right]_{-\frac{\pi}{2}}^{\frac{\pi}{2}}$$

$$= \frac{1}{2}\left\{\frac{\pi}{2} - \frac{1}{2}\sin(2\pi/2) - (-\pi/2) + \frac{1}{2}\sin(2(-\pi/2))\right\}$$

$$= \frac{1}{2}\left(\frac{\pi}{2} - \frac{1}{2}\cancel{\sin(\pi)}^{0} + \pi/2 + \frac{1}{2}\cancel{\sin(-\pi)}^{0}\right]$$

$$= \frac{1}{2}\left[\frac{\pi}{2} + \pi/2\right]$$

$$= \frac{\pi}{2} \quad \text{Ans}$$

Ex

$$\int (\cos^3\theta)\,\underline{\sin\theta\, d\theta}$$

let $\cos\theta = t$

$\sin\theta\, d\theta = -dt$

$$= -\int (t)^3\, dt$$

$$= -\frac{t^{3+1}}{3+1} + C$$

$$= -\frac{1}{4}\cos^4\theta + C$$

VECTOR

Physical Quantity

Scalar

→ magnitude

Ex - mass, volume, distance, work, density, Power, Electric flux, current, Resistance, voltage, etc.

Speed,

Mass of object = 20 kg

Temp of room = 37°C

VECTOR

→ magnitude

→ Direction

→ follow law of vector addition

Ex - displacement, velocity, acceleration, Force, Linear momentum, Impulse, Ang. momentum, Torque, Electric field, magnetic field, Dipole moment,

Ex A person is moving in East direction with speed 20 m/s

$$\boxed{\text{Velocity} = 20 \times \text{East}}$$

Representation of Physical Quantity

→ Symbolic / Alphabatic

→ Geo-metrical Rep.

Velocity = $\vec{v}$

Speed = v = $|\vec{v}|$

Acceleration = $\vec{a}$

Force = $\vec{F}$

Work = W

Power = P

Linear momentum = $\vec{P}$

Electric field = $\vec{E}$

magnetic field = $\vec{B}$

distance = d

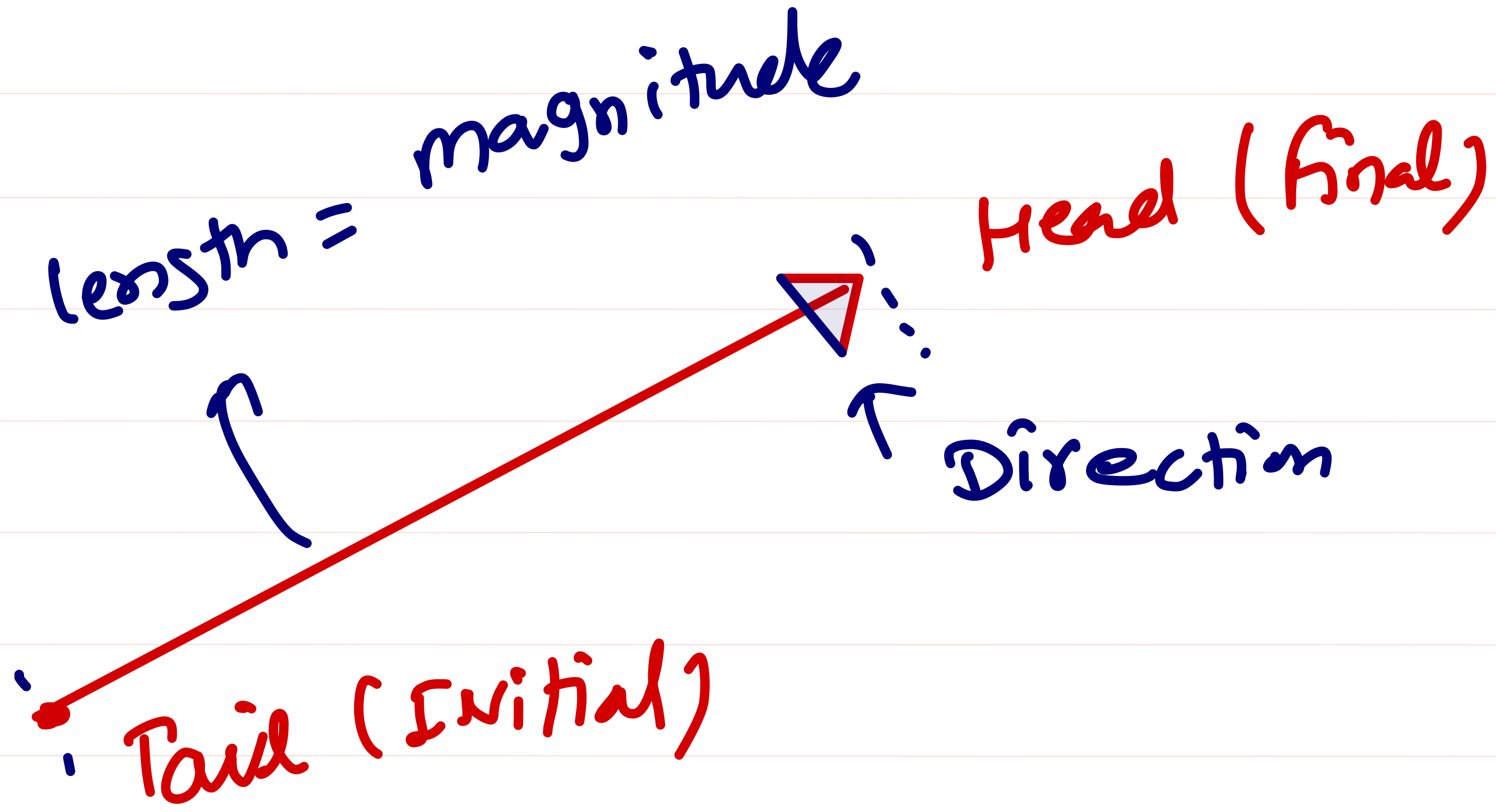
displacement = $\vec{S}$

Ang. velocity = $\vec{\omega}$ (omega)

Ang. Acceleration = $\vec{\alpha}$ (Alpha)

Torque = $\vec{\tau}$ (Tau)

(ii)



Magnitude of vector Quantity

= mode of Quantity

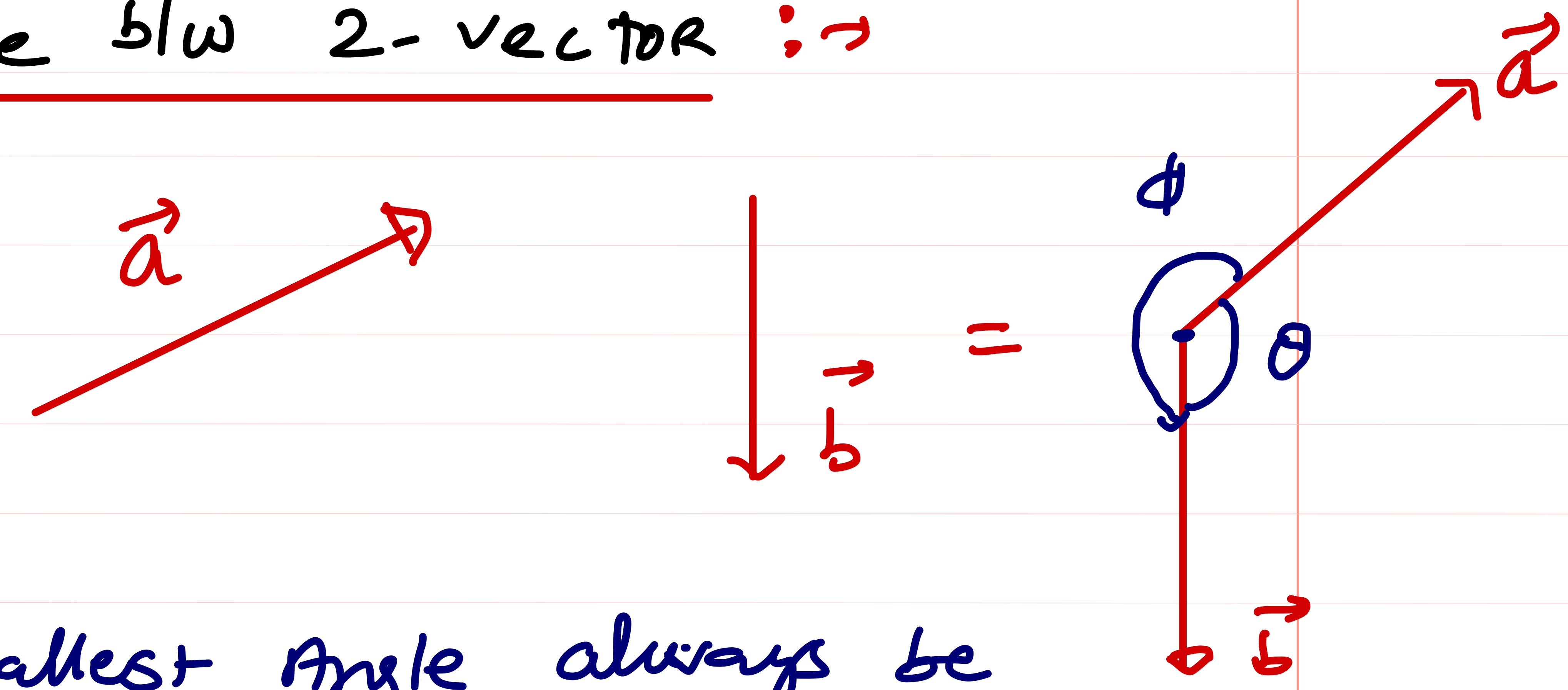
= value of Quantity

$|\vec{a}| = a$ = magnitude

$|\vec{F}| = F$

$|\vec{v}| = v$

Angle b/w 2-vector :→



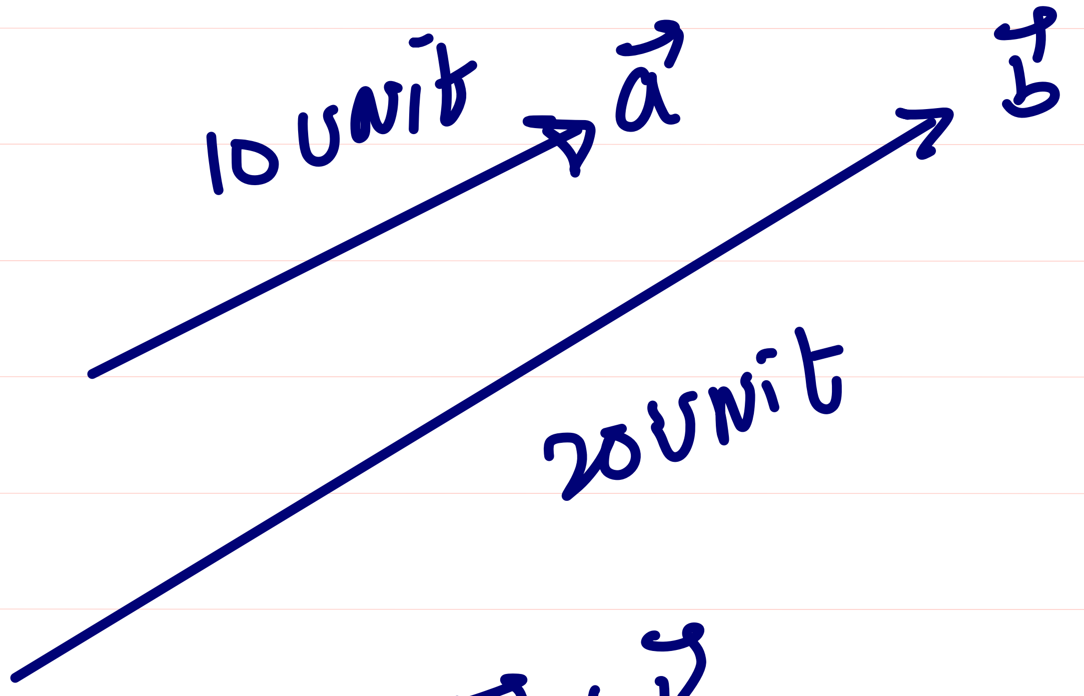
→ Smallest Angle always be Angle b/w 2-vector

Here Angle b/w $\vec{a}$ & $\vec{b}$ is θ

NOTE :→ We can move a vector from one place to another without changing its Direction and magnitude

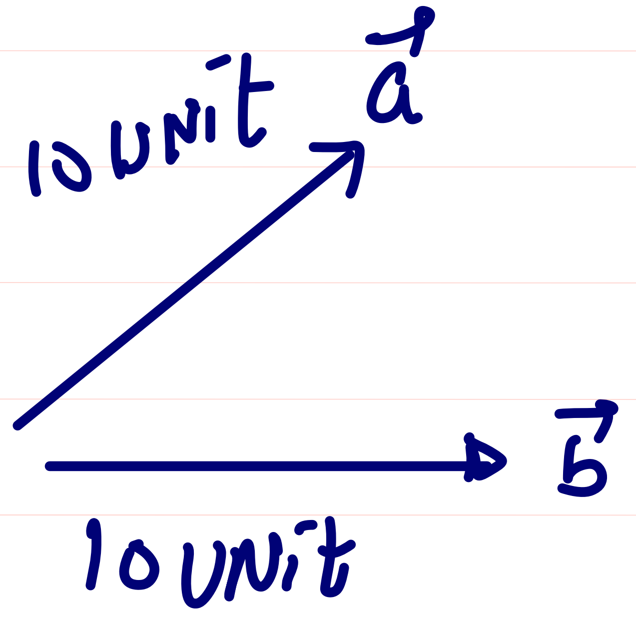
Note: How one can change a vector

1. By changing its magnitude
2. By changing its Direction
3. By Rotating



$\vec{a} \neq \vec{b}$

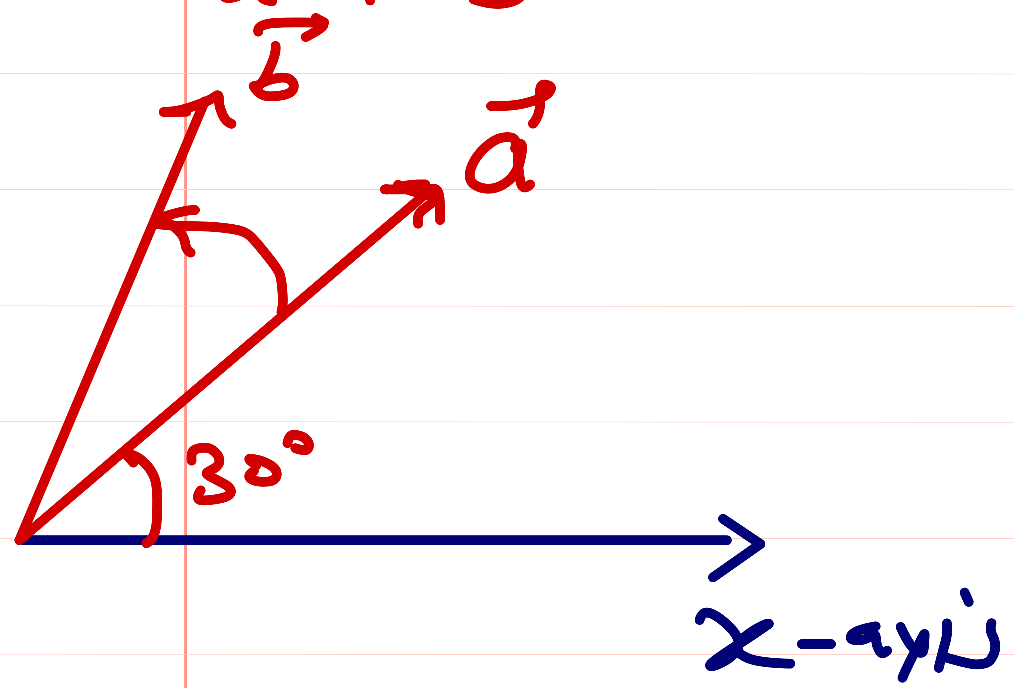
magnitude change



$\vec{a} \neq \vec{b}$

Direction is diff.

Rotated by 15°



$\vec{b} \neq \vec{a}$

Types of vector :→

① Equal vector

If $\vec{a} = \vec{b}$

$|\vec{a}| = |\vec{b}|$ = both have same magnitude

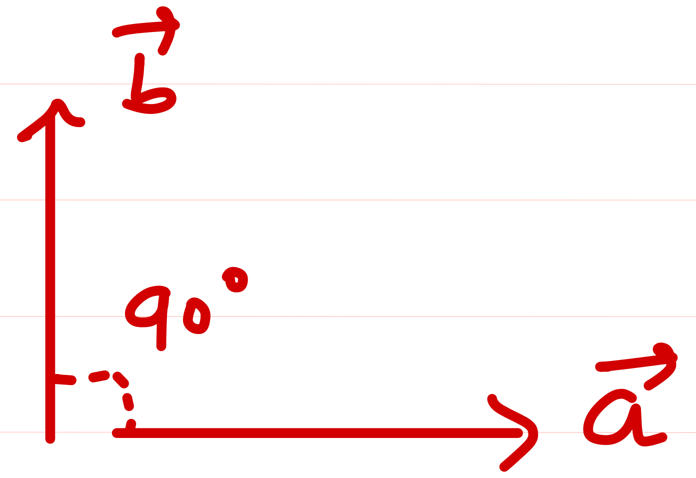
both have same Direction

$\longrightarrow \vec{a}$

$\longrightarrow \vec{b}$

Angle b/w = $0°$

② Normal vector (Perpendicular / orthogonal)



$$\boxed{\text{Angle} = 90° \text{ OR } \frac{\pi}{2} \text{ rad}}$$

③ Unit vector

↳ A vector whose magnitude is one

↳ use for Rep. Dirn of vector

↳ Symbol $\hat{a}$ (a cap)

$\hat{F}$ $\quad \hat{n}$ $\quad \hat{i}$ $\quad \hat{j}$ $\quad \hat{k}$

$|\hat{F}| = |\hat{n}| = |\hat{i}| = |\hat{j}| = |\hat{k}| = 1$

Vector = magnitude × Dir^n

Dir^n = $\frac{\text{Vector}}{\text{magnitude}}$

$$\boxed{\hat{a} = \frac{\vec{a}}{|\vec{a}|} = \frac{\vec{a}}{a}}$$

Unit vector Along x-axis = $\hat{i}$

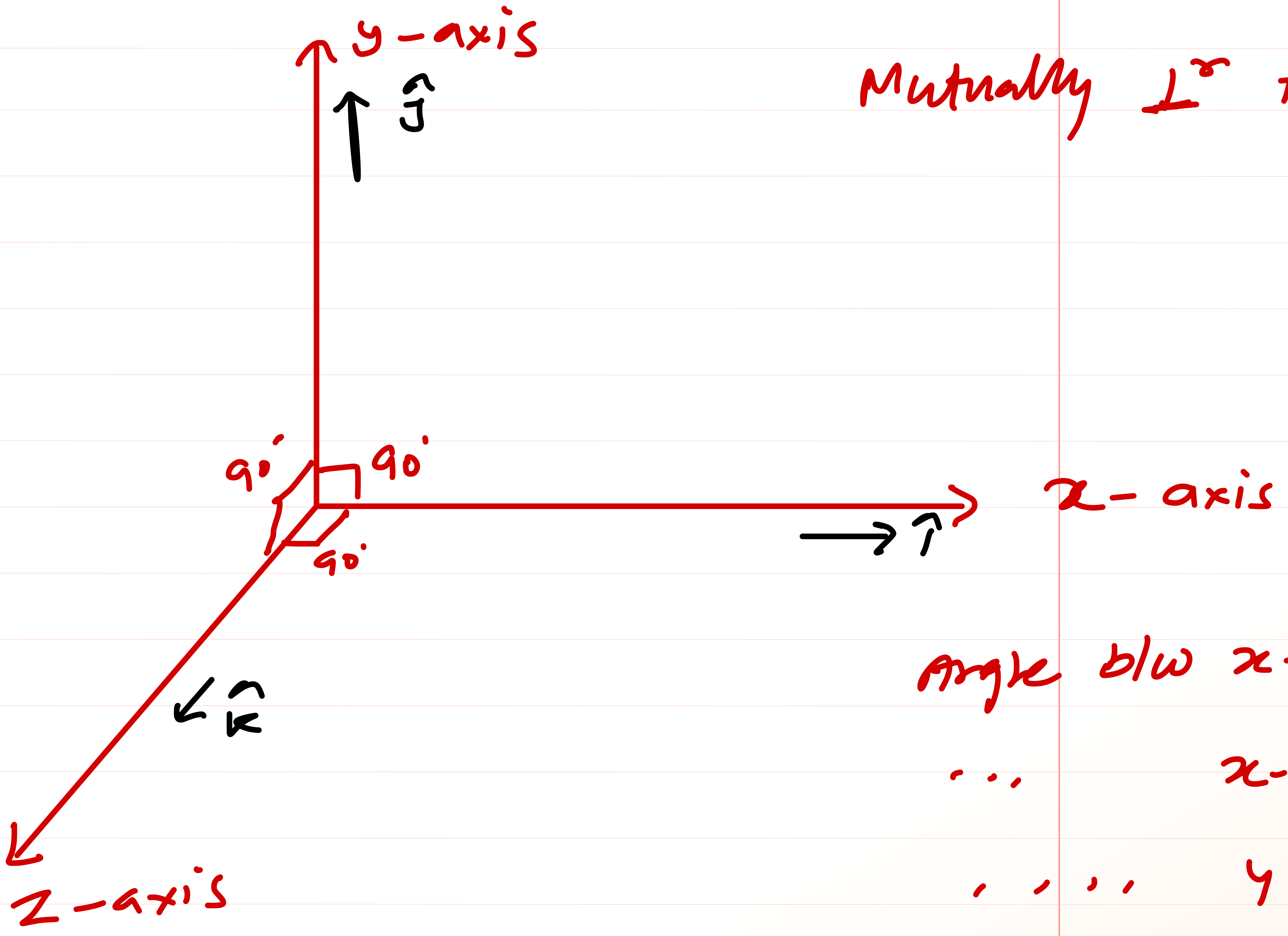
Unit vector Along y-axis = $\hat{j}$

Unit vector Along z-axis = $\hat{k}$

Unit vector Along −x-axis = $-\hat{i}$

" " " " −y-axis = $-\hat{j}$

" " " " −z-axis = $-\hat{k}$



Mutually ⊥^{r} to each other

Angle b/w x-y = 90°

" " x-z = 90°

" " y-z = 90°

$\vec{v} = 20\hat{j}$ (m/s)

$\vec{v} = -10\hat{k}$ m/s