Razdaan Notes

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Chapter#3 (Vectors):

Notes:

- north of east → start from east to northward.
- east of due north → start from N to eastward
- $\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$ | $\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k}$
- Resultant vector:

$$\vec{R} = R_x\hat{i} + R_y\hat{j} + R_z\hat{k}$$

- $\vec{R_x} = B_x\hat{i} + A_x\hat{i}$

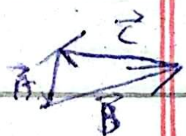
Similarly others.

- $|\vec{A}| = \sqrt{A_x^2 + A_y^2 + A_z^2}$
- $|\vec{R}| = \sqrt{R_x^2 + R_y^2 + R_z^2}$
- $R_x = A_x + B_x$
- $\vec{R_x} = A_x\hat{i} + B_x\hat{i}$

or $= (A_x + B_x)\hat{i}$

- minimum dist → find components then add them as scalars (not vectors)
- $\vec{B} + \vec{C} = \vec{A}$

$\vec{C} = \vec{A} - \vec{B}$



- $\phi = \tan^{-1}\left(\frac{A_y}{A_x}\right)$

or

- $\phi = \tan^{-1}\left(\frac{R_y}{R_x}\right)$ → without sign

now

$-\,+$	$+\,+$
$\theta = \pi - \phi$	$\theta = \phi$
$-\,-$	$+\,-$
$\theta = \pi + \phi$	$\theta = 2\pi - \phi$

- Ground velocity = (v_x, v_y)
- Ground speed = $|v_x, v_y|$

- Position & Displacement:

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

- $\Delta\vec{r} = \vec{r_2} - \vec{r_1}$
- Always resolve vector in $x, y, (z)$ components.
  - ↳ then add / Subtract
- always draw vector diagrams
- always resolve into components.

(b/c most mistakes happen if you do not split into x, y.)

- $\vec{A} + \vec{B} = \vec{B} + \vec{A}$
- $\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$
  - ↳ $(-\vec{B})$ = negative of vector $\vec{B}$
- $\hat{A} = \dfrac{\vec{A}}{|A|}$ (unit vector)
- $\vec{A} + (-\vec{A}) = \vec{0}$ = null vector.

addition of vectors = head to tail rule.

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

$\vec{a}+(\vec{b}+\vec{c}) = (\vec{a}+\vec{b})+\vec{c}$ (associative.)

θ ⊥ saath = base & hyp | hyp = longest approx slope

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

↳ $A_x = A\cos\theta$

$A_y = A\sin\theta$

→ $|\vec{A}| = \sqrt{A_x^2 + A_y^2}$

→ $\tan\theta = \dfrac{A_y}{A_x}$

if 1st Quad ← $\theta = \tan^{-1}\dfrac{A_y}{A_x}$

but cases

if other quads

find $\phi = \tan^{-1}\left(\dfrac{A_y}{A_x}\right)$

irrespective of signs

then check and apply suitable relation from given below

2nd	1st
$\theta = \pi - \phi$	$\theta = \phi$
3rd	4th
$\theta = \pi + \phi$	$\theta = 2\pi - \phi$

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

projection of B on A = $B\cos\theta$

projection of A on B = $A\cos\theta$

θ = b/w $\vec{A}$ & $\vec{B}$

$\vec{A}\cdot\vec{B} = \vec{B}\cdot\vec{A}$ (scalar product is commutative.)

$\hat{i}\cdot\hat{j} = 0$

bc $\hat{i}\cdot\hat{j} = (1)(1)\cos 90^\circ = 0$ ($\because \cos 90^\circ = 0$)

$\hat{i}\cdot\hat{i} = 1$

self product = sq of its magnitude

↳ $\vec{A}\cdot\vec{A} = AA\cos 0^\circ = A^2$

$\vec{A}\cdot\vec{B} = (A_x\hat{i} + A_y\hat{j} + A_z\hat{k})\cdot(B_x\hat{i} + B_y\hat{j} + B_z\hat{k})$

$= (A_xB_x + A_yB_y + A_zB_z)$ → scalar quantity.

$\vec{A}\times\vec{B} = AB\sin\theta\,\hat{n}$

$\hat{n}$ = unit vector ⊥ to plane containing A & B

its direction = Right hand rule.

R.H.R. = finger = first vector

curl in the direction of second vector

erect thumb = direction of $\hat{n}$

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

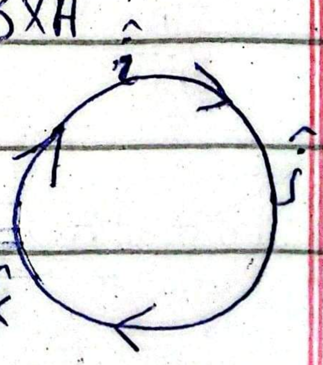
↳ $\vec{A}\times\vec{B} = -\vec{B}\times\vec{A}$

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

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

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

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



- F_{net} = +, − کر کے actual impact
- F_{total} = total +, + کر کے total forces.
- Avg velocity / acceleration میں
  eq of motions کو use کر دیا
- change in displacement ⇒ $\Delta d = d_2 - d_1$

- total disp ⇒ $d = d_1 + d_2$
- $\hat{i} \times \hat{i} = 0 \quad \because \sin 0° = 0$

- $$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$$
- $|\vec{A} \times \vec{B}|$ = area of parallelogram