* Engg. Mechanics *

→ Study of Motion of rigid bodies under the action of forces.

Statics (rest)
- → force & moment
- → Equilibrium
- → plane Trusses
- → principle of virtual work

Dynamics (motion)
- kinematics (motion) ($\vec{r}, \vec{v}, \vec{a}$)
- kinetic (motion a with caus of motior ($\vec{r}, \vec{v}, \vec{a},$

* Dynamics →

• Vector Algebra →

* Vector →

"Those physical quantities which have mag. as well as dirn and follows triangle law of vector addition." are called vector quantities."

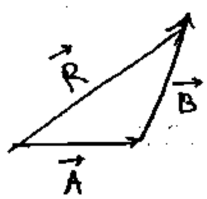
e.g. $\vec{V}, \vec{\omega}, \vec{P}, \vec{L}, \vec{F}, \vec{T}$ etc.

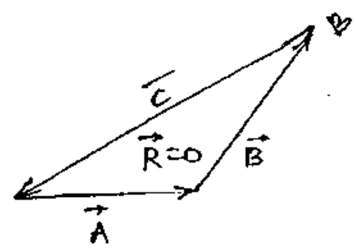
* Triangle law of vector addition →

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

$\vec{A} + \vec{B} + \vec{C} = 0$

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

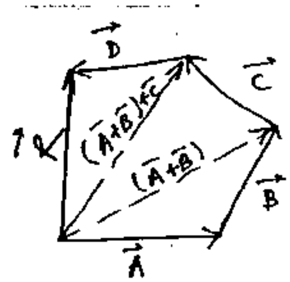


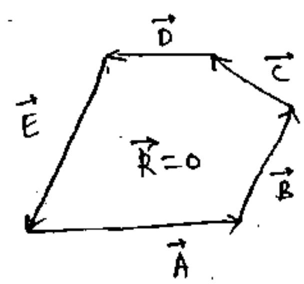


• polygon Rule →

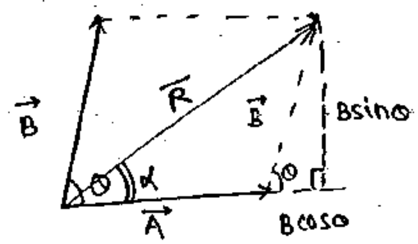
$\vec{R} = \vec{A} + \vec{B} + \vec{C} + \vec{D}$

$\vec{A} + \vec{B} + \vec{C} + \vec{D} + \vec{E} = 0$





* parallelogram law →



→ (most used condⁿ)

(outward vectors)

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

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

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

Note: [If head-head or Tail-Tail then (+ sign in) $2AB\cos\theta$ term

[If head-tail then, (-ve) sign].

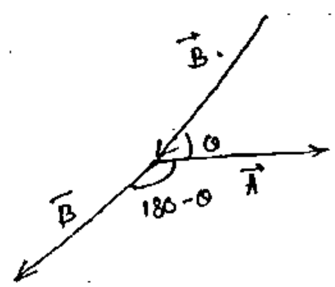
Vector = mag (dirⁿ)

unit vector = (1) (dirⁿ) = dirⁿ.

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

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

e.g ①

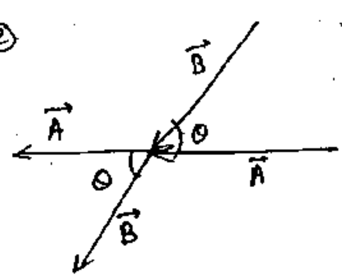


$$\therefore\ R = \sqrt{A^2 + B^2 + 2AB\cos(180 - \theta)}$$

$$= \sqrt{A^2 + B^2 + 2AB(-\cos\theta)}$$

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

②



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

Que.: Resultant of two vectors A & B is R. If B is doubled then the New Resultant is $\perp$ar to $\vec{A}$. then.

a) $A = B$

b) $A = R$

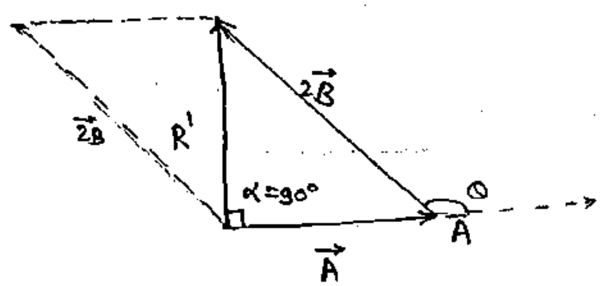
✓ c) $B = R \rightarrow$ <u>Ans</u>

d) None.

$\rightarrow$ $\underbrace{A \; \& \; B}_{\theta} \longrightarrow R$

$$\therefore R^2 = A^2 + B^2 + 2AB\cos\theta \text{ —— (1)}$$

$\underbrace{A \; \& \; 2B}_{\theta} \longrightarrow R'$



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

$$\therefore \tan\alpha = \frac{2B\sin\theta}{A + 2B\cos\theta}$$

$\tan 90° = \infty$

$$\therefore A + 2B\cos\theta = 0$$

$$\cos\theta = -\frac{A}{2B} \text{ —— (2)}$$

$\therefore$ from (1) & (2)

$$A^2 + B^2 + 2AB\left(\frac{-A}{2B}\right) = R^2$$

$$\therefore \boxed{B = R}$$