ARJUNA

NEET FASTRACK 2024

Lecture No. - 04

Physics

Motion in Straight Line

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TODAYS TARGETS

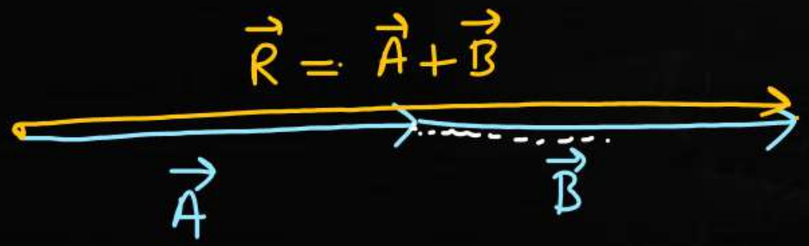
① Questions on Magnitude of Vectors.

② Subtraction of Vectors.

④ Rectangular Component of Vector.

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

Maximum value of $|\vec{R}|$ when $\theta = 0^\circ$



$$|\vec{R}|_{max} = \sqrt{A^2 + B^2 + 2AB(\cos(0^\circ))}$$

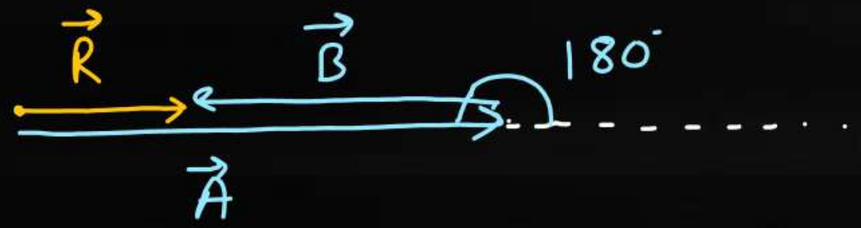
$$|R_{max}| = \sqrt{A^2 + B^2 + 2AB} = \sqrt{(A+B)^2}$$

$$\boxed{R_{max} = A + B}$$

- Maximum value of $\cos(\theta) = +1$ when $\theta = 0^\circ$
- Minimum value of $\cos\theta$ $\cos(\theta) = -1$ when $\theta = 180^\circ$

$$\boxed{-1 \leq \cos\theta \leq 1}$$

- Minimum Value of $|\vec{R}|$ when $\theta = 180°$



$$|\vec{R}|_{min} = \sqrt{A^2+B^2+2AB\cos(180°)}$$

$$|\vec{R}|_{min} = \sqrt{A^2+B^2+2AB(-1)}$$

$$\boxed{|\vec{R}|_{min} = \sqrt{A^2+B^2-2AB}}$$

$$|\vec{R}_{min}| = \sqrt{(A-B)^2}$$

$$\boxed{|\vec{R}|_{min} = A-B}$$

→ if $\vec{R} = \vec{A} + \vec{B}$ then,

$$|A - B| \leq |\vec{R}| \leq |A + B|$$

$$4 \leq |\vec{R}| \leq 16$$

Q:→ If $|\vec{A}| = 10$ units

$|\vec{B}| = 6$ units.

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

Then which of following can be Value of $|\vec{R}| = ?$

(A) 18 (B) 2 (C) 8 (D) 20

$|\vec{R}|_{max} = 10 + 6 = 16$ unit.

$|\vec{R}|_{min} = |10 - 6| = 4$

Q :→ if $|\vec{A}| = 12$ units

$|\vec{B}| = 5$ units.

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

then $|\vec{R}|$ <u>can-not</u> be equal to.

(A) 8

(B) 5

(C) 15

(D) 17

$R_{max} = 12 + 5 = 17$.

$R_{min} = 12 - 5 = 7$

Q:→ If $|\vec{A}| = 20$ units

$|\vec{B}| = 12$ units

$\vec{R} = \vec{A} + \vec{B}$, then $|\vec{R}|$ Can-not be.

$8 \leq |\vec{R}| \leq 32$

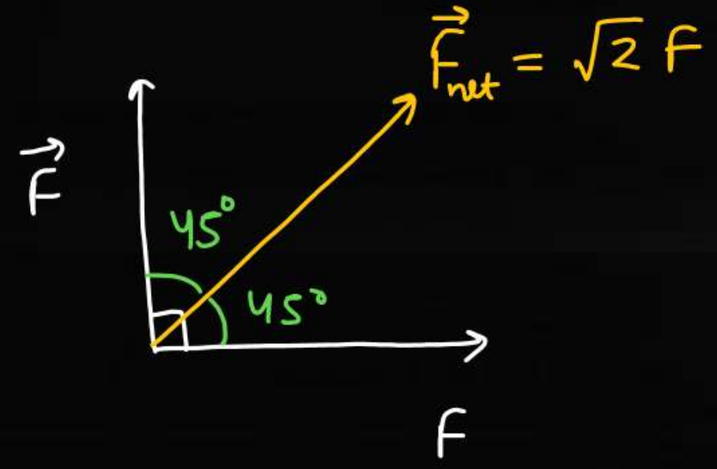
(A) 10 units ✓

(B) 24 units ✓

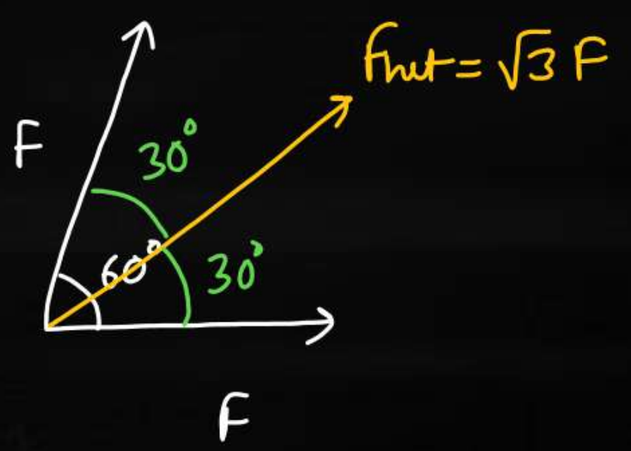
(C) 30 units. ✓

(D) 36 units.

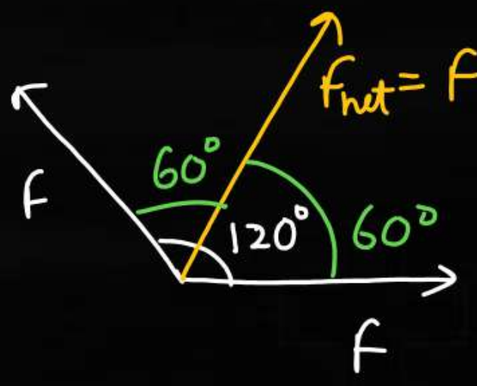
Recap:

① 

- Two vectors of Equal Magnitude at $\theta = 90°$ will have Resultant $\sqrt{2}F$.

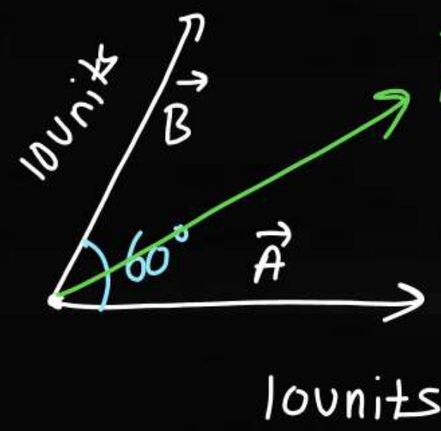
② 

- Two vectors of equal Magnitude at $\theta = 60°$ will have $F_{Res} = \sqrt{3}F$.

③ 

- Two vectors of Equal Magnitude at $\theta = 120°$ will have $\vec{F}_{net} = F$

Q: →

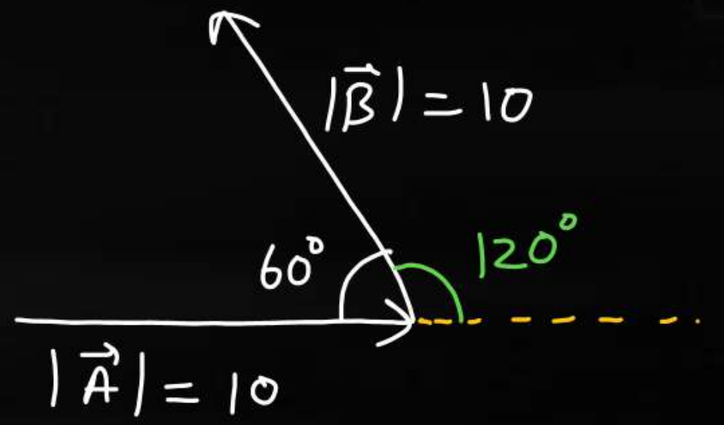


$\vec{R} = \sqrt{3}\,10$

$\vec{R} = 10\sqrt{3}$

$\vec{R} = |\vec{A} + \vec{B}|$, Find $|\vec{R}|$

Q: →



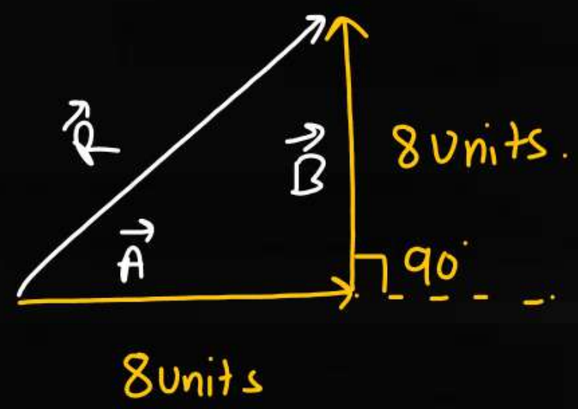
Fing $|\vec{R}|$, where $\vec{R} = \vec{A} + \vec{B}$

$|\vec{R}| = 10\sqrt{3}$ units ✗

$|\vec{R}| = 10$ units ✓

Logic θ is 120° Not 60°

∴



Find $|\vec{R}| = ?$

$$|\vec{R}| = \sqrt{2}(8)$$

$$= 8\sqrt{2} \text{ units.}$$

Q:→ if $\vec{R} = \vec{A} + \vec{B}$ and.

$$\boxed{|\vec{R}| = \sqrt{A^2 + B^2}}$$

Find Angle b/w $\vec{A}$ & $\vec{B}$.

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

Squaring Both side.

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

$$2AB\cos\theta = 0$$

$$\cos\theta = 0 \Rightarrow \boxed{\theta = 90^\circ}$$

Subtraction of Vectors :

→ There is No Rule / Law for Subraction in Vectors Alzebra.

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

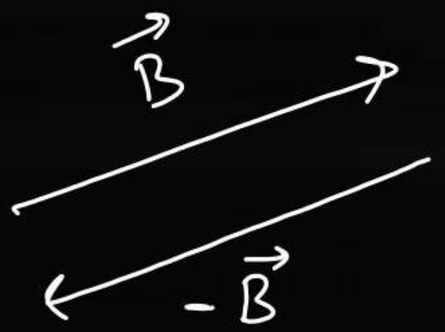
$$\boxed{\vec{R} = \vec{A} + (-\vec{B})}$$

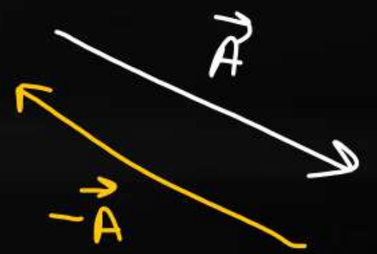
Vector Quantity :

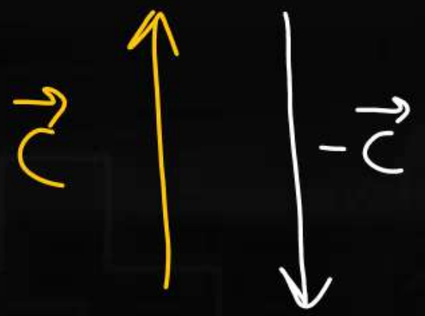
① Quantities that Need Direction & Magnitude for complete Description.

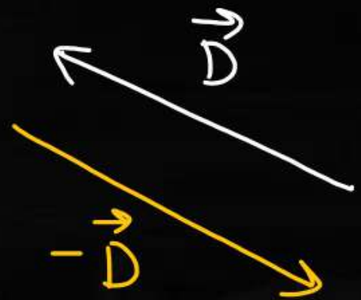
② Thy must follow Vector Law of Alzebra..

Negative of Vector

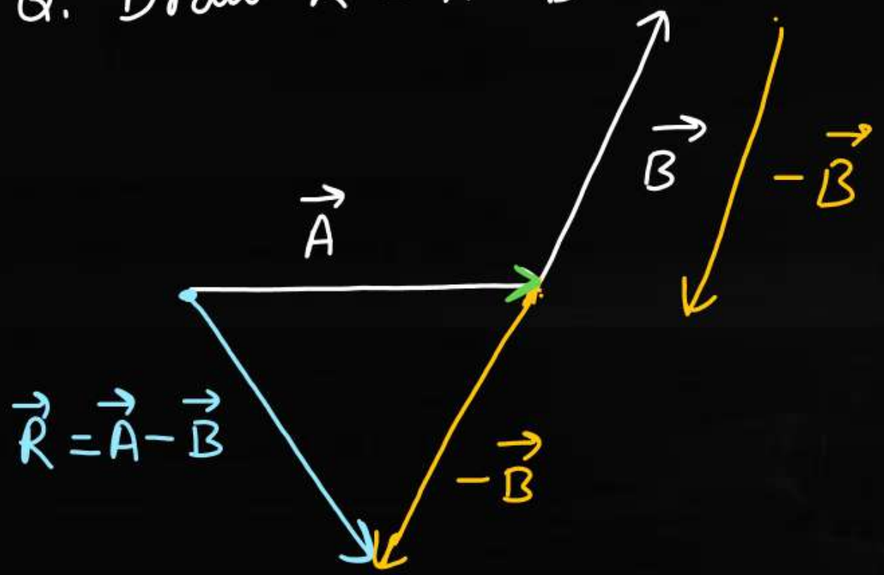
① 

② 

③ 

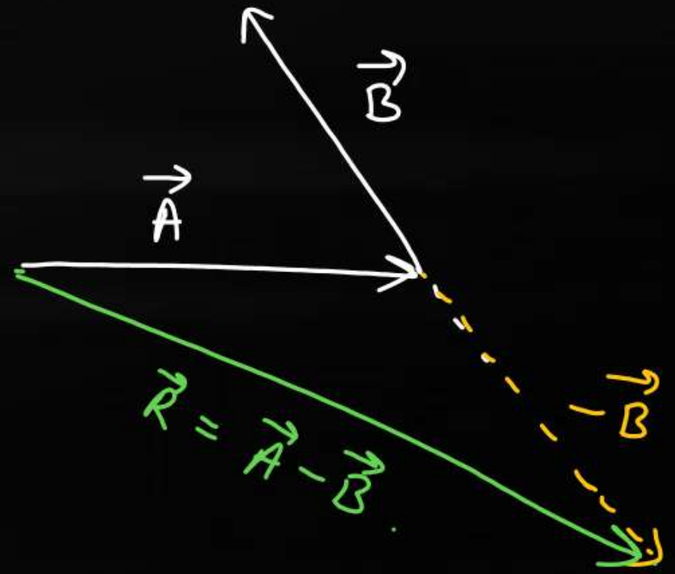
④ 

Q:→ Q: Draw $\vec{R} = \vec{A} - \vec{B} = \vec{A} + (-\vec{B})$

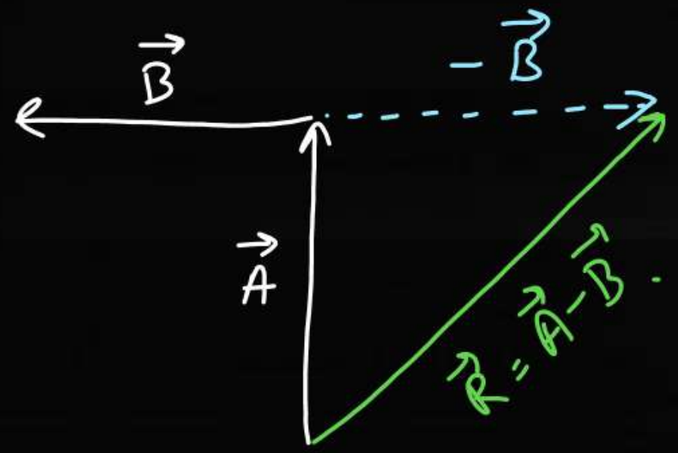


Q:→ Draw $\vec{R} = \vec{A} - \vec{B}$

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

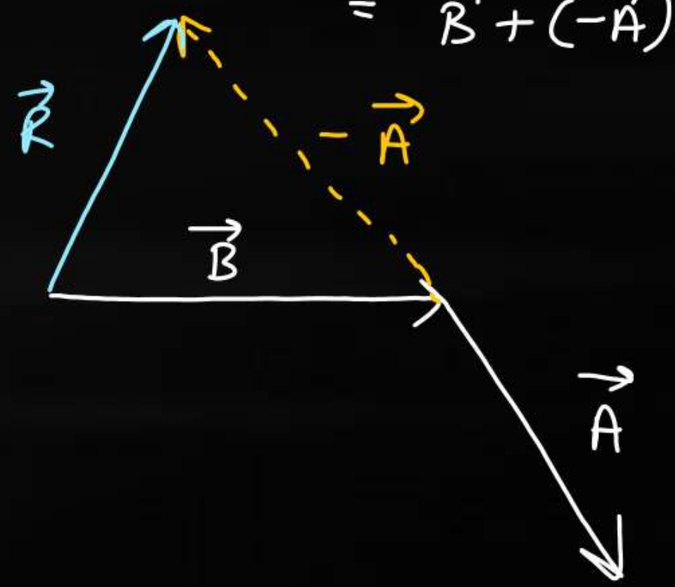


Q:→ Draw $\vec{R} = \vec{A} - \vec{B} = \vec{A} + (-\vec{B})$



Q:→ Draw $\vec{R} = \vec{B} - \vec{A}$

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



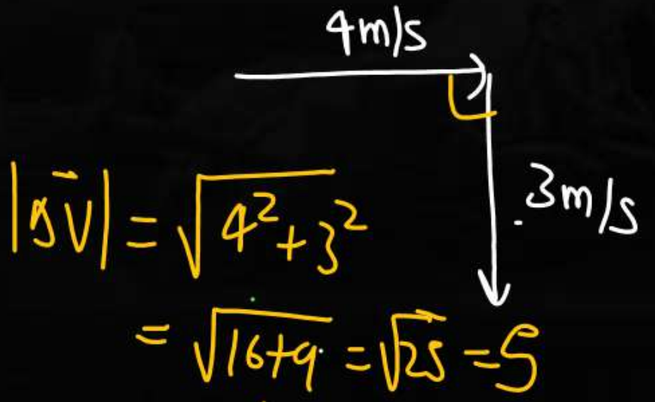
Q:→ A man travelling with 3m/s Along North, turns towards East and start walking with 4m/s. towards East.

find <u>change in its Velocity</u>.

$$\Delta\vec{V} = \vec{V}_f - \vec{V}_i$$

$$= \vec{V}_f + (-\vec{V}_i)$$

$$\vdots$$



initial

A man travelling with speed 6m/s in East turns towards South and starts moving with speed 4m/s. find change in its velocity.

final.

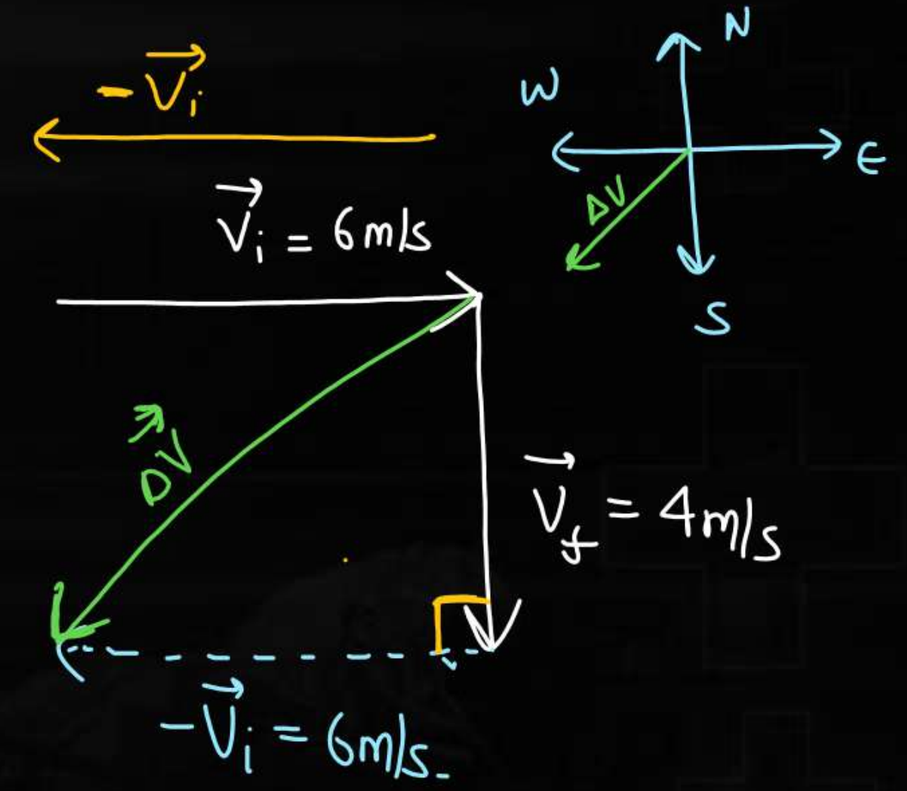
$$\Delta\vec{V} = \vec{V}_f - \vec{V}_i$$

$$\Delta\vec{V} = \vec{V}_f + (-\vec{V}_i)$$

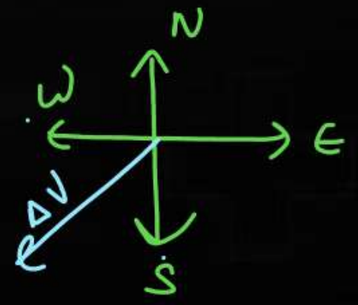
$$|\Delta\vec{V}| = \sqrt{4^2 + 6^2}$$

$$= \sqrt{16 + 36}$$

$$|\Delta\vec{V}| = \sqrt{52}\,(S\text{-}W)$$

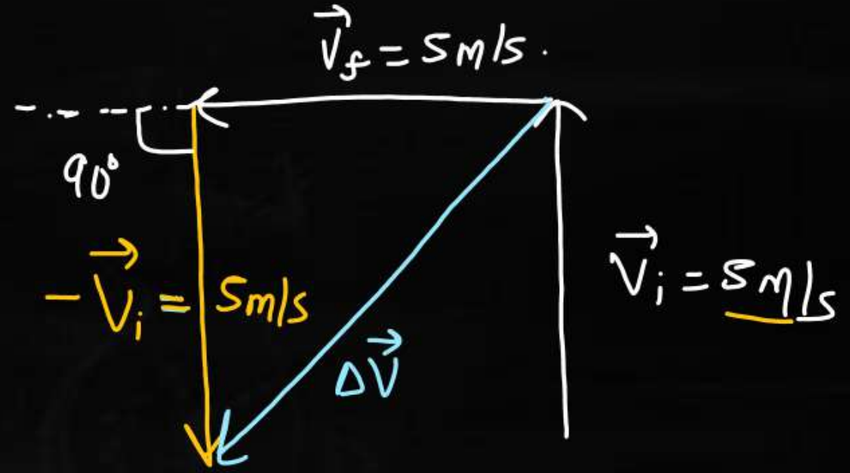


Q:→ A Boat travelling with speed 5m/s in North Direction turns towards West and continue Moving with same speed. find the change in its Velocity.



$$\Delta\vec{V} = \vec{V}_f - \vec{V}_i$$

$$= \vec{V}_f + (-\vec{V}_i)$$



$$|\Delta\vec{V}| = \sqrt{2}\cdot 5$$

$$= 5\sqrt{2}\ m/s\ (S\text{-}W)$$


THANK You