
YAKEEN
NEET 2.0
2026
Vectors
Physics
Lecture - 3
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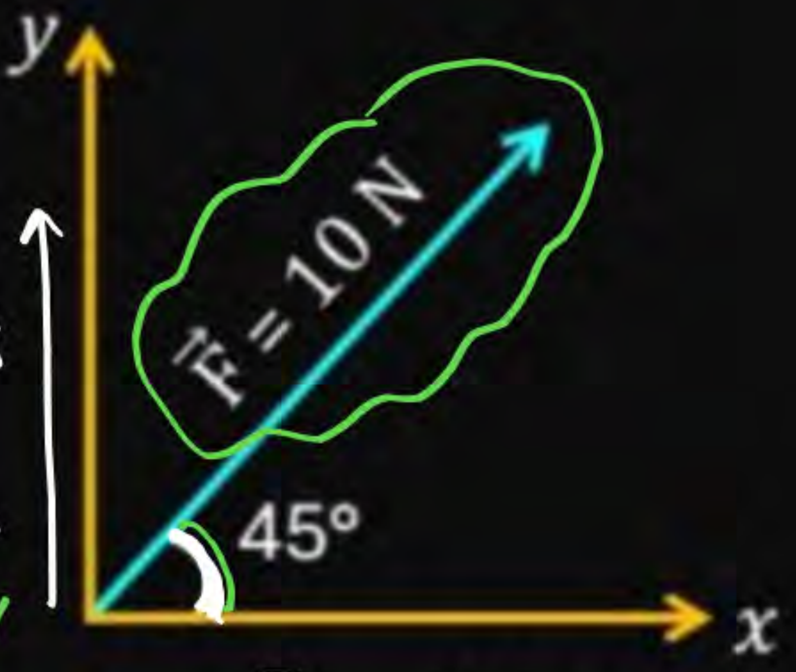
Topics to be covered

H/W

1. [redacted] direction vector
2. [redacted] finding unit vector ✓
3. [redacted] Vector addition → Triangle law of vector addition.
4. [redacted]


@MRPHYSICSS

H/W



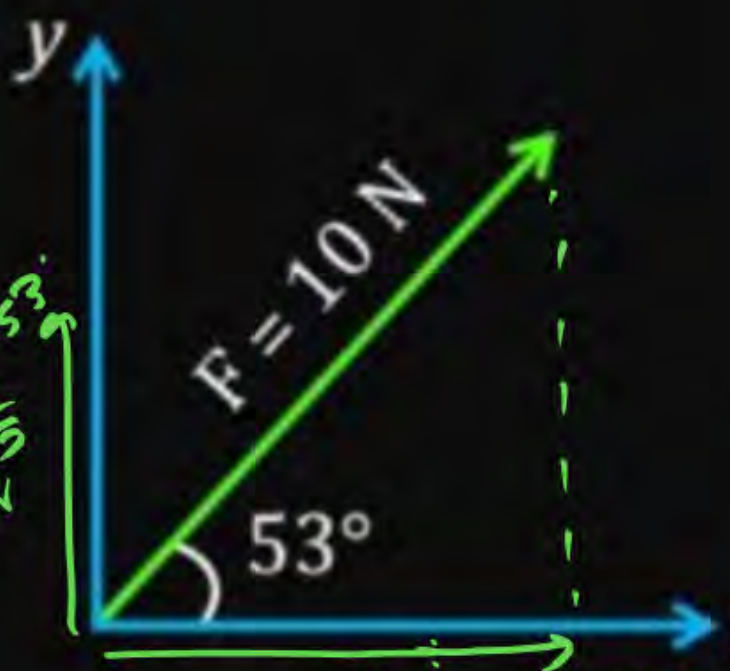
$F_y = 10\sin 45°$

$F_y = 10 \times \frac{1}{\sqrt{2}}$

$= \frac{10}{\sqrt{2}} N$ ✓

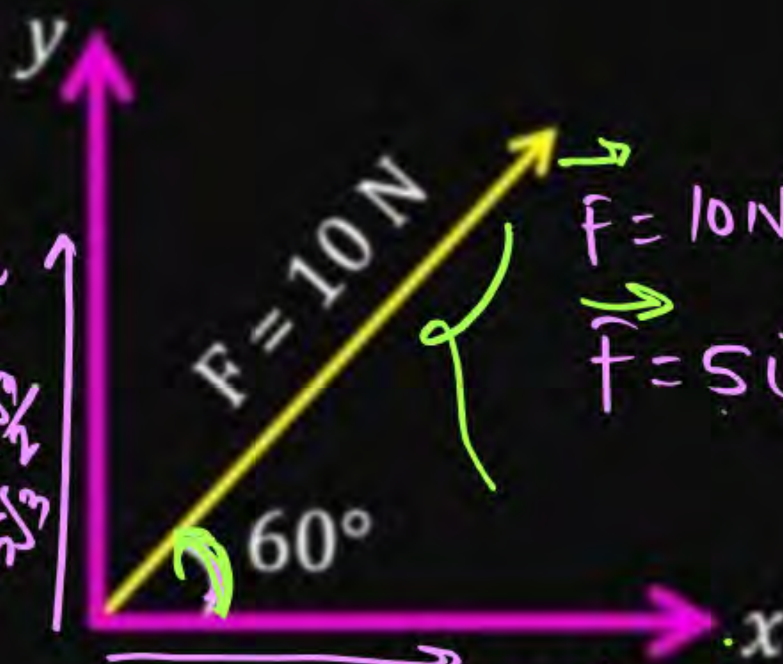
$F_x = F\cos 45°$

$= 10 \times \frac{1}{\sqrt{2}} = \frac{10}{\sqrt{2}} N$ ✓



$F_y = 10\sin 53° = 10 \times \frac{4}{5} = 8N$

$F_x = 10\cos 53° = 10 \times \frac{3}{5} = 6N$



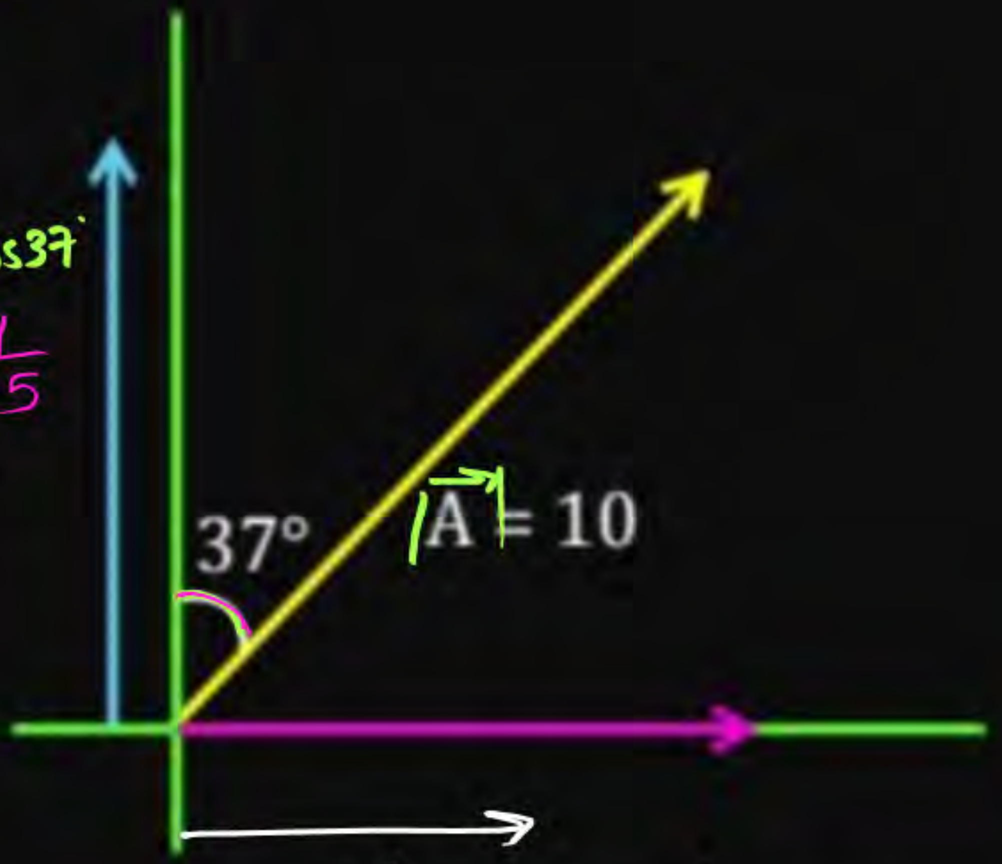
$F_y = 10\sin 60° = 10 \times \frac{\sqrt{3}}{2} = 5\sqrt{3}$

$F_x = 10\cos 60 = 10 \times \frac{1}{2} = 5N$

$\vec{F} = 10N$ at angle 60° from x-axis ✓

$\vec{F} = 5\hat{i} + 5\sqrt{3}\hat{j}$

H/W



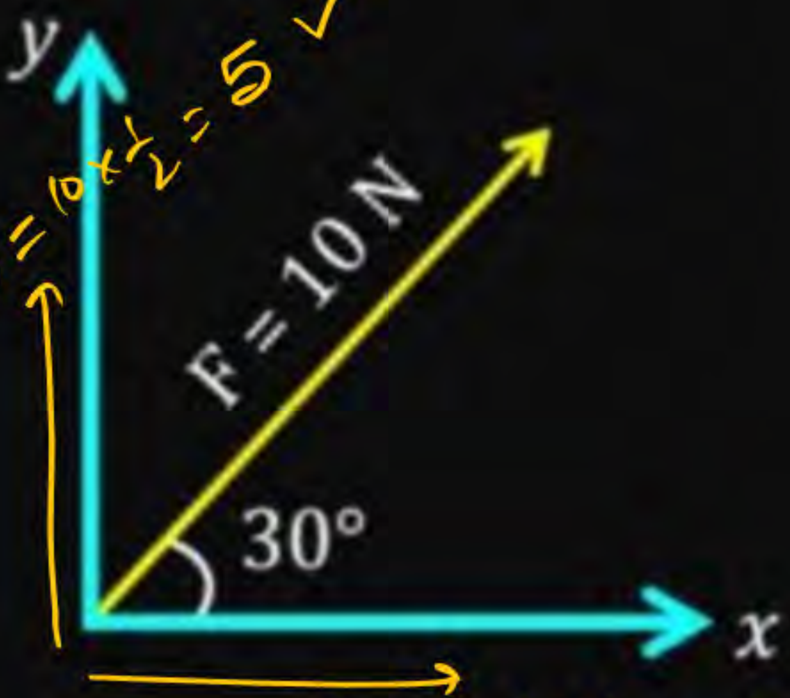
$A_y = 10\cos 37^\circ$

$= 10 \times \frac{4}{5}$

$= 8$

$A_x = 10\sin 37^\circ$

$= \cancel{10}^{2} \times \frac{3}{\cancel{5}} = \underline{\underline{6}}$



$10\sin 30^\circ = 10 \times \frac{1}{2} = 5$ ✓

$F_x = 10\cos 30^\circ = 10 \times \frac{\sqrt{3}}{2} = 5\sqrt{3}$

Question H/W

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

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

Find magnitude of Vector:

$\vec{A} = 2\hat{\imath} + 3\hat{\jmath}$ $\rightarrow |\vec{A}| = \sqrt{2^2 + 3^2} = \sqrt{4+9} = \sqrt{13}$

$\vec{B} = 3\hat{\imath} + 4\hat{\jmath}$ $\longrightarrow |\vec{B}| = \sqrt{3^2 + 4^2} = 5$

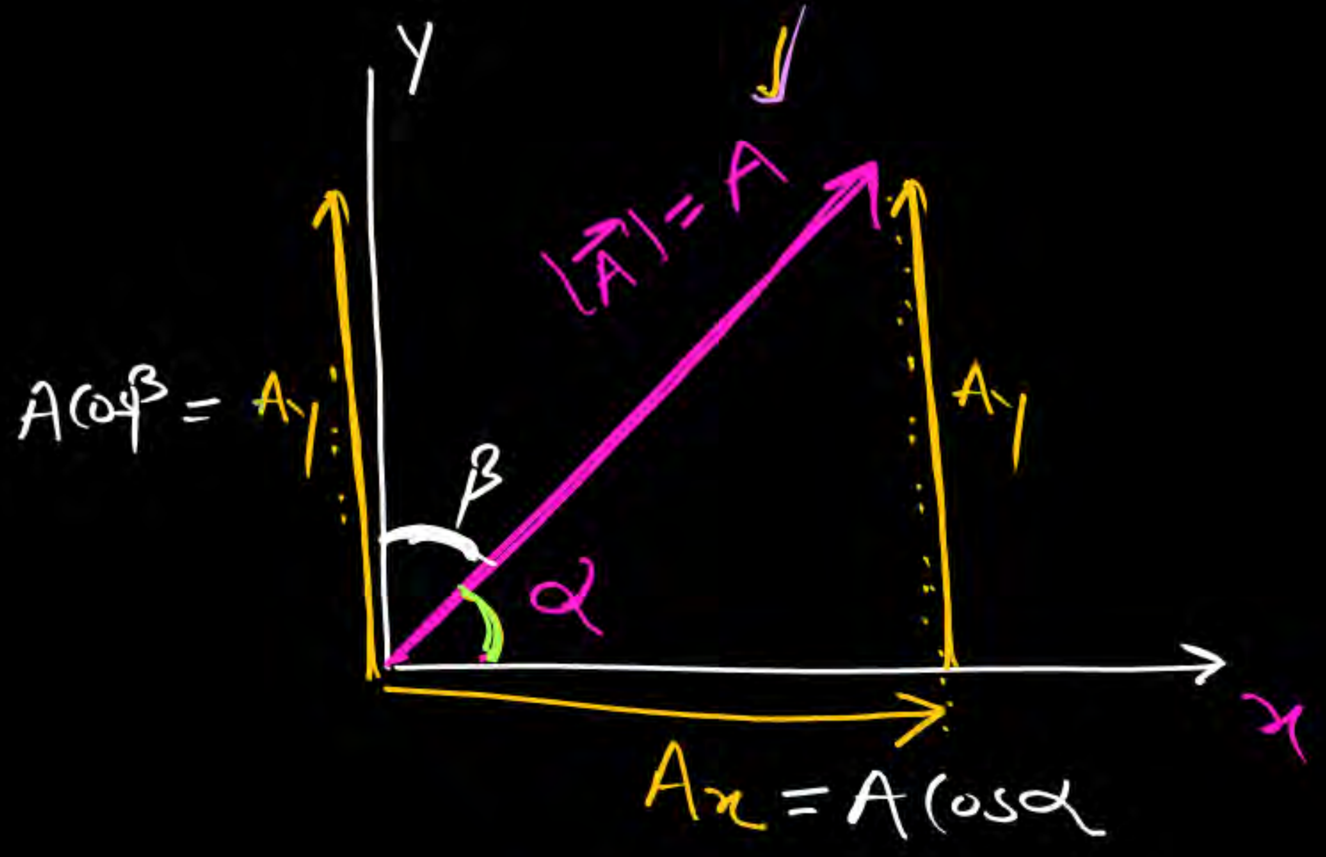
$\vec{C} = 3\hat{\imath} + 4\hat{\jmath} + 5\hat{k}$ $\longrightarrow |\vec{C}| = \sqrt{3^2 + 4^2 + 5^2} = \sqrt{9+16+25} = \sqrt{50}$

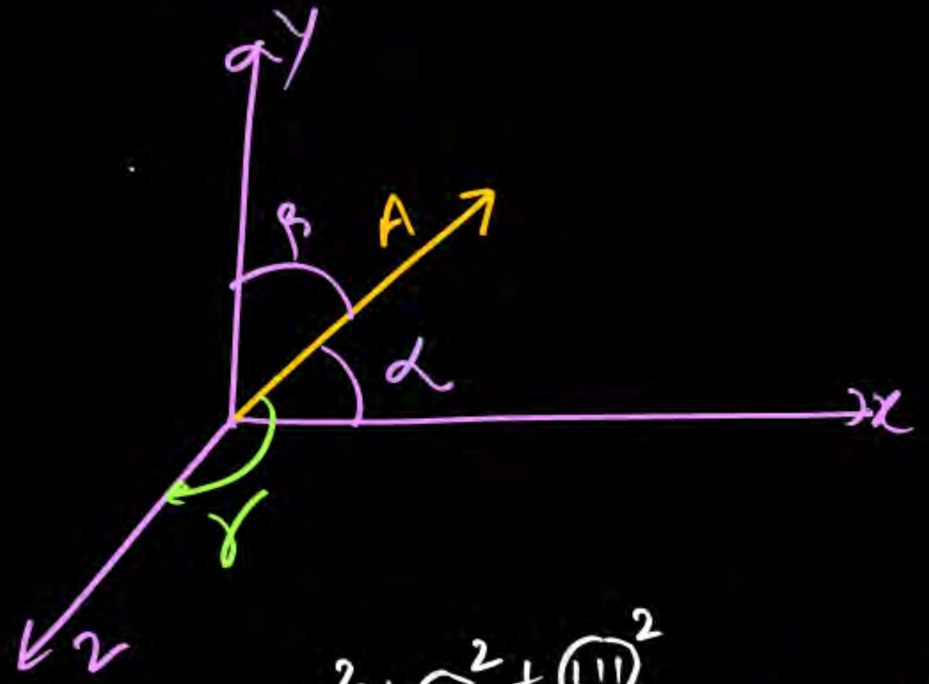
$\vec{D} = \hat{\imath} - \hat{\jmath} + \hat{k}$ $\rightarrow |\vec{D}| = \sqrt{(1)^2 + (-1)^2 + (1)^2} = \sqrt{3}$

$\vec{E} = 6\hat{\imath} - 8\hat{\jmath} + 10\hat{k}$ $\rightarrow |\vec{E}| = \sqrt{6^2 + (-8)^2 + (10)^2} = \sqrt{36+64+100} = \sqrt{200} = 10\sqrt{2}$

$\vec{F} = 10\hat{\imath} - 10\hat{\jmath} - 10\hat{k}$ $\rightarrow |\vec{F}| = \sqrt{(10)^2 + (-10)^2 + (-10)^2} = \sqrt{100+100+100} = \sqrt{300} = \sqrt{3 \times 100} = \underline{\underline{10\sqrt{3}}}$

Direction of vector from x, y & z-axis :-





- $\cos\alpha = \frac{A_x}{A}$ $\quad \alpha$ = Angle b/w $\vec{A}$ & x-axis — (I)
- $\cos\beta = \frac{A_y}{A}$ $\quad \beta$ = Angle b/w $\vec{A}$ & y-axis — (II)
- $\cos\gamma = \frac{A_z}{A}$ $\quad \gamma$ = Angl b/w $\vec{A}$ & z-axis — (III)

$(I)^2 + (II)^2 + (III)^2$

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = \frac{A_x^2}{A^2} + \frac{A_y^2}{A^2} + \frac{A_z^2}{A^2}$$

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = \frac{A_x^2 + A_y^2 + A_z^2}{A^2}$$

Puting value of A^2

we know $A^2 = A_x^2 + A_y^2 + A_z^2$

$$\boxed{\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1}$$

*

γ

(Q) If A vector making an angle α with x-axis, β with y axis and γ with z-axis then find $\boxed{\sin^2\alpha + \sin^2\beta + \sin^2\gamma = ??}$

Sol^n

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$$

$$\boxed{\sin^2\alpha + \cos^2\alpha = 1}$$

$$\boxed{\cos^2\alpha = 1 - \sin^2\alpha}$$

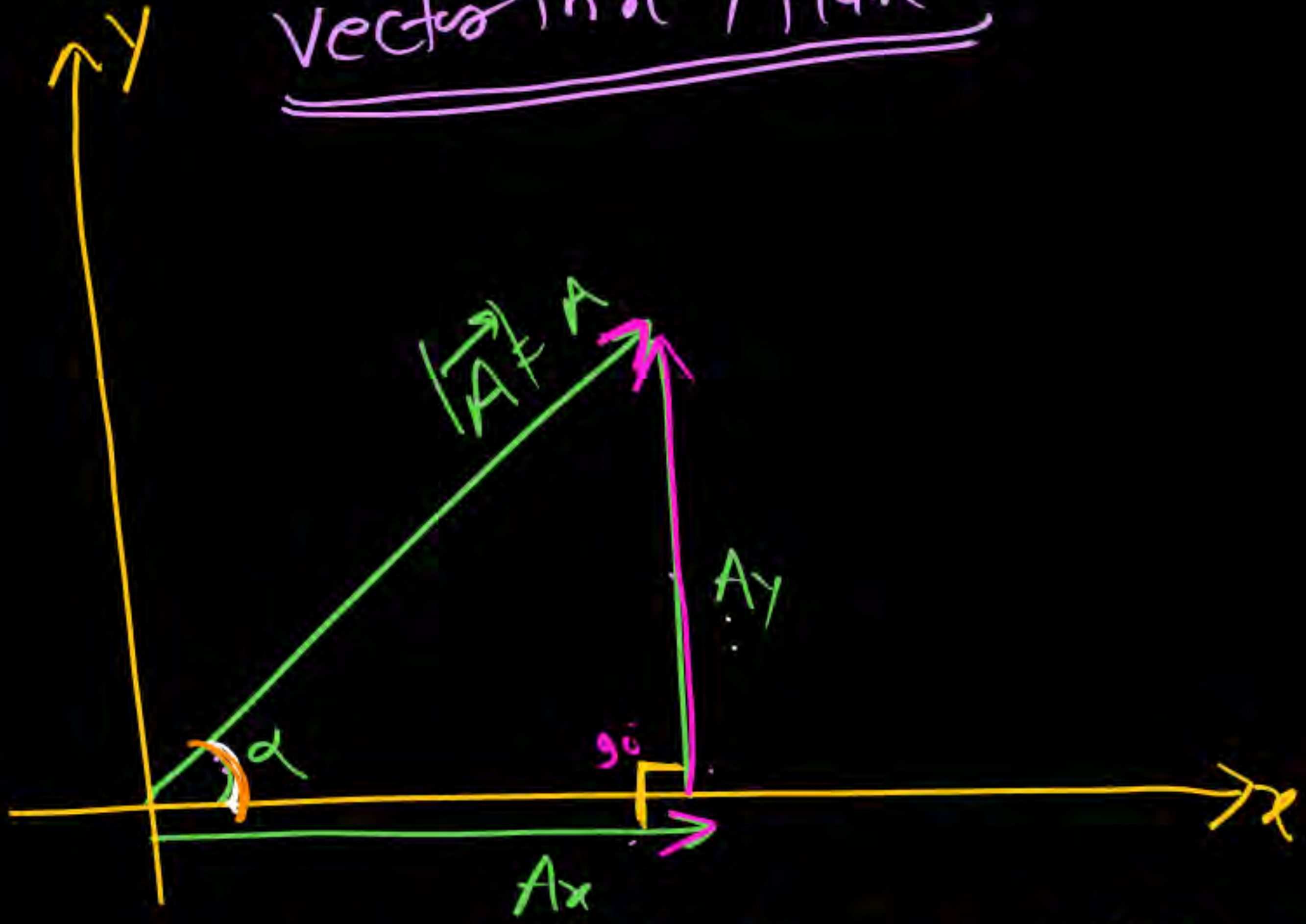
$$1 - \sin^2\alpha + 1 - \sin^2\beta + 1 - \sin^2\gamma = 1$$

$$3 - (\sin^2\alpha + \sin^2\beta + \sin^2\gamma) = 1$$

$$3 - 1 = \sin^2\alpha + \sin^2\beta + \sin^2\gamma$$

$$\boxed{2 = \sin^2\alpha + \sin^2\beta + \sin^2\gamma}$$

Vector in x-y plane



$|\vec{A}| = A$ = magnitude of A

A_x = component of A along x-axis

A_y = component of A along y-axis

always valid for any 2-D or 3-D vector

■ $\cos\alpha = \dfrac{A_x}{A}$ — (i)

■ $\boxed{\tan\alpha = \dfrac{A_y}{A_x}}$ — (ii) → Only for 2-D vector

■ $\sin\alpha = \dfrac{A_y}{A}$ — (iii)

Ex- $\vec{A} = 4\hat{i} + 3\hat{j}$

$|A| = \sqrt{4^2+3^2} = 5$

Sol^n $\tan\alpha = \dfrac{3}{4}$

$\boxed{\alpha = 37^\circ}$

Sol^n

$$\boxed{\begin{aligned}\cos\alpha &= \frac{A_x}{A} = \frac{4}{5} \\ \alpha &= 37^\circ\end{aligned}}$$

Question

Vector $\vec{A} = 5\hat{i} + 5\sqrt{3}\hat{j}$ then find angle of vector $\vec{A}$ from x-axis.

Sol^n

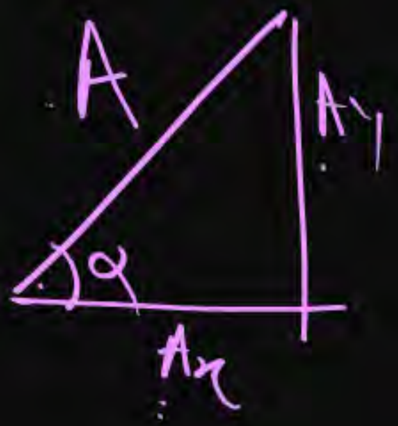
$$|\vec{A}| = \sqrt{5^2 + (5\sqrt{3})^2}$$

$$= \sqrt{25 + 25 \times 3}$$

$$= \sqrt{25 + 75}$$

$$= \sqrt{100}$$

$$= 10$$



Method-1

$$\cos\alpha = \frac{5}{10} = \frac{1}{2}$$

$$\alpha = 60^\circ$$

Method-2

$$\tan\alpha = \frac{\cancel{5}\sqrt{3}}{\cancel{5}}$$

$$\boxed{\tan\alpha = \sqrt{3}}$$

$$\alpha = 60^\circ$$

Question

The angles which a vector $\hat{\imath} + \hat{\jmath} + \sqrt{2}\,\hat{k}$ makes with X, Y and Z axes respectively are

1. $60°, 60°, 60°$
2. $45°, 45°, 45°$ (31%)
3. $\boxed{60°, 60°, 45°}$
4. $45°, 45°, 60°$

Wrong

$\tan\alpha = \frac{A_y}{A_x}$

$\tan\alpha = \frac{1}{1}$

$\alpha = 45°$

$|\vec{A}| = \sqrt{1^2 + 1^2 + (\sqrt{2})^2}$

$= \sqrt{1+1+2} = \sqrt{4} = 2$

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

$\alpha = 60$

$\beta = 60$

$\cos\gamma = \frac{A_z}{A}$

$\cos\gamma = \frac{\cancel{\sqrt{2}}}{2\cancel{\sqrt{2}}}$

$\cos\gamma = \frac{1}{\sqrt{2}}$

$\boxed{\gamma = 45°}$

Question

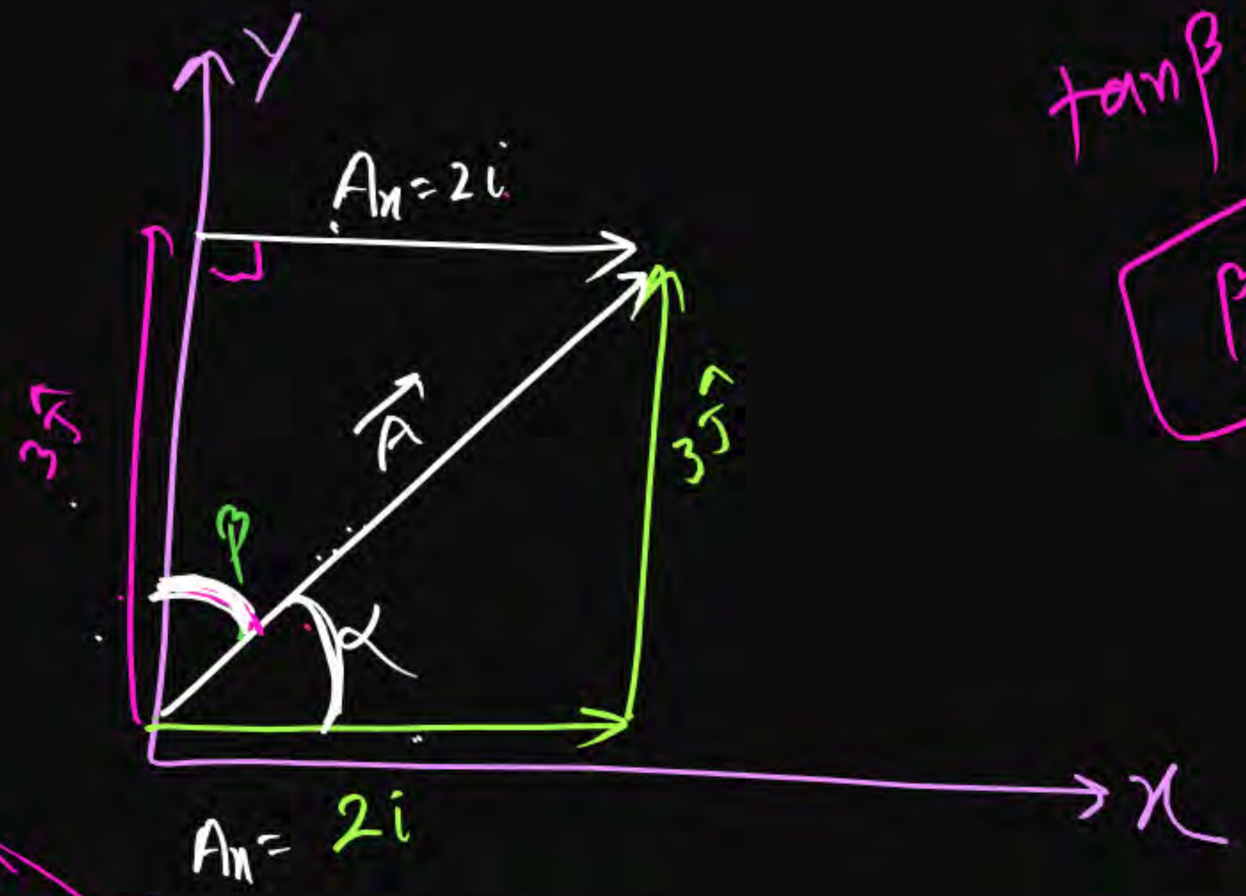
Given $\vec{A} = 2\hat{\imath} + 3\hat{\jmath}$, the angle between $\vec{A}$ and Y-axis is

(1) $\sin^{-1}\frac{2}{3}$

(2) $\cos^{-1}\frac{2}{3}$

(3) $\boxed{\tan^{-1}\frac{2}{3}\ (48\%)}$

(4) $\tan^{-1}\frac{3}{2}$ (32%)



$\tan\beta = \frac{2}{3}$

$\boxed{\beta = \tan^{-1}(2/3)}$

$\cos\beta = \frac{3}{\sqrt{13}} = \frac{B}{H}$

$\tan\beta = \frac{2}{3}$

$P = \sqrt{H^2 - B^2}$

$P = 2$

$|A| = \sqrt{4+9} = \sqrt{13}$

checking unit vector

what is unit vector ??

→ A vector having magnitude unit (1)
& it represent diretion.

→ MR Box → find magnitude of vector → if magnitude is one then it is unit vector.

\# $\vec{A} = \hat{i}$ ⟸ unit vector ✓

\# $\vec{B} = \hat{i} + \hat{j}$ → $|\vec{B}| = \sqrt{1^2 + 1^2} = \sqrt{2}$

$\vec{B}$ is Not unit vector

\# $\vec{C} = \hat{i} + \hat{j} - \hat{k}$

$|\vec{C}| = \sqrt{3}$ → $\vec{C}$ is Not unit vector

\# $\vec{D} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$

$|\vec{D}| = \sqrt{\left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2} = \sqrt{\frac{1}{2} + \frac{1}{2}}$

$= \sqrt{1} = 1$

↳ yes $\vec{D}$ is unit vecto

\# $\vec{E} = \sin\theta\,\hat{i} - \cos\theta\,\hat{j}$

$|\vec{E}| = \sqrt{(\sin^2\theta) + (-\cos\theta)^2}$

$= \sqrt{1} = 1$

Yes unit vecto.

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

$$|\vec{F}| = \sqrt{1^2 + (-1)^2 + (1)^2}$$

$$= \sqrt{1 + 1 + 1}$$

$$= \underbrace{\sqrt{3}}$$

finding of unit vector.

$$\vec{A} = A\,\hat{A}$$

unit vector

(unit vecto) $\hat{A} = \dfrac{\vec{A}}{A}$

find unit vector of given vector

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

$$|\vec{A}| = \sqrt{1^2 + 1^2} = \sqrt{2}$$

$$\hat{A} = \frac{\vec{A}}{|\vec{A}|} = \frac{i + \hat{j}}{\sqrt{2}} = \frac{1}{\sqrt{2}} i + \frac{1}{\sqrt{2}} \hat{j}$$

$\vec{A} = 3\hat{i} + 4\hat{j}$ find its unit vector

Soln

$$|\vec{A}| = \sqrt{3^2 + 4^2}$$

$$= \sqrt{9+16}$$

$$= \sqrt{25} = 5$$

$$\hat{A} = \frac{\vec{A}}{|\vec{A}|} = \frac{3\hat{i}+4\hat{j}}{5} = \frac{3}{5}\hat{i} + \frac{4}{5}\hat{j}$$

$\vec{A} = 3\hat{i} - 5\hat{j} + 4\hat{k}$ find its unit vector

Sol^n

$$|\vec{A}| = \sqrt{(3)^2 + (-5)^2 + (4)^2}$$

$$= \sqrt{9 + 25 + 16}$$

$$= \sqrt{50} = \sqrt{25 \times 2} = 5\sqrt{2}$$

$$\hat{A} = \frac{\vec{A}}{|\vec{A}|} = \frac{3\hat{i} - 5\hat{j} + 4\hat{k}}{5\sqrt{2}}$$

Question

If $\vec{A} = 0.6\hat{i} + \beta\,\hat{j}$ is a unit vector then, find value of 'β'?

1. 0.4
2. 0.8
3. 0.6
4. 0.7

$$\boxed{(0.6)^2 = \left(\frac{6}{10}\right)^2 = \frac{36}{100} = 0.36}$$

$$\vec{A} = 0.6\hat{i} + \beta\hat{j}$$

$$|\vec{A}| = 1 = \sqrt{(0.6)^2 + \beta^2}$$

$$1^2 = (0.6)^2 + \beta^2$$

$$1 = 0.36 + \beta^2$$

$$\beta^2 = 1 - 0.36$$

$$\beta^2 = 0.64$$

$$\beta = \sqrt{0.64} = \frac{8}{10} = 0.8$$

Question

Find value of β if $\vec{A}$ is *a* unit vector $\vec{A} = 0.4\hat{\imath} + 0.3\hat{\jmath} + \beta\hat{k}$.

H/W

$|\vec{A}| = 1$

Question

H/W Level up

If $\vec{A} = 2\hat{\imath} + \hat{\jmath} + 2\hat{k}$ and $\vec{B} = \hat{\imath} + \hat{\jmath} + 2\hat{k}$ then find direction $\vec{C}$ magnitude same as $\vec{A}$ and direction along $\vec{B}$.

Vector addition

Two vector $\vec{A}$ & $\vec{B}$ are given; then

vector addition of $\vec{A}$ & $\vec{B}$ = **Resultant** of $\vec{A}$ & $\vec{B}$ ✓

\# $\vec{A} + \vec{B}$ = vector addition (direction ke sath)

$|\vec{A}| + |\vec{B}| = A + B$ = Sum of magnitude of $\vec{A}$ & $\vec{B}$ (dir^n ke sath add nahi kiya) ✓

$|\vec{A} + \vec{B}|$ = magnitude of Resultant of $\vec{A} + \vec{B}$ ✓

Vector addition in terms of their component

$$\begin{cases} \vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k} \\ \vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k} \end{cases}$$

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

Question

Three forces given by vectors $2\hat{\imath} + 2\hat{\jmath}$; $-2\hat{\imath} - 2\hat{\jmath}$ and $-4\hat{\imath}$ are acting together on a point object at rest. The object moves along the direction

1. x-axis ✓ Ans

$$\vec{F_1} + \vec{F_2} + \vec{F_3} = \cancel{2}\hat{i} + \cancel{2\hat{j}} - \cancel{2\hat{i}} - \cancel{2\hat{j}} - 4\hat{i} = \underbrace{-4\hat{i}}_{\text{Answer}}$$

2. y-axis

3. z-axis

4. Object does not move

Question

Two vector $\vec{A} = 6\hat{i}$ and $\vec{B} = 8\hat{j}$ then find $\vec{A}+\vec{B}$, direction of $\vec{A}+\vec{B}$ from $\vec{A}$.

Sol^n

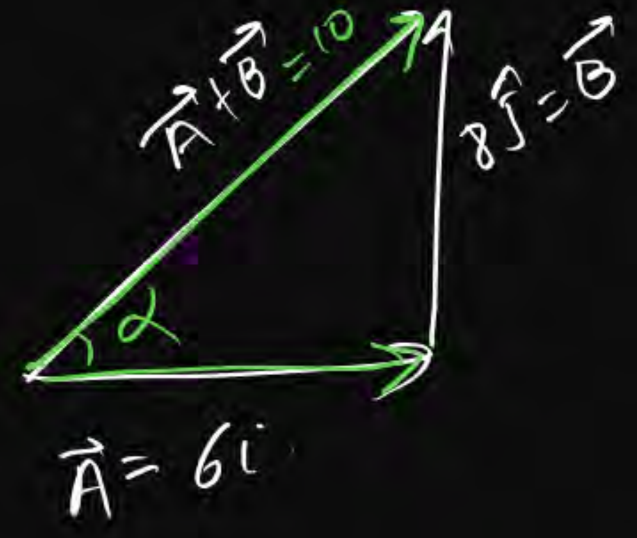
$$\vec{A}+\vec{B} = 6\hat{i} + 8\hat{j}$$

$$\boxed{\vec{A}+\vec{B} = 6\hat{i}+8\hat{j}}$$

$$|\vec{A}+\vec{B}| = \sqrt{6^2+8^2}$$

$$= \sqrt{36+64}$$

$$= \sqrt{100} = 10$$



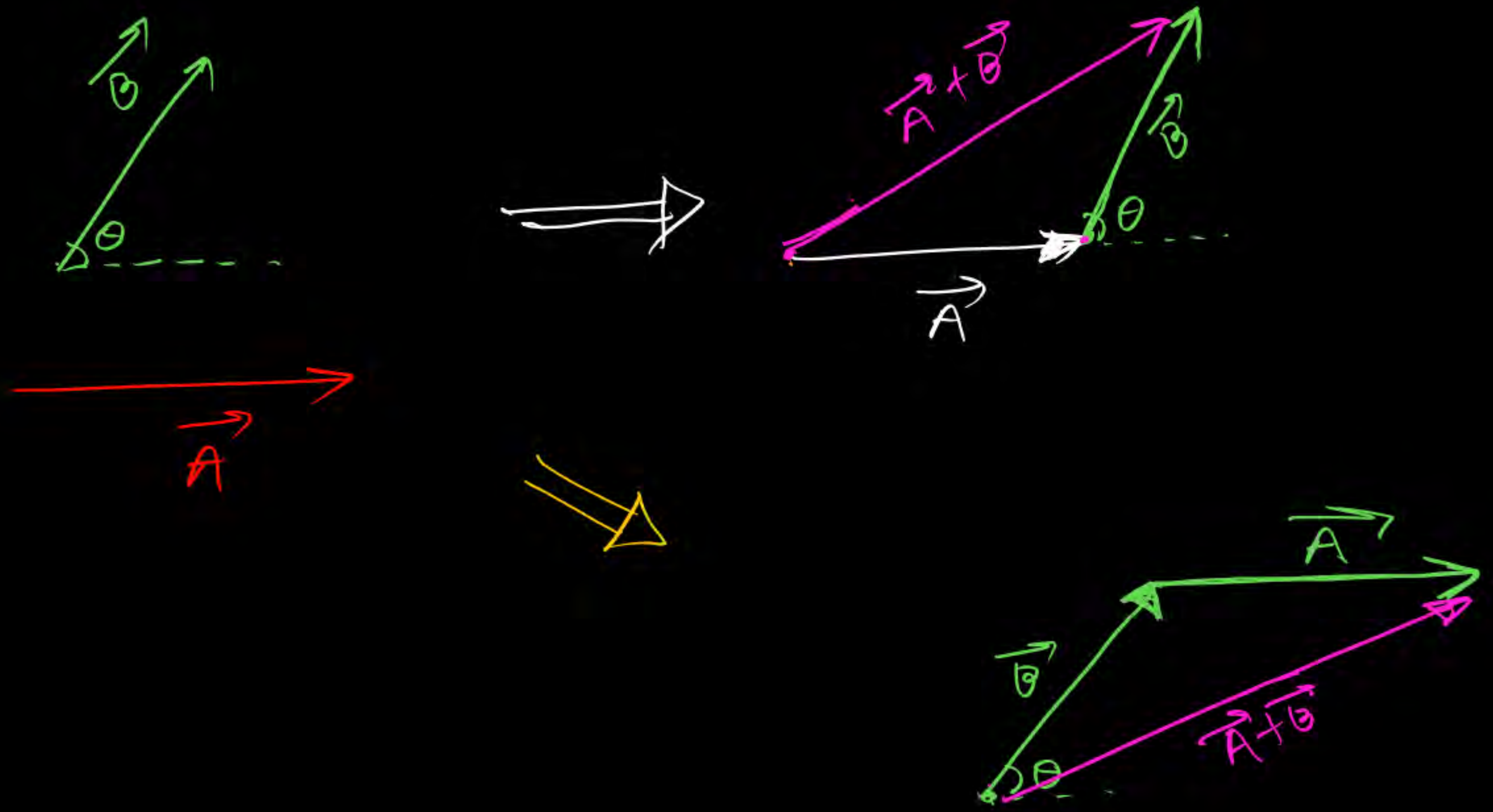
$$\tan\alpha = \frac{8}{6} = \frac{4}{3}$$

$$\alpha = 53^\circ$$

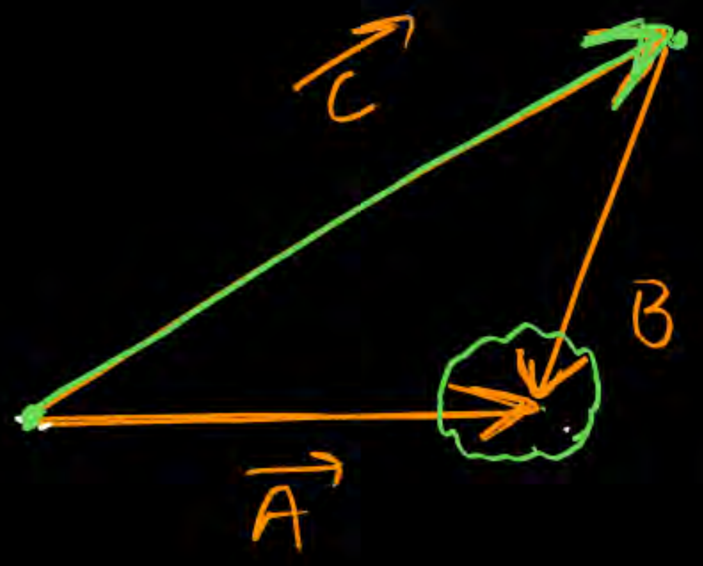
Triangle law of vector addition:

~~Draw 1^{st} vector; and start Drawing 2^{nd} vector from head of 1^{st} vector then Resultant will be Tail of 1^{st} vector to head of 2^{nd} vector.~~

Pahle 1^{st} vector Ko Banao, Jaha 1^{st} vector end (head) ho Raha hai wahi se 2^{nd} vector Banao; & 1^{st} Ke tail se 2^{nd} Ke head Ko milado wo resultant Batayega $\vec{A}+\vec{B}$



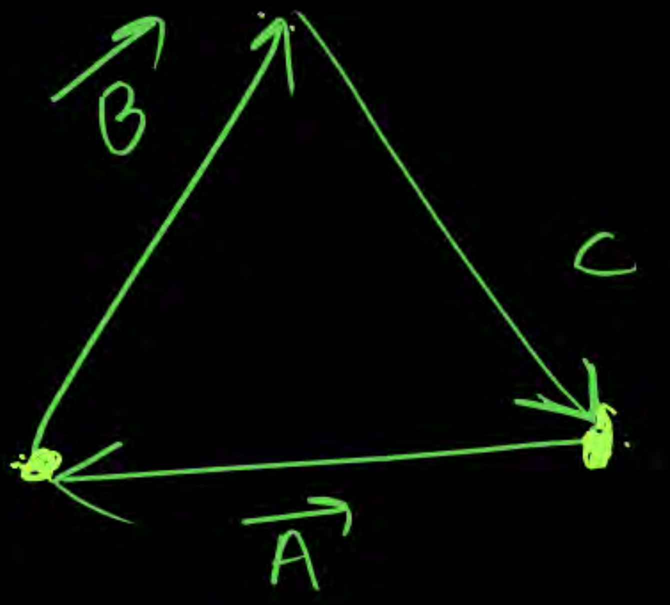
$\vec{B}$
θ
$\vec{A}$
$\vec{A}+\vec{B}$
$\vec{B}$
θ
$\vec{A}$
$\vec{A}$
$\vec{B}$
θ
$\vec{A}+\vec{B}$



$\vec{A} + \vec{B}$ ✗

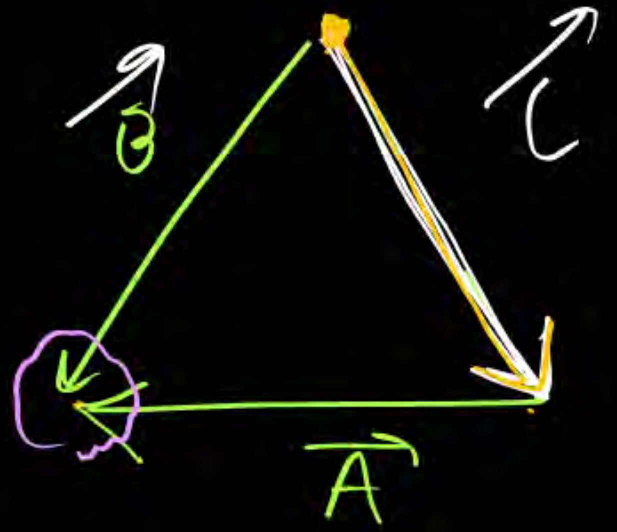
$$\boxed{\vec{C} + \vec{B} = \vec{A}}$$ ✓

MR* → head to head
mat lo ✓

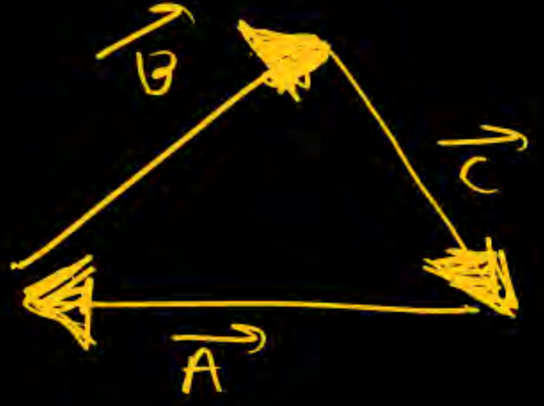


$$\boxed{\vec{A}+\vec{B}+\vec{C}=0}$$

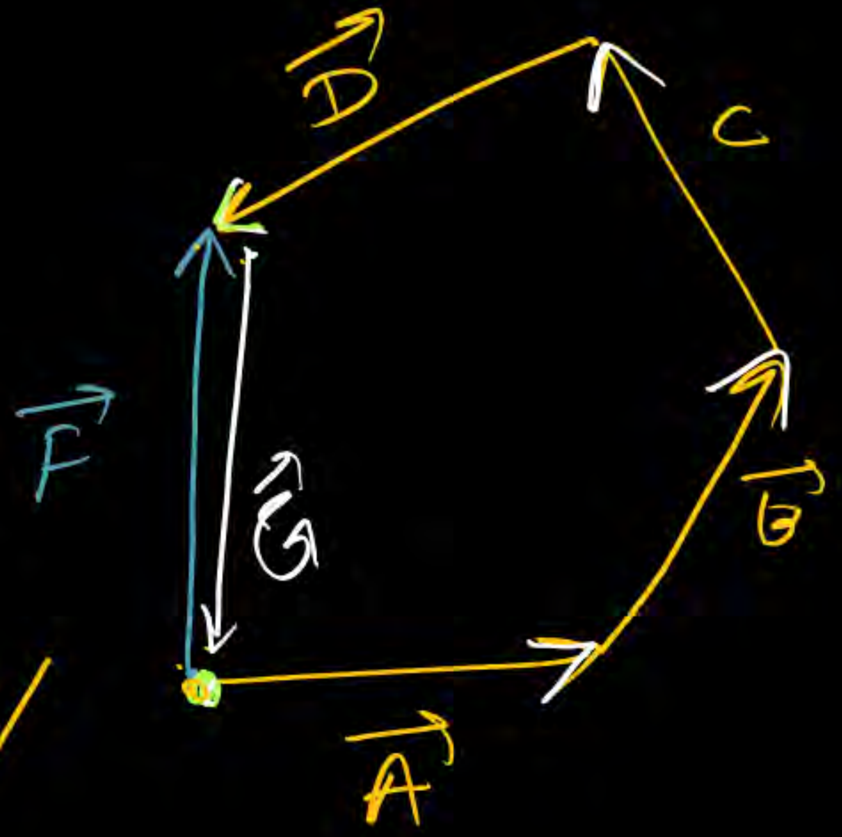
$$\boxed{\vec{B}+\vec{C}+\vec{A}=0}$$



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



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



$$\vec{F} = -\vec{G}$$ ✓

$$\vec{A}+\vec{B}+\vec{C}+\vec{D}=\vec{F}$$ ✓

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

THANK
YOU