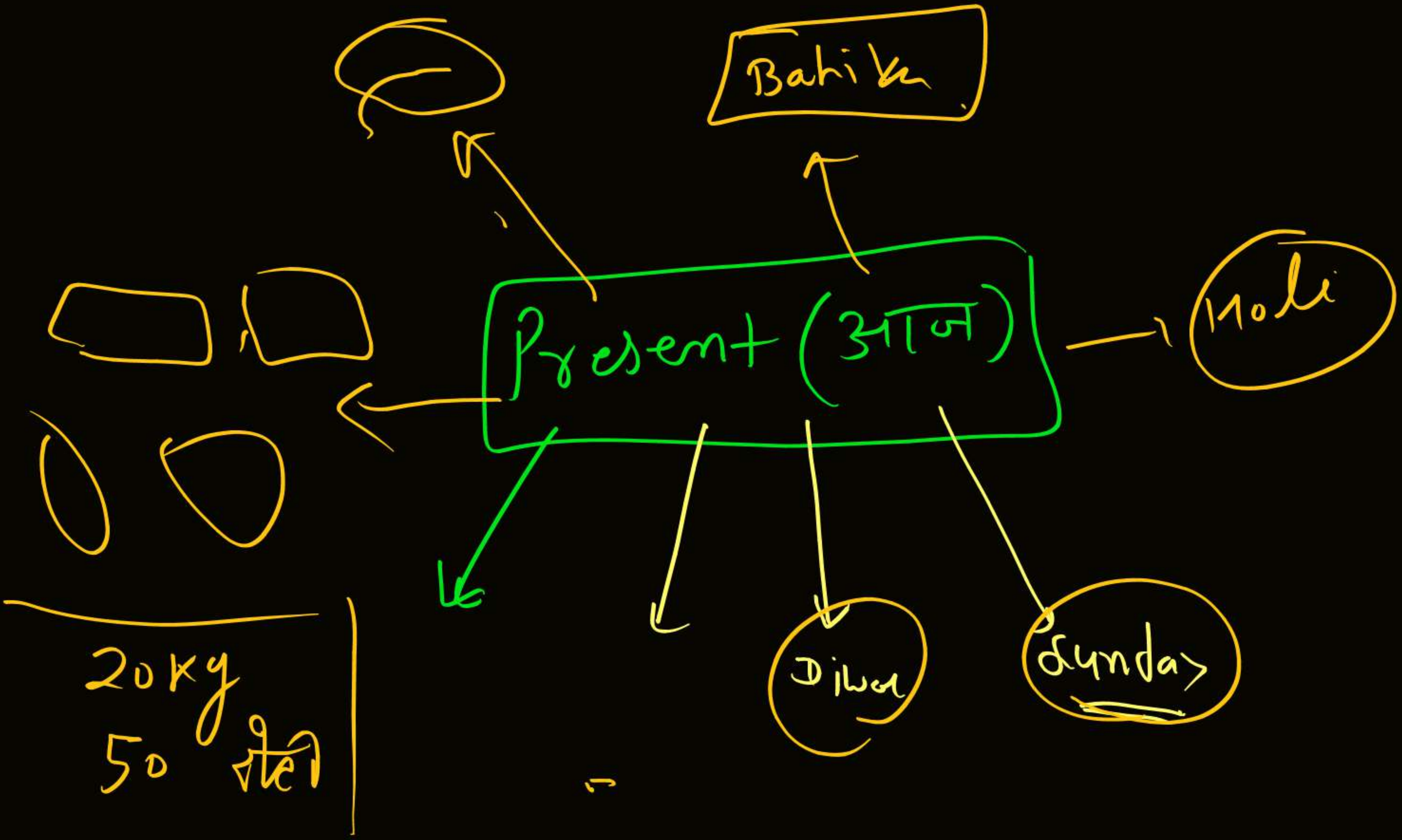
ARJUNA NEET BATCH

घर → 1 → 2 News Paper - T.V ← PCB

VECTOR SUBTRACTION AND DOT PRODUCT

LECTURE - 02



Present (आज)
Holi
Sunday
20kg
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NEET

Todays Goal

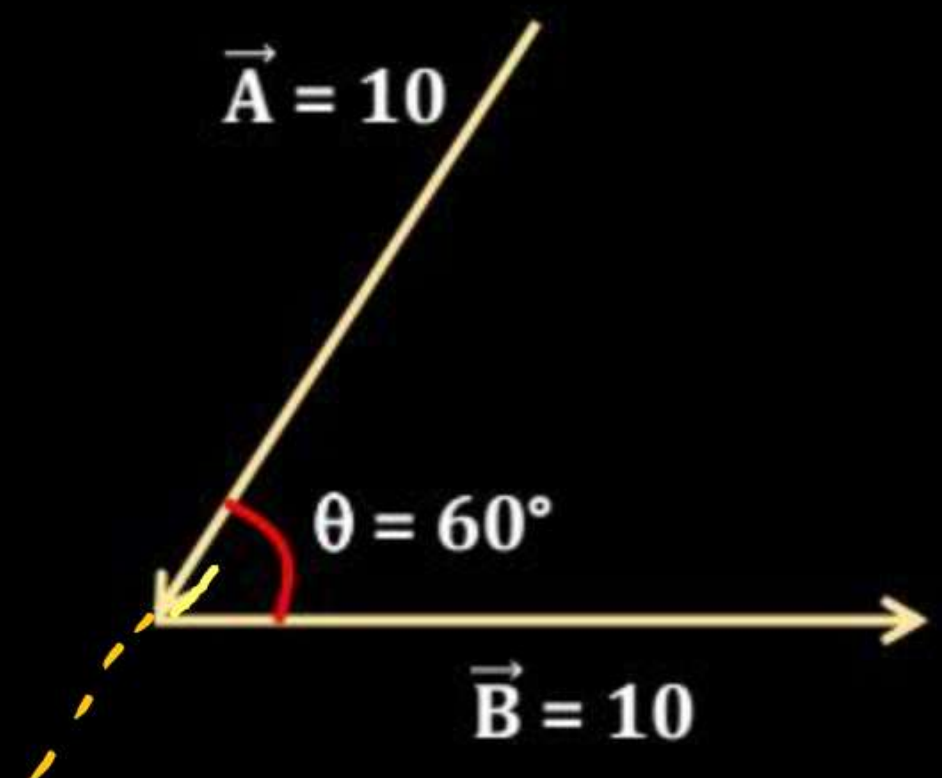
→ Vector subtraction

→ Question practice

→ Dot Product

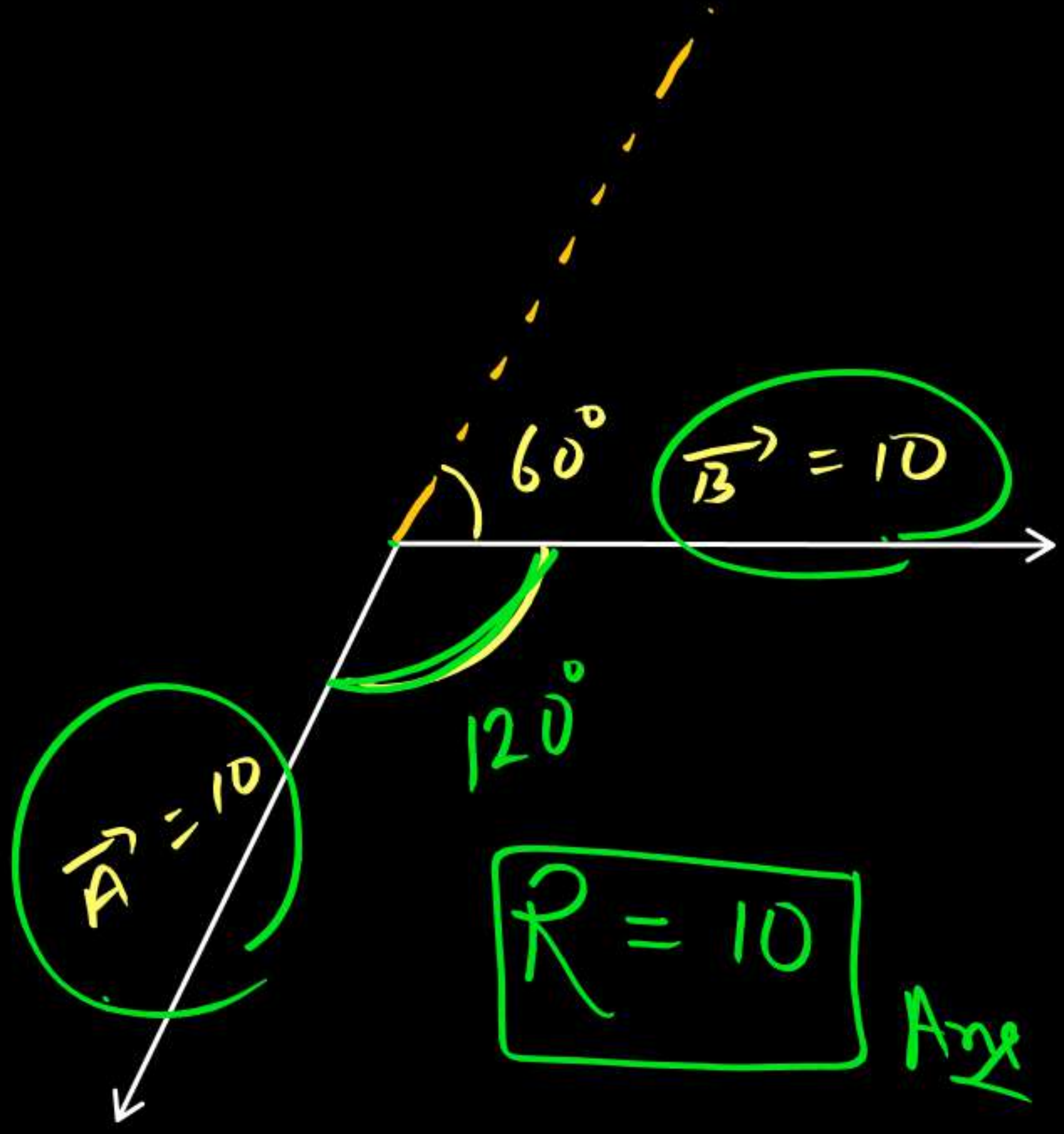
Find $\vec{A}+\vec{B}$ = ??.

Q



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

$$= \sqrt{(10)^2+(10)^2+2\times 10\times 10\times(\cos 120^\circ)}$$



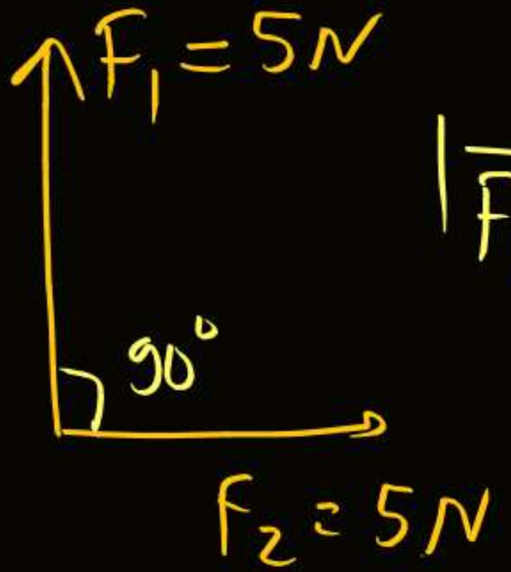
$\boxed{R = 10}$ Ans

• Resultant of two vectors having same magnitude

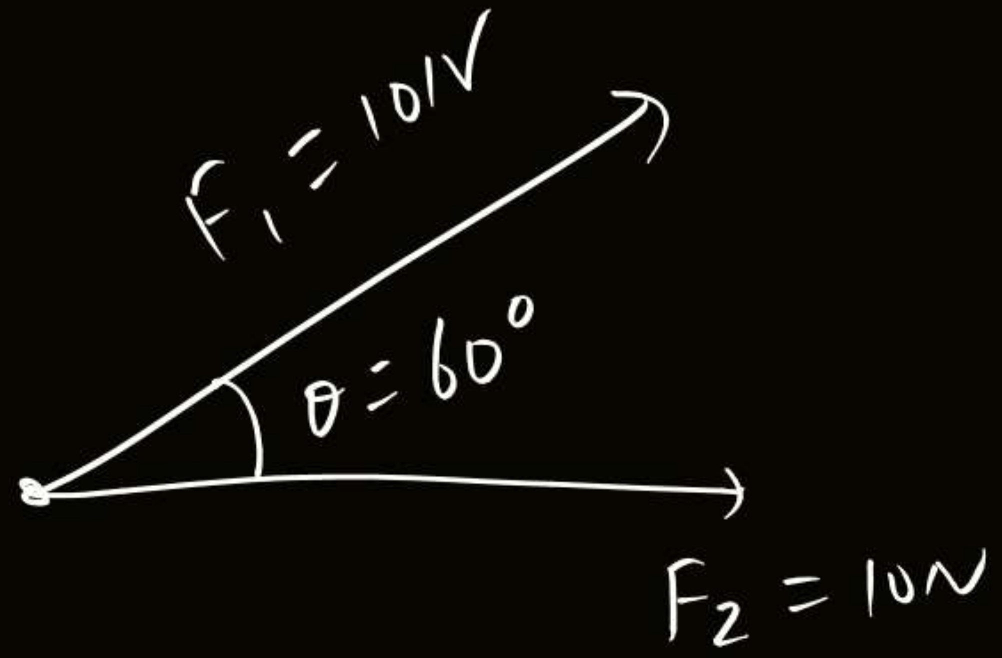
$$R = 2A\cos\left(\theta/2\right)$$

$\theta = 0^\circ$	$\theta = 60^\circ$	$\theta = 90^\circ$ *	$\theta = 120^\circ$	$\theta = 180^\circ$
$R = 2A$	$R = \sqrt{3}A$	$R = \sqrt{2}A$	$R = A$	$R = 0$

#

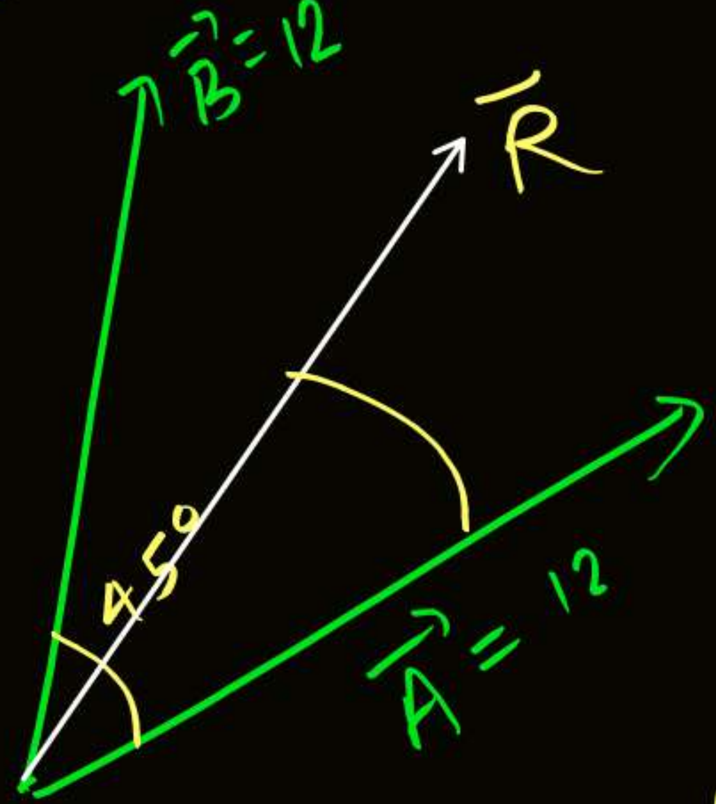


$$|\vec{F_1} + \vec{F_2}| = 5\sqrt{2}\ N \quad \text{Ans}$$



$$\left|\vec{F_1} + \vec{F_2}\right| = 10\sqrt{3}$$

AIEEE-2010



find Angle b/w $(\vec{R} = \vec{A} + \vec{B})$ $\vec{R}$ & $\vec{A}$ is ??

(1) 90 (3) 18°

(2) 45° (4) 22.5°

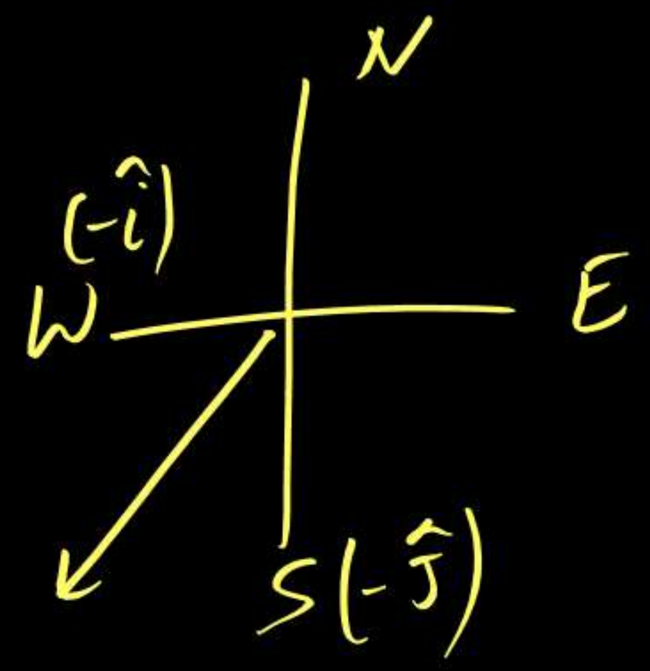
A truck travelling due north at 20 ms^{-1} turns west and travels with same speed. What are the changes in velocity?

(a) $20\sqrt{2}$ ms^{-1} south-west (b) 40 ms^{-1} south-west

(c) $20\sqrt{2}$ ms^{-1} north-west (d) 40 ms^{-1} north-west

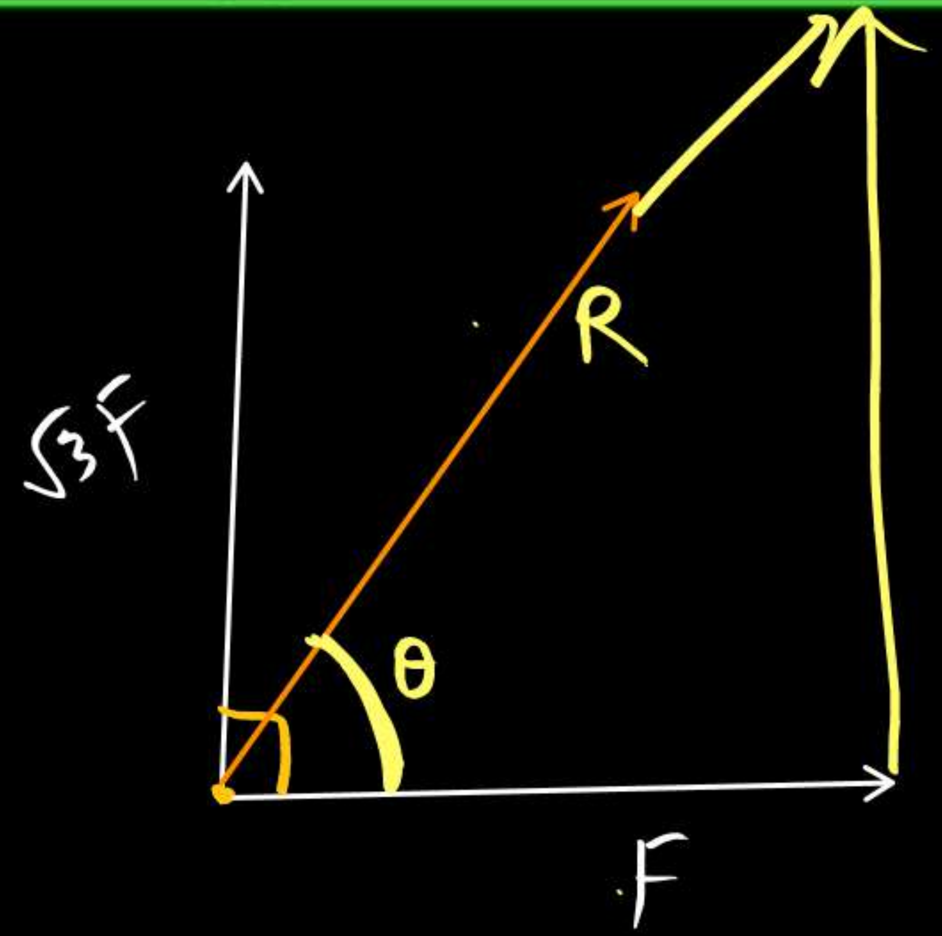
Sol^n change in velocity

$$\Delta v = \vec{v}_f - \vec{v}_i = \underbrace{-20\hat{i} - 20\hat{j}}$$



Two force of magnitude F and $\sqrt{3}\ F$ act at right angles to each other. Their resultant makes an angle β with F. The value of β is

(a) 30°
(b) 45°
(c) 60°
(d) 135°

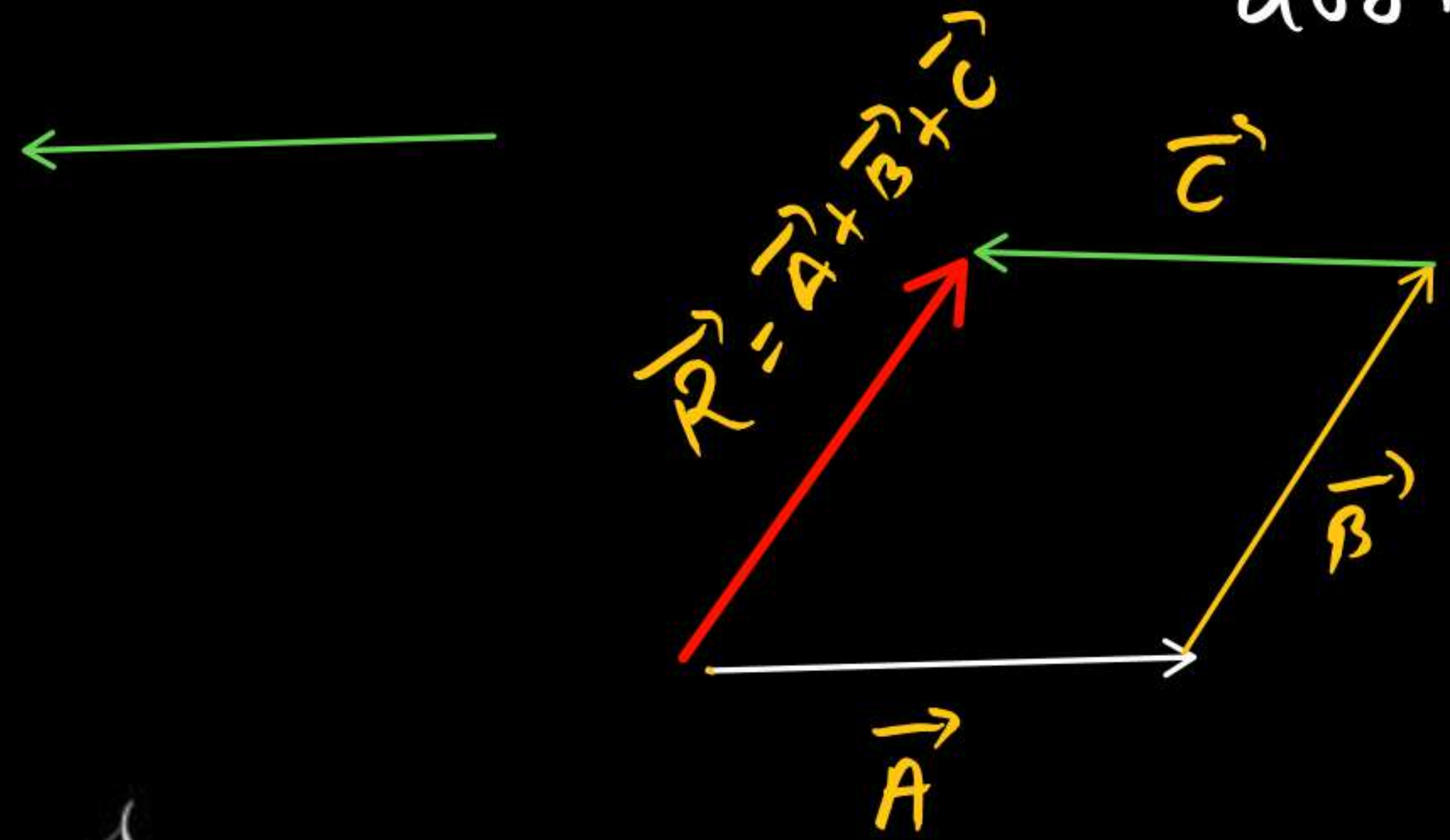


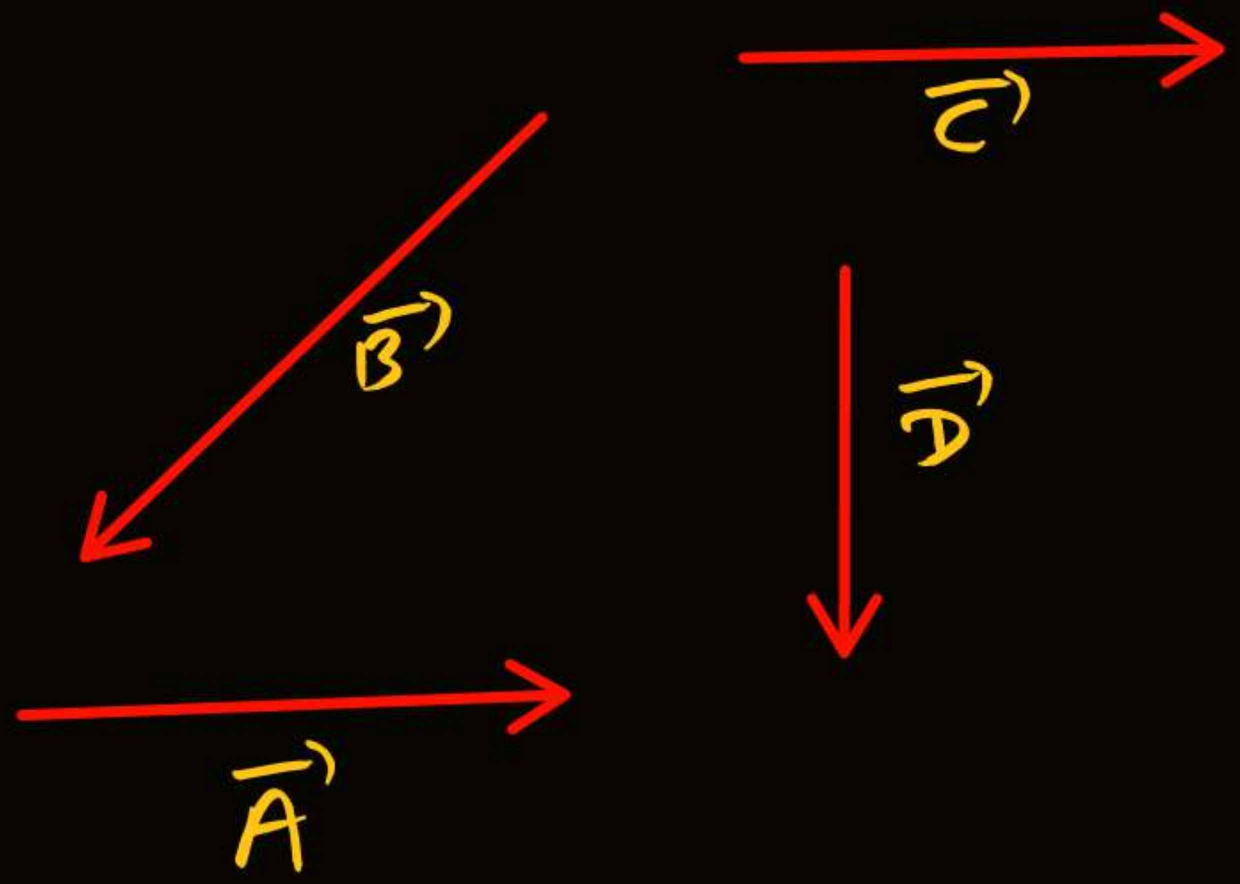
$$\tan\theta = \frac{\sqrt{3}\cancel{F}}{\cancel{F}}$$

$$\theta = 60°$$

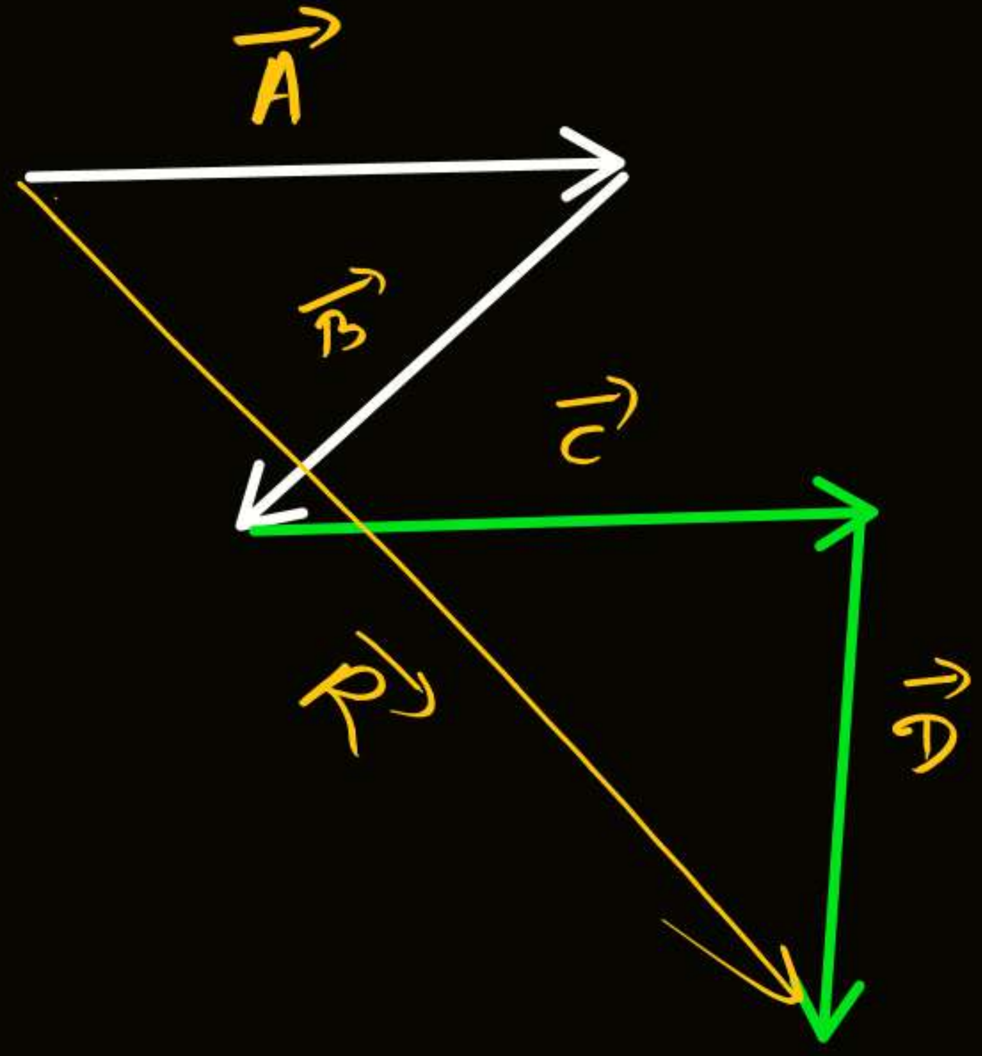
POLYGON LAW OF VECTOR ADDITION

→ Same as Triangle law of vector addition but for more than 2-vector

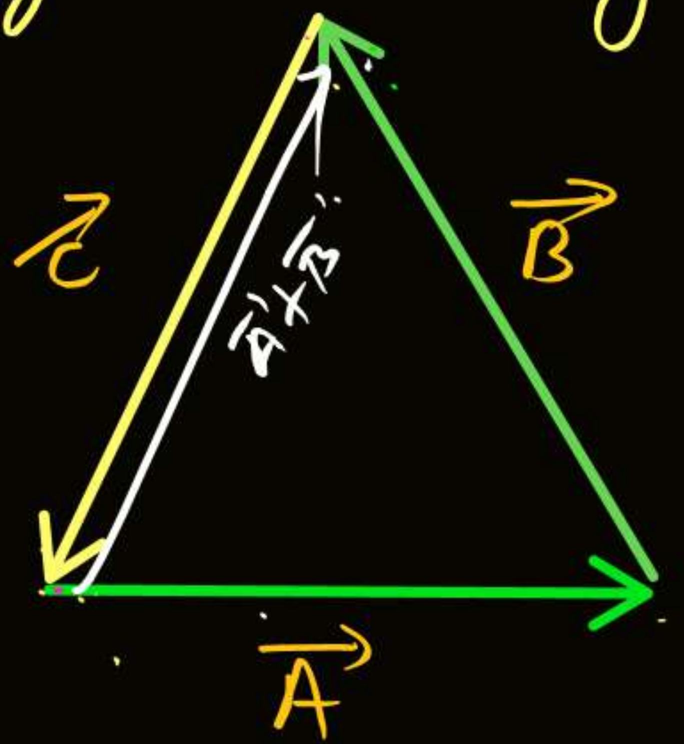




$\Rightarrow$ find $\vec{A}+\vec{B}+\vec{C}+\vec{D} = ??$



for given diagram correct option is.



(a) $\vec{A}+\vec{B}+\vec{C}=0$

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

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

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

Sol^n $\vec{A}+\vec{B}+\vec{C}=0$

$\boxed{\vec{A}+\vec{C}=-\vec{B}}$ *

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

Correct

Q. If $\vec{A} = 2\hat{i} + 2\hat{j}$ then find unit vector of $\vec{A}$.

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

$$\hat{A} = \frac{\vec{A}}{A} = \frac{2\hat{i}+2\hat{j}}{\sqrt{(2)^2+(2)^2}} = \left[\frac{2\hat{i}+2\hat{j}}{2\sqrt{2}}\right] = \frac{\hat{i}+\hat{j}}{\sqrt{2}}$$

Unit vector

Q If $\vec{A} = 2\hat{i} + 2\hat{j} + 2\hat{k}$ then find unit vector.

Sol^n $\hat{A} = \dfrac{\vec{A}}{|A|} = \dfrac{2\hat{i} + 2\hat{j} + 2\hat{k}}{\sqrt{(2)^2 + (2)^2 + (2)^2}} = \dfrac{2\hat{i} + 2\hat{j} + 2\hat{k}}{2\sqrt{3}}$

Q If $\vec{A} = \sin\theta\,\hat{i} + \cos\theta\,\hat{j}$ then find unit vector of $\vec{A}$

Sol^n $\underbrace{\hat{A}}_{\text{unit vector}} = \dfrac{\vec{A}}{|A|} = \dfrac{\sin\theta\,\hat{i} + \cos\theta\,\hat{j}}{\sqrt{\sin^2\theta + \cos^2\theta}} = \underbrace{\sin\theta\,\hat{i} + \cos\theta\,\hat{j}}$

Q If $\underbrace{\vec{A} = 3\hat{i} + 2\hat{j} + 4\hat{k}}$ then find direction of $\vec{A}$.

Sol^n

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

magnitude = 1

$$\text{direction of } \hat{A} = \hat{A} = \frac{\vec{A}}{A} = \frac{3\hat{i} + 2\hat{j} + 4\hat{k}}{\sqrt{(3)^2 + (4)^2 + (2)^2}} = \frac{3\hat{i} + 2\hat{j} + 4\hat{k}}{\sqrt{29}}$$

Q. If $\vec{A} = 2\hat{i} + \sqrt{5}\hat{j}$ and $\vec{B} = 5\hat{i} + \sqrt{5}\hat{j}$ then find a vector which is parallel of $\vec{A}$ and magnitude equal to $\vec{B}$.

$$\boxed{\vec{A} = 2\hat{i} + \sqrt{5}\hat{j}} \qquad \boxed{\vec{B} = 5\hat{i} + \sqrt{5}\hat{j}}$$

$$\# \quad \vec{C} = |\vec{B}|\,\hat{A}$$

$\hookrightarrow$ dir^n of $\vec{C}$ & $\vec{A}$ is same

$$= \left(\sqrt{25+5}\right) \times \frac{(2\hat{i}+\sqrt{5}\hat{j})}{\sqrt{4+5}} = \frac{\sqrt{30}}{3}\left(2\hat{i}+\sqrt{5}\hat{j}\right)$$

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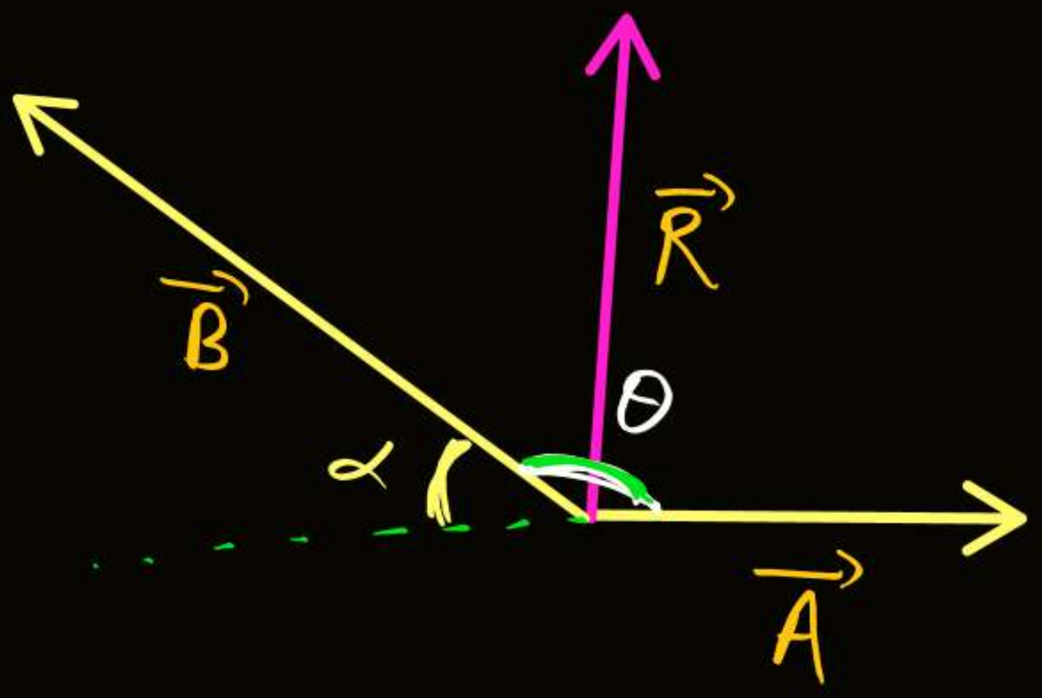
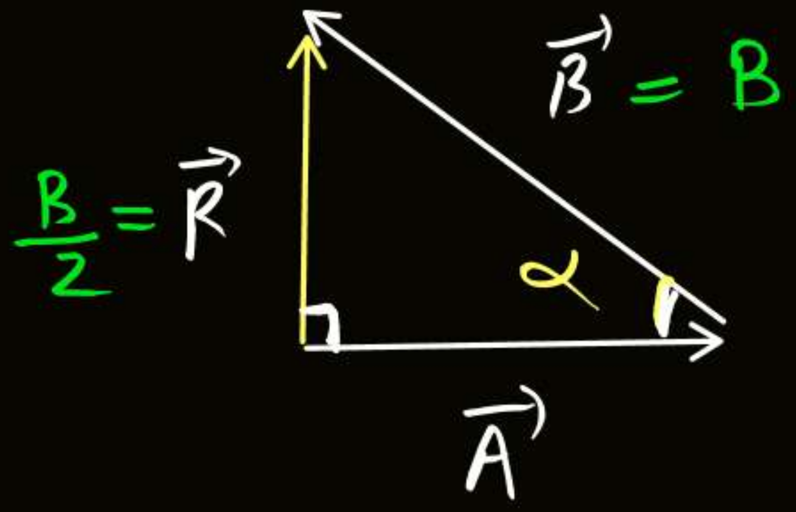
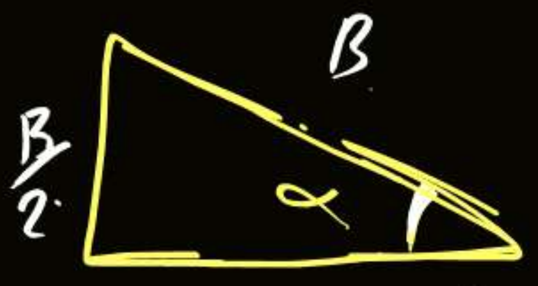
(Q) Resultant of two vector Perpendicular to smaller vector and half in magnitude of other vector then Angle b/w vector is ??

Sol^n



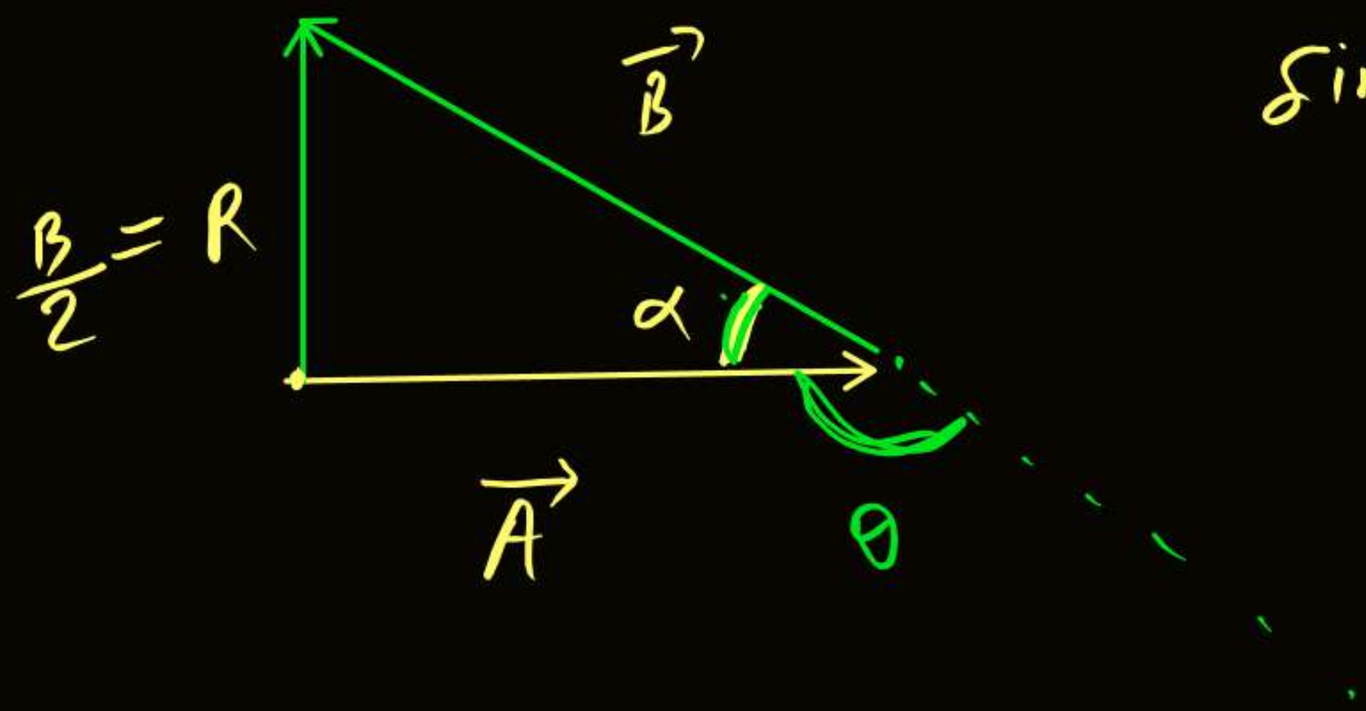




$\sin\alpha = \frac{\cancel{B}}{2\cancel{B}}$

$\boxed{\alpha = 30^\circ}$

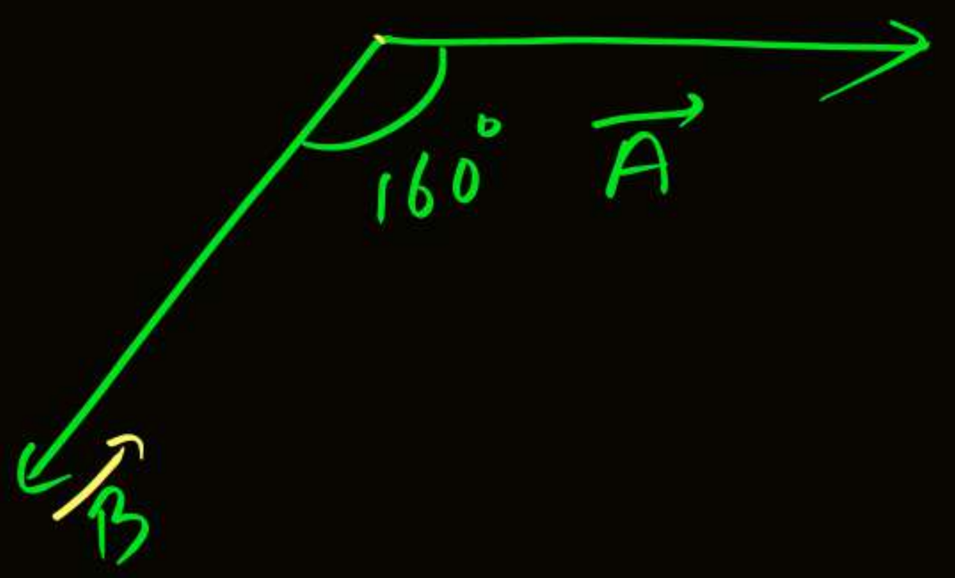
$\theta = 180 - 30^\circ$
$= \underline{150^\circ}$



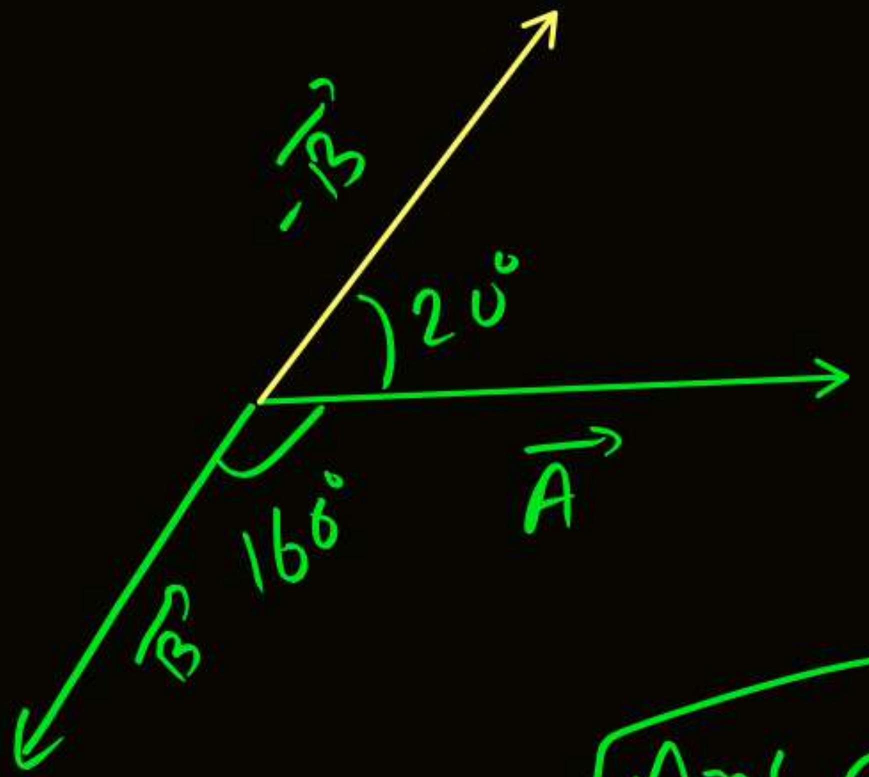
$$\sin\alpha = \frac{\frac{B}{2}}{B} = \frac{1}{2}$$

$$\boxed{\alpha = 30^\circ}$$

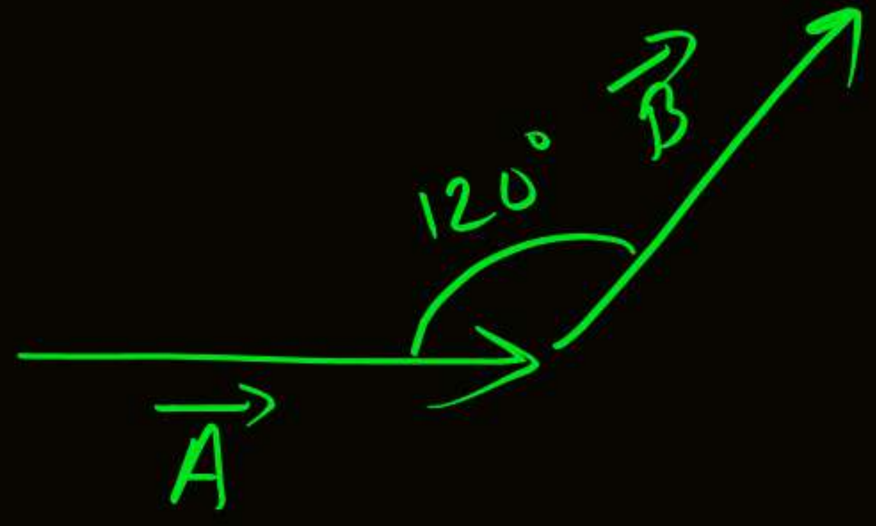
find angle b/w $\underline{\vec{A}}$ & $\underline{-\vec{B}}$

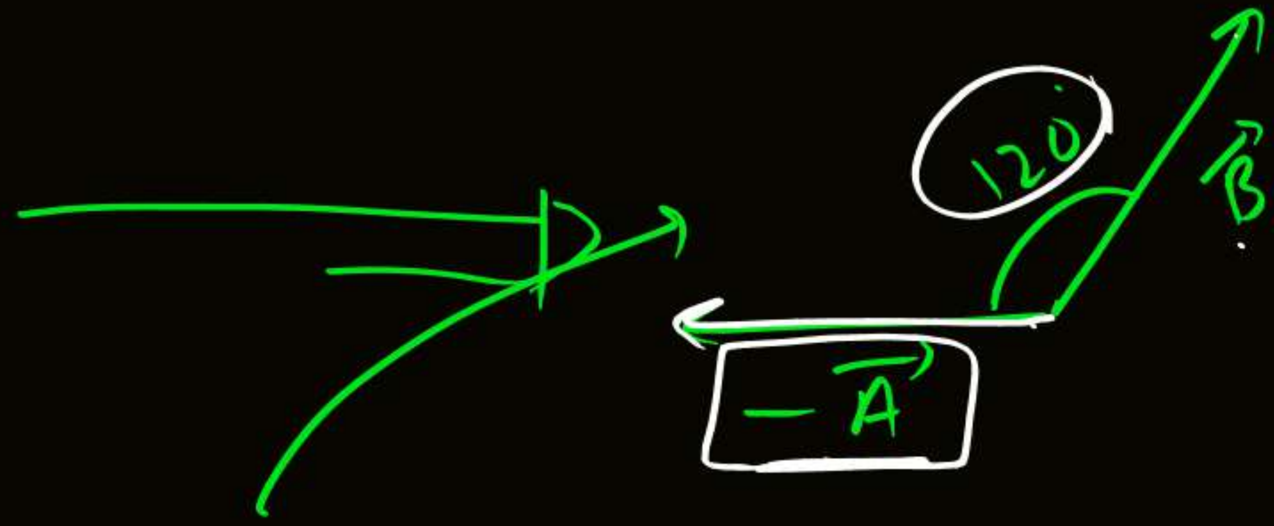


Sol^n



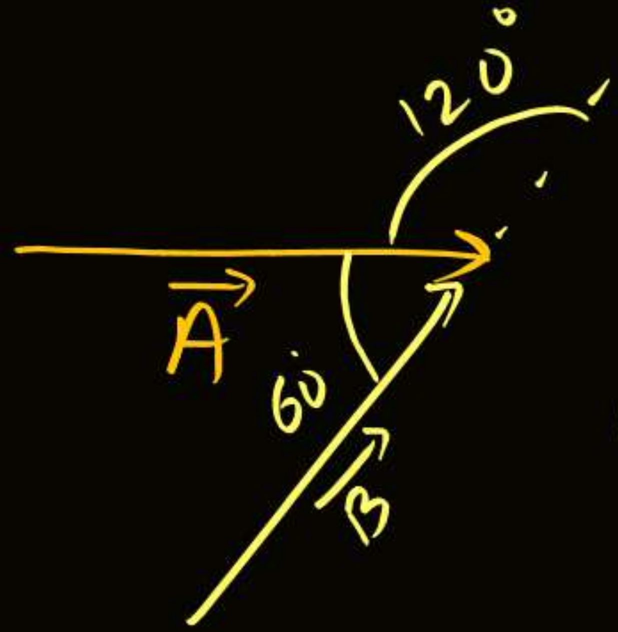
$\boxed{\text{Ans } 20^\circ}$





Q find Angle b/w $\vec{B}$ & $-\vec{A}$

Sol^n



60° → Angle b/w $\vec{A}$ & $\vec{B}$

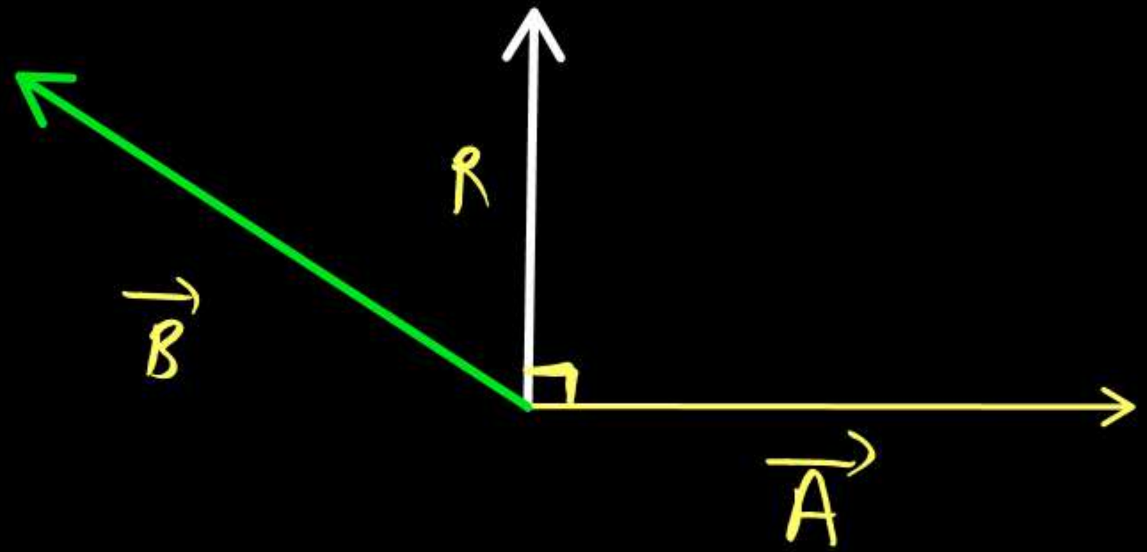
120° Angle b/w $\vec{B}$ & $-\vec{A}$

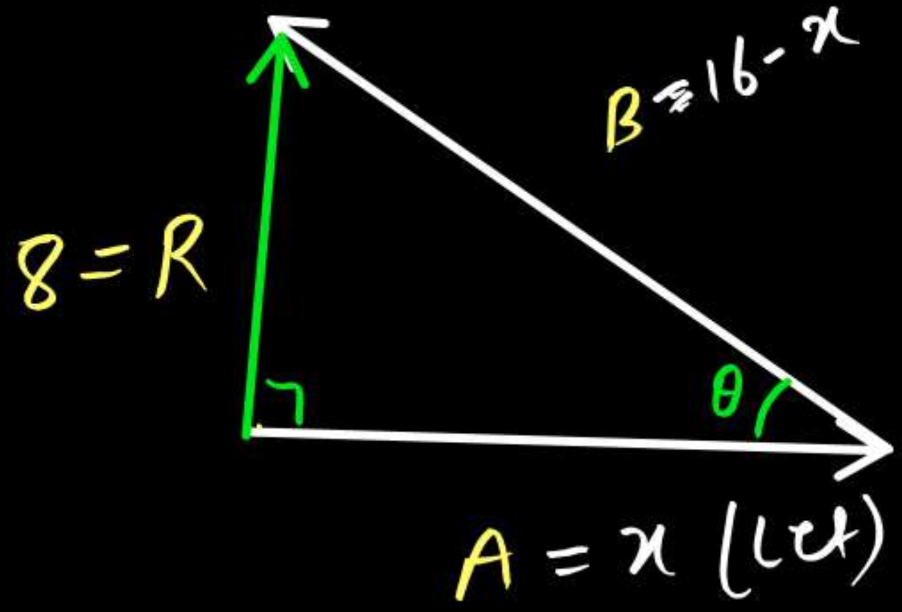
Magnitude of vector sum of two vector is 8 but sum of their magnitude is 16 and resultant is perpendicular to smaller vector, find these vector.

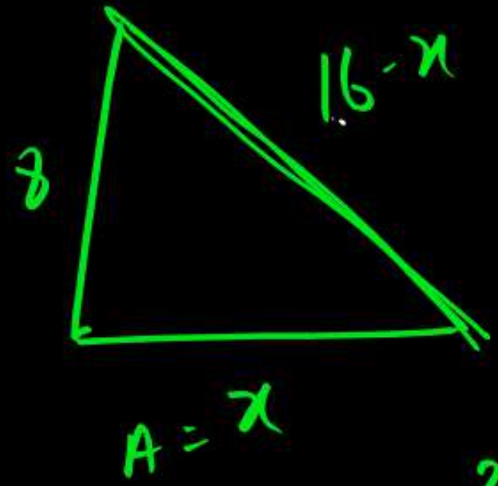
NEET Max^m

$$|\vec{A} + \vec{B}| = \vec{R} = 8$$

$$|\vec{A}| + |\vec{B}| = 16$$







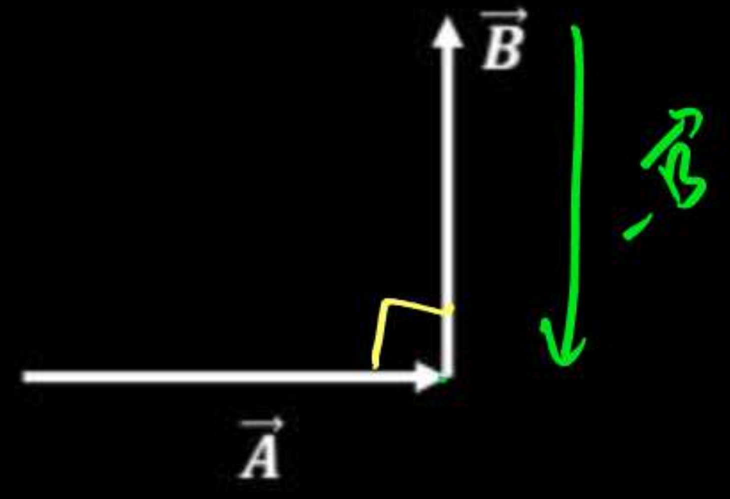
$$x^2 + 8^2 = (16 - x)^2$$

$$\cancel{x^2} + 64 = 256 - 32x + \cancel{x^2}$$

$$32x = 192$$

$$\boxed{x = 6}, \ 10$$

Two vector $\vec{A}$ and $\vec{B}$ are given in the figure :



$$\underbrace{\vec{A} - \vec{B} = \vec{A} + (-\vec{B})}_{\text{Same}}$$

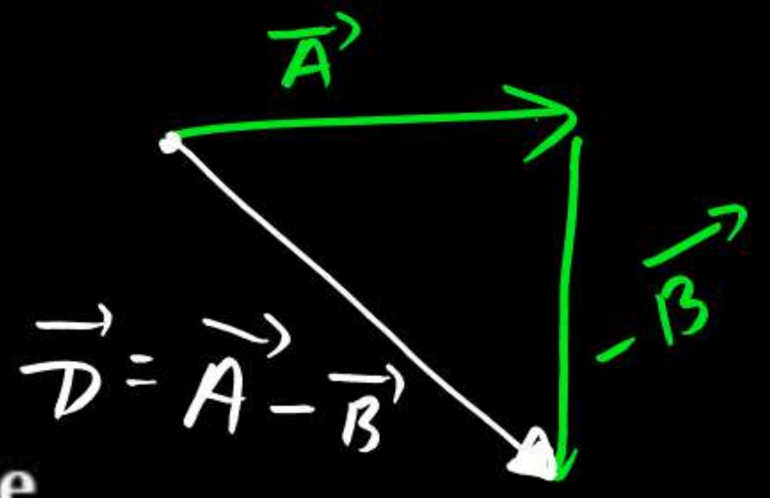
Then $\vec{A} - \vec{B}$ is given by

~~(a)~~ 

~~(b)~~ 

~~(c)~~ 

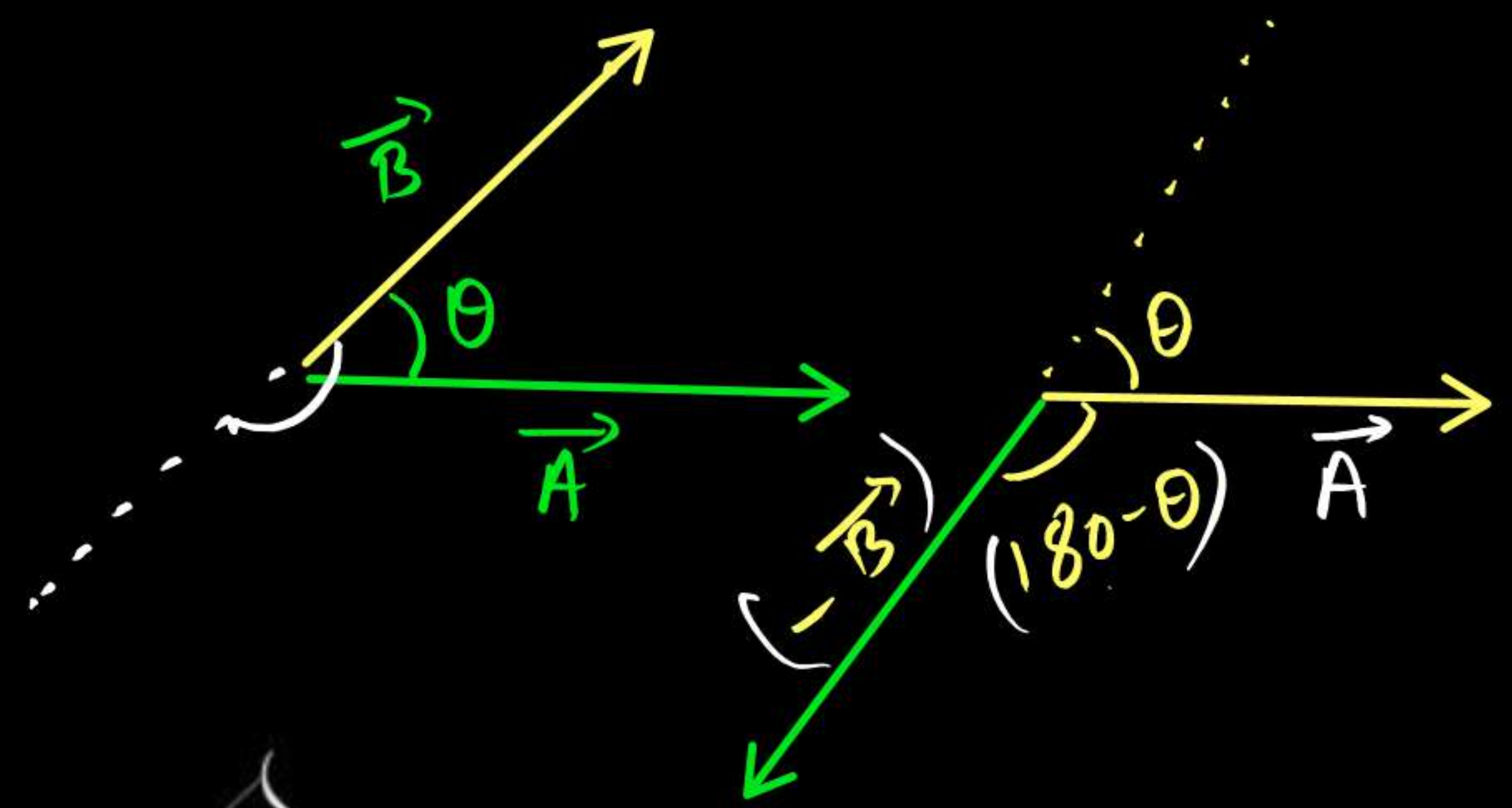
(d) None of these



VECTOR SUBTRACTION

$$\boxed{\vec{D} = \vec{A} - \vec{B}} \longrightarrow \text{find magnit of } \vec{D}$$

magnitude of $-\vec{B}$ & $\vec{B}$ is same



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

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

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

$\theta = 0^\circ$

$D = A - B$

90°

$D = \sqrt{A^2 + B^2}$

180°

$D = A + B$

$$\boxed{A - B \leq R \leq A + B}$$

$$\boxed{A - B \leq D \leq A + B}$$

MR*

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

If magnitude of $|\vec{A}| = |\vec{B}|$ then.

use

$$\boxed{\begin{aligned} 1 + \cos\theta &= 2\cos^2\theta/2 \\ 1 - \cos\theta &= 2\sin^2\theta/2 \end{aligned}}$$

$$D = \sqrt{2A^2 - 2A^2\cos\theta}$$

$$= \sqrt{2A^2(1 - \cos\theta)}$$

$$D = \sqrt{2A^2(2\sin^2\theta/2)} = 2A\sin(\theta/2)$$

MK*

$$\boxed{D = 2A\sin(\theta/2)}$$ → vector subtraction of two vectors of same magnitude.

$\theta = 0$, $D = 0$

$\theta = 60°$, $D = A$

$\theta = 90°$, $D = \sqrt{2}A$

$\theta = 120°$, $\boxed{D = \sqrt{3}A}$

$180°$, $D = 2A$

---

vector addition in a case two vectors of same magnitude.

$$\boxed{R = 2A\cos\theta/2}$$

$\theta = 0°$, $2A$

$\theta = 60°$, $\sqrt{3}A$

$90°$, $R = \sqrt{2}A$

$120°$, $R = A$

$180°$, $R = 0$

If sum of two unit vector is also unit vector then find magnitude of vector subtraction.

1 1

Sol^n

$|\vec{A}| = 1$

$|\vec{B}| = 1$

$|\vec{R}| = 1$

when angle b/w $\vec{A}$ & $\vec{B}$ is $\boxed{120^\circ}$

$D = 2A \sin(\theta/2)$

$= 2 \times 1 \sin\left(\frac{120}{2}\right)$

$= \cancel{2}\frac{\sqrt{3}}{\cancel{2}}$

$\boxed{D = \sqrt{3}}$

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$\vec{A} + \vec{B} = \vec{R}$ and $\vec{A} - \vec{B} = \vec{D}$ then find angle between $\vec{A}$ and $\vec{B}$ if $R = D$.

Sol^n

$\boxed{\text{imp}}$

Ans $\Rightarrow$ 90°

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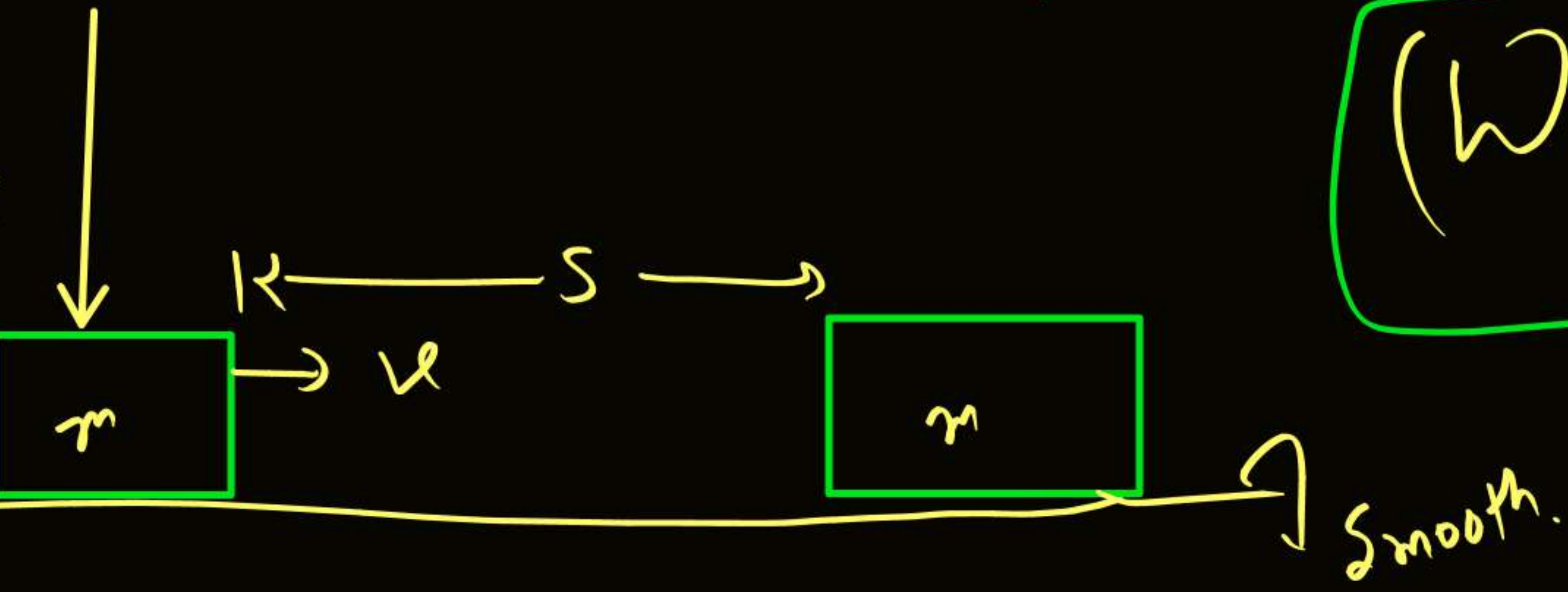
Work (9th)

$$W = F\,S\,\cos\theta$$

force

displacement

m.R ने force लगाया $= F$

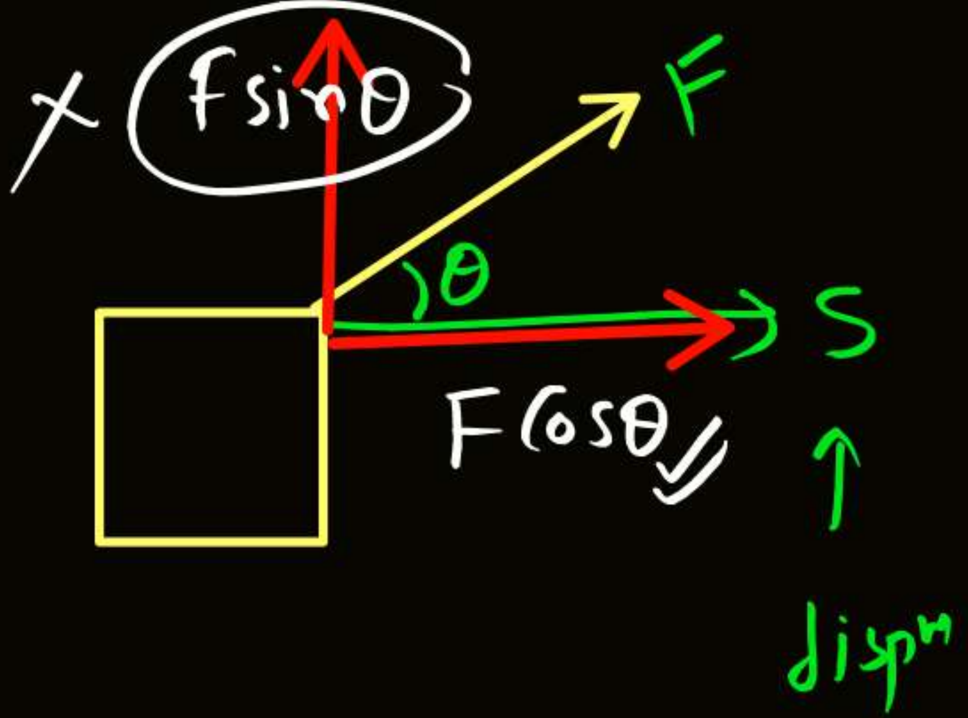


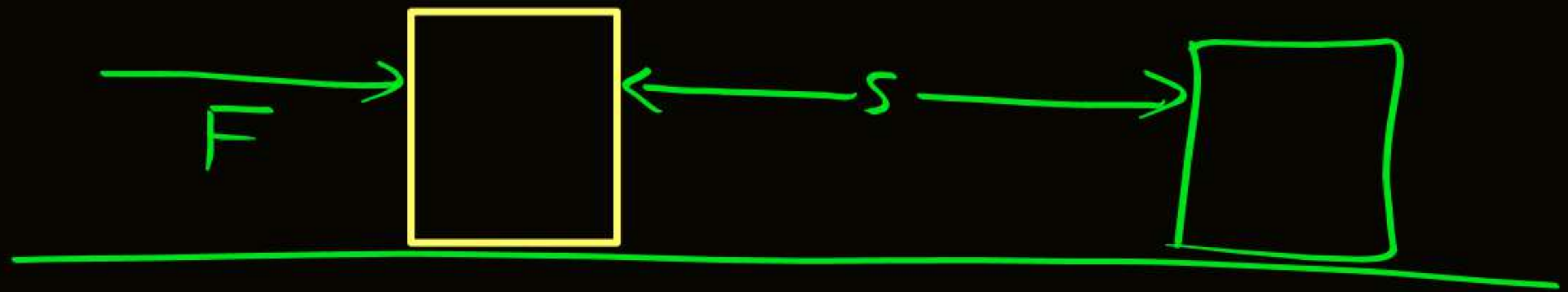
$$\boxed{(\text{Work})_{\text{BY m.R}} = 0}$$

$$= FS\cos 90$$

$$= FS \times 0$$

$$= 0$$





$$W = F\,S\,\cos 0^\circ$$

+ve

$$W = F\cos\theta\,[s]$$

Work

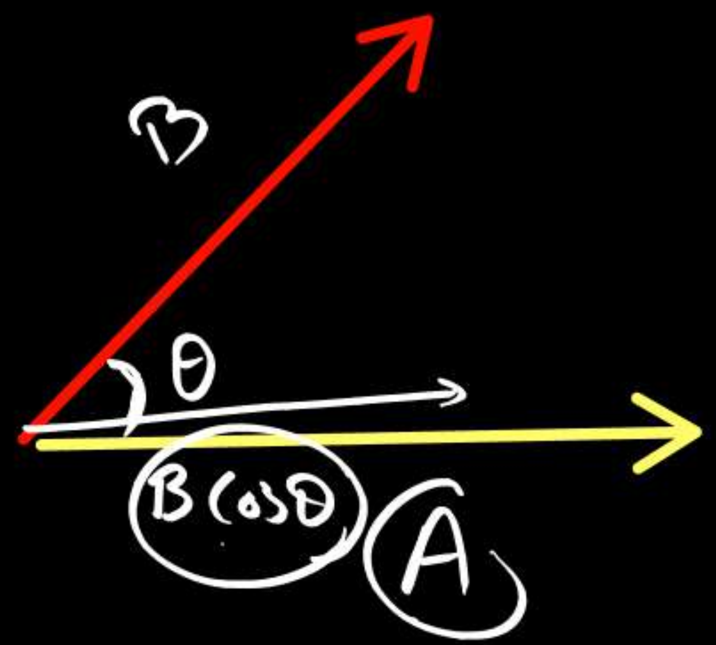
SCALAR PRODUCT

[Dot. Product of Vector]

$$\boxed{\begin{aligned}\vec{A}\bullet\vec{B} &= (\text{Component of A along B}) \times |\vec{B}| \\ &= (\text{Component of B along A}) \times A\end{aligned}}$$

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

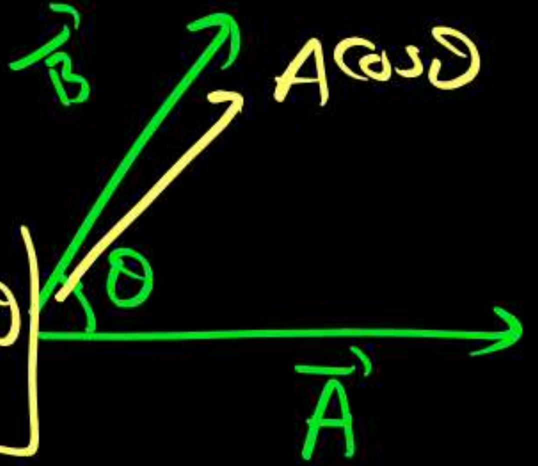
θ = Angle between $\vec{A}$ and $\vec{B}$



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

dot Product.

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



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APPLICATION OF DOT PRODUCT

(i) Angle between vectors :

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

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

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

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THANK YOU ☺

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