ARJUNA NEET BATCH

VECTOR - 2

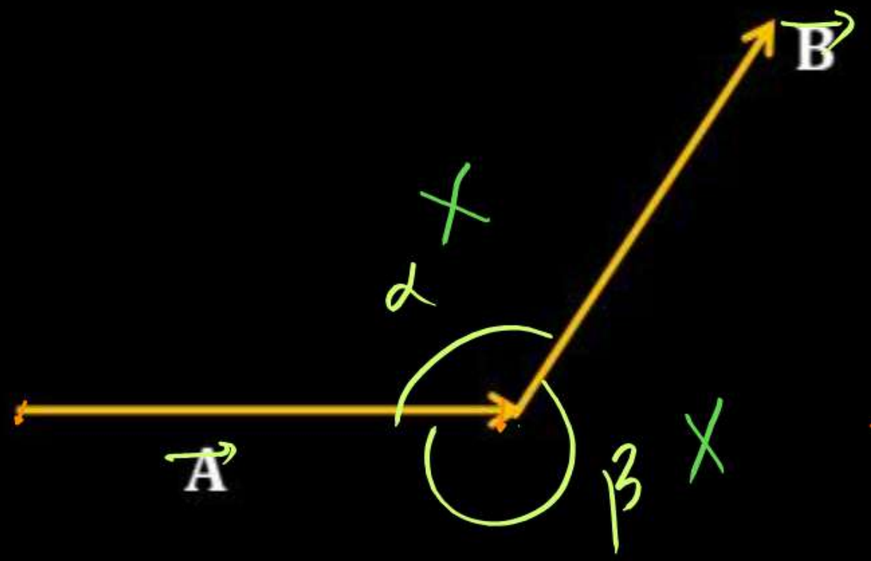
LECTURE - 18

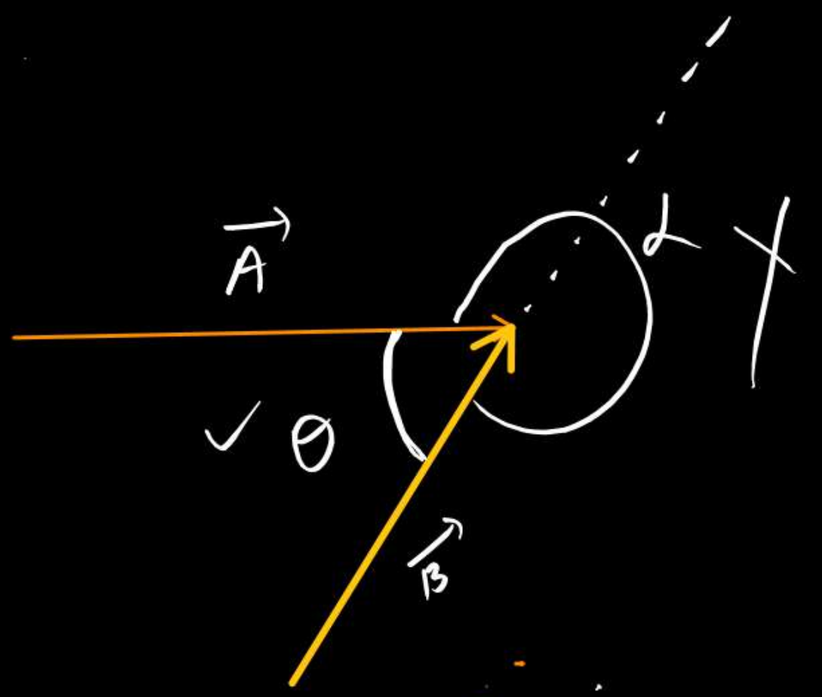
Todays goal

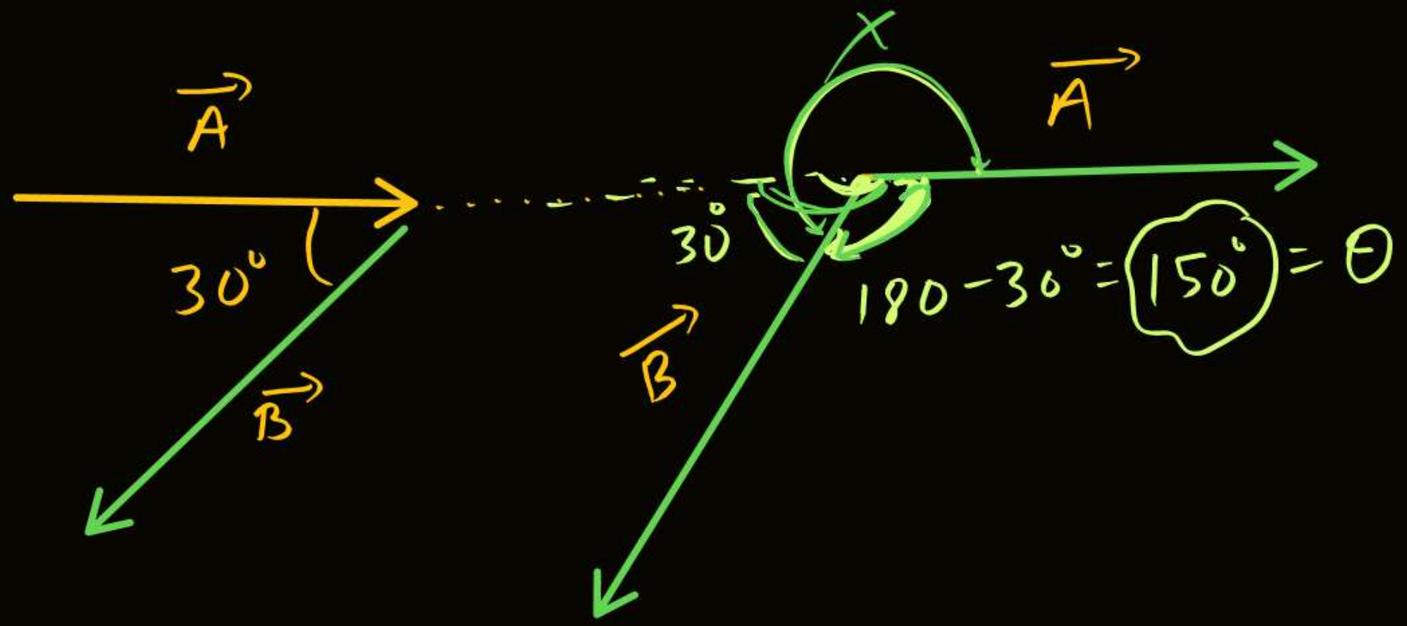
- Angle b/w vector
- Type of vector
- Component of vector
- magnitude of vector

ANGLE BETWEEN VECTOR

Angle between two vector is a smaller Angle of the two angle when they are placed head to head or tail to tail.

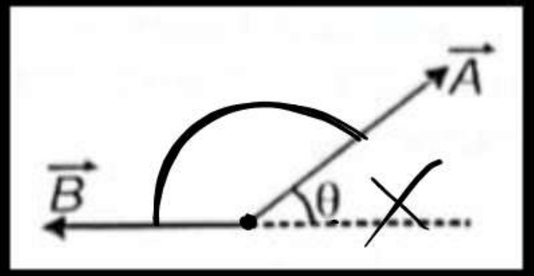




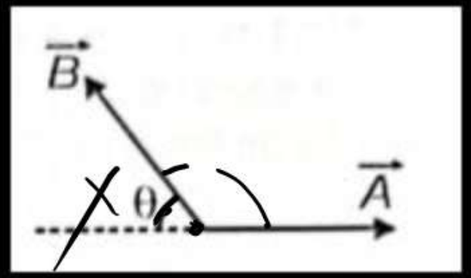

A
30°
B
30°
B
X
A
180 - 30° = 150° = θ

Let θ be the angle between vectors $\vec{A}$ and $\vec{B}$. Which of the following figures correctly represents the angle θ?

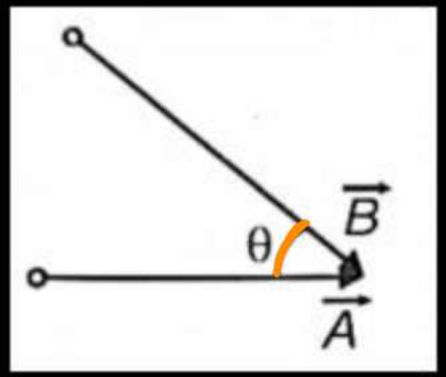
(a)



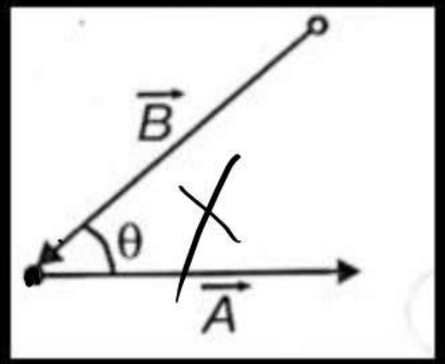
(b)



(c)



(d)



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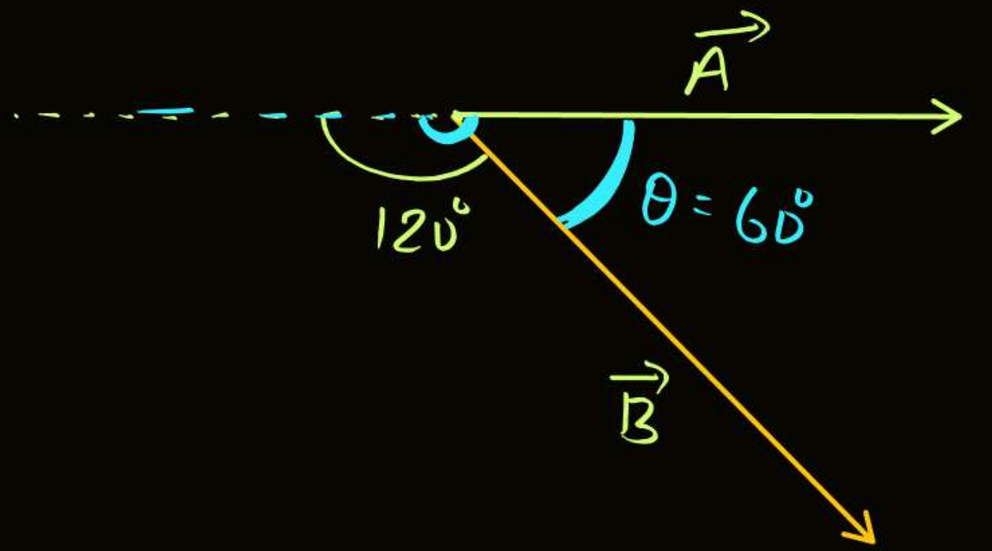
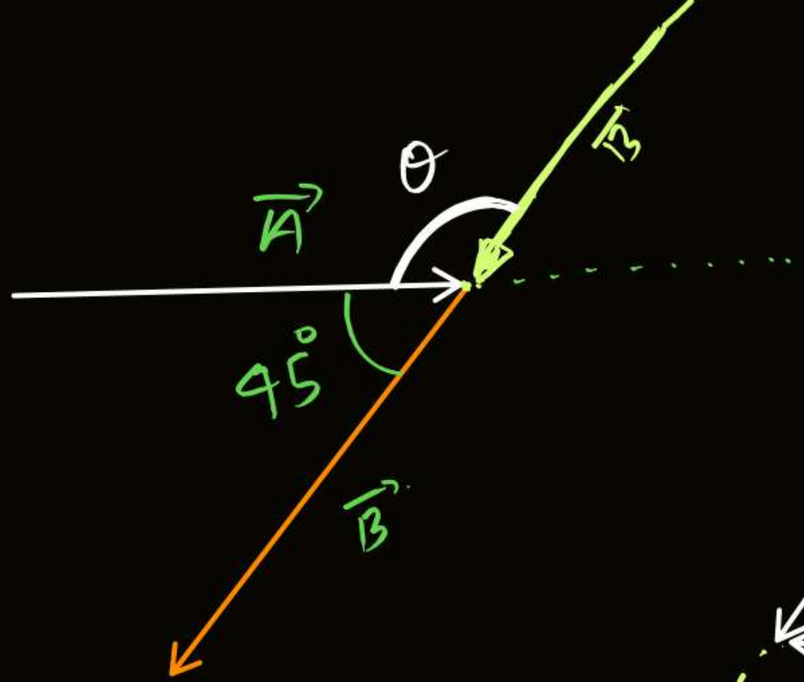
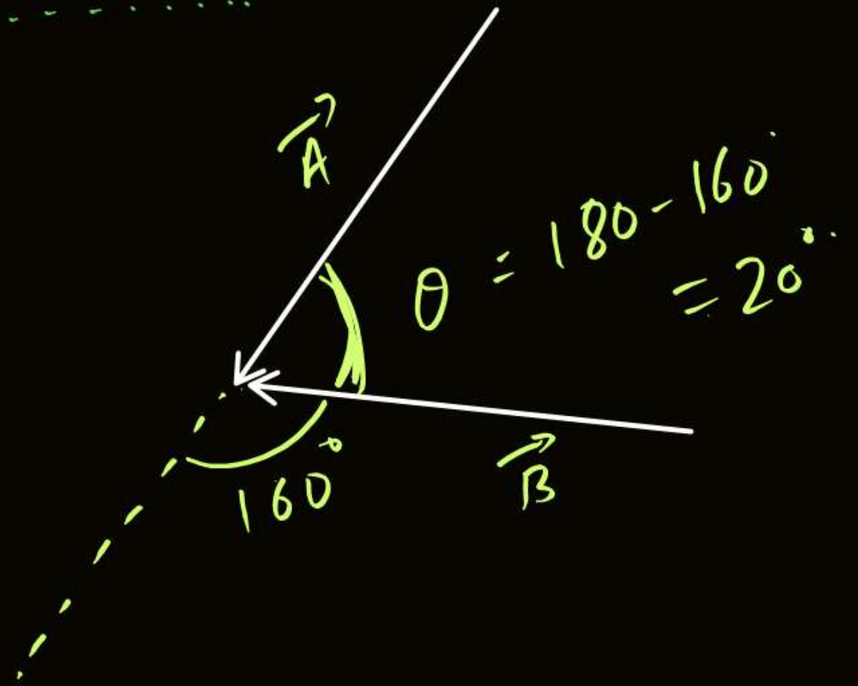


Angle b/w $\vec{A}$ & $\vec{B}$



$\theta = 135°$

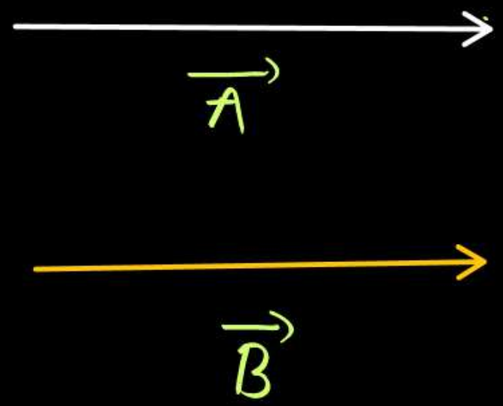


TYPE OF VECTOR

1. Equal Vector :

Having same magnitude and direction of same nature.

Ex - velocity / force / accn.

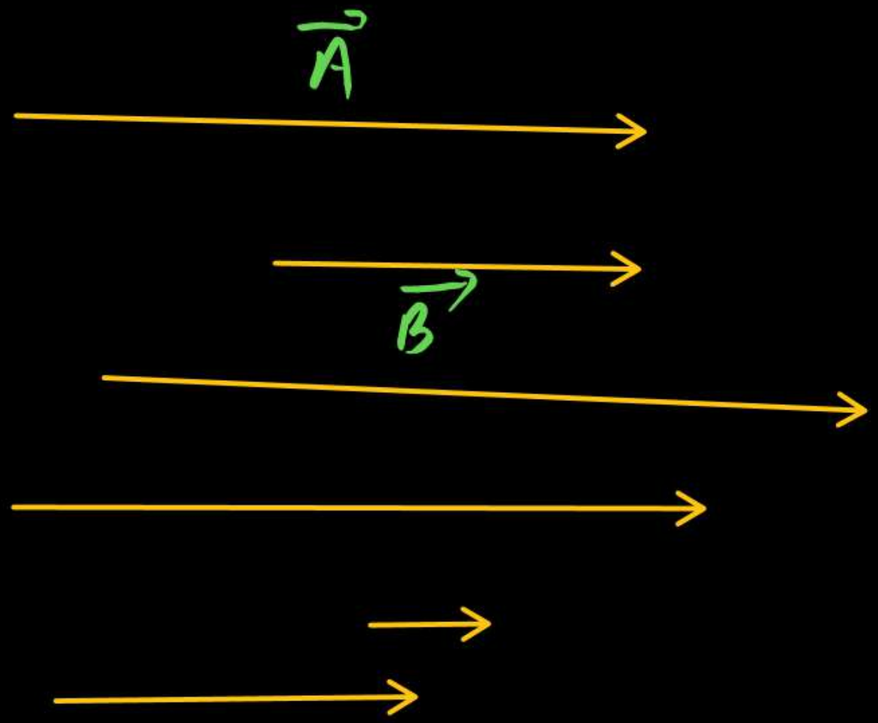


$\vec{A} = \vec{B}$

Force = velocity ✗

2. Parallel vector :

Having same direction but magnitude may or may not equal.



all equal vectors are Parallel vectors ✓

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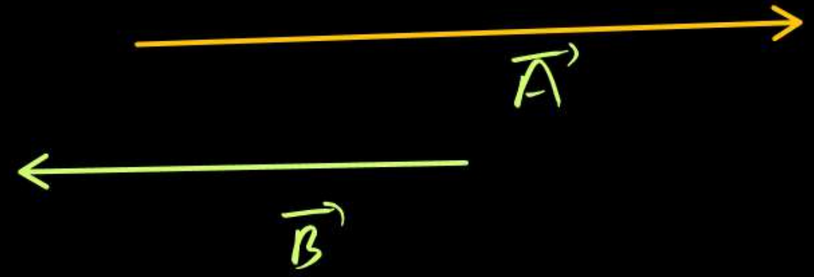
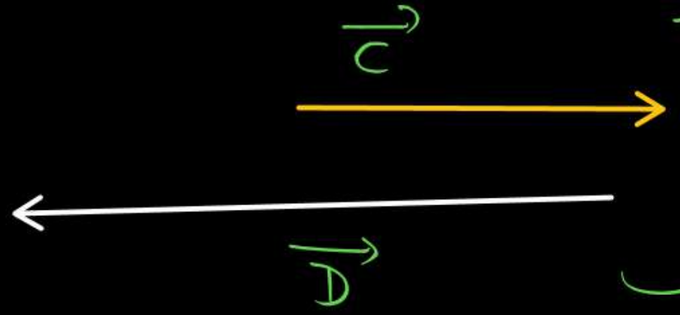
(2.4) Anti-Parallel vector :

→ have opposite dir^{n} Magnitude may or may not be equal.



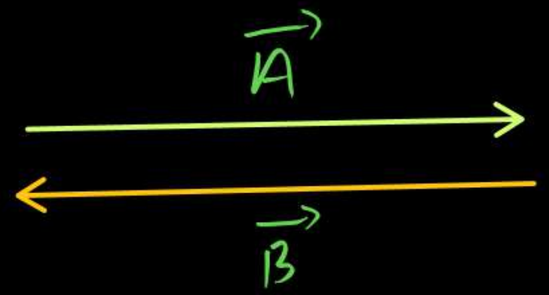
$\theta = 180^{\circ}$



→ Anti Parallel

2. – ve vector's

Having same magnitude but opposite direction.



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

3. Zero vector/null vector :

↳ have zero magnitude is called zero vector.

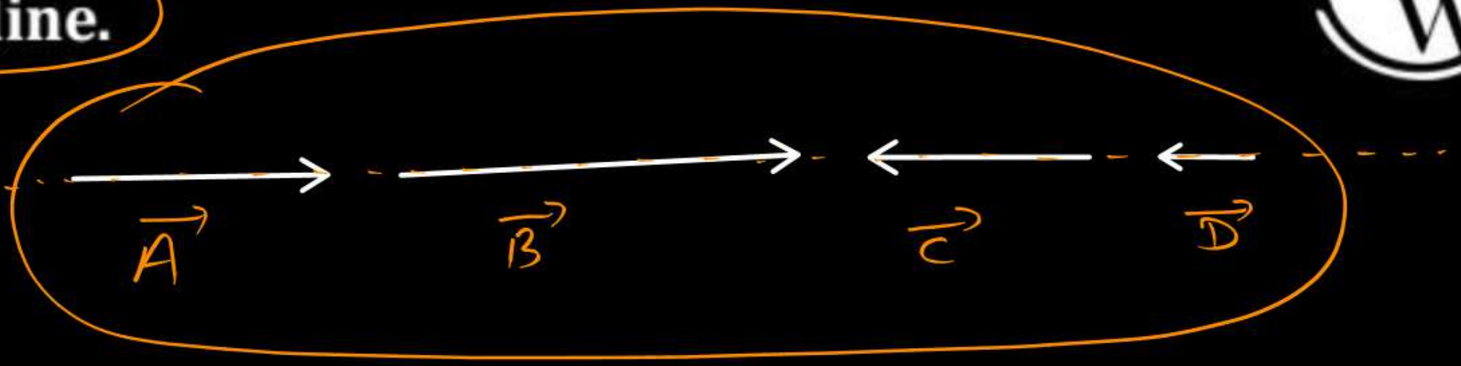
rest

velocity = 0 m/s

net force = 0 N

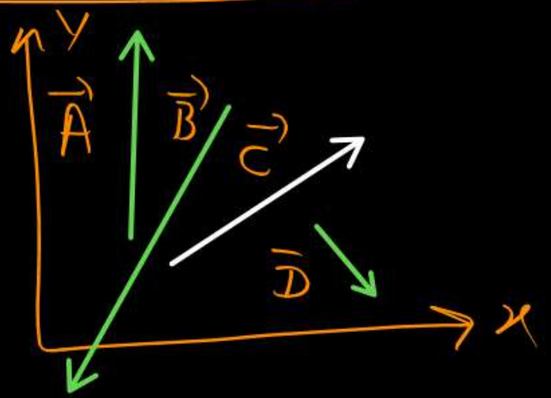
3. ~~Collins~~ vector are in same line.

Co-liner vector



4. Coplanar vector :

All Vector are in same plane



5. Unit vector :

A vector **Which have unit magnitude and represent direction.**

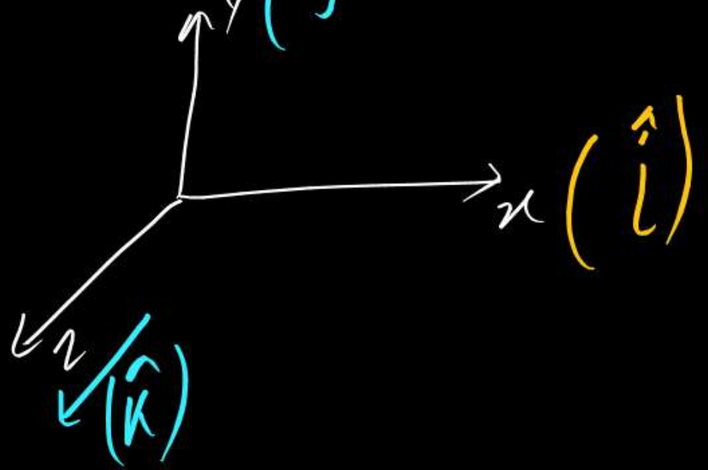
$$\vec{A} = A\hat{A}$$

$\hat{A}$ → direction.

$$\hat{A} = \frac{\vec{A}}{A} = \text{direction.}$$

10 along y-axis $= 10\hat{j}$

$V = 10\,m/s$ along x-axis $= 10\hat{i}$



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Which of the following represents a unit vector?

(a) $\frac{|\vec{A}|}{\vec{A}}$

(b) $\frac{\vec{A}}{|\vec{A}|}$

(c) $\frac{\vec{A}}{\vec{A}}$

(d) $\frac{|\vec{A}|}{|\vec{A}|}$

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

$|\vec{A}|$ → magnitude of $\vec{A}$

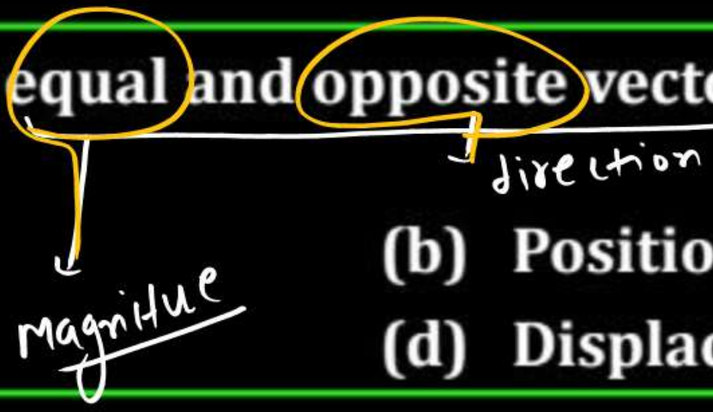
A vector is added to an equal and opposite vector of similar nature, forms a

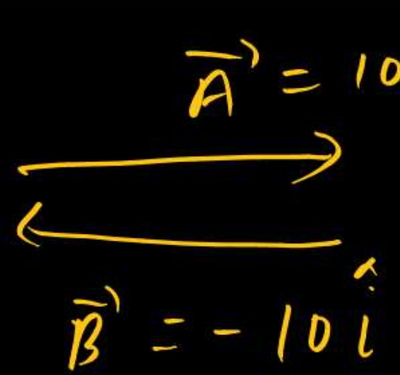
(a) Unit vector

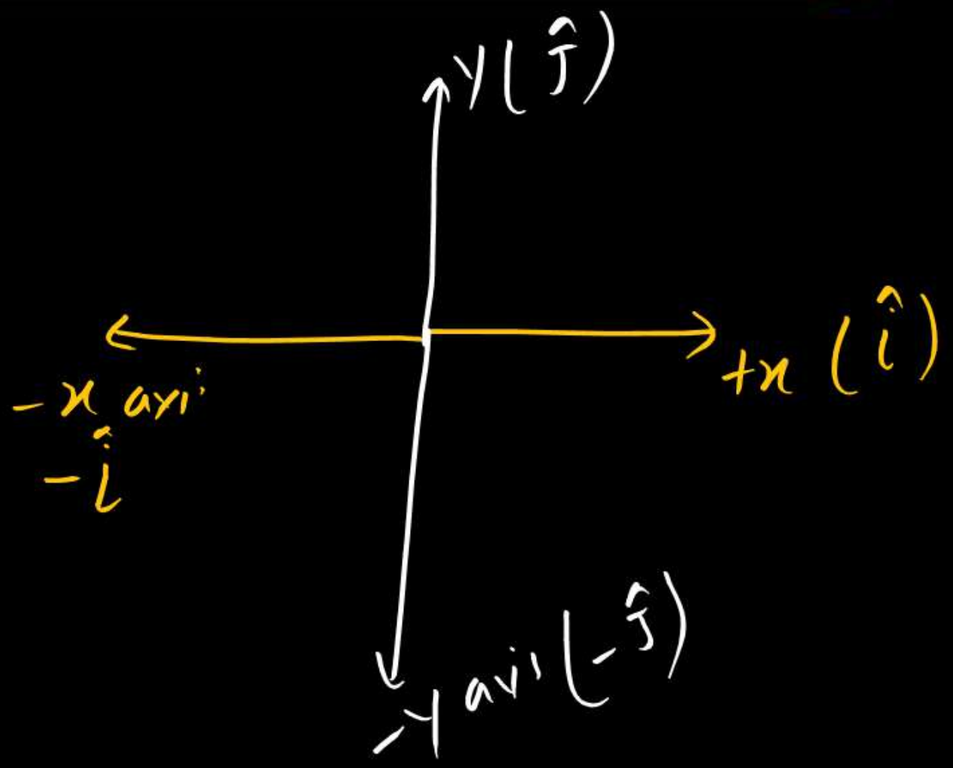
(b) Position vector

(c) Null vector

(d) Displacement vector

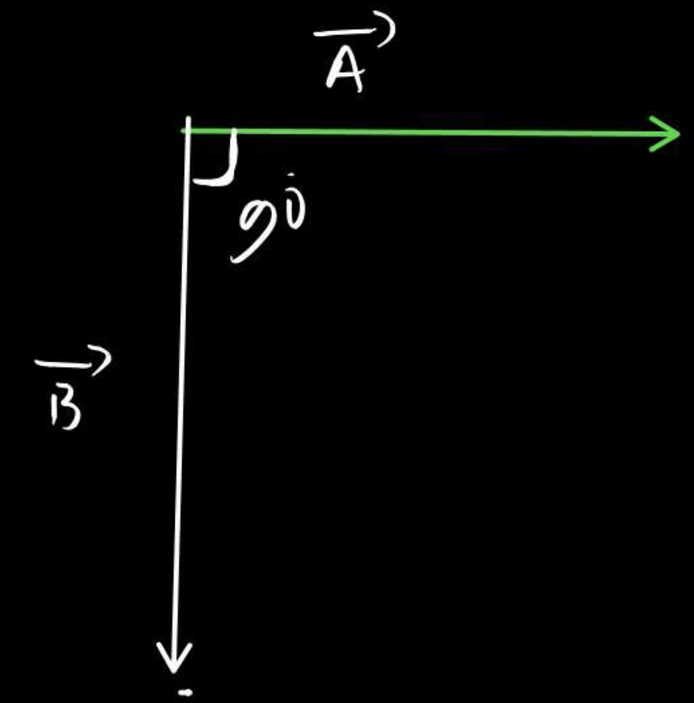






6. Orthogonal vectors

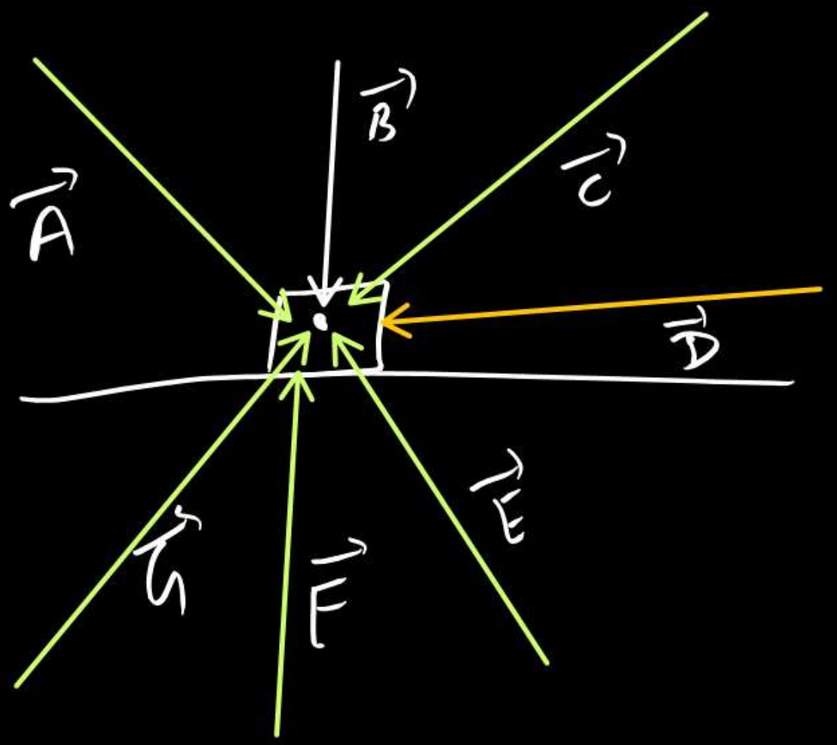
Vector exactly perpendicular to each other.



$\vec{A}$ & $\vec{B}$ are orthogonal to each other

7. Con-current vectors

Vector exactly acting at a point.



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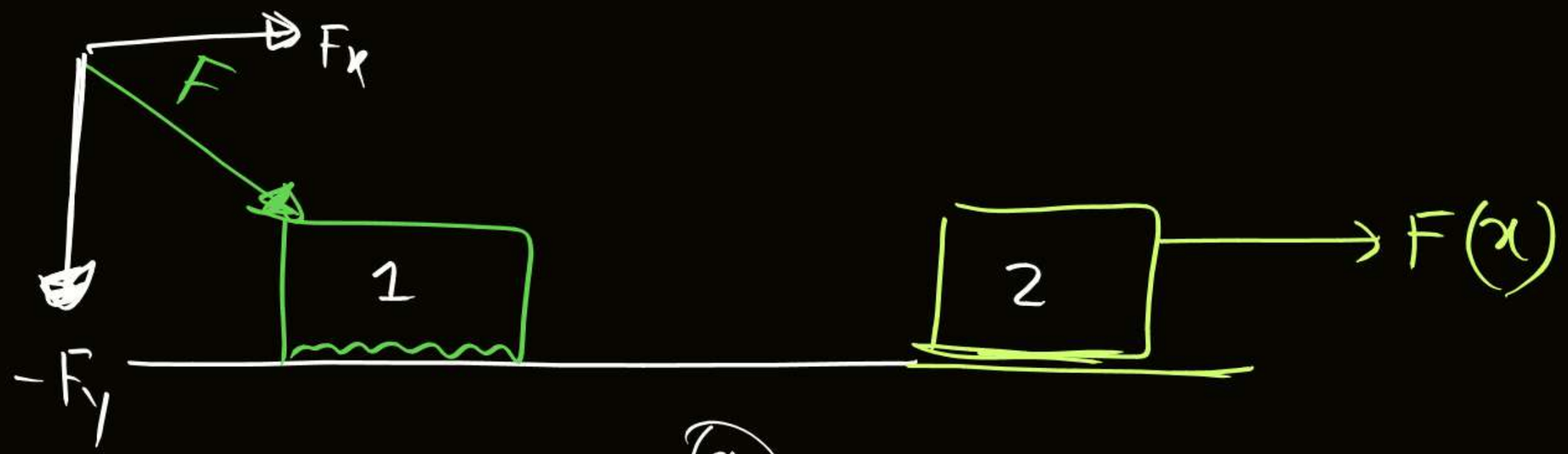
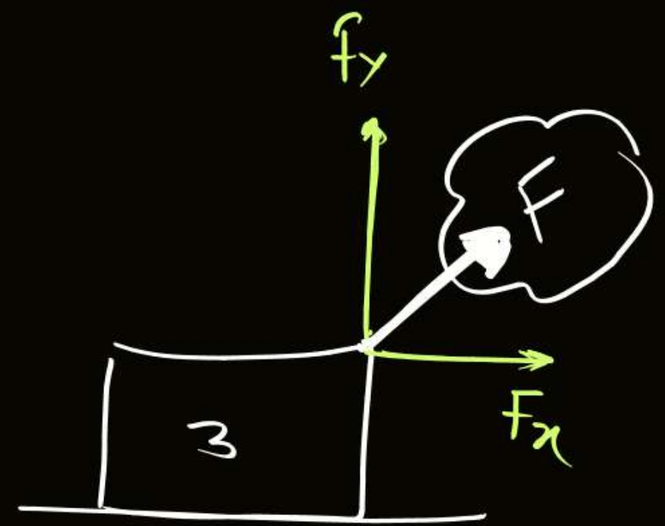
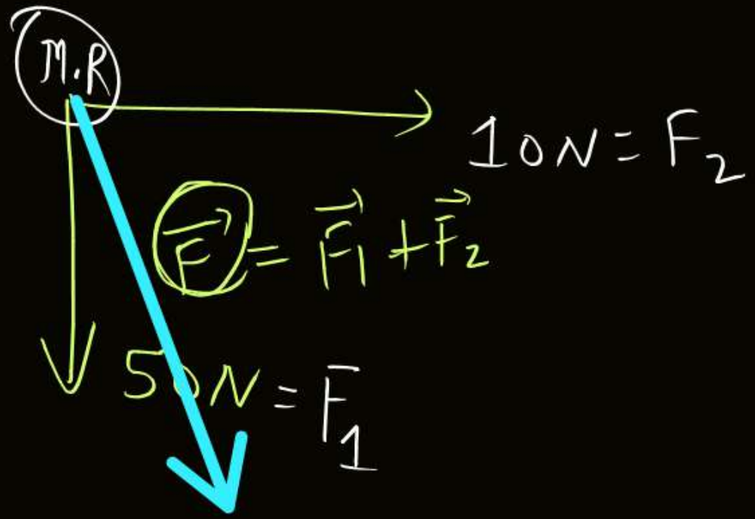
effect

Component



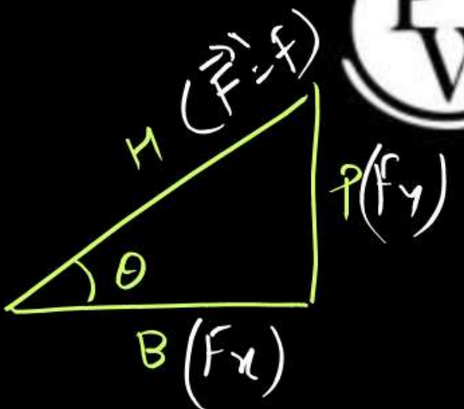


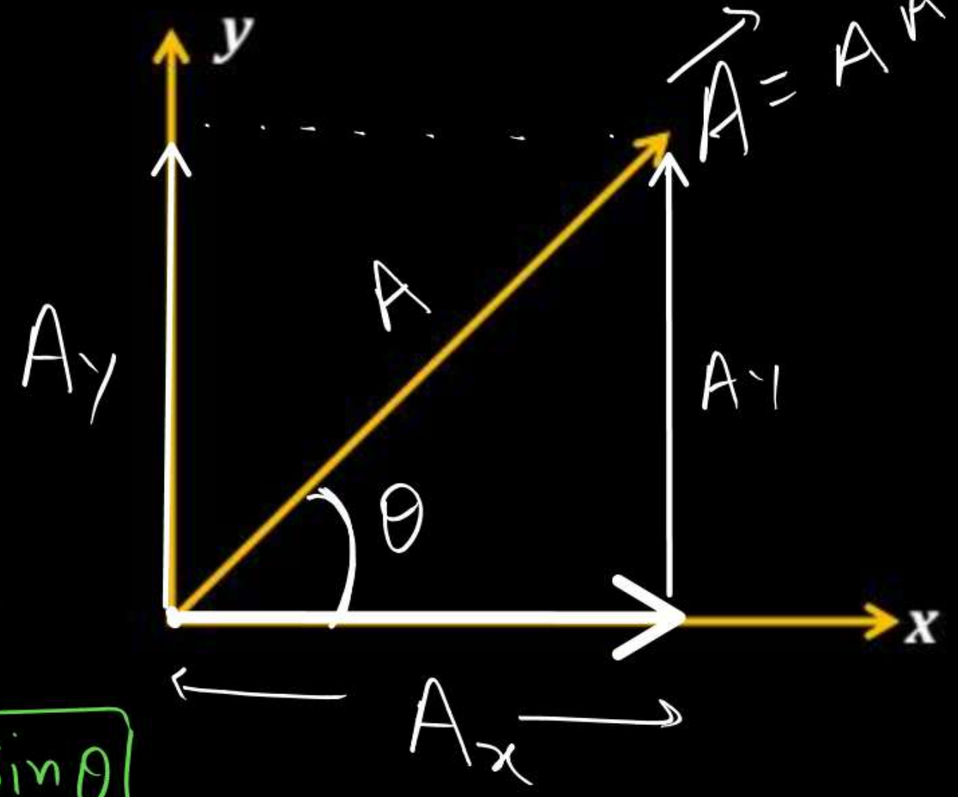


COMPONENT OF VECTOR

vector को तोड़ना किसको या
vector को Break करना

effect





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

$\sin\theta = \frac{A_y}{A}$

$A_y = A\sin\theta$

$\cos\theta = \frac{A_x}{A}$

$A_x = A\cos\theta$

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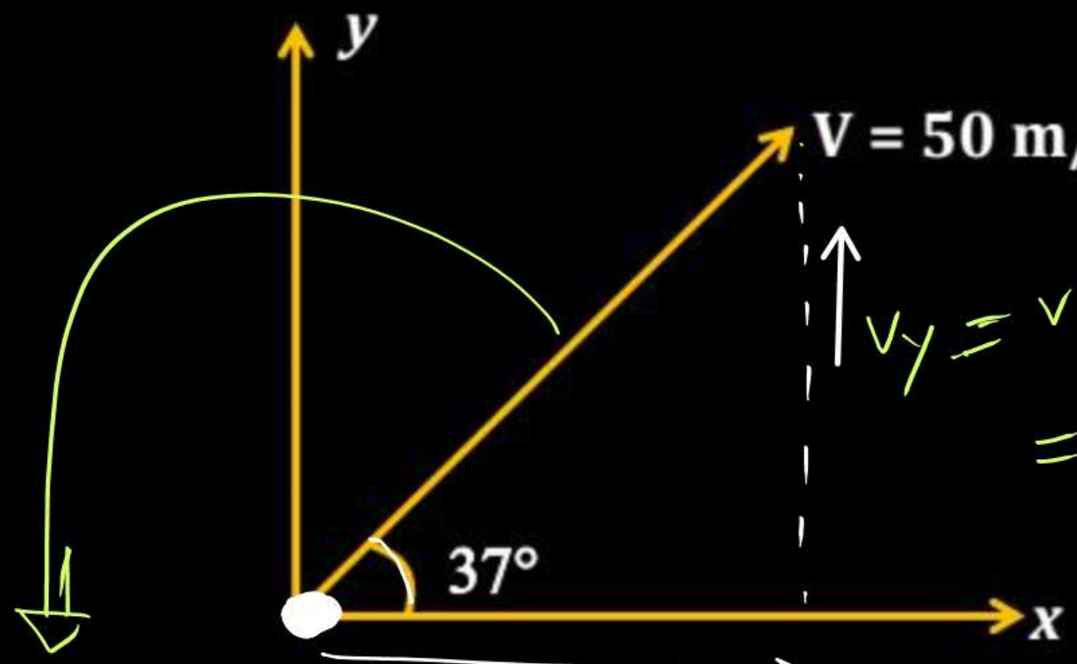
Find .... velocity of object along x-axis.



$V_y = V \sin 37^\circ \hat{j}$

$= 50 \times \frac{3}{5} = 30\hat{j}$

$V_x = V \cos 37^\circ$

$= 50 \times \frac{4}{5} = 40 m/s \hat{i}$

$\vec{V} = 40\hat{i} + 30\hat{j}$

Ans

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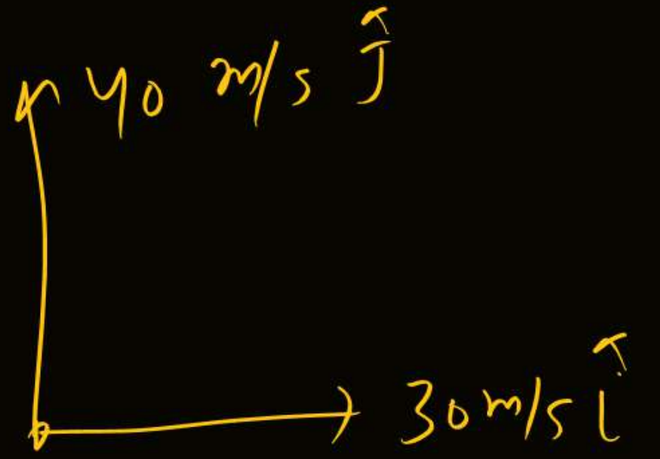
30 m/s $\hat{i}$

40 m/s $\hat{i}$

$$\vec{A} = 30\,m/s\,\hat{i} + 40\,m/s\,\hat{i}$$

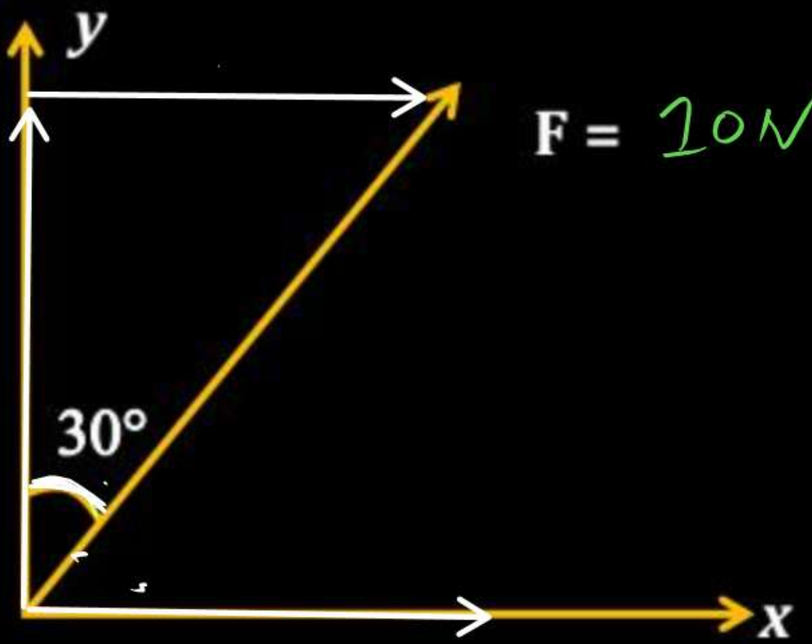
$$= 70\,m/s\,\hat{i}$$ ✓



$\vec{v} = 30\hat{i} + 40\hat{j}$

$= 70$ ✗

Find .....



$F_y = F\cos 30^\circ$

$= 5\sqrt{3}\,\hat{j}$

$F_x = F\sin 30 = 5\hat{i}$

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Magnitude of Vector

Addition of component of vector

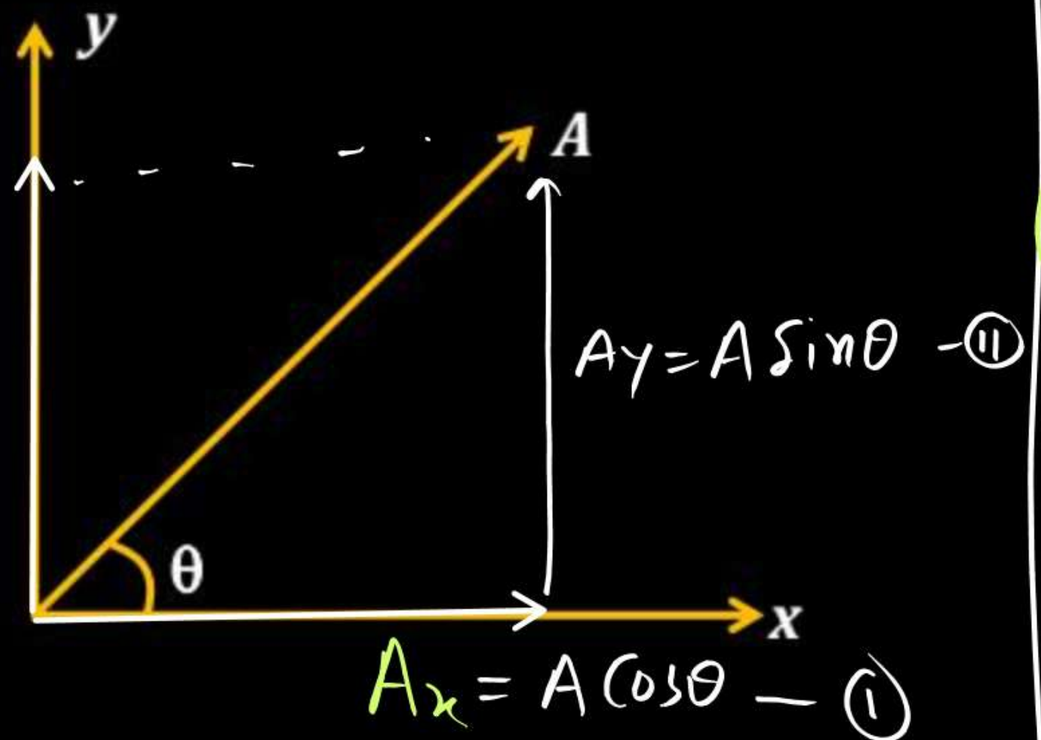
$$\vec{A} = A_x \hat{i} + A_y \hat{j}$$

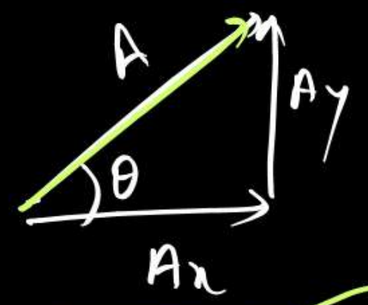
$$(I)^2 + (II)^2$$

$$A_x^2 + A_y^2 = A^2 [\sin^2\theta + \cos^2\theta]$$

$$A^2 = A_x^2 + A_y^2$$

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





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

मगजूरी

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Find magnitude of vector :

(i) $\vec{A} = 2\hat{i} + 3\hat{j}$ (ii) $\vec{A} = 3\hat{i} + 4\hat{j}$ (iii) $\vec{A} = 8\hat{i} + 6\hat{j} + 10\hat{k}$

(iv) $\vec{A} = \hat{i} - \hat{j} + \hat{k}$ (v) $\vec{A} = \hat{i} + \hat{k} + 2\hat{j}$

Soln (i) $A = \sqrt{A_x^2 + A_y^2}$

$= \sqrt{(2)^2 + (3)^2}$

$= \sqrt{4 + 9}$

$= \sqrt{13}$

(ii) $A = \sqrt{9 + 16}$

$= \sqrt{25}$

$= 5$

(iii) $A = \sqrt{64 + 36 + 100}$

$= \sqrt{200}$

$= 10\sqrt{2}$

(iv) $A = \sqrt{(1)^2 + (-1)^2 + (1)^2}$

$= \sqrt{3}$

(v) $A = \sqrt{(1)^2 + (1)^2 + 4}$

$= \sqrt{6}$

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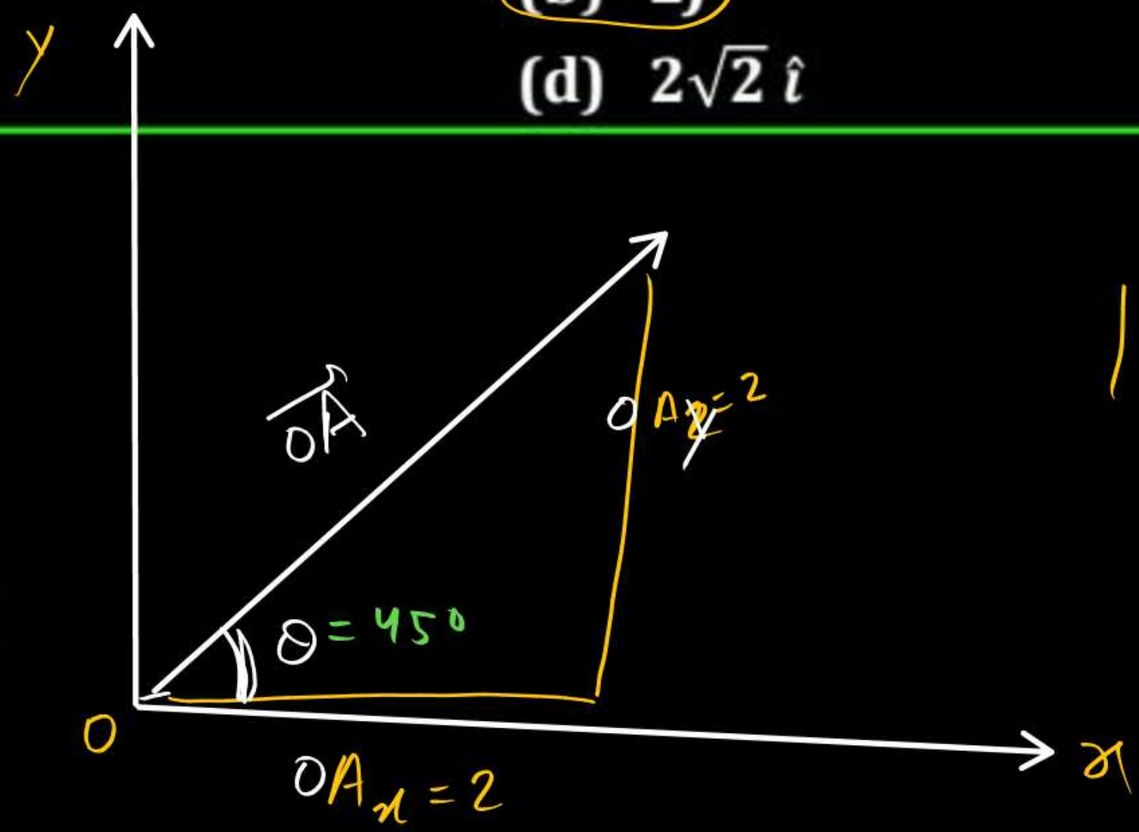
The vector $\overrightarrow{OA}$ where O is origin is given by $\overrightarrow{OA} = 2\hat{i} + 2\hat{j}$. Now its is rotated by 45° anticlockwise about 0. what will be the new vector?

(a) $2\sqrt{2}\,\hat{j}$ (b) $2\hat{j}$

(c) $2\hat{i}$ (d) $2\sqrt{2}\,\hat{i}$



$$\# \quad \tan\theta = \frac{(OA)_y}{(OA)_x}$$

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

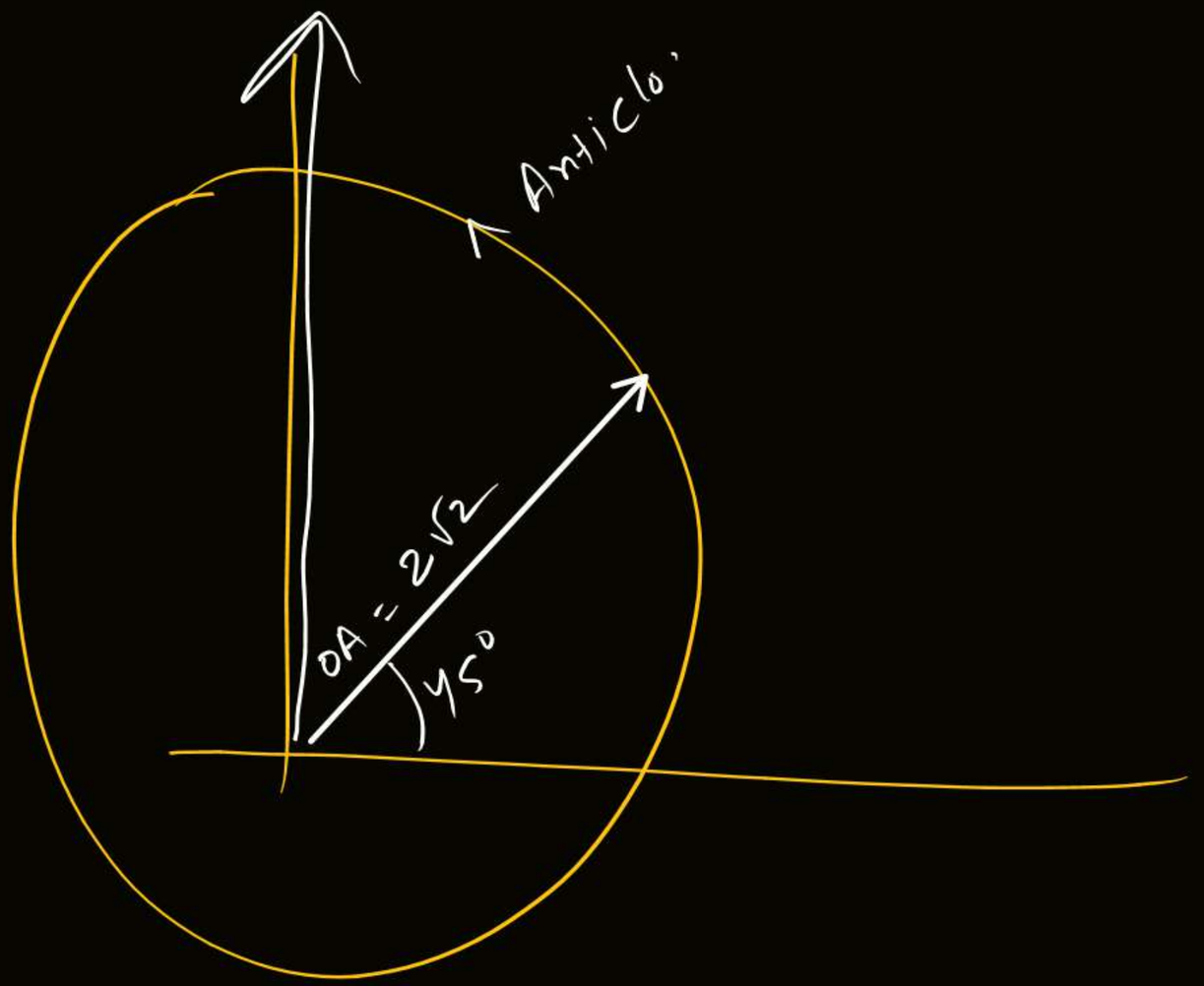
$$\tan\theta = 1$$

$$\theta = 45°$$

$$|\overrightarrow{OA}| = \sqrt{4+4}$$

$$= \sqrt{8}$$

$$= 2\sqrt{2}$$


Anticlo,
OA = 2√2
45°

Basic Properties of Vector

- **Multiplication of vector with scalar :**

$\vec{A} = 2\hat{i}$

find $3\vec{A} = 3(2\hat{i})$

$= 6\hat{i}$

- **Addition of vector with scalar :** ✗

find $\frac{\vec{A}}{2} = \frac{2\hat{i}}{2} = \hat{i}$

$\vec{A} + 3$

Not Possible

$\Rightarrow 3\hat{i} + 3$

$= 3(\hat{i} + 1)$ ✗

- **Addition of two vector :**

$\vec{A} = 2\hat{i} + 3\hat{j}$ $\quad \vec{B} = 3\hat{i} - \hat{j}$

find $\vec{A} + \vec{B} = ?$

$\vec{A} + \vec{B} = 2\hat{i} + 3\hat{j} + 3\hat{i} - \hat{j}$

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

$\vec{A}$ is a vector of magnitude 2.7 units due east. What is the magnitude and direction of vector $4\vec{A}$?

(a) 4 Units due east

(b) 4 Units due west

(c) 2.7 Units due east

(d) 10.8 Units due east

$|\vec{A}| = 2.7$ unit

$\hat{A}$ = east

Unit vector does not have any

(a) Direction ✓

(b) Magnitude ✓ (Unit + magni)

(c) Unit

(d) All of these

kg / m / sec.

$\vec{A} = 10\ m/s\ \hat{i}$

$\hat{A} = \dfrac{\vec{A}}{|\vec{A}|} = \dfrac{10\ m/s\ \hat{i}}{10\ m/s} = 1\ \hat{i}$

The magnitude of $\hat{i} + \hat{j}$ is

(a) 2

(b) 0

(c) $\sqrt{2}$

(d) 4

A vector multiplied by the number 0, results into (A) then vector becomes

(a) 0 (null vector)

(b) $\vec{A}$

(c) $\vec{A}$

(d) $\hat{A}$

If $\vec{P}+\vec{Q}=\vec{0}$ then which of the following is necessarily true?

(a) $\vec{P}=\vec{0}$

(b) $\vec{P}=-\vec{Q}$

(c) $\vec{Q}=\vec{0}$

(d) $\vec{P}=\vec{Q}$

$$\vec{P}+\vec{Q}=\vec{0}$$

$$\boxed{\vec{P}=-\vec{Q}}$$

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The displacement of a particle from a point having position vector $2\hat{i} + 4\hat{i}$ to another point having position vector $5\hat{i} + 1\hat{i}$ is

(a) 3 units
(b) $3\sqrt{2}$ unites
(c) 5 units
(d) $5\sqrt{3}$ units

$2\hat{i} + 4\hat{i}$ → initial Position vecto

$5\hat{i} + 1\hat{i}$ → final Position.

$$\text{displacment} = \vec{r}_f - \vec{r}_i$$

$$= (5\hat{i} + 1\hat{j}) - (2\hat{i} + 4\hat{j})$$

$$= 3\hat{i} - 3\hat{j}$$

magnitude $3\sqrt{2}$

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

(a) x-axis
(b) y-axis
(c) z-axis
(d) Object does not move

$$F_{net} = \vec{F_1} + \vec{F_2} + F_3$$

$$= 2\hat{i} + 2\hat{j} + 2\hat{i} - 2\hat{j} - 4\hat{i}$$

$$= 0$$

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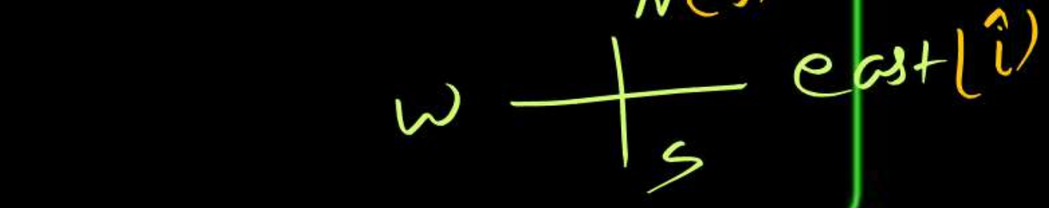
A body moves 6 m north, 8m east and 10 m vertically upwards, the resultant displacement of body from its initial position is

(a) $10\sqrt{2m}$

(b) 10 m

(c) $\frac{10}{\sqrt{2}}$ m

(d) 20 m



$\text{disp}^n = 6\hat{j} + 8\hat{i} + 10\hat{k}$

TRIANGLE LAW OF VECTOR ADDITION

To add two vector $\vec{A}$ and $\vec{B}$ shift any of two such that tail of B at the head of $\vec{A}$ then sum of $\vec{A}$ and $\vec{B}$ is $\vec{R}$. Which is from tail of A to head of $\vec{B}$.

THANK YOU ☺