Data Science and Artificial Intelligence

Linear Algebra

Lecture No.- 01

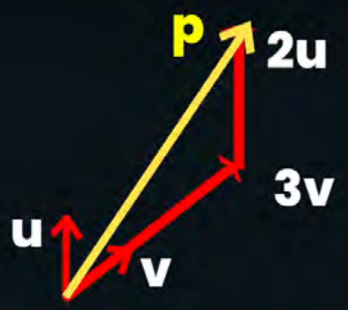
By- Rahul Sir

Topics to be Covered

Topic Geometric Vectors

Geometric Vectors

Geometric Vectors



$$p = 2u + 3v$$

Geometric Vectors

Linear Algebra

Linear Algebra 01

Module 01

- ✓ Geometrical Vectors
- ✓ Vector space (1)
- ✓ Vector space - Problem (2)
- ✓ determinant of matrix (Introduction matrix)

✓ Module 02

- ✓ matrix
- ✓ matrix Transformations
- ✓ Iteration of matrix
- ✓ matrix Properties

Geometric Vectors

Linear Algebra :: (Vectors)

$$\text{quantities} \begin{cases} \text{Vector} \\ \text{Scaler} \\ \text{Tensor} \end{cases}$$

✓ Scaler quantity → magnitude (How much)

(measurement)

Temp → 60°c, 50°c, 30°c, −1°c

2) Vector quantity

magnitude + Direction

✓ Torque → mag + Direction
✓ Momentum → mag + Direction
✓ Impulse − mag + Direction
✓ velocity − mag + Direction
✓ Displacement,

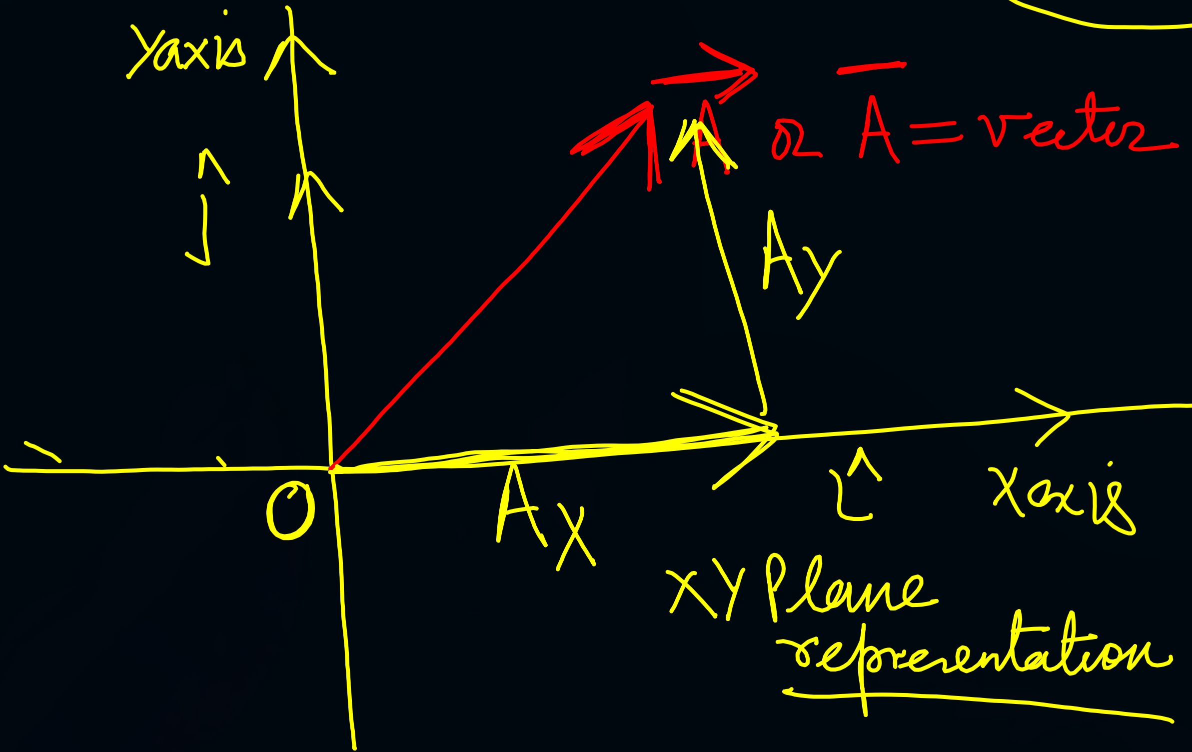
5, −5, +7, −7, 8, −8

Geometric Vectors

Vector quantity $\longrightarrow$ magnitude + Direction

$\overline{\text{V}}$elocity $\longrightarrow$ 5 M/SEC (magnitude ✓) + (Direction ?)

$\longrightarrow$ −5 M/SEC magnitude ✓ + (Direction ?)



$$\vec{A} = \vec{A_x}\,x + \vec{A_y}\,y = [A_x, A_y]$$

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

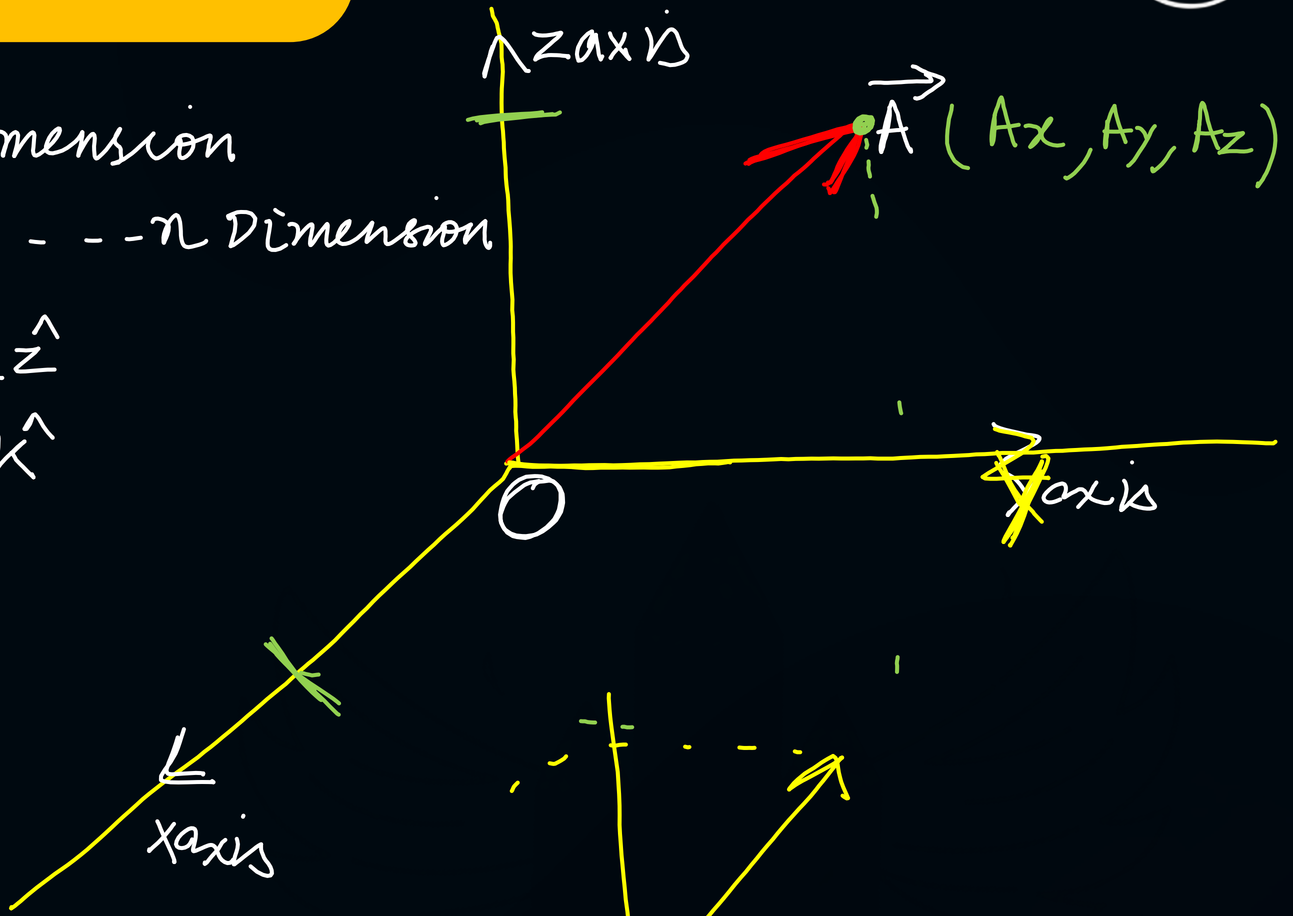
$$\vec{A} = \vec{A_x}\,\hat{x} + \vec{A_y}\,\hat{y}$$

Geometric Vectors

Vectors always one Dimension but projection 2d, 3d - - - n Dimension

$$\vec{A} = \vec{A_x}\hat{x} + \vec{A_y}\hat{y} + \vec{A_z}\hat{z}$$

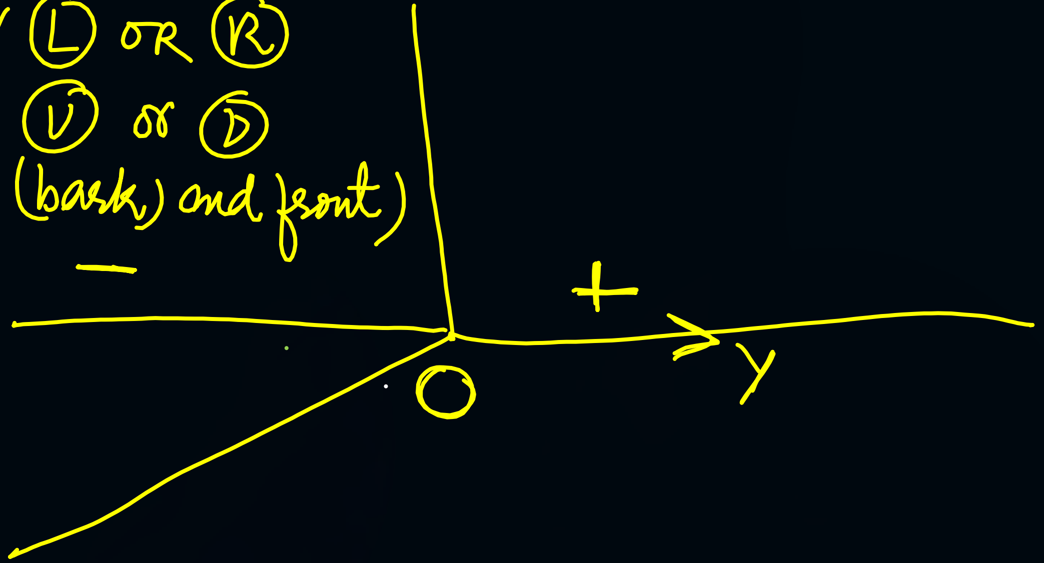
$$\vec{A} = \vec{A_x}\hat{i} + \vec{A_y}\hat{j} + A_z\hat{k}$$



Y (L) or (R)

Z (U) or (D)

X (back) and front)



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

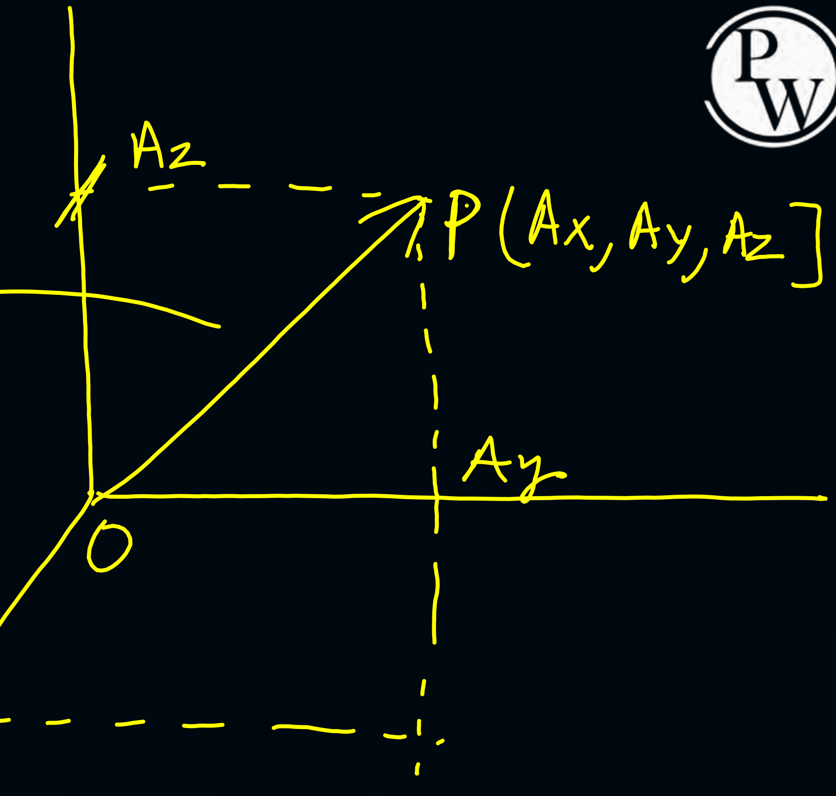
$$|\vec{A}| = \text{mode } \vec{A}$$

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

→ Length of a vector

→ magnitude of a vector

Length of a vector



1) $\vec{A} = 2\hat{i} + 3\hat{j}$

$A_x = 2$

$A_y = 3$

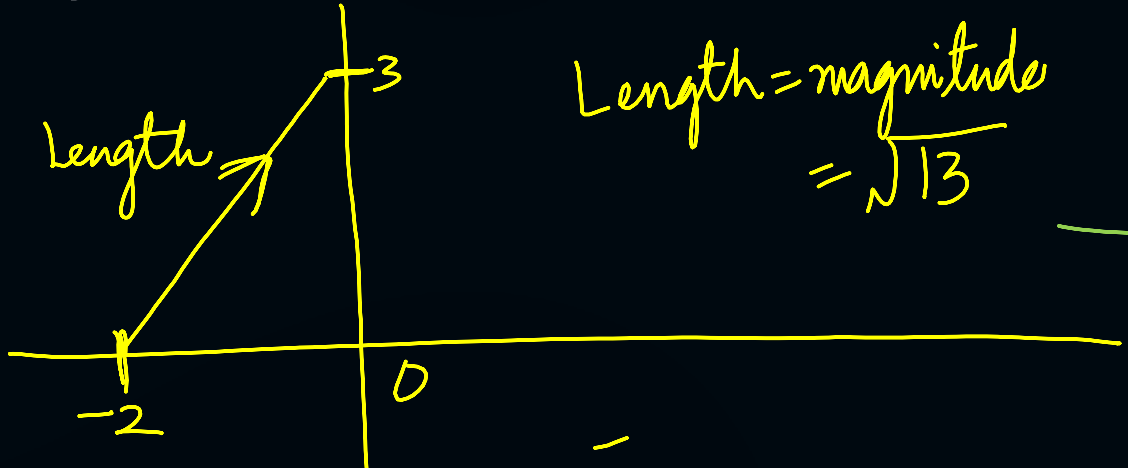
→ Using Phythagorous:

$= (2)^2 + (3)^2$

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

magnitude of a vector $= \sqrt{13}$

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



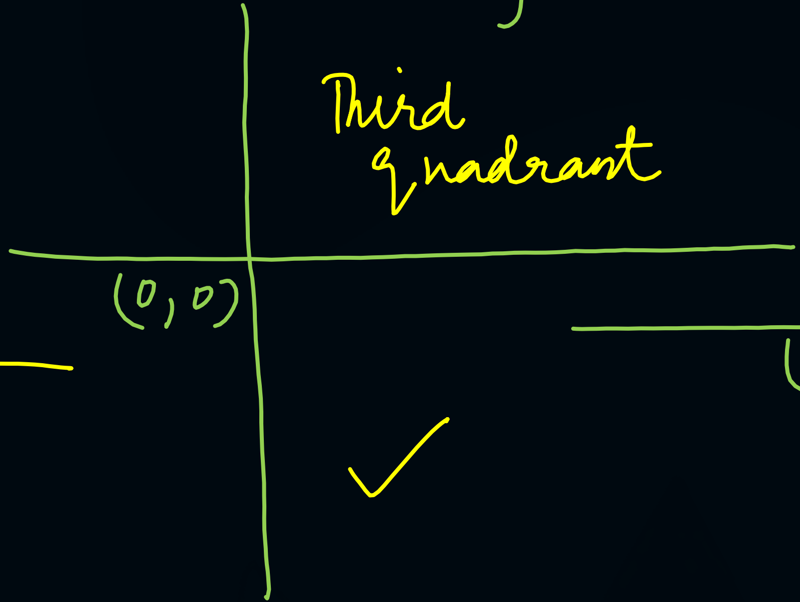
Length = magnitude

$= \sqrt{13}$

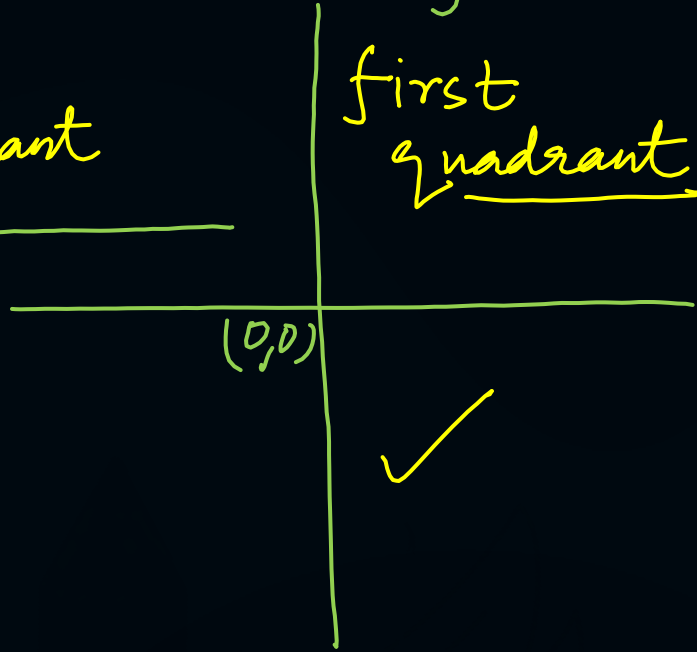
$= \sqrt{(-2)^2 + (3)^2}$

$= \sqrt{13}$

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



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



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

Length / modulus / distance / magnitude

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

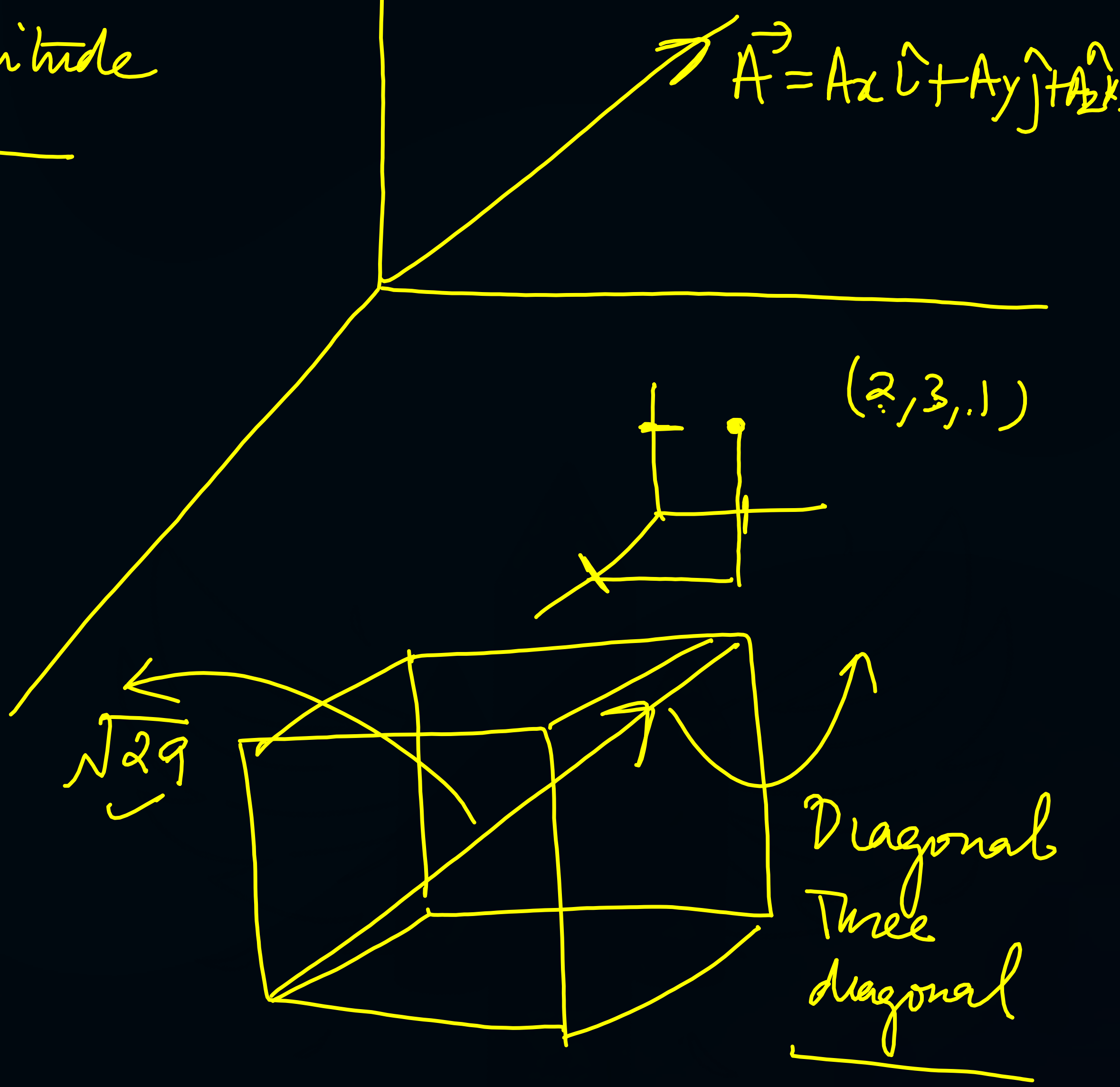
$$|A| = \sqrt{29}$$

Length of vector

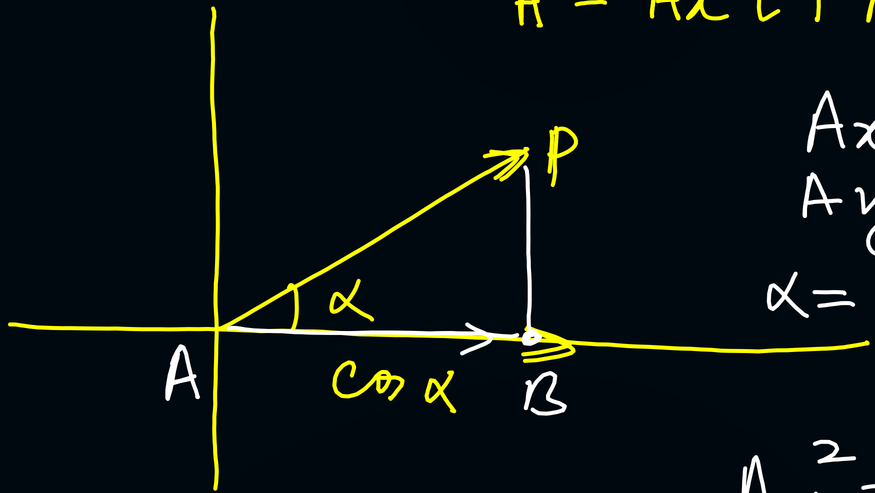
$$\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$$

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

Different
- $A_x \longrightarrow$ Direction ✓
- $A_y \longrightarrow$ ✓
- $A_z \longrightarrow$ ✓



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



$$A_x = AP\cos\alpha \quad \text{—} (1)$$
$$A_y = AP\sin\alpha \quad \text{—} (2)$$

$\alpha =$ Direction

$AP =$ Length of vector

$$A_x^2 = AP^2\cos^2\alpha \quad \text{—} (1)$$
$$A_y^2 = AP^2\sin^2\alpha \quad \text{—} (2)$$

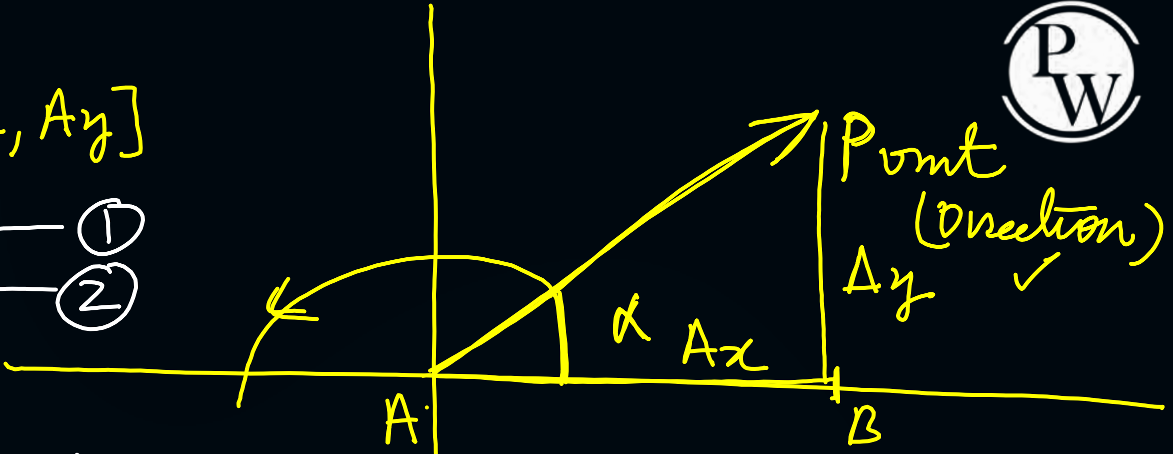
Length of vector

$$\boxed{AP = \sqrt{A_x^2 + A_y^2}}$$

Equ^n (2) ÷ equ^n (1)

$$\frac{AP\sin\alpha}{AP\cos\alpha} = \frac{A_y}{A_x}$$

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



$$\cos\alpha = \frac{AB}{AP}$$

$$\cos\alpha = \frac{A_x}{AP}$$

$$A_x = AP\cos\alpha$$

$$\sin\alpha = \frac{PB}{AP}$$

$$PB = AP\sin\alpha$$

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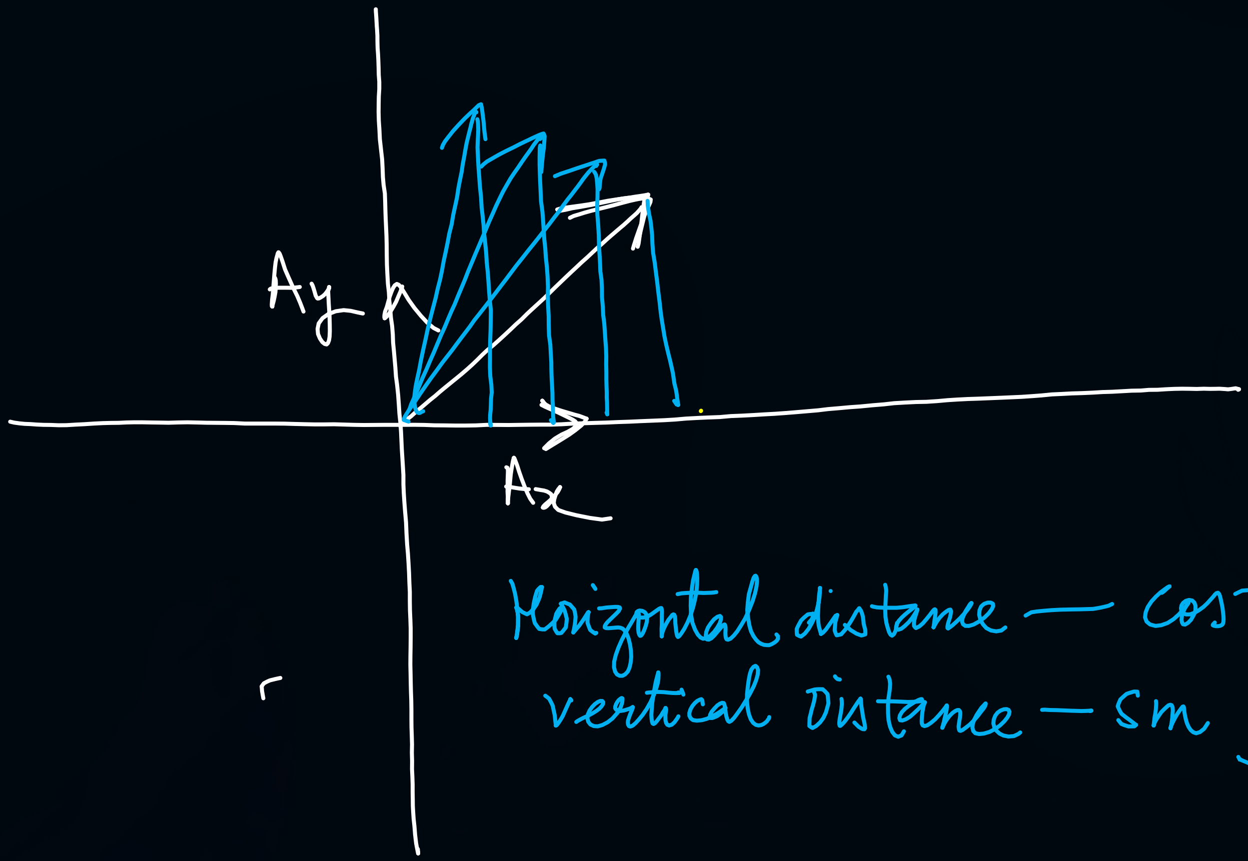
$$\boxed{\tan\alpha = \frac{A_y}{A_x}, \quad \sqrt{A_x^2 + A_y^2} = \text{Length}}$$

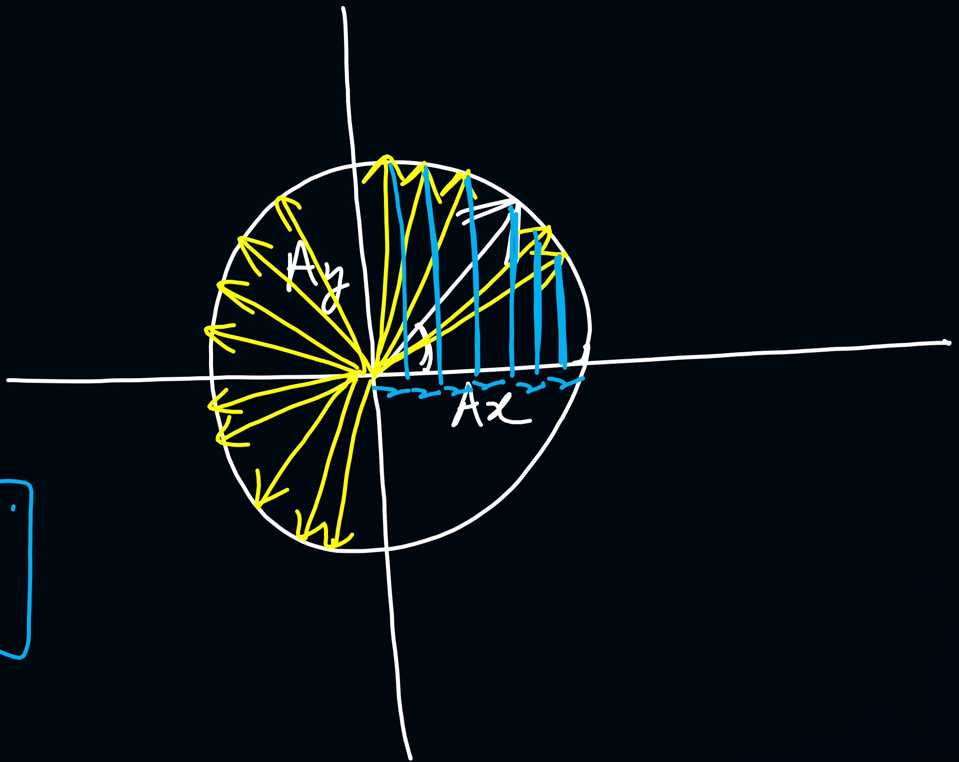
Length $L = \sqrt{A_x^2 + A_y^2}$

magnitude + Direction

(angle) $\alpha = \tan^{-1}\left(\frac{A_y}{A_x}\right)$

Direction





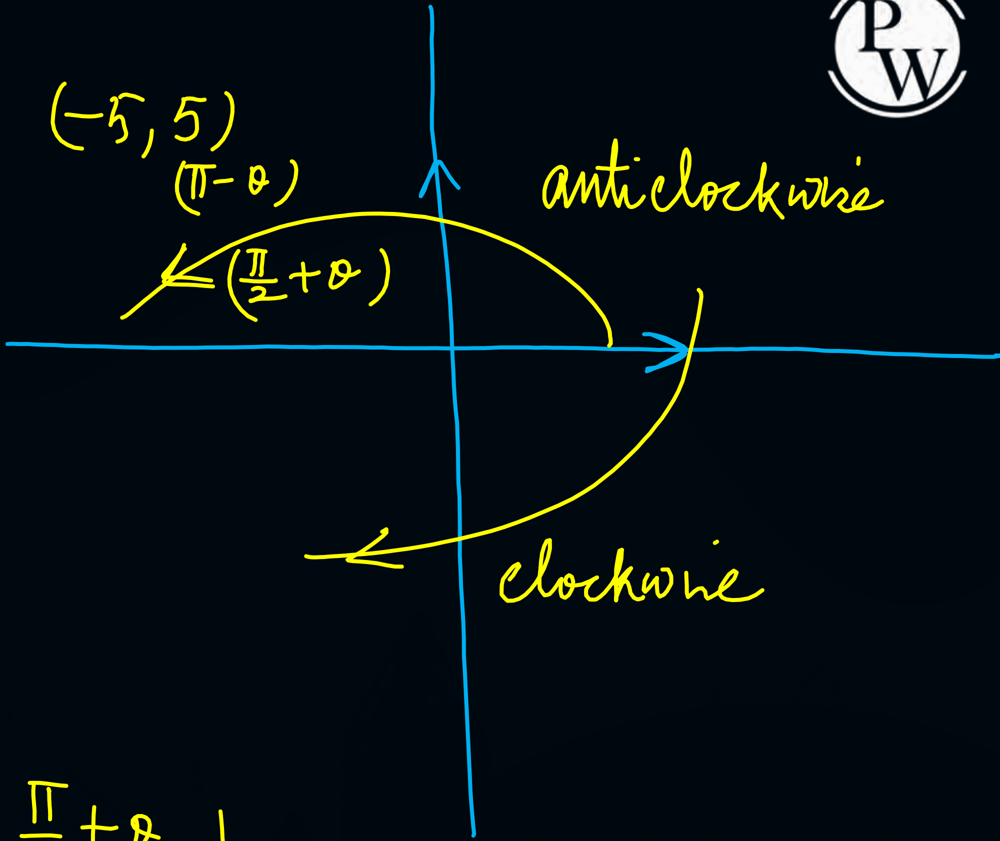
Horizontal distance — cos
vertical Distance — sin

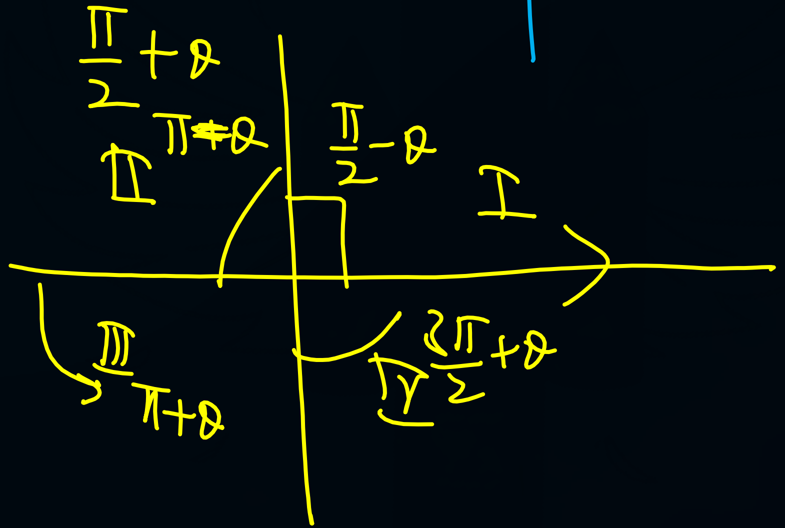
Magnitude + Direction

L, α

$L = 5\sqrt{2}$	135°
$L = 5\sqrt{2}$	45°
$L = 5\sqrt{2}$	225°
$L = 5\sqrt{2}$	315°

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





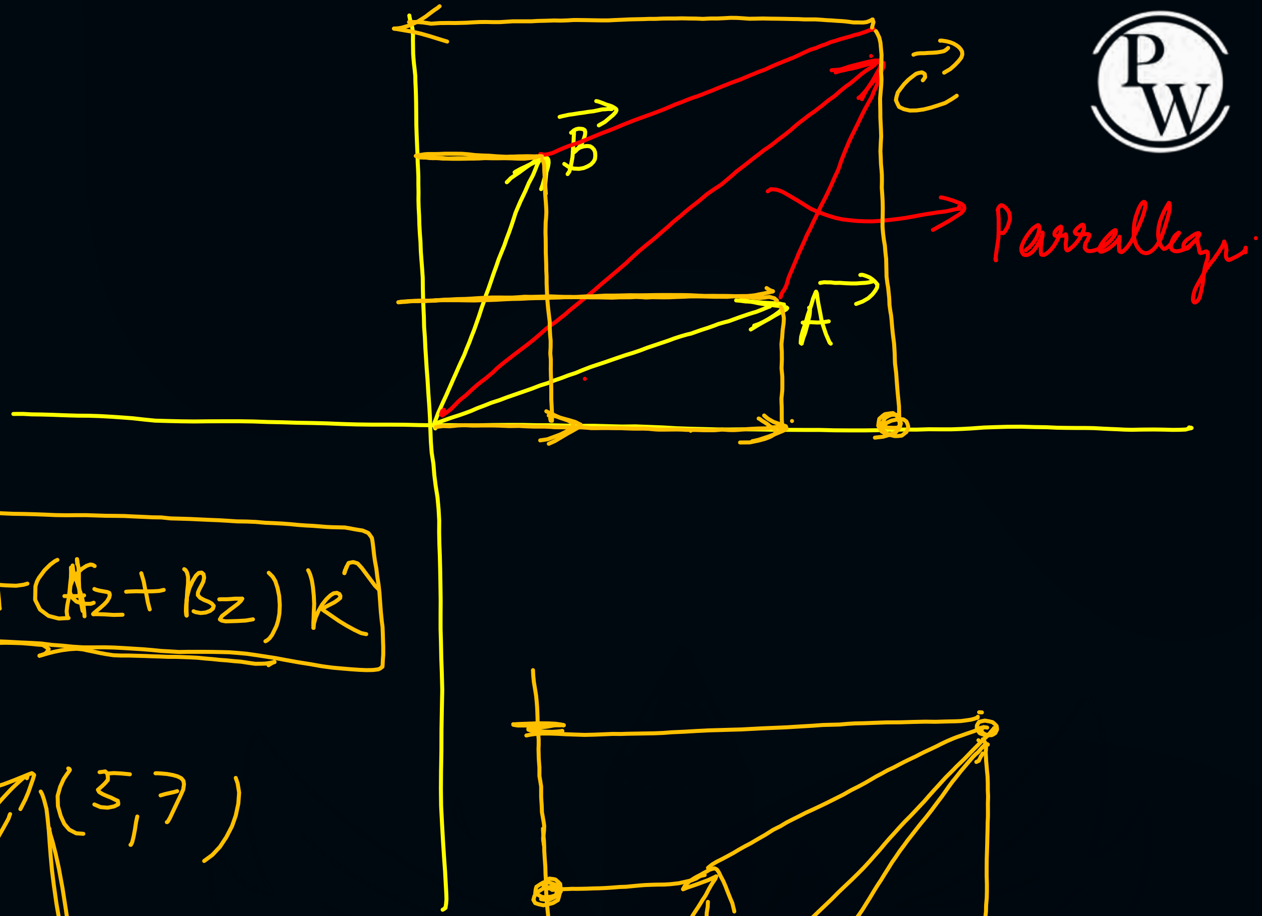
Addition of Vector :

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

$\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k}$

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

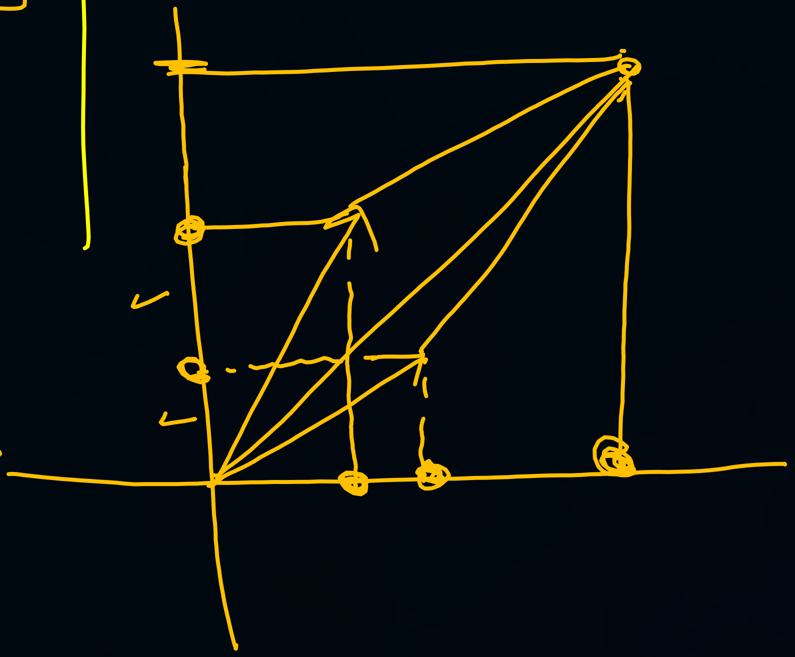
$$\boxed{\vec{C} = (A_x+B_x)\hat{i} + (A_y+B_y)\hat{j} + (A_z+B_z)\hat{k}}$$



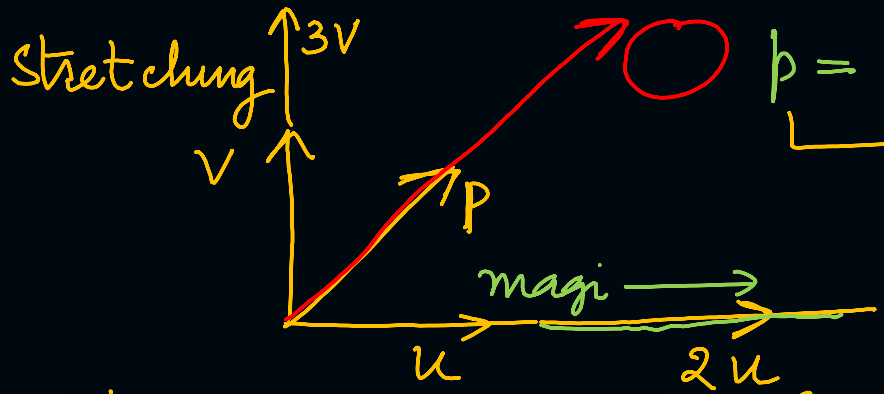
$\vec{A} = 2\hat{i} + 3\hat{j}$

$\vec{B} = 3\hat{i} + 4\hat{j}$

$\vec{A} + \vec{B} = 5\hat{i} + 7\hat{j}$

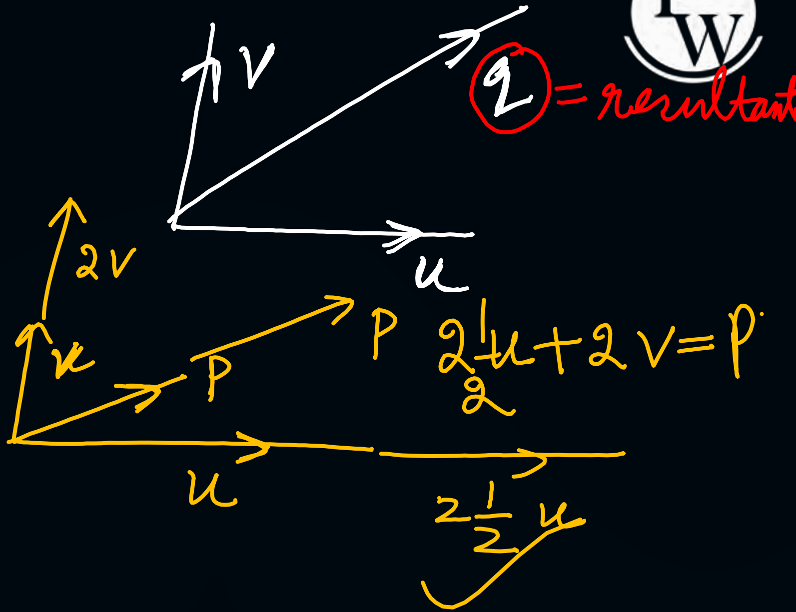


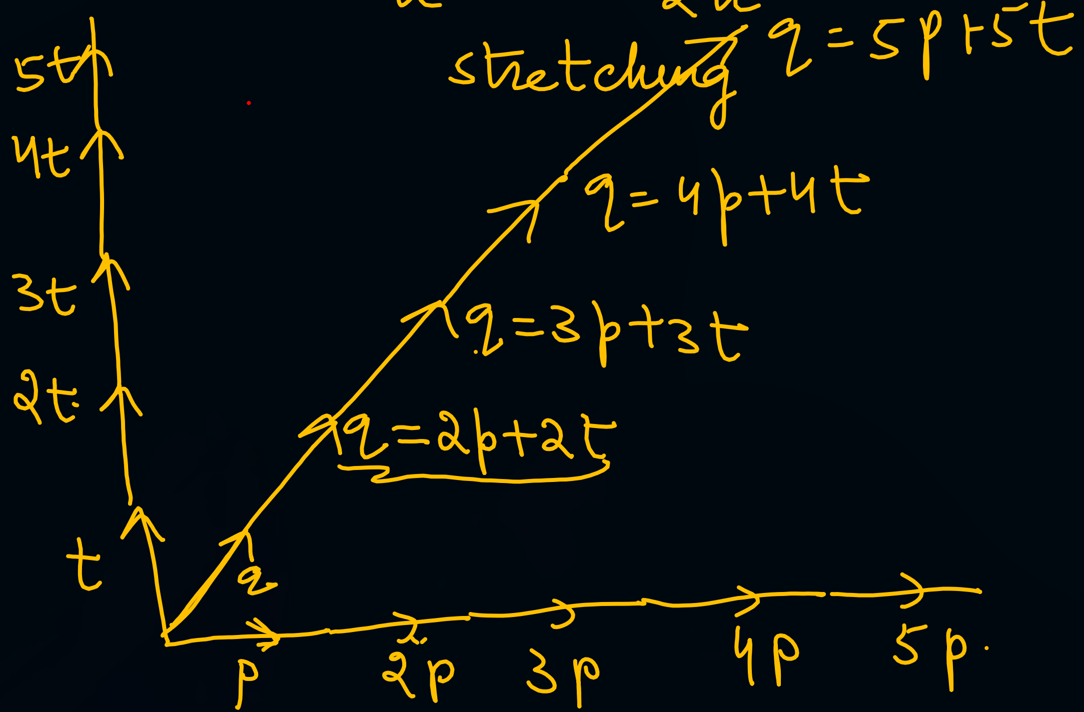
Linear combination:



$p = 2u + 3v$

$\underbrace{2u+3v}_{\text{Linear combination}}$



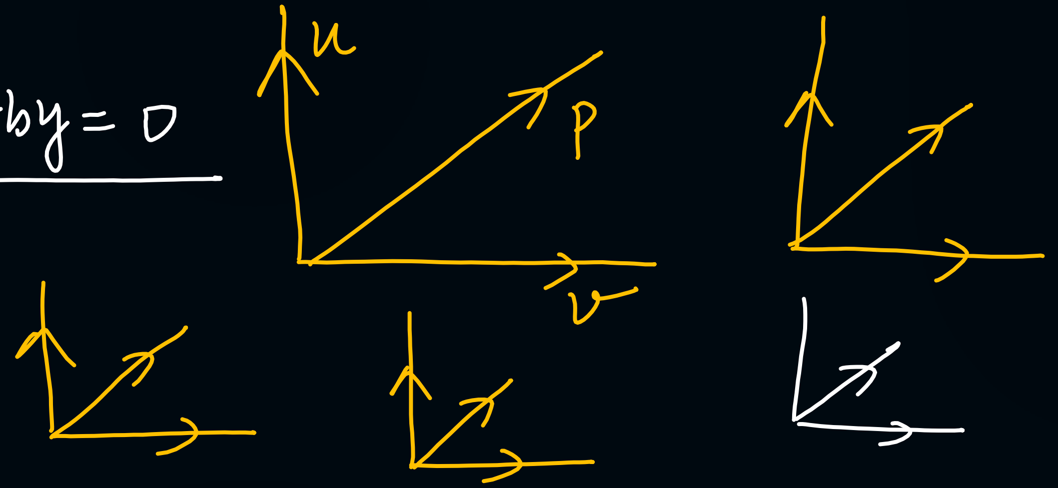


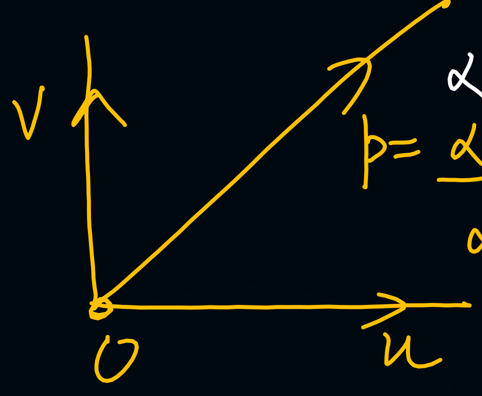
Linear combination

$L = ax + by$

$q = 5p + 5t$

$ax+by=0$





$\alpha=0, \beta=0$

$p=\alpha u+\beta v$

α and β Are change. Then p is also change.

$\alpha x+\beta y=0$ If $\alpha=0$ $\beta=0$

x and y Are Independent vector

$\alpha u+\beta v=0$

$\boxed{\text{Linear combination } L=\alpha x+\beta y}$

$\alpha=0$

$\beta=0$

Independent

$\alpha=0$ $\beta=0$ X and y Are Independent.

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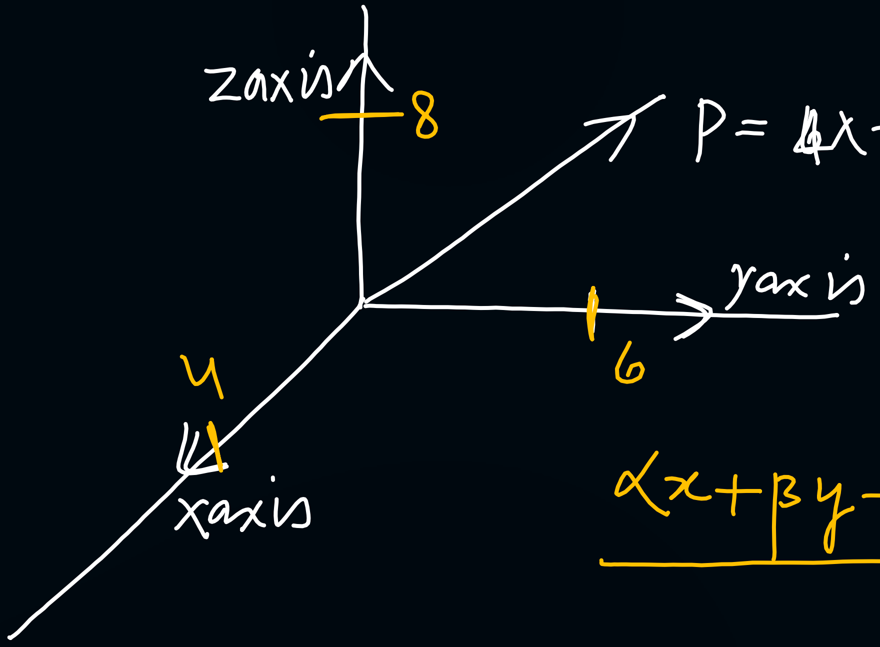


$P = 4x + 6y + 8z$

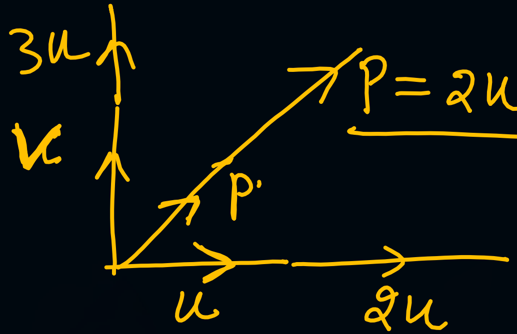
$4x + 6y + 8z = 0$

Linear combination of Three.

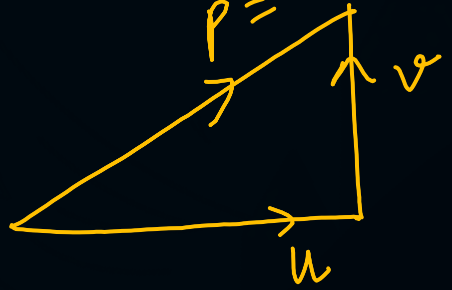
Plane.

α, β, γ

$\alpha x + \beta y + \gamma z = 0$



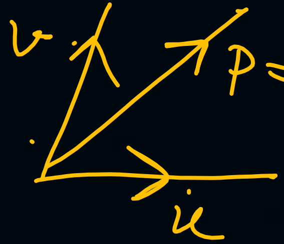
$P = 2u + 3v$



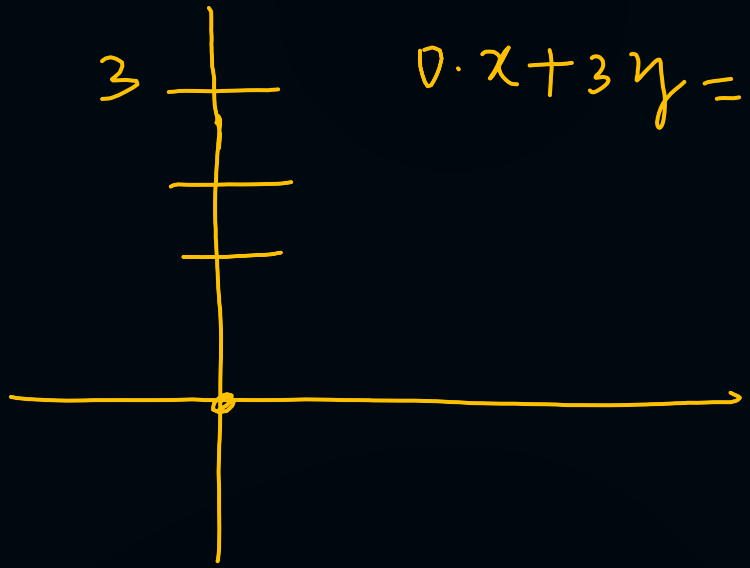
$P = \alpha u + \beta v$

α, β

stretching factor



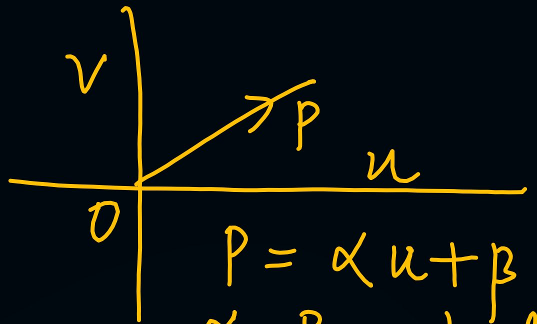
$P = \alpha u + \beta v$



$0 \cdot x + 3y = 0$

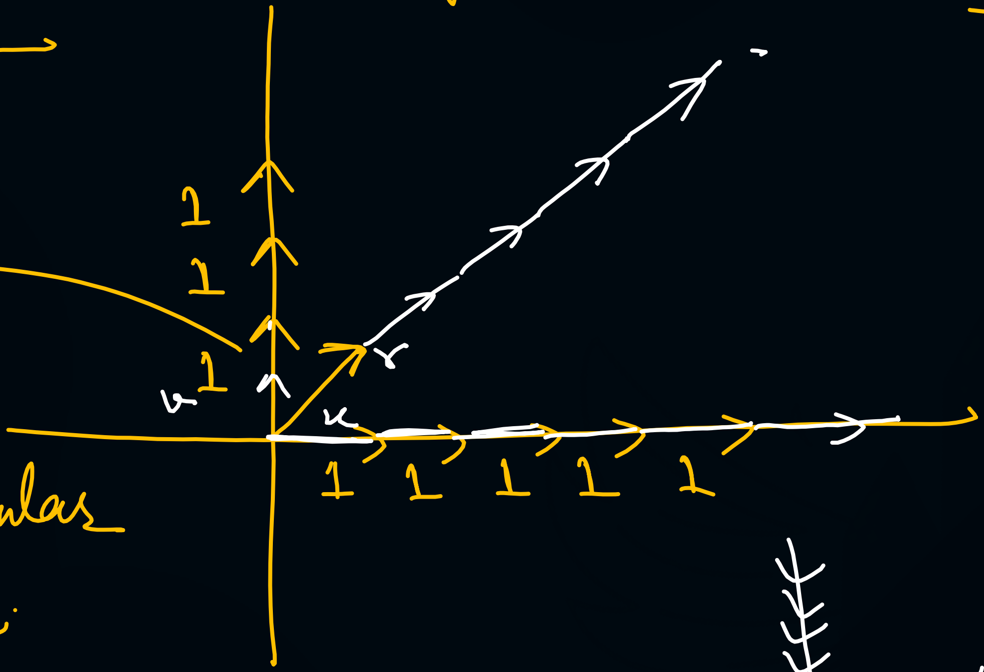
$5x + 3y = 0$

$5x + 3y = k$



$P = \alpha u + \beta v$

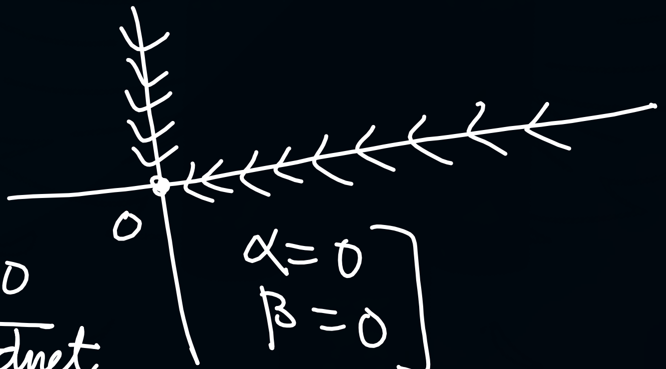
α, β = stretching coefficients



u, and v are Perpendicular to each other.

$\alpha = 0$, $\beta = 0$ $\quad \alpha u + \beta v = 0$

$u \cdot v = 0$ dot product = 0

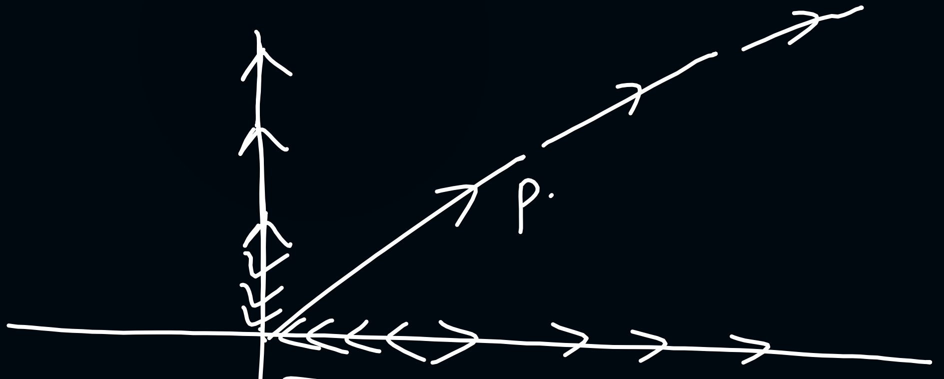


$u \cdot v = 0$

dot product

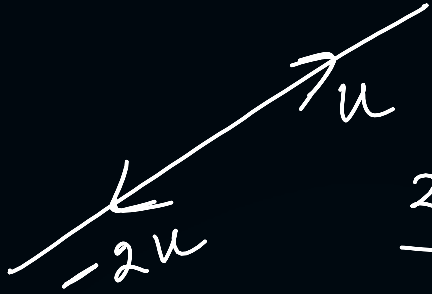
$\alpha = 0$

$\beta = 0$



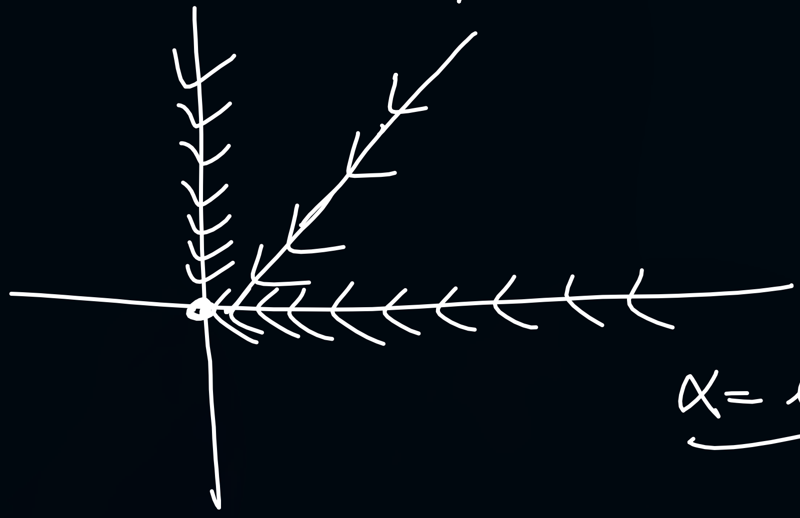
$\boxed{\alpha = 0 \quad \beta = 0}$

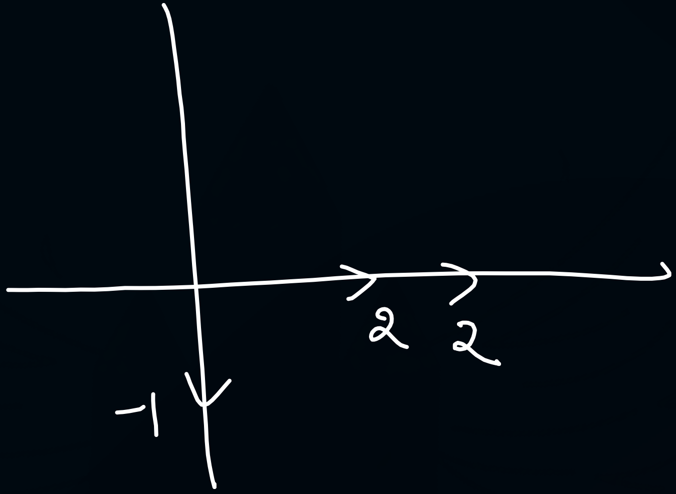
$u \cdot v$ orthogonal
Perpendicular.



$2 \cdot u - v = 0$

$\alpha = 2$
$\beta = -1$





$\alpha =$ eigenvalues

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Rahul Sir PW

10 to 12

Basic

✓ Linear combination

David C-Lay.

linear algebra.

THANK - YOU