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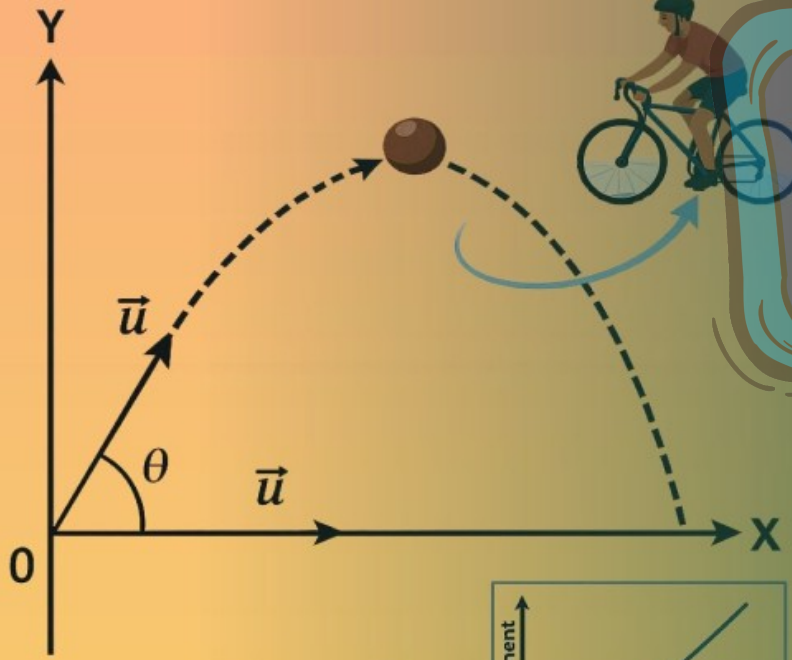
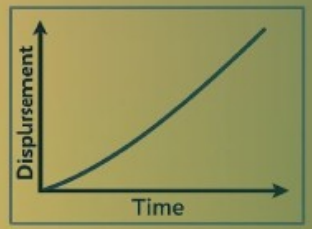




CLASS – 11

PHYSICS

Chapter – 3

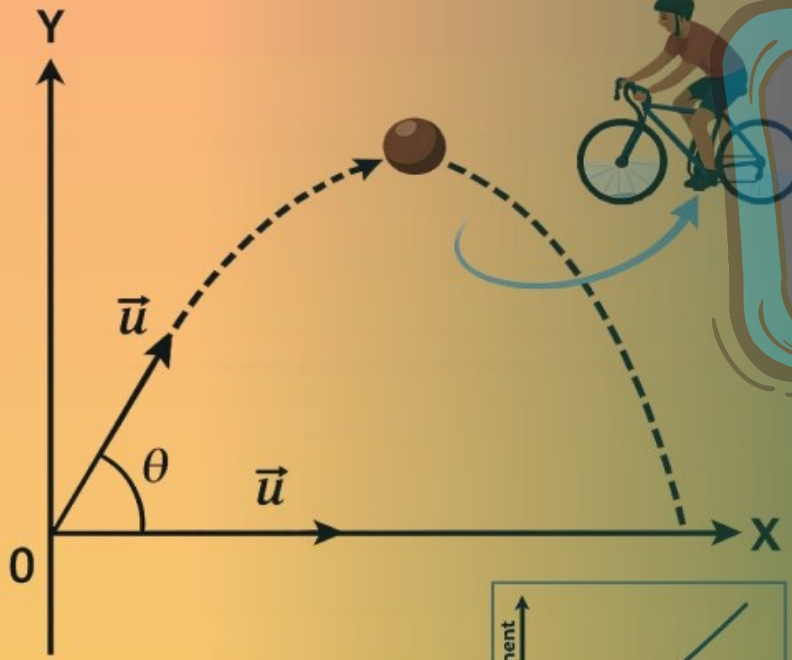
Motion in a Plane

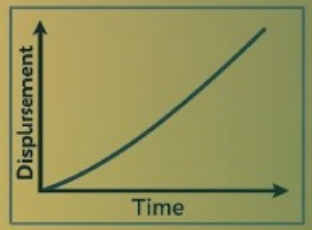
Part – 1

Scalar and Vector Quantities

Alok Gaur

OVERVIEW





1. Scalars and Vectors
2. Addition of Vectors
3. Resolution of Vectors
4. Projectile Motion
5. Uniform Circular Motion

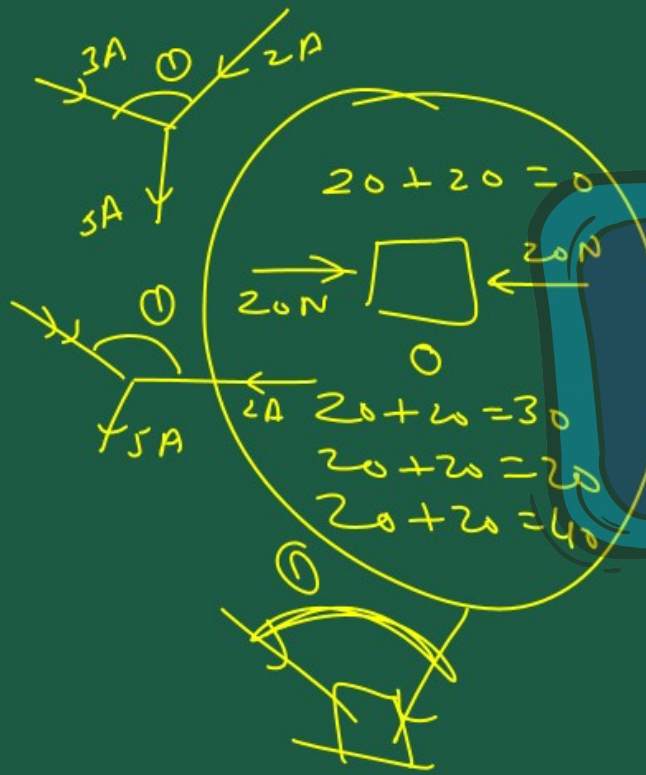
SCALAR QUANTITIES

The physical quantities which have only magniture and no direction are called scalar quantities.

Example :

- Speed
- Work
- Electric flux etc.

VECTOR QUANTITIES

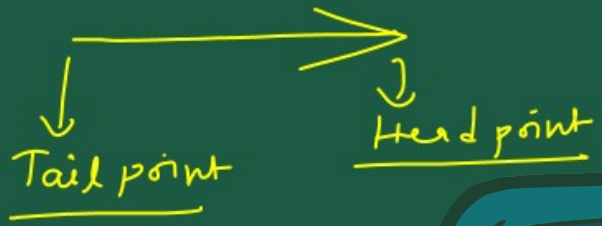


The physical quantities which have both magniture and direction are called vector quantities. follows vector laws

Example :

- Acceleration
- Force etc.

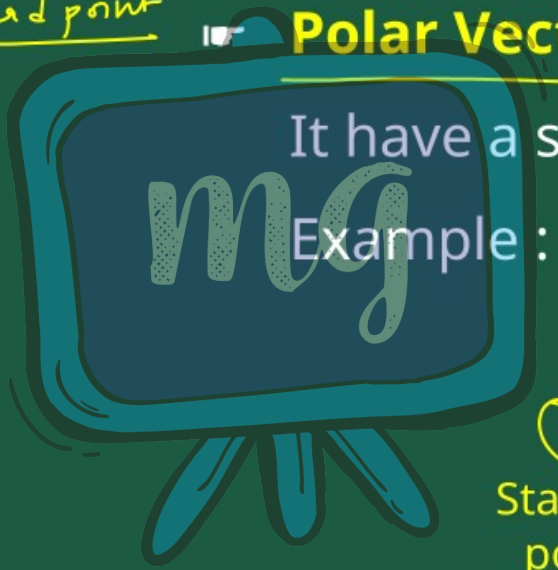
TYPES OF VECTOR QUANTITIES



Polar Vector

It have a starting point.

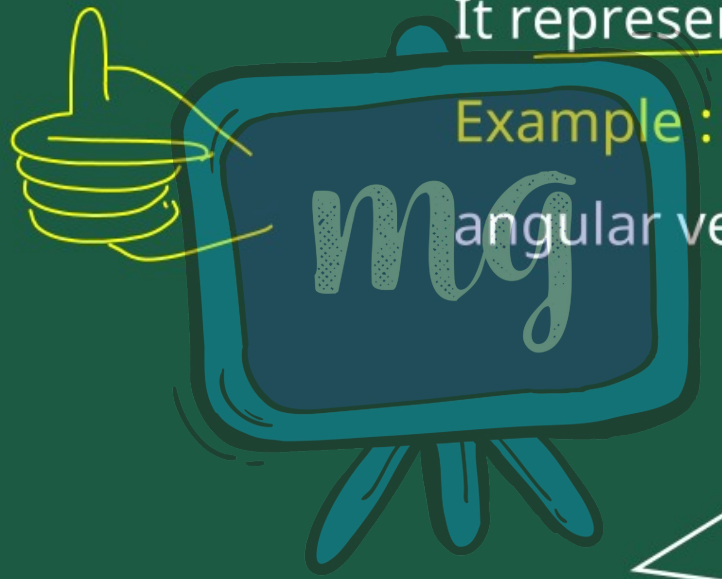
Example : Displacement, Force.

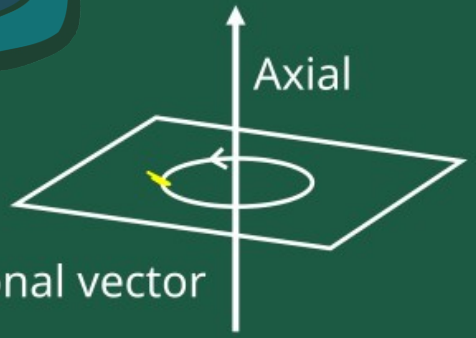


☛ Axial Vector

It represents rotational effects.

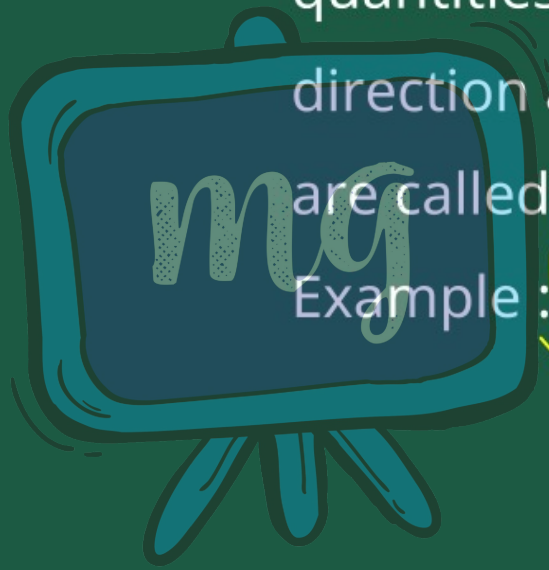
Example : Angular displacement, angular velocity.





- Tensor quantities : The physical quantities which have no specified direction and have different mass are called tensors.

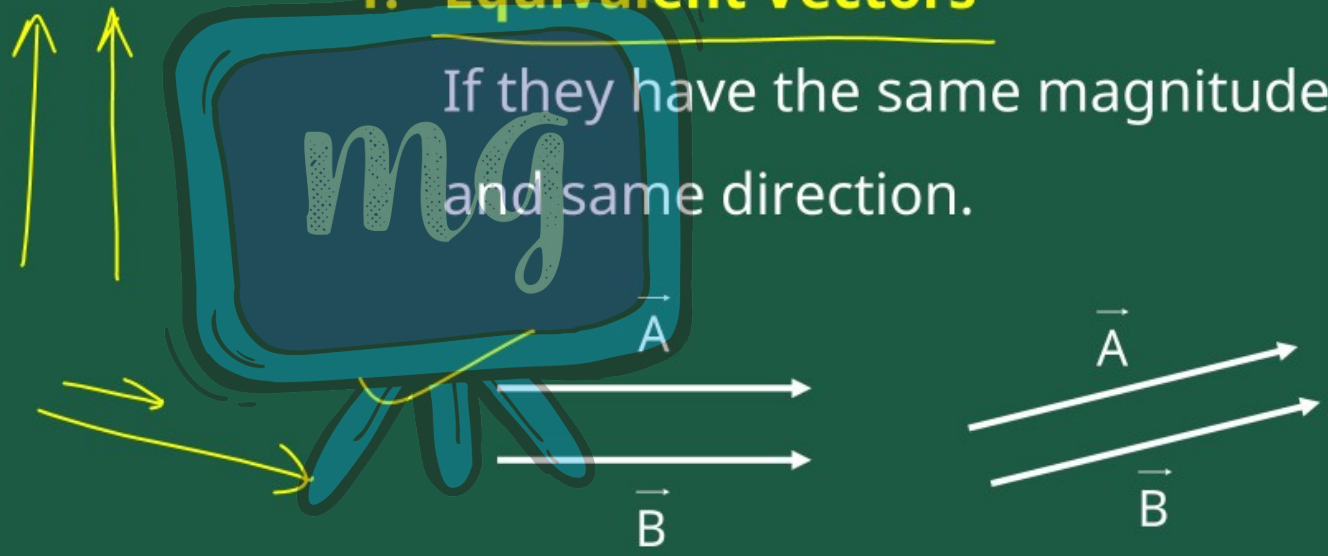
  Example : Moment of Intertia.



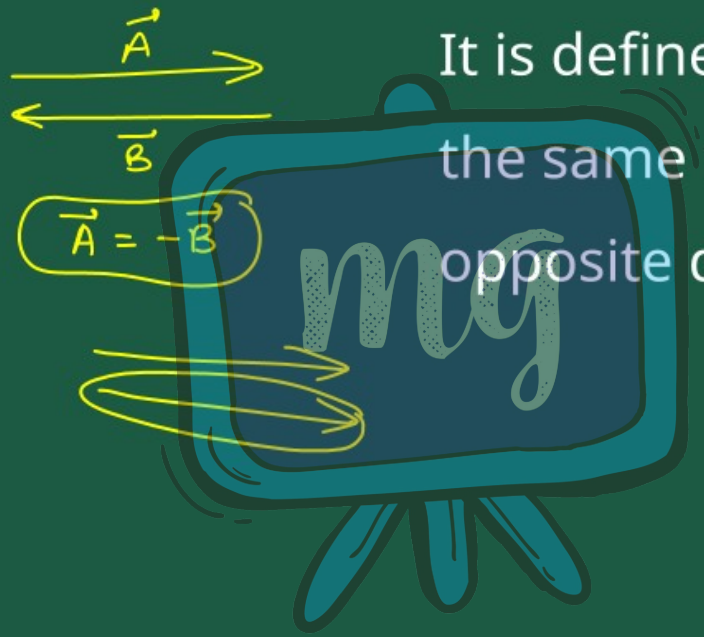
TYPES OF VECTOR

1. Equivalent Vectors

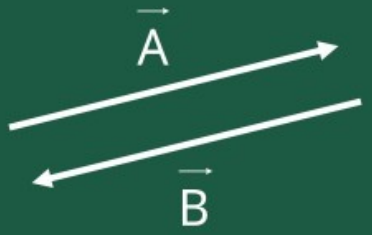
If they have the same magnitude and same direction.



2. Negative Vectors



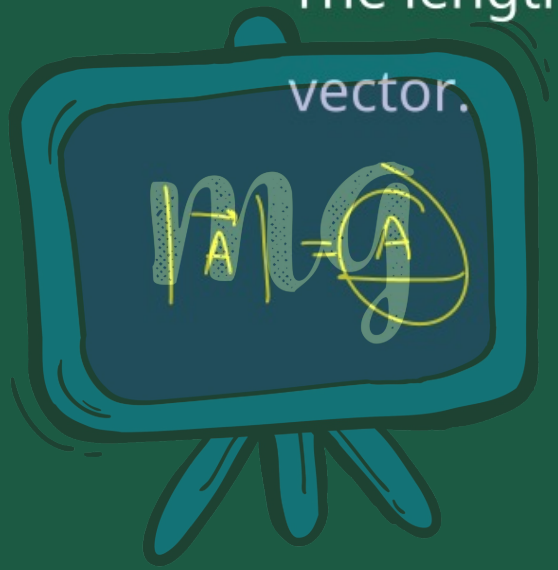
It is defined as another vector having the same magnitude but having an opposite direction.



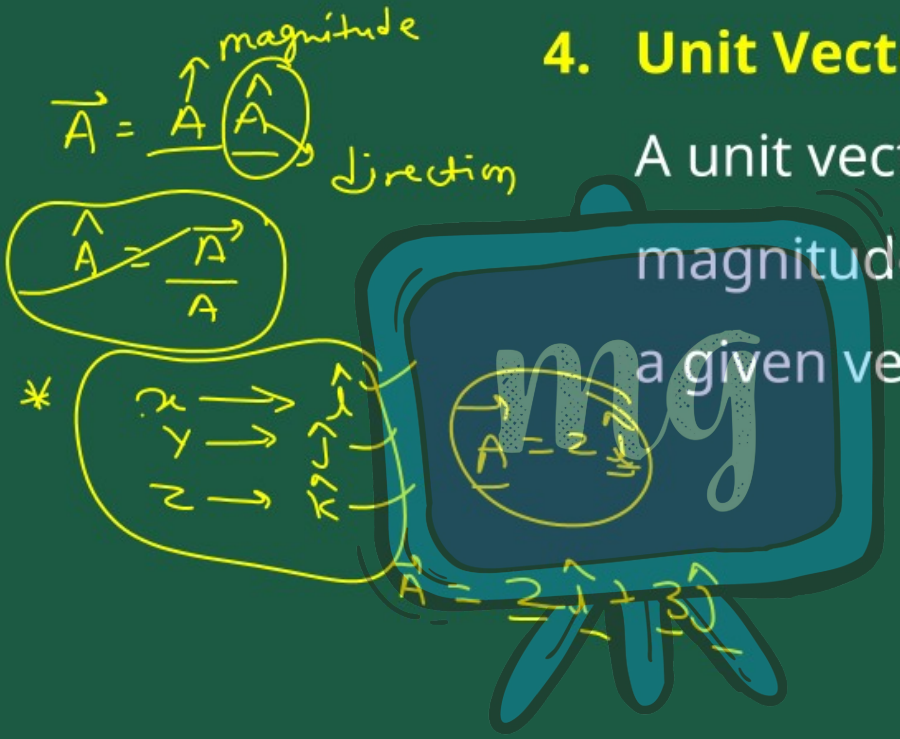
3. Modulus of a vector

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

The length or the magnitude of that vector.



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

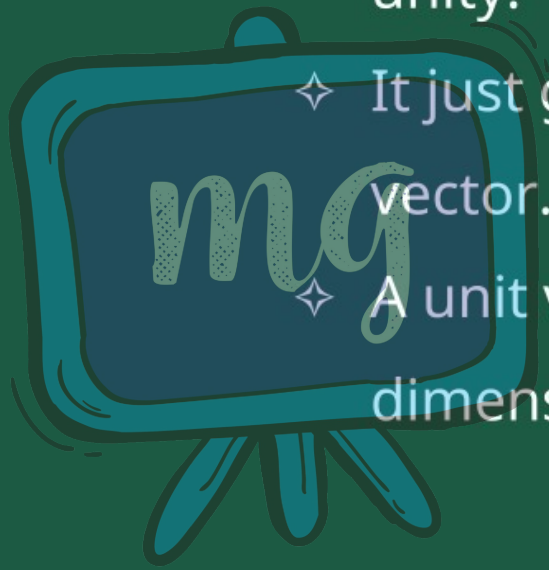


4. Unit Vector

A unit vector is a vector of unit magnitude drawn in the direction of a given vector.

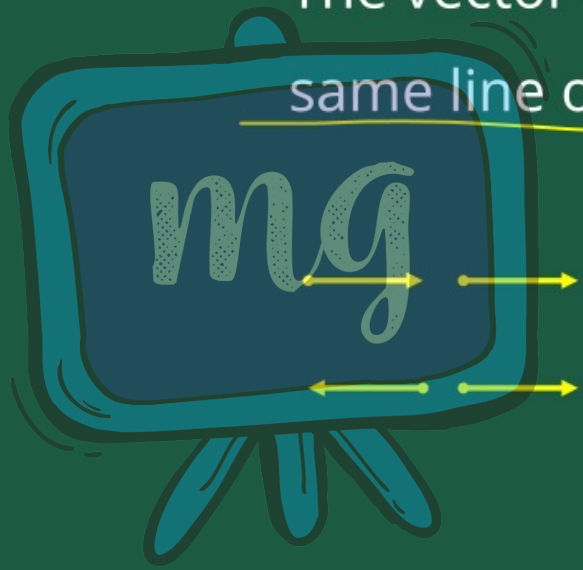
$$\hat{A} = \frac{\vec{A}}{|\vec{A}|}$$

- The magnitude of a unit vector is unity.
- It just gives the direction of a vector.
- A unit vector has no units or dimensions.



5. Collinear Vector

The vector which either act along the same line or along parallel lines.



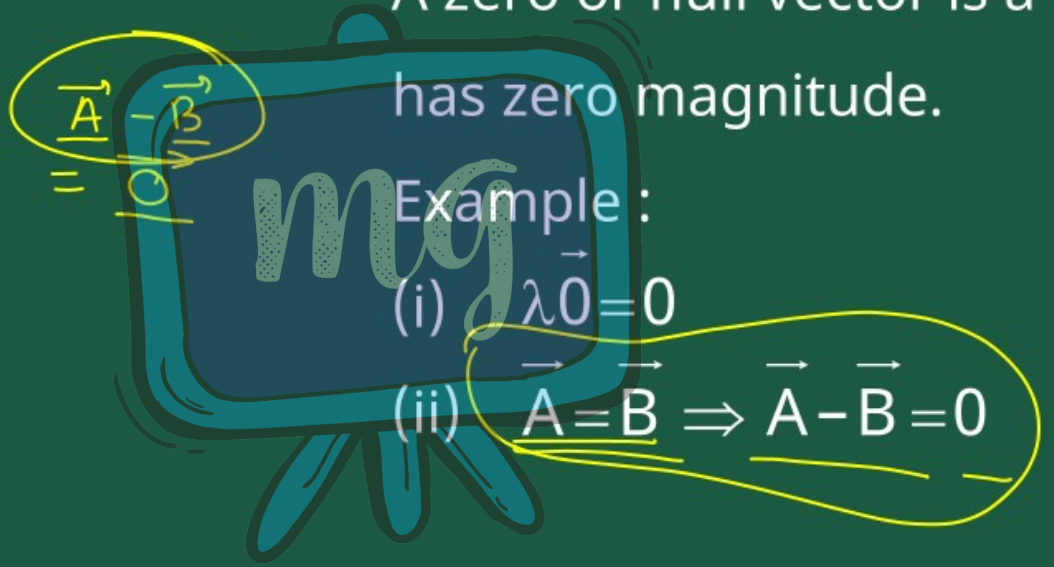
Like or parallel

unlike or anti–parallel

6. Zero Vector

(null vector)

A zero or null vector is a vector that has zero magnitude.



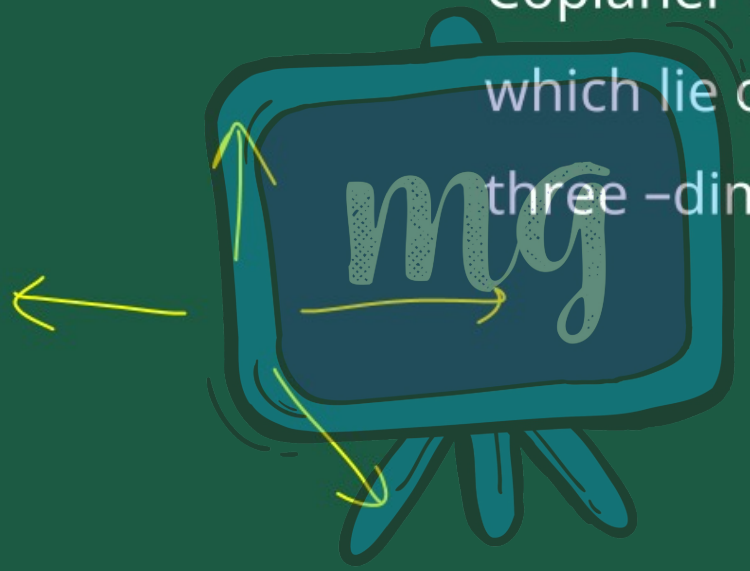
Example :

(i) $\vec{\lambda 0} = 0$

(ii) $\vec{A} = \vec{B} \Rightarrow \vec{A} - \vec{B} = 0$

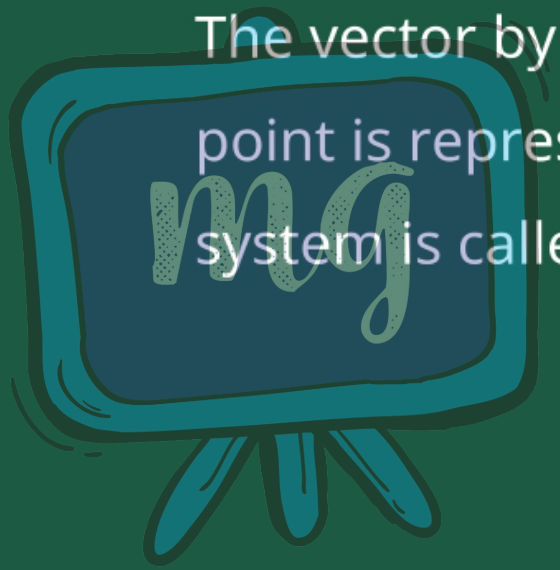
7. Coplaner Vector

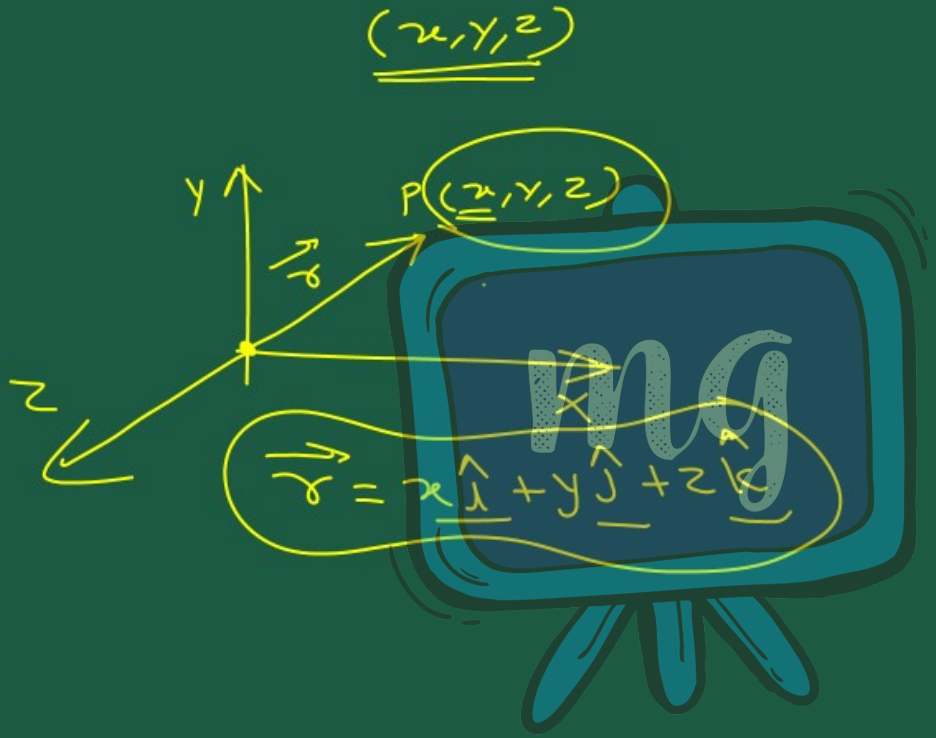
Coplaner vectors are the vectors which lie on the same plane in a three –dimensional space.

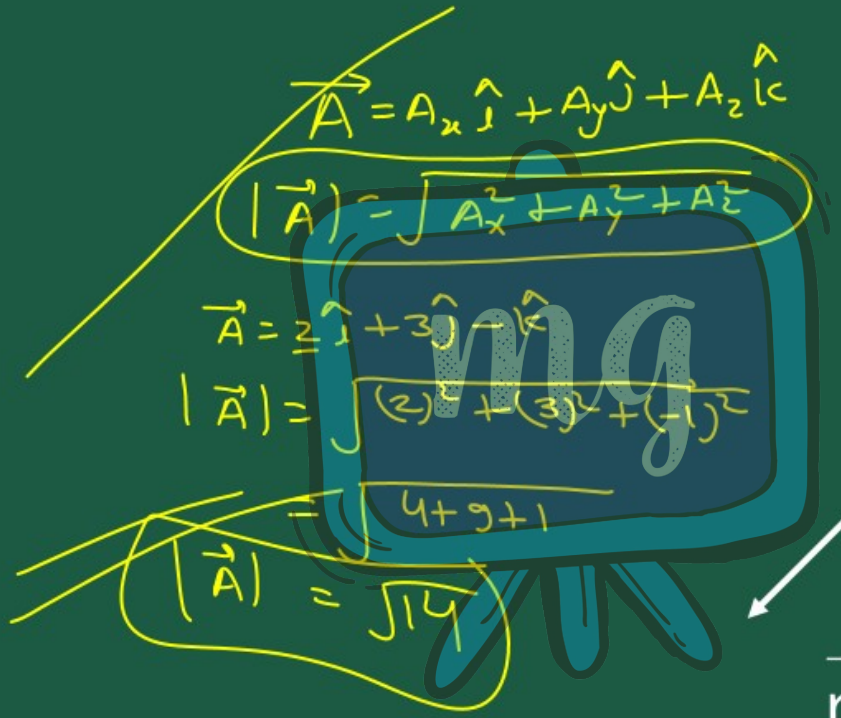


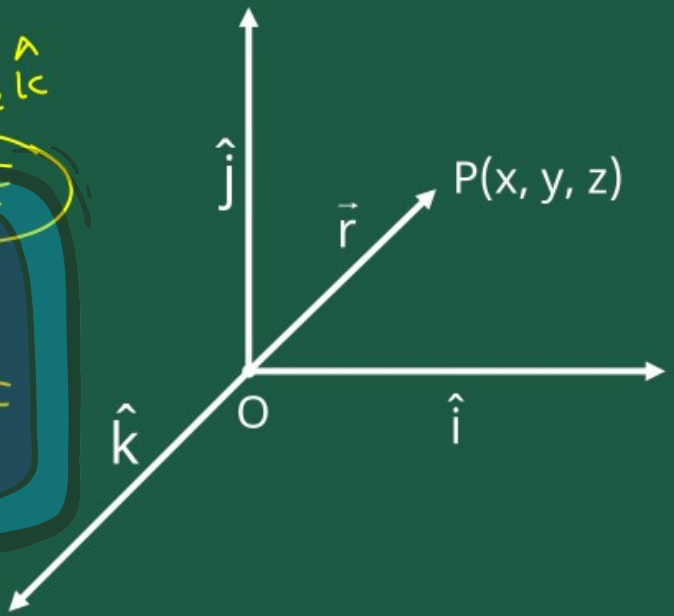
POSITION VECTOR

The vector by which the position of a point is represented in the reference system is called the position vector.







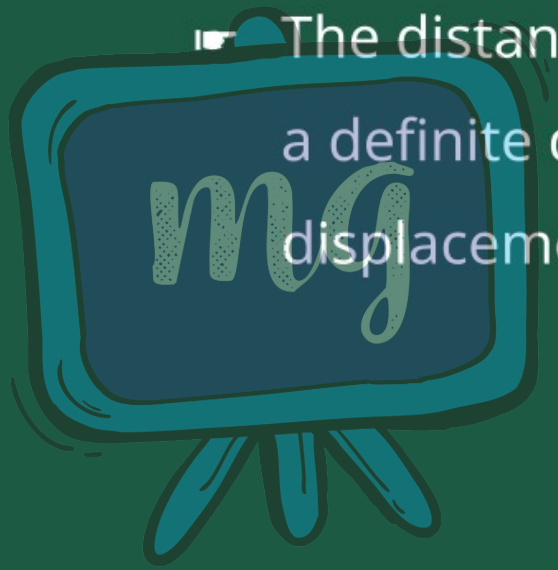


$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

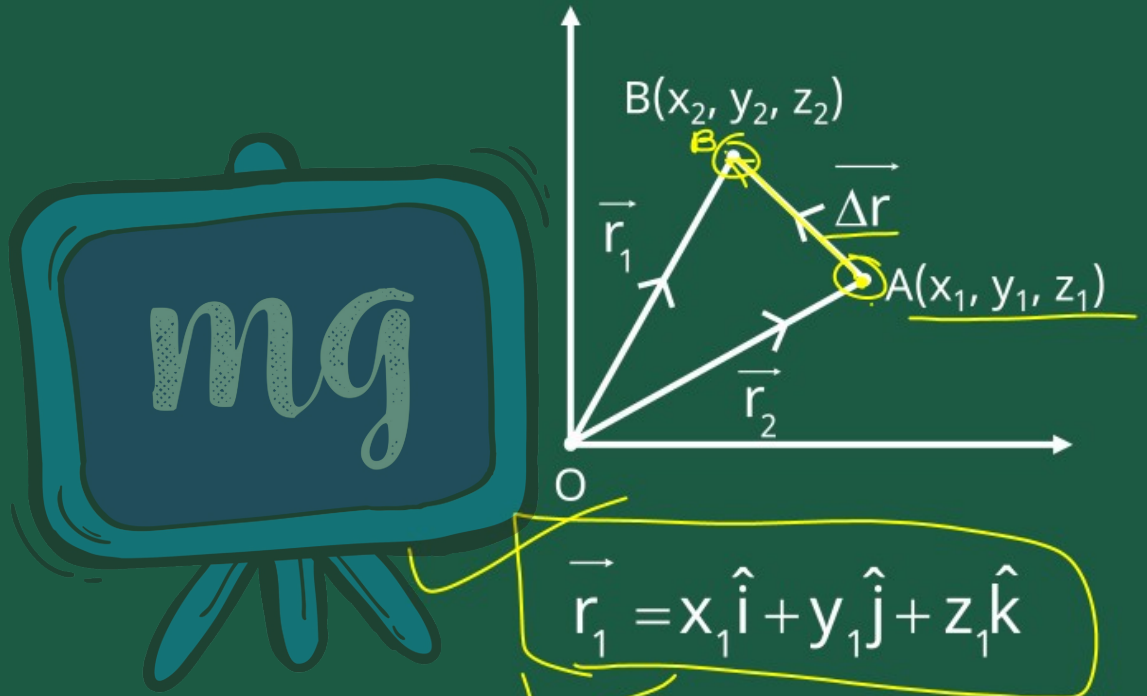
$$r_1 = |\vec{r}| = \sqrt{x^2 + y^2 + z^2}$$

DISPLACEMENT VECTOR

☛ The distance covered by an object in a definite direction is called the displacement of the object.



- The difference of two positions vectors that have the same origin point can be represented by displacement vector.
(The vectro joining the initial position of the particle with the final position)



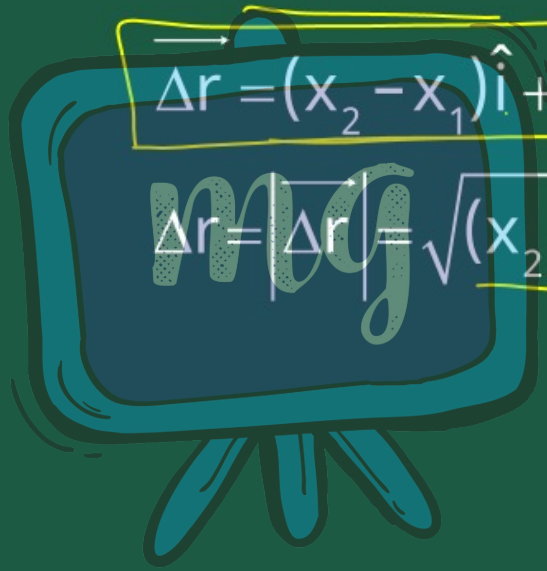
$$\vec{r}_1 = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$$

$$\vec{r}_2 = x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$$

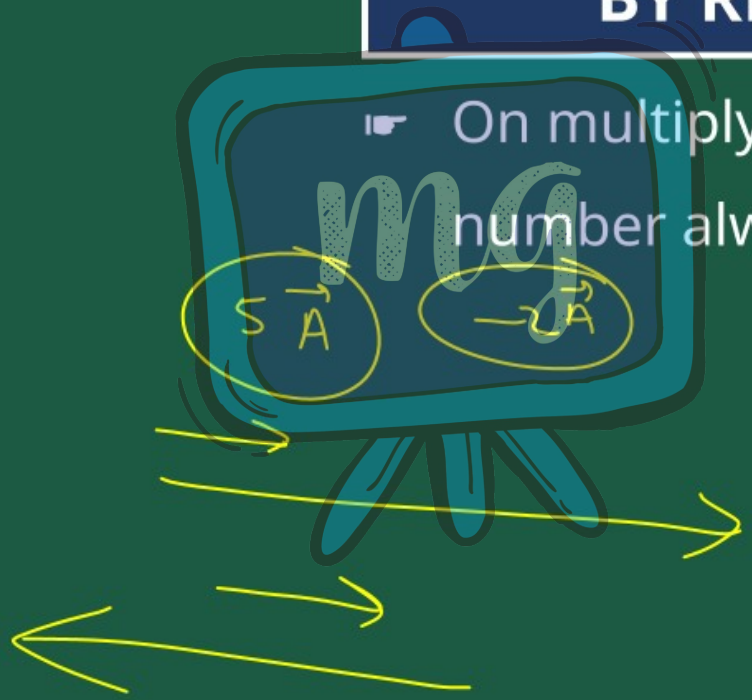
$$\overrightarrow{\Delta r} = \vec{r}_2 - \vec{r}_1$$

$$\overrightarrow{\Delta r} = (x_2 - x_1)\hat{i} + (y_2 - y_1)\hat{j} + (z_2 - z_1)\hat{k}$$

$$\Delta r = |\overrightarrow{\Delta r}| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$



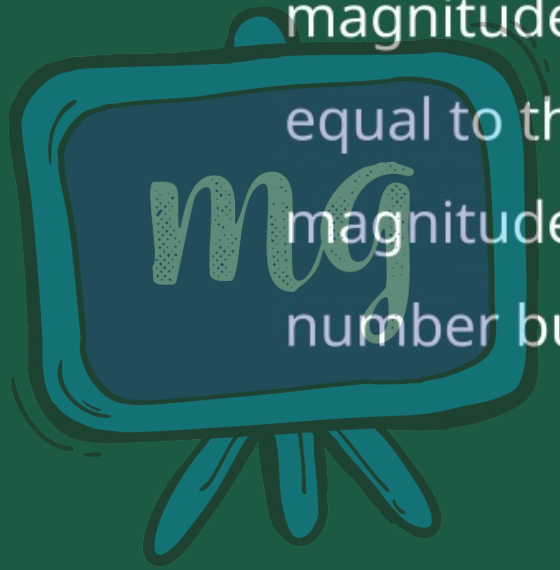
MULTIPLICATION OF VECTORS BY REAL NUMBERS



☛ On multiplying a vector by a real number always a vector is obtained.

- If the real number is positive then the magnitude of the vector obtained is equal to the product of magnitude of the vector and the number and the direction is along the direction of the given vector.

- If the number is negative then the magnitude of the obtained vector is equal to the product of the magnitude of the vector and the number but the directin is opposite.

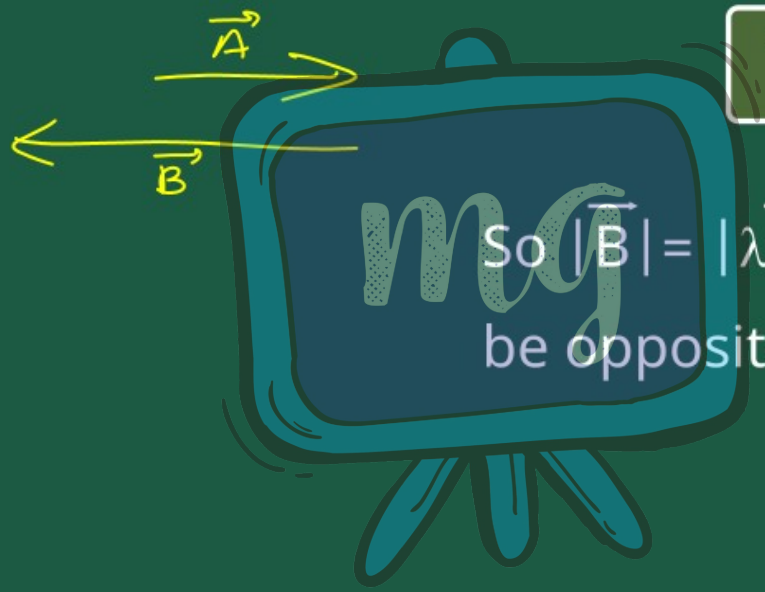


☛ If λ is a rela number of positive number and $\vec{A}$ is the given number then

$$\vec{B} = \lambda\vec{A} \quad (\lambda > 0)$$

So $|\vec{B}| = |\lambda\vec{A}|$ and direction of $\vec{B}$ will be the direction of $\vec{A}$.

Where if



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

So $|\vec{B}| = |\lambda\vec{A}|$ and direction of $\vec{B}$ will be opposite to the direction of $\vec{A}$.

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LEARNING OUTCOMES

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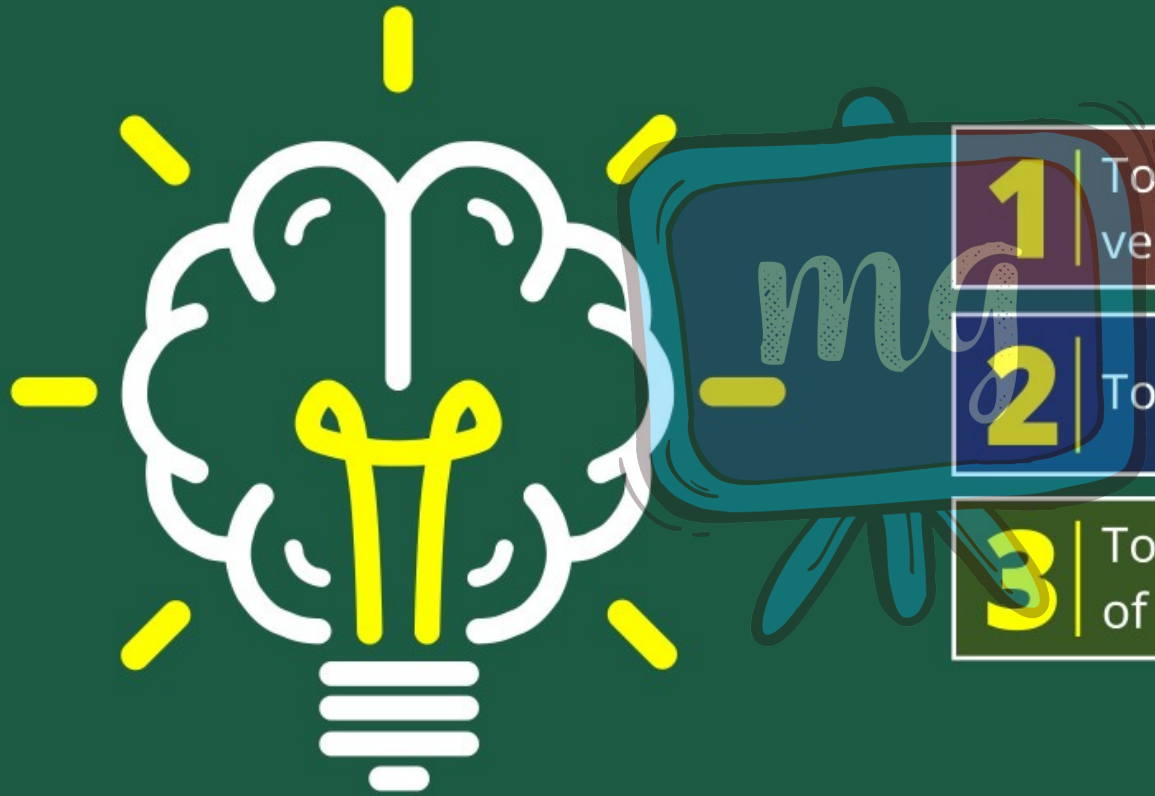

1. To study for scalar and vector quantities
2. To study types of vector
3. To study for multiplication of vectors by real numbers

ASSESSMENT

1 Which of the following is a scalar quantity?

A Displacement

B Velocity

C Electric Current

D Force

2 Which of the following is a vector quantity?

A Density

B Mass density

C Charge density

D Electric density

3 Find the magnitude of vector $\vec{A} = 12\hat{i} + 5\hat{j}$

A 5

B 12

C 17

D 13

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

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

$\vec{A} = 12\hat{i} + 5\hat{j}$

$|\vec{A}| = \sqrt{(12)^2 + (5)^2}$

$= \sqrt{144 + 25}$

$= 13$