Date 14/09/2021
Page 1

Motion In a plane

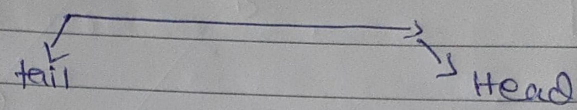
Vectors → The scaler quantity which contains both magnitude and direction are known as vectors

Example → Displacement, velocity etc.

Vector representation

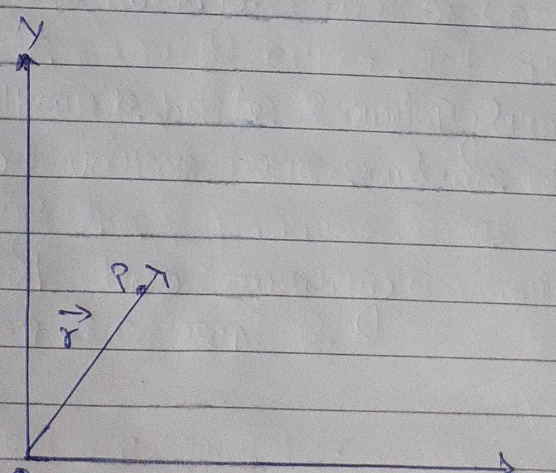
vector's are represented by arrow,

i,e, →



the end part of the arrow is called its tail and the front part (ie the arrow head) is called its head.

Position and Displacement vectors



Let 'P' be the position of the object in x-y plane at time t.

Join O to P,

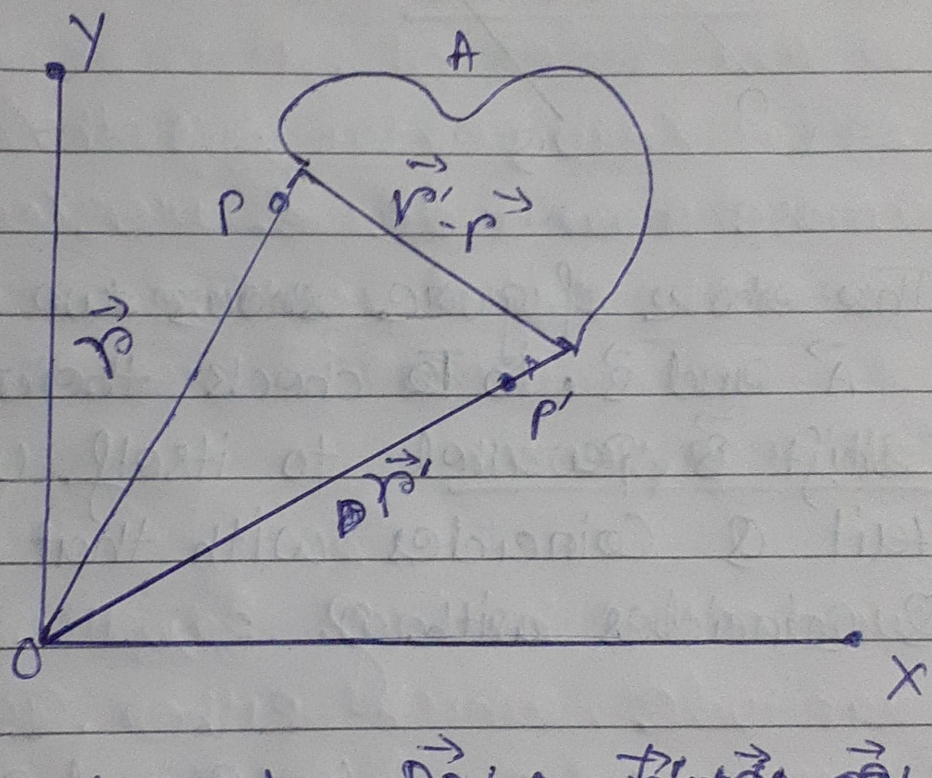
$\vec{OP}$ is called "position vector" of the object.

It is represented by $\vec{r}$ or r

Now,

Let the object move from P to P' through the path PAP' in time $t' - t$.

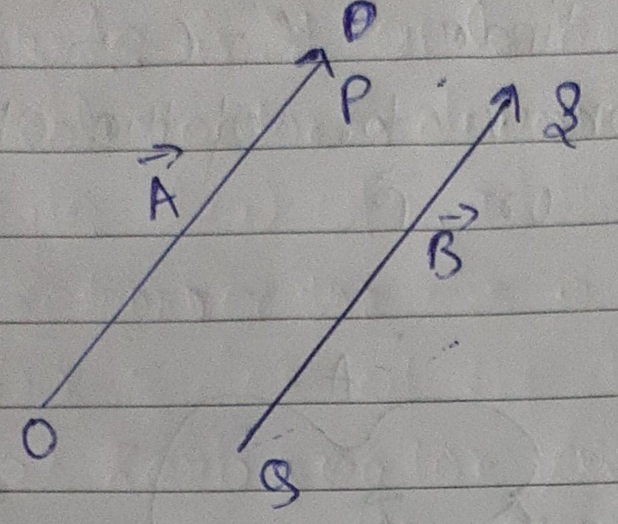
Now the position vector of the object at time t' is given by $\vec{OP'}$ or $\vec{r'}$,



Displacement vector $\vec{PP'}$ or $\vec{r'} - \vec{r}$

Equality of vectors

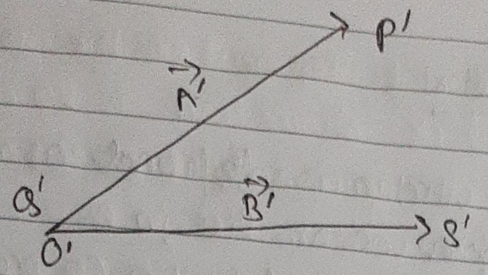
Two vectors $\vec{A}$ and $\vec{B}$ are ~~say~~ said to be equal if, and only if, they have same magnitude and the same direction.



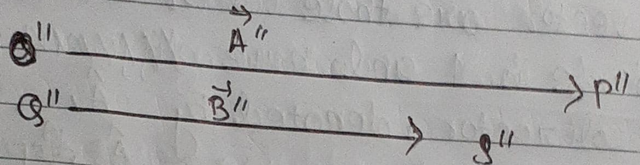
The above figure shows two equal vectors $\vec{A}$ and $\vec{B}$. To ~~To~~ check their equality, shift $\vec{B}$ parallel to itself untill its tail S coincides with that of $\vec{A}$, i.e, S coincides with O.

Since, their ~~a~~ heads Q and P also coinsides the two vectors are said to be equal.

In general, ~~eea~~ equality is indicated as $\vec{A} = \vec{B}$



vectors $\vec{A'}$ and $\vec{B'}$, have the same mangnitude but they are not equal because they have different direction.



Even if we shift $\vec{B'}$, parallel to itself so that its tail Q'' coinsides with the tail O'' of $\vec{A''}$, the tip S'' of $\vec{B''}$ doesnot conincide with the tip P'' of $\vec{A''}$

- Few Fundamental Definations in vector Algebra

i) Negetive vector

The negative of a vector is defined as another vector having the same magnitude but drawn in opposite direction.

example → The -ve vector of $\vec{A}$ is $-\vec{A}$

ii) Equal vector

Two or more vectors are equal when they have the same length (i.e. magnitude) and have the same direction.

iii) **Co-planer vector**

~~⊕~~ Co-planer vector is defined as if two or more vector lie in a same plane are said to be co-planer.

iv) **Unit vector**

Unit vector are those vector whose magnitude is 1 and have ~~different~~ any director, denoted by $\hat{A}$,

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

v) **Zero vector**

Zero vector are those vectors whose magnitude's are zero but have a pi... direction.

vi) **Collinear vector**

Two vectors having equal or unequal magnitude, which either act along the same line or along the parallel lines in the same direction or along the parallel lines in opposite direction are called collinear vectors.

vii) **Free vector and Localised vector**

In our study, vectors do not have fixed locations. So shifting of a vector parallel to itself leaves the vector unchanged.

viii) Like and unlike vectors

The vectors having same direction are called Like vectors.

The vectors having opposite direction are called unlike ~~vector~~ vectors.

★ Some points to be noted

• Unit Vector

→ Unit vectors are those vectors, ~~used to~~ which are being ~~us~~ used for s

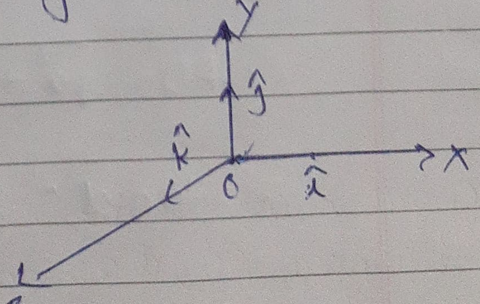
• Some Points to be Noted about unit vectors

1) Unit vector

Unit vectors has no dimension or unit, they are used to specify a direction only.

unit vectors along the x-y- and z-axis of a rectangular coordinate system are denoted by

$\hat{i}, \hat{j}, \hat{k}$



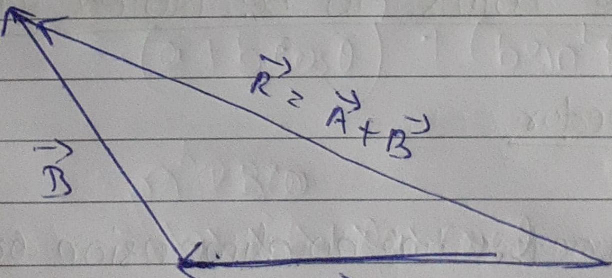
The magnitude of the unit vector is one unit and it's direction is same as that of the given vector. Since these are unit vector.

$$|\hat{i}| = |\hat{j}| = |\hat{k}| = 1$$

- ## Addition of vectors

i) Triangle law of addition.

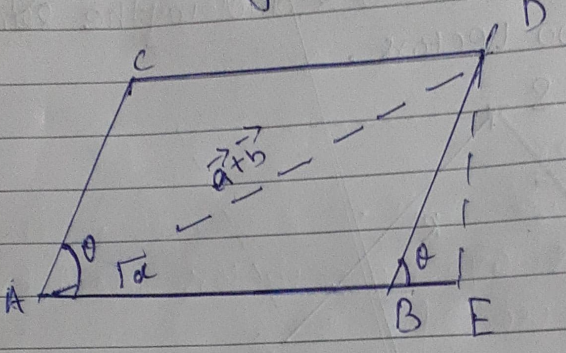
Triangle law of addition states that when two vectors are represented as two sides of the triangle with the order of magnitude and direction, then the ~~tho~~ third side of the triangle represents the magnitude and direction of the ~~resolt ve~~ resultant vector.



In the above figure the $\vec{R}$ gives the ~~reset~~ resultant vector of the two vector, $\vec{A}$ and $\vec{B}$.

Parallel law of vector addition

The resultant of two vector quantities represented in magnitude, direction and sense by ~~by~~ two adjacent sides of a parallelogram both of which are directed toward or away from their point of intersection is the diagonal of the parallelogram through that point.



$$AD^2 = (AB + BE)^2 + (DE)^2$$

$$= (a + b\cos\theta)^2 + (b\sin^2\theta)$$

$$= \sqrt{a + Ab^2 + 2ab\cos\theta}$$

$$= a^2 + 2ab\cos\theta + b^2$$

$$= a^2 + b^2 + 2ab\cos\theta$$

$$\therefore AD = \sqrt{a^2 + b^2 + 2ab\cos\theta}$$

$$\therefore \tan\alpha = \frac{DE}{AE} = \frac{b\sin\theta}{a + b\cos\theta}$$