Vector

Father of Vector : J. Willard Gibbs

1) If A and B is the two points then it's vector notation from A to B is $\overrightarrow{AB}$ Where 'AB' indicates the magnitude and 'upper arrow' indicates the direction.

2) In Vector, $\overrightarrow{AB}$ = - $\overrightarrow{BA}$

3) If O (0,0) is the origin and A (x,y) be the any point on space then the position vector, $\vec{a}$ = **a** = $\overrightarrow{OA}$ = (x,y) in Row Vector

Or

$$\overrightarrow{OA} = \begin{pmatrix} x \\ y \end{pmatrix}$$ in Column Vector

4) If P (x_1,y_1) and Q (x_2,y_2) are the two points then vector

$\overrightarrow{PQ}$ = (x_2-x_1 , y_2-y_1) In row

and it's Magnitude, $\left|\overrightarrow{PQ}\right|$ = PQ = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

and direction, tan θ = $\dfrac{y_2-y_1}{x_2-x_1}$

5) If A (x,y) be the any point then $\left|\vec{A}\right| = \sqrt{x^2+y^2}$

Direction, tan θ = $\dfrac{y}{x}$ or θ = $\tan^{-1}\left(\dfrac{y}{x}\right)$

6) Intercept of Vector and relation of Direction :

X-intercept	Y-intercept	Direction (Angle $-\theta$)
Positive (+ve)	0	$\theta = 0^0$
Negative (-ve)	0	$\theta = 180^0$
0	Positive	$\theta = 90^0$
0	Negative	$\theta = 270^0$
Positive	Positive	$0^0<\theta<90^0$
Negative	Positive	$90^0<\theta<180^0$
Negative	Negative	$180^0<\theta<270^0$
Positive	Negative	$270^0<\theta<360^0$

7) Unit Vector :

Magnitude of Unit Vector = 1 unit

Unit Vector, $\hat{a} = \dfrac{\vec{a}}{|\vec{a}|}$

Also, We can also write $\vec{a}$ = (x,y) = $x\hat{i} + y\hat{j}$

8) If $\vec{a}$ = (x_1,y_1) and $\vec{b}$ = (x_1,y_1) are said to be equal if $x_1=x_2$ and $y_1=y_2$

9) Like and Unlike Vectors :

$\vec{a}$ and $\vec{b}$ are said to be like if $\vec{a}=k\vec{b}$ and

Direction of $\vec{a}$ = Direction of $\vec{b}$

Otherwise Unlike. Where k is scalar.

i.e $\vec{a} = k\vec{b}$ is written as $(x_1,y_1) = (kx_1,ky_1)$

NOTE : All like or unlike vectors are Parallel Vector.

Addition of Vector

10) In ΔABC, the Triangle Law of Vector Addition is

$$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$$

11) In □ABCD, the Parallelogram Law of Vector Addition is

$$\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} = \overrightarrow{AD}$$

12) Addition of two Vectors :

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} + \begin{pmatrix} x_2 \\ y_2 \end{pmatrix} = \begin{pmatrix} x_1 + x_2 \\ y_1 + y_2 \end{pmatrix}$$

13) If $\vec{a}$ and $\vec{b}$ are two vectors then $\vec{a} + \vec{b}$ and k$\vec{a}$ both are Vectors, this is Closure Property.

14) $\vec{a} + \vec{b} = \vec{b} + \vec{a}$, this is Commutative Property.

15) $\vec{a} + (\vec{b} + \vec{c}) = (\vec{a} + \vec{b}) + \vec{c}$, this is Associative Property.

16) $\vec{a} + (-\vec{a}) = 0$, this is Inverse Property.

17) $k(\vec{a} + \vec{b}) = k\vec{a} + k\vec{b}$, this is Distributive Property.

18) $\vec{a} + 0 = 0 + \vec{a} = \vec{a}$, this is Identity Property.

19) Subtraction of Two Vectors :

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} - \begin{pmatrix} x_2 \\ y_2 \end{pmatrix} = \begin{pmatrix} x_1 - x_2 \\ y_1 - y_2 \end{pmatrix}$$

20) In ΔABC , M is the midpoint of BC then $\overrightarrow{AB} + \overrightarrow{AC} = 2\,\overrightarrow{AM}$

Thank You!!!