(Geometry)

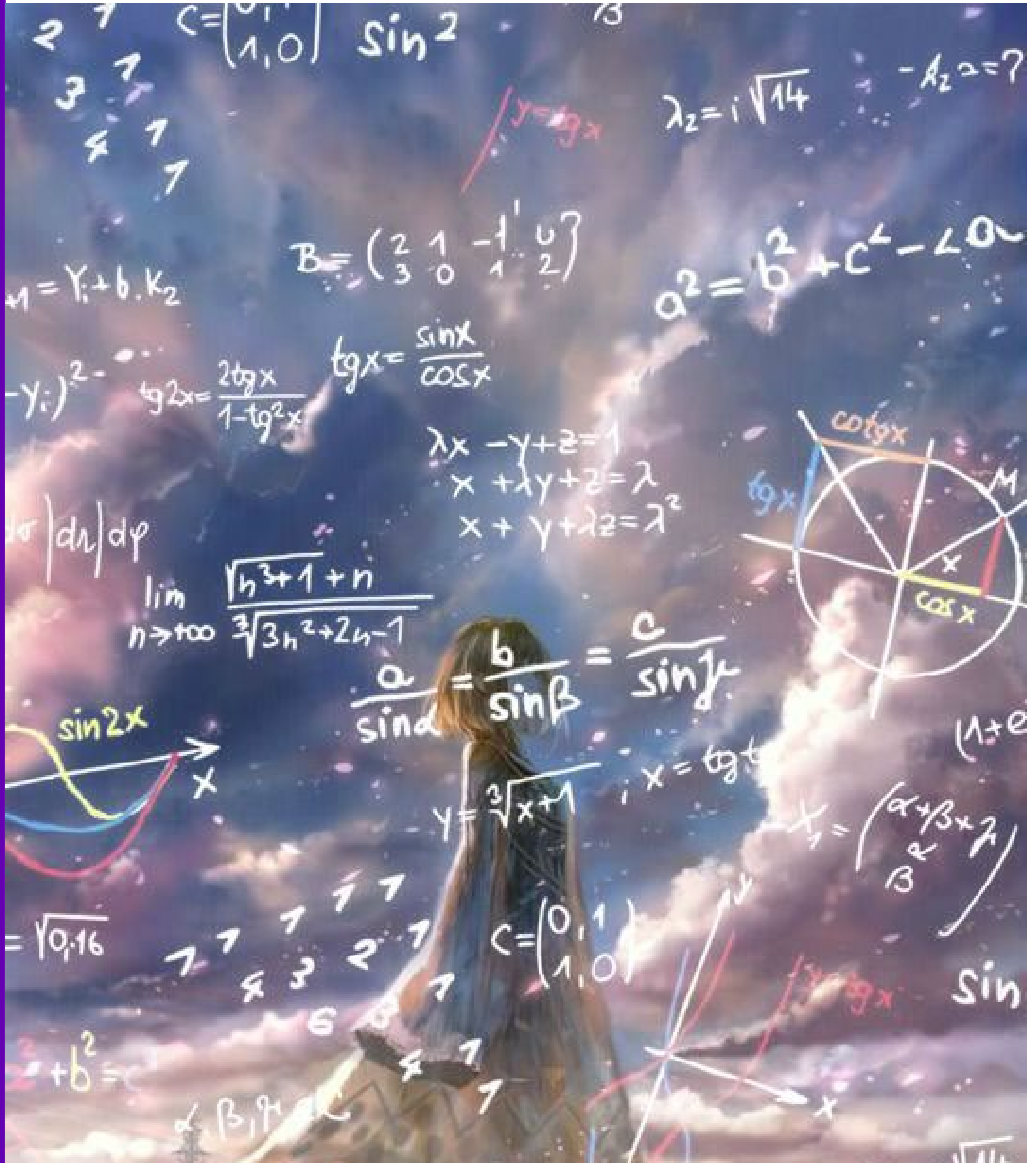
Secondary 1

2 nd term

calculus

unit 3 lesson 2

(Vectors)



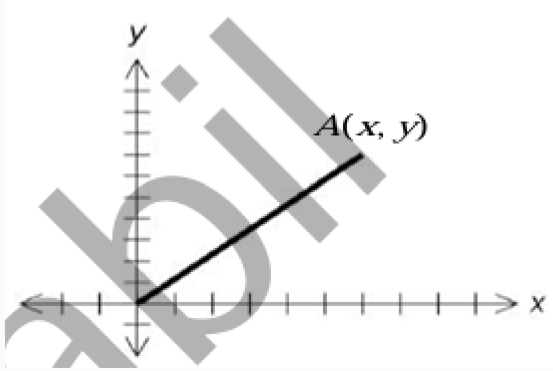
The position vector:

Definition: The position vector of a given point A with respect to the origin point O is the directed line segment $\overrightarrow{OA}$ which its starting point is the origin point O and the given point A is its ending point.

remark

All position vectors have the same starting point (O) , then we denote the position Vector $\overrightarrow{OA}$ by the symbol $\overrightarrow{A}$, and is written as

$\overrightarrow{A}=(x , y)$



The norm vector:

It is the length of the line segment that represents the vector.

If $\overrightarrow{A}$ =(x , y), then $||\overrightarrow{A}||$ = the length of $\overrightarrow{OA}$ and if we used the law of the distance between two points to find the length of $\overrightarrow{OA}$, then:

$$||\overrightarrow{A}|| = \int X^2 + Y^2$$

If $\overrightarrow{A}$=(x ,y), then $||A||$ =the length of $\overrightarrow{OA}$

The length of $\overrightarrow{OA}$ = $\int (x-0)^2 + (y-0)^2$ then $||\overrightarrow{A}|| = \int x^2 + y^2$

The unit vector:

It is a vector whose norm is unity.

A=$(\frac{3}{5}, \frac{4}{5})$ is unit vector because: $||A|| = \int (\frac{3}{2})^2 + (\frac{4}{5})^2$ **=**1

The zero vector: **it is a vector whose norm equals zero and denoted by $\overrightarrow{O}$, where $\overrightarrow{O}$ =(0,0) and it has no direction.**

The Polar form of the position vector:

If the position vector $\overrightarrow{OA}$ makes an angle of measure θ with the positive direction of X-axis
Then the polar form of the position vector $\overrightarrow{OA}$ =($\|\overrightarrow{A}\|, \theta$)

Remark: if the position vector of the point A (x , y) is in the polar form $\overrightarrow{OA}$ =($\|\overrightarrow{A}\|, \theta$), then X= $\|\overrightarrow{OA}\|$ COS θ ,y = $\|\overrightarrow{OA}\|$ SIN θ
Where tan $\theta = \frac{y}{x}$
And the cartesian form of the vector $\overrightarrow{OA}$ is $\overrightarrow{OA}$ =($\|\overrightarrow{OA}\|$ COS θ ,

$\|\overrightarrow{OA}\|$ SIN θ)

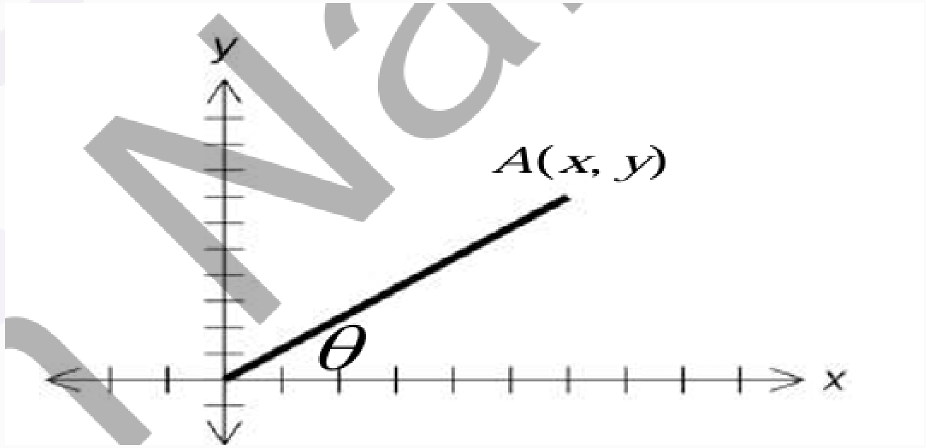
Cartesian form: A = (x , y)

Polar from : A =($\|A\|$, θ)

Fundamental form : A=x t + y j

($\|A\|$,θ) polar form=($\|A\|$ COS θ , $\|A\|$ SIN θ) Cartesian form

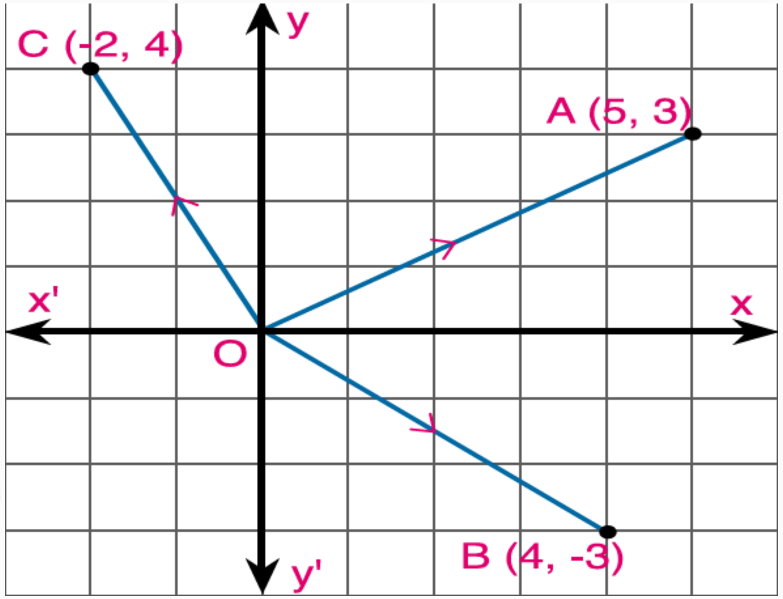
(x , y) Cartesian form=($\sqrt{x^2 + y^2, tan^{-1} \frac{y}{x}}$) polar from



Example (1)

In the figure opposite: A (5,3) , B(4,-3) C (-2,4) then:

$\overrightarrow{OA}$ is the position vector of the point A with respect to the origin point O, and corresponding to the ordered pair (5, 3) and is Written as $\overrightarrow{OA}$=(5,3)



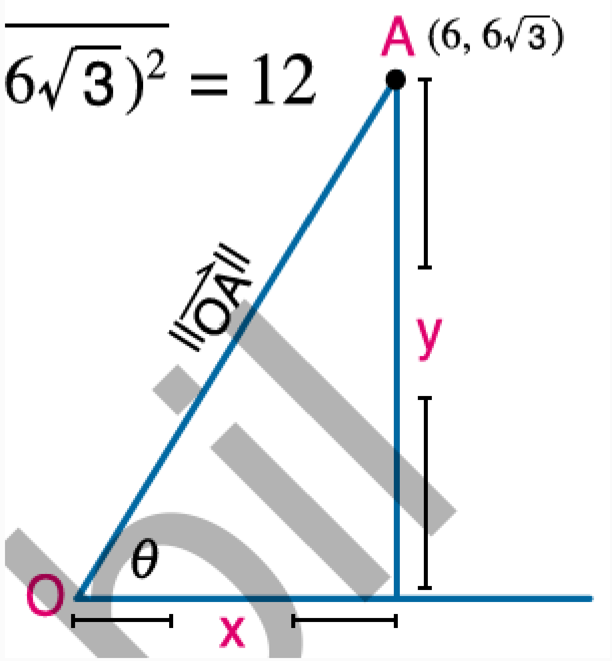
$\overrightarrow{OB}$ is the position vector of point B with respect to the origin point where $\overrightarrow{OB}$ = (4, —3) and also $\overrightarrow{OC}$ =(-2,4)

NOTE: **ALL position vectors have the same starting point (O) then it is possible to denote the position vector $\overrightarrow{OA}$ by the symbol $\overrightarrow{A}$ and the position vector $\overrightarrow{OB}$ by the symbol $\overrightarrow{B}$ and so on, then:**

$\overrightarrow{A} = (5,3)$, $\overrightarrow{B} = (4,-3)$, $\overrightarrow{C} = (-2,4)$

Example (2)

In the orthogonal coordinate plane, If A(6, 6∫ 3). Find the polar form of the position vector of point A with respect to the origin point O .



POINTS TO REMEMBER:

- If $\overrightarrow{A} = (3\ ,-4)$

  , then $\|\overrightarrow{A}\| = \sqrt{(3)^2 + (-4)^2} = 5$ length units.

- If $\overrightarrow{B} = \left(-3\ ,3\sqrt{3}\right)$

  , then $\|\overrightarrow{B}\| = \sqrt{(-3)^2 + (3\sqrt{3})^2} = 6$ length units.

- If $\overrightarrow{C} = (-3\ ,K)$ and $\|\overrightarrow{C}\| = 3\sqrt{2}$

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

  $\therefore 9 + K^2 = 18$

  $\therefore K^2 = 9$

  $\therefore K = \pm 3$

Example (3)

IF $\overrightarrow{OA}$ is the position vector of the point A with respect to the origin point, then find the coordinates of the point A in each of the following :

1. $OA = (10\sqrt{3}, 60^\circ)$
2. $OA = (6\sqrt{2}, 135^\circ)$
3. $OA = (8, \frac{4\pi}{3})$

Example (4)

If $\overrightarrow{OA}$ is the position vector of the point A with respect to the origin point, then find the polar form of the vector $\overrightarrow{OA}$ in each of the :

1) $\overrightarrow{OA} = (4, 4\sqrt{3})$