Series 1

Exercise 1

A material point M is moving along a trajectory in space R (O; $\vec{\imath},\vec{\jmath},\vec{k}$). The Cartesian coordinates of M are:

- $x(t) = 2 + 3cos\left(\frac{\pi}{2}t\right);$ $y(t) = 4 + 3sin\left(\frac{\pi}{2}t\right);$ $z(t) = 0$
- $x(t) = 2cos\left(\frac{\pi}{2}t\right);$ $y(t) = 4sin\left(\frac{\pi}{2}t\right);$ $z(t) = 0$

1. Determine the equation of the trajectory of point M. What is its nature?

2. Draw the trajectory of the mobile.

3. Give the expression of the position vector $\overrightarrow{OM}$ in fixed base Cartesian coordinates.

4. Determine the velocity vector $\vec{v}$ and the acceleration vector $\vec{a}$ of the mobile M in the fixed base.

Exercise 2

Let us consider a point M in motion whose Cartesian coordinates are at each instant:

$x(t) = 3t + 2;$ $y(t) = -t^2;$ $z(t) = 3$

1. Give the expression of the position vector $\overrightarrow{OM_1}$ at time t=1s then $\overrightarrow{OM_2}$ at time t= 2s.Then represent these vectors and the displacement vector $\overrightarrow{M_1M_2}$.

2. During the duration $dt=t_2-t_1$ the position vector has varied by a value $\overrightarrow{OM_2} - \overrightarrow{OM_1} = d\overrightarrow{OM}$. Calculate the coordinates of the position variation vector $d\overrightarrow{OM}$.

Exercise 3

1. Determine the trajectory of the plane motion of the mobile M which is defined by the time equations:

$$x = \ln t$$

$$y = t + \frac{1}{t}$$

2. Calculate the velocity vector $\vec{v}$, the acceleration vector $\vec{a}$ and their magnitudes at t=1s.