



Series 1

Exercise 1

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

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

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

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 $t=1s$.