

First name :

Physics – 01

Last name :

Academic year: 2025 – 2026

Group :

Time : 30 min

Micro Interrogation No. 03 (Groupe 3 and 6)

In the basic Cartesian coordinate system (\vec{i}, \vec{j}) , a particle M moves according to the following equations:

$$\begin{cases} x = 2t \\ y = -2t^2 + 8 \end{cases}$$

- 1- Find the trajectory equation of the movement $y = f(x)$.
 - 2- Give the expression of the position vector \overrightarrow{OM} .
 - 3- Determine the components of the velocity vector \vec{V} and its magnitude $\|\vec{V}\|$.
 - 4- Determine the components of the acceleration vector $\vec{\gamma}$ and its magnitude $\|\vec{\gamma}\|$.
 - 5- Calculate the scalar product $\vec{V} \cdot \vec{\gamma}$ and vector product $\vec{V} \wedge \vec{\gamma}$.
 - 6- Calculate the normal γ_N and tangential γ_T components of the acceleration vector in the intrinsic coordinate system.
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Standard correction of Micro – Interrogation No 3, PHYSICS-1 (Section 1/2)

5 pts

1) Trajectory Equation $y = f(x)$

$$y = f(x): \quad y = -\frac{x^2}{2} + 8 \quad \text{0.5}$$

2) Position vector \overline{OM}

$$\overline{OM} = x \vec{i} + y \vec{j}$$

$$\Rightarrow \overline{OM} = 2t \vec{i} + (-2t^2 + 8) \vec{j} \quad \text{0.5}$$

3) Components and modulus of the velocity vector \vec{V}

$$\vec{V} = V_x \vec{i} + V_y \vec{j}$$

$$\begin{cases} V_x = \frac{dx}{dt} = 2 & \text{0.5} \\ V_y = \frac{dy}{dt} = -4t & \text{0.5} \end{cases} \Rightarrow \vec{V} = 2 \vec{i} - 4t \vec{j}$$

$$\|\vec{V}\| = \sqrt{V_x^2 + V_y^2} = 2\sqrt{1 + 4t^2} \quad \text{0.25}$$

4) Components and modulus of the acceleration vector $\vec{\gamma}$

$$\vec{\gamma} = \gamma_x \vec{i} + \gamma_y \vec{j}$$

$$\begin{cases} \gamma_x = \frac{dV_x}{dt} = 0 & \text{0.5} \\ \gamma_y = \frac{dV_y}{dt} = -4 & \text{0.5} \end{cases} \Rightarrow \vec{\gamma} = -4 \vec{j}$$

$$\|\vec{\gamma}\| = \sqrt{\gamma_x^2 + \gamma_y^2} = 4 \quad \text{0.25}$$

5) Scalar $\vec{V} \cdot \vec{\gamma}$ et vectorial $\vec{V} \wedge \vec{\gamma}$ products

$$\text{vectors: } \begin{cases} \vec{V} = 2\vec{i} - 4t \vec{j} \\ \vec{\gamma} = -4 \vec{j} \end{cases}$$

$$\triangleright \vec{V} \wedge \vec{\gamma} = -8 \vec{k} \quad \text{0.5}$$

$$\triangleright \vec{V} \cdot \vec{\gamma} = 16t \quad \text{0.5}$$

6) Components of the acceleration vectors γ_T and γ_N

we have:

$$\vec{\gamma} = \gamma_T \vec{u}_T + \gamma_N \vec{u}_N$$

$$\Rightarrow \begin{cases} \gamma_T = \frac{dV}{dt} \\ \gamma_N = \sqrt{\gamma^2 - \gamma_T^2} \end{cases} \Rightarrow \begin{cases} \gamma_T = \frac{4t}{\sqrt{1 + 4t^2}} & \text{0.25} \\ \gamma_N = 4 \frac{\sqrt{1 + 3t^2}}{\sqrt{1 + 4t^2}} & \text{0.25} \end{cases}$$