

Mécanique du point

Questions de cours:

- 1- Force conservative: force dont W ne dépend pas du chemin suivi
 ex de force conservative: le poids, ...
 ex de force non conservative: une force de frottement

2- $dE_p = -dW = -\vec{F} \cdot d\vec{\ell}$
 $= -R(x-x_0) dx$
 $\hookrightarrow E_p(x) = \frac{1}{2} R x^2 + C_{te}$

3- $dE_m = dW_{nc}$

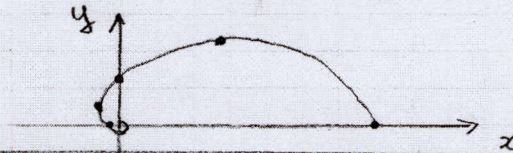
Mouvement en spirale:

1a- $\rho = \sqrt{x^2 + y^2} = b e^{-kt}$; $\varphi = \arctan\left(\frac{y}{x}\right) = kt$

1b- eq. polaire: $\rho(\varphi) \Rightarrow \rho = b e^{-\varphi}$

1c- $\begin{cases} \varphi = 0 \rightarrow \rho = b ; \varphi = \frac{\pi}{4} \rightarrow \rho = 0,46b ; \varphi = \frac{\pi}{2} \rightarrow \rho = 0,216b \\ \varphi = \frac{3\pi}{4} \rightarrow \rho = 0,09b ; \varphi = \pi \rightarrow \rho = 0,04b ; \varphi \rightarrow +\infty \rightarrow \rho = 0 \end{cases}$

$\hookrightarrow$



2a- $\vec{v}_{P/R} = \begin{vmatrix} \dot{\rho} \\ \rho \dot{\varphi} \end{vmatrix}_{R_e} = \begin{vmatrix} -kb e^{-kt} \\ kb e^{-kt} \end{vmatrix}_{R_e}$

2b- $\vec{v}_{P/R} \cdot \vec{OP} = \dot{\rho} \rho = -kb^2 e^{-2kt}$

$\hookrightarrow \cos \varphi = \frac{\vec{v}_{P/R} \cdot \vec{OP}}{\|\vec{v}_{P/R}\| \cdot \|\vec{OP}\|} = \frac{-kb^2 e^{-2kt}}{\sqrt{2} kb e^{-kt} \cdot b e^{-kt}} = -\frac{1}{\sqrt{2}} \Rightarrow \varphi = \frac{3\pi}{4}$

2c- $\|\vec{v}_{P/R}\| = \sqrt{2} kb e^{-kt} \Rightarrow \|\vec{v}_{P/R}\| \searrow \text{qd } t \nearrow \Rightarrow \text{mouvement retardé}$

3a- $\vec{a}_{P/R} = \begin{vmatrix} \ddot{\rho} - \rho \dot{\varphi}^2 \\ \rho \ddot{\varphi} + 2\dot{\rho} \dot{\varphi} \end{vmatrix}_{R_e} = \begin{vmatrix} (k^2 b - b k^2) e^{-kt} \\ -2k^2 b e^{-kt} \end{vmatrix}_{R_e} = \begin{vmatrix} 0 \\ -2k^2 b e^{-kt} \end{vmatrix}_{R_e}$

3b- $\vec{a}_{P/R} = a_t \vec{e}_t + a_n \vec{e}_n$ avec $a_t = \dot{v} = -\sqrt{2} k^2 b e^{-kt}$
 $a_n = \sqrt{a^2 - a_t^2} = \sqrt{2} k^2 b e^{-kt}$

3c- $a_n = \frac{v^2}{\rho} \Rightarrow \rho_b = \sqrt{2} b e^{-kt}$