Corrigé Type Examen Final Physique 1 2018/2018

Exo 1/8Pt A/1 - $\begin{cases} x = t^2 - 1 \\ y = 2t \end{cases} \Rightarrow y^2 - 4x - 4 = 0$ ou $y = 2\sqrt{x+1}$ (0,5)

2) $\vec{v} = \frac{d\vec{OM}}{dt} = 2t\vec{i} + 2\vec{j}$ (0,5) (0,5) et $|\vec{v}| = \sqrt{4t^2+4}$ m/s (0,25)

3) $\vec{a} = \frac{d\vec{v}}{dt} = 2\vec{i}$ (0,25) (0,5) et $|\vec{a}| = 2\ m/s^2$ (0,25)

4) $a_T = \frac{dv}{dt} = \frac{d(\sqrt{4t^2+4})}{dt} = \frac{d(2\sqrt{t^2+1})}{dt} = \frac{2t}{\sqrt{t^2+1}}$ m/s² (0,25) (0,25)

$a^2 = a_N^2 + a_T^2 \Rightarrow a_N^2 = a^2 - a_T^2$ et $a_N = \sqrt{a^2 - a_T^2}$ (0,25)

$a_N = \sqrt{4 - \frac{4t^2}{(t^2+1)}} = \frac{2}{\sqrt{t^2+1}}$ m/s² (0,25)

5) $a_N = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{a_N} = \frac{\frac{4t^2+4}{2}}{\sqrt{t^2+1}} = 2(t^2+1)^{3/2}$ m (0,25) (0,25)

B/6) $\vec{OM} = r\vec{e_r} = A\cos\omega t.\vec{e_r}$ (0,5) (0,5)

7) $\vec{V} = \frac{d\vec{OM}}{dt} = \dot{r}\vec{e_r} + r\dot{\theta}\vec{e_\theta} = -A\omega\sin\omega t\vec{e_r} + A\omega\cos\omega t\vec{e_\theta}$ (0,5) (0,5)

$|\vec{V}| = \sqrt{(-A\omega\sin\omega t)^2 + (A\omega\cos\omega t)^2} = A\omega$ m/s (0,5)

$\vec{a} = \frac{d\vec{v}}{dt} = (\ddot{r} - r\dot{\theta}^2)\vec{e_r} + (2\dot{r}\dot{\theta} + r\ddot{\theta})\vec{e_\theta}$ (0,5)

$\vec{a} = (-A\omega^2\cos\omega t - A\cos\omega t(\omega)^2)\vec{e_r} + (2A\omega\sin\omega t(\omega) + 0)\vec{e_\theta}$

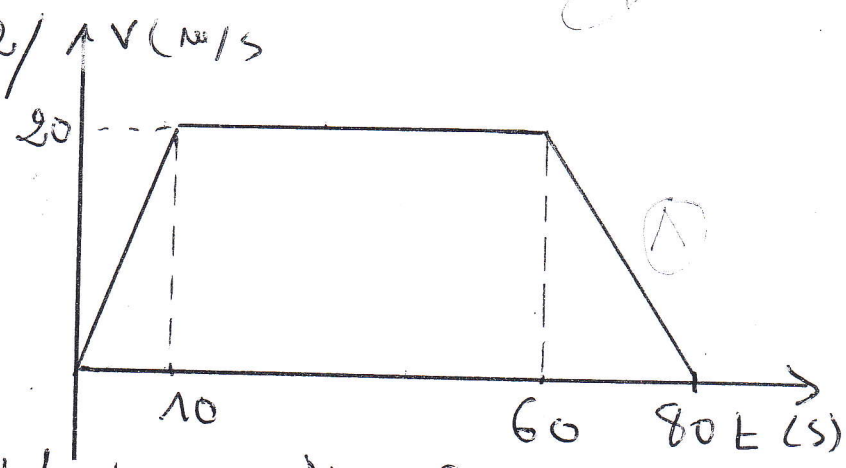
$\vec{a} = -2A\omega^2\cos\omega t\vec{e_r} - 2A\omega^2\sin\omega t\vec{e_\theta}$ (0,5)

$|\vec{a}| = 2A\omega^2$ m/s² (0,5)

exo 2/ (6pts) 1) equations de la vitesse et nature du mvt :

temps	a (m/s²)	V (m/s)	Nature du mvt
[0, 10s]	$2 = cste \Rightarrow$	$V = at + V_0 = 2t$	$\vec{a}.\vec{v} > 0$ MRUA accéléré (0,5)
[10s, 60s]	0	$V = \int a\,dt \Rightarrow V = 20$ (at = 10s)	MRU (0,5)
[60s, t_1]	$-1 = cste$	$V = at + V_0 = -t + 80$	$\vec{a}.\vec{v} < 0$ MRUA retardé (0,5)

2/



3) Valeur de t_1 :

à $t = t_1$ on a $V(t_1) = 0$

donc : $-t_1 + 80 = 0$

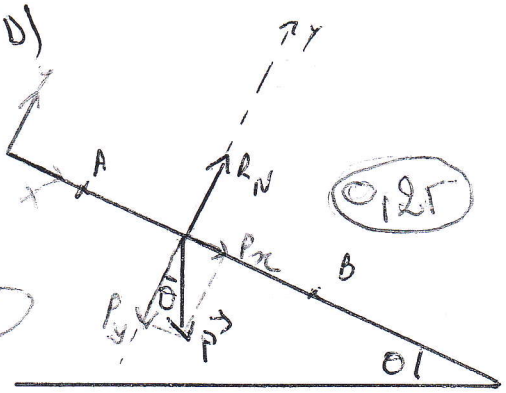
$\Rightarrow t_1 = 80\,s$ (0,5)

4/ Les equations horaires x(t) :

Temps	Equations horaires x(t)
[0, 10s]	MRUV : $x = \frac{1}{2}at^2 + V_0t + x_0$: $x = t^2$ (0,5)
[10s, 60s]	MRU : $x = V_0t + x_0$: $x = 20t - 100$ (0,5)
[60s, 80s]	MRUV : $x = \frac{1}{2}at^2 + V_0t + x_0$: $x = -\frac{t^2}{2} + 80t - 1900$ (0,5)

exo 3/ (6pts) A/ frottement negligeable et $V_A = 0$

1) Nature du mvt : $\sum \vec{F}_{ext} = m\vec{a}$ (PFD) (0,25)



(0,25)

Ox : $P_x = ma \Rightarrow mg\sin\theta = ma$

$a = g\sin\theta = 3,35\,m/s^2$ (0,5)

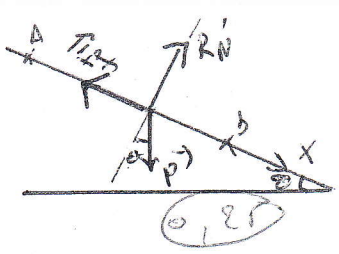
$a = cste$ et $\vec{a}.\vec{v} > 0 \Rightarrow$ MRUA accéléré (0,25)

MRUV $\Rightarrow x = \frac{1}{2}at^2 + V_0t + x_0$

$x - x_0 = AB = \frac{1}{2}at^2 \Rightarrow t = \sqrt{\frac{2AB}{a}}$ (0,25)

AN $\Rightarrow t = 1,09\,s$ (0,5)

AN: $a' = 2,36\ m/s^2$ (0,2pt)



(0,25)

(PFD): $\sum \vec{F}_{ext} = m\vec{a}$

$\rightarrow$ Oy

$R_N - P_y = 0$

$R_N = P_y = mg\cos\theta$ (0,25)

$\downarrow$ Ox

$P_x - F_f = m a'$ (0,25)

$F_f = \mu R_N$ (0,25)

$P_x - \mu R_N = m a' \Rightarrow mg\sin\theta - \mu mg\cos\theta = m a'$

$$\mu = \frac{g\sin\theta - a'}{g\cos\theta} = \tan\theta - \frac{a'}{g\cos\theta}$$ (0,25)

AN: $\mu = 0,107$ (0,25)

B/ a/ frottement négligeable $\Rightarrow$ système conservatif (0,25)

$\Delta E_{mec} = 0 \qquad E_{mec}(C) - E_{mec}(B) = 0$ (0,25)

$\left(E_c(C) + E_p(C)\right) - \left(E_c(B) + E_p(B)\right) = 0$

$\frac{1}{2}m\cancel{V_C^2}^{0} + mgz_C - \frac{1}{2}mV_B^2 - \cancel{mgz_B}^{0} = 0$ (0,5)

$mgz_C = \frac{1}{2}mV_B^2$ avec $z_C = BC\sin\alpha$.

$$BC = \frac{V_B^2}{2g\sin\alpha}$$ AN: $BC = 1,3\ m$ (0,25)

b/ avec frottement $\Rightarrow$ système Non conservatif: (0,25)

(0,25) $\Delta E_{mec} = \sum W_{B\to C}(\vec{F}_{NC}) = W(\vec{F}_{frott}) = \int_B^C \vec{F}_f \cdot d\vec{l}$ (0,25)

$mgBC\sin\theta - \frac{1}{2}mV_B^2 = +\mu R_N \cdot BC \cdot \cos\pi = -\mu mg\cos\theta\, BC$

$$BC = \frac{V_B^2}{2g(\sin\theta + \mu\cos\theta)}$$ (0,25) ; AN: $BC = 1,03\ m$ (0,25)