C.2

P.1 $\vec{F} = \left(\frac{A}{z} - mg\right)\hat{k}$

$-dV = \vec{F}\cdot d\vec{r} = \left(\frac{A}{z} - mg\right)dz$

$V(z) = mgz - A\ln z$

a) z^* de equilibrio $\vec{F}(z) = 0 \rightarrow \boxed{z^* = \frac{A}{mg}}$

1/1

Frecuencia ω_0 de pequeñas oscilaciones

$\omega_0^2 = \frac{1}{m}\left.\frac{d^2V}{dz^2}\right|_{z^*}$ $\qquad \frac{d^2V}{dz^2} = \frac{A}{z^2}$

$\omega_0^2 = \frac{1}{m}\frac{A}{A^2}m^2g^2 = \frac{mg^2}{A}$

1.5/1.5

$\omega_0 = g\sqrt{\frac{m}{A}} = \frac{2\pi}{T} \rightarrow \boxed{T = \frac{2\pi}{g}\sqrt{\frac{A}{m}}}$

Si solo llego a esto: -0.2

b) CONSERVACIÓN DE ENERGÍA

$\frac{1}{2}mv_0^2 + V(z^*) = V(2z^*)$ 2.5/2.5

$v_0 = \left[\frac{2A}{m}(1 - \ln 2)\right]^{1/2}$

c) En $z = 2z^*$ $\quad F(2z^*) = ma$

$\frac{A}{2z^*} - mg = ma \rightarrow \frac{\cancel{A}}{2\cancel{A}}mg - \cancel{m}g = \cancel{m}a$

$\boxed{a = -\frac{g}{2}}$

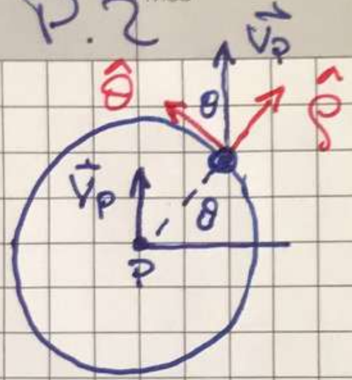
1/1

Día Mes Año

Día Mes Año

P.2

a)



$$\vec{v} = \vec{v}\,' + \vec{v}_P + \vec{\omega}_0 \times \vec{r}\,'$$

$$\vec{v}\,' = v_0 \hat{\theta}$$

$$\vec{v}_P = \omega_0 \frac{R}{2} \left(\operatorname{sen}\theta \, \hat{\rho} + \cos\theta \, \hat{\theta} \right)$$

$$\vec{\omega}_0 \times \vec{r}\,' = \omega_0 \hat{k} \times \frac{R}{2} \hat{\rho} = \omega_0 \frac{R}{2} \hat{\theta}$$

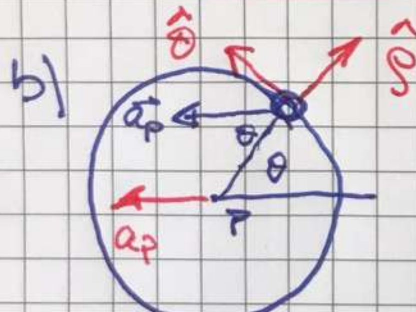
$$\vec{v} = \omega_0 \frac{R}{2} \operatorname{sen}\theta \, \hat{\rho} + \left[v_0 + \omega_0 \frac{R}{2} \left(1 + \cos\theta \right) \right] \hat{\theta}$$

$$\theta = \frac{\pi}{2} \qquad \vec{v}_{\pi/2} = \omega_0 \frac{R}{2} \hat{\rho} + \left(v_0 + \omega_0 \frac{R}{2} \right) \hat{\theta}$$

$$v = \left[\frac{\omega_0^2 R^2}{4} + \left(v_0 + \omega_0 \frac{R}{2} \right)^2 \right]^{1/2}$$

$$2/2 \qquad \boxed{ v_{\theta=\pi/2} = \left[\frac{\omega_0^2 R^2}{2} + v_0^2 + v_0 \omega_0 R \right]^{1/2} }$$

b)



$$\vec{a} = \vec{a}\,' + \vec{a}_P + 2\vec{\omega}_0 \times \vec{v}\,' + \vec{\omega}_0 \times \left(\vec{\omega}_0 \times \vec{r}\,' \right)$$

$$\vec{a}\,' = -\frac{v_0^2}{R/2} \hat{\rho}$$

$$\vec{a}_P = \omega_0^2 \frac{R}{2} \left(-\cos\theta \, \hat{\rho} + \operatorname{sen}\theta \, \hat{\theta} \right)$$

$$2\vec{\omega}_0 \times \vec{v}\,' = 2\omega_0 \hat{k} \times v_0 \hat{\theta}$$
$$= -2 v_0 \omega_0 \hat{\rho}$$

$$\vec{\omega}_0 \times (\vec{\omega}_0 \times \vec{r}\,') = \omega_0 \hat{k} \times \left(\omega_0 \hat{k} \times \frac{R}{2}\hat{\rho}\right)$$
$$= \omega_0^2 \frac{R}{2}\, \hat{k} \times \hat{\theta} = -\frac{\omega_0^2 R}{2} \hat{\rho}$$

$$\vec{a} = -\frac{2V_0^2}{R}\hat{\rho} - \frac{\omega_0^2 R}{2}\cos\theta\, \hat{\rho} + \frac{\omega_0^2 R}{2}\,\mathrm{sen}\,\theta\, \hat{\theta} -$$
$$- 2\omega_0 v_0 \hat{\rho} - \omega_0^2 \frac{R}{2}\hat{\rho}$$

$$\theta = \frac{\pi}{2}$$

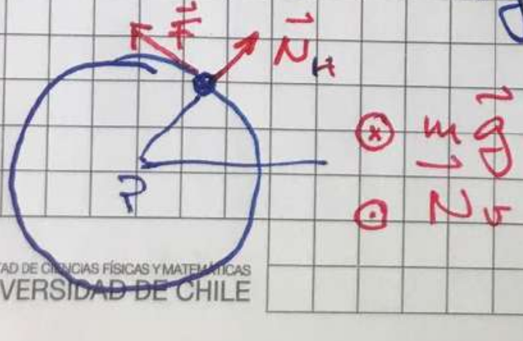
$$\vec{a} = -\left(\frac{2V_0^2}{R} + 2v_0\omega_0 + \omega_0^2 \frac{R}{2}\right)\hat{\rho} + \omega_0^2 \frac{R}{2}\hat{\theta}$$

$$\boxed{|\vec{a}| = \left[\left(\frac{2V_0^2}{R} + 2v_0\omega_0 + \omega_0^2\frac{R}{2}\right)^2 + \frac{\omega_0^4 R^2}{4}\right]^{1/2}}$$

2/2

c) Ec. movimiento

$$m\vec{a}\,' = \vec{F} + m\vec{g} + \vec{N}_v + \vec{N}_H + (-m\vec{a}_P) +$$
$$+ 2\vec{v}\,' \times \vec{\omega}_0 +$$
$$+ (\vec{\omega}_0 \times \vec{r}\,') \times \vec{\omega}_0$$



P.2. (3)

$$\boxed{m\vec{a}' = -m\frac{v_0^2}{R/2}\hat{\rho}} \qquad \boxed{m\vec{g} + \vec{N}_V = 0}$$

$$\boxed{\vec{N}_H = N_H\hat{\rho}} \qquad \boxed{\vec{F} = F\hat{\theta}}$$

$$-m\vec{a}_p = \omega_0^2\frac{R}{2}(\cos\theta\,\hat{\rho} - \operatorname{sen}\theta\,\hat{\theta})$$

$$2\vec{v}'\times\vec{\omega}_0 = 2v_0\omega_0\hat{\rho}$$

$$(\vec{\omega}_0\times\vec{r}')\times\vec{\omega}_0 = \omega_0^2\frac{R}{2}\hat{\rho}$$

COMPONENTE DE EC. DE MOV. SEGUN $\hat{\theta}$

$\hat{\theta}$) $$0 = F - \omega_0^2\frac{R}{2}\operatorname{sen}\theta$$

$$F = \frac{\omega_0^2 R}{2}\operatorname{sen}\theta \quad m$$

$$|F|_{MAX} = \frac{\omega_0^2 R}{2} \quad \text{en } \theta_1 = \pi/2$$

$$\text{y } \theta_2 = \frac{3\pi}{2}$$

2/2