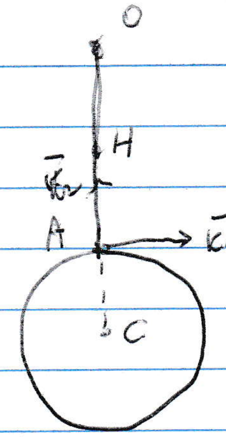
1)



$$\overline{AG} = \frac{m\overline{AH} + m\overline{AC}}{2m} = mR\bar{k}_2 - mR\bar{k}_2 = 0 \qquad G \equiv A$$

$$I_A^{\,as} = \frac{m(2R)^2}{3} = \frac{4}{3}mR^2$$

$$I_A^{\,an} = mR^2 + mR^2 = 2mR^2$$

$$I_A^{\,totale} = \frac{4}{3}mR^2 + 2mR^2 = \frac{10}{3}mR^2$$

2) $T = \frac{1}{2}2m\, v_A^2 + I_A\, \omega^2 + \frac{1}{2}\frac{2m}{3} v_P^2$

$v_A^2 = 4R^2\dot\theta^2 \qquad \omega = \dot\theta \qquad \overline{OP} = (3R\,\mathrm{sen}\,\theta + R\,\mathrm{sen}\,\varphi)\,\bar{e}_1 + (-3R\cos\theta - R\cos\varphi)\,\bar{e}_2$

$v_P = (3R\cos\theta\,\dot\theta + R\cos\varphi\,\dot\varphi)\,\bar{e}_1 + (3R\,\mathrm{sen}\,\theta\,\dot\theta + R\,\mathrm{sen}\,\varphi\,\dot\varphi)\,\bar{e}_2$

$v_P^2 = 9R^2\dot\theta^2 + R^2\dot\varphi^2 + 6R(\cos\varphi\cos\theta + \mathrm{sen}\,\varphi\,\mathrm{sen}\,\theta)\,\dot\varphi\dot\theta$

$T = \frac{1}{2}\cancel{8}mR^2\dot\theta^2 + \frac{10}{3}mR^2\dot\theta^2 + \frac{2}{3}m\left(9R^2\dot\theta^2 + R^2\dot\varphi^2 + 6R\cos(\theta-\varphi)\right)\dot\theta\dot\varphi$

$V = 2mg\,y_A + \frac{2}{3}mg\,y_P - \bar{F}\cdot\overline{OP} = -2mg\,2R\cos\theta - \frac{2}{3}mg(3R\cos\theta + R\cos\varphi)$

$- mg(3R\,\mathrm{sen}\,\theta + R\,\mathrm{sen}\,\varphi - 3R\cos\theta - R\cos\varphi) = mgR(-3\cos\theta - 3\,\mathrm{sen}\,\theta - \mathrm{sen}\,\varphi + \frac{1}{3}\cos\varphi)$

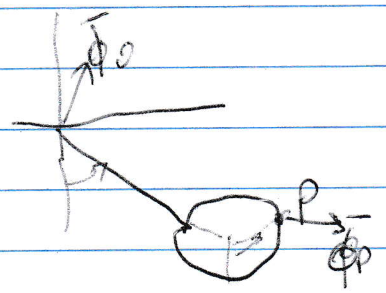
$\frac{\partial V}{\partial\theta} = 3mgR(\mathrm{sen}\,\theta - \cos\theta) = 0 \qquad \frac{\partial V}{\partial\varphi} = -mgR(\cos\varphi + \frac{1}{3}\mathrm{sen}\,\varphi) = 0 \qquad \mathrm{tg}\,\varphi = -3$

$\theta = \frac{\pi}{4}, \frac{5\pi}{4} \qquad \varphi = \varphi_0 = \mathrm{arctg}(-3), \ \varphi_0 + \pi$

$\frac{\partial^2 V}{\partial\theta^2} = 3mgR(\cos\theta + \mathrm{sen}\,\theta) \qquad \frac{\partial^2 V}{\partial\varphi^2} = mgR(\mathrm{sen}\,\varphi - \frac{1}{3}\cos\varphi) = mgR\cos\varphi(\mathrm{tg}\,\varphi - \frac{1}{3})$

> 0 se $\theta = \frac{\pi}{4} \qquad \frac{\partial^2 V}{\partial\varphi^2} = -mgR\frac{10}{3}\cos\varphi > 0$ se φ nel 2° quadrante ($\cos\varphi < 0$)

3)



punto: $\frac{2}{3}m\bar{g} + \bar{F} + \bar\phi_P = 0 \qquad |\phi_P^t| \le f_s|\phi_P^n|$

$\phi_P^x = -mg \qquad \phi_P^y = -\frac{1}{3}mg$

$\bar{n} = \mathrm{sen}\,\varphi\,\bar{e}_1 - \cos\varphi\,\bar{e}_2 \qquad \bar{t} = \cos\varphi\,\bar{e}_1 + \mathrm{sen}\,\varphi\,\bar{e}_2$

$\phi_t = -mg(\cos\varphi + \frac{1}{3}\mathrm{sen}\,\varphi) \qquad \phi_n = mg(-\mathrm{sen}\,\varphi + \frac{1}{3}\cos\varphi)$

$|\cos\varphi + \frac{1}{3}\mathrm{sen}\,\varphi| \le f_s\,|\mathrm{sen}\,\varphi - \frac{1}{3}\cos\varphi|$

$\overline{OA}\times 2m\bar{g} + \overline{OP}\times(-\bar\phi_P) = 0 \qquad -2mgR\,\mathrm{sen}\,\theta + \frac{1}{3}mgR(3\,\mathrm{sen}\,\theta + \mathrm{sen}\,\varphi)$

asta + anello $\qquad -4mgR\,\mathrm{sen}\,\theta + \frac{1}{3}mgR(3\,\mathrm{sen}\,\theta + \mathrm{sen}\,\varphi) + mgR(3\cos\theta + \cos\varphi) = 0$