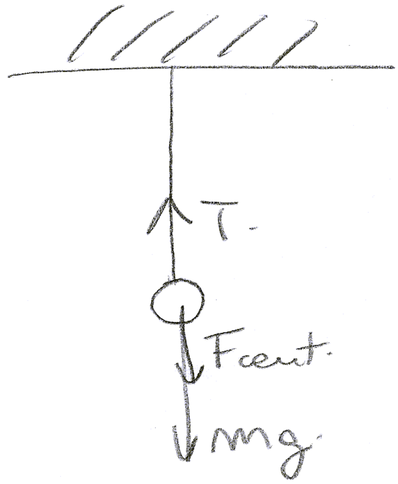
Pauta ejercicio 5

P1]

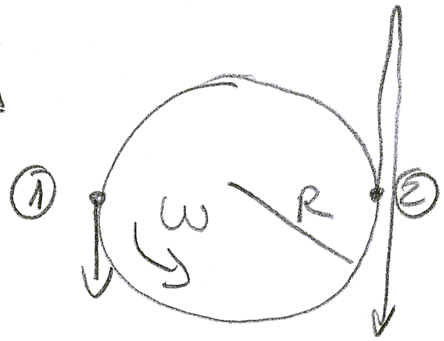
$$F_{cent.} = m l \omega^2$$



$$-mg + T = m l \omega^2 = m\vec{a}$$

$$T = m(g + l\omega^2)$$

P2]



$$y_1)\ 0 - R = -\omega R t_1 - g\frac{t_1^2}{2}$$

$$y_2)\ 0 - R = \omega R t_2 - g\frac{t_2^2}{2}$$

$$\Rightarrow t_2^2 - \frac{2\omega R t_2}{g} - \frac{2R}{g} = 0$$

la parábola pasa 2 veces por el punto de partida

$$\Rightarrow t_2 = \frac{\omega R}{g} \pm \frac{1}{2}\sqrt{\frac{4\omega^2 R^2}{g^2} - \frac{8R}{g}}$$

$$t_1 = -\frac{\omega R}{g} + \frac{1}{2}\sqrt{\frac{4\omega^2 R^2}{g^2} - \frac{8R}{g}}$$

$\omega = \frac{2\pi}{T} \Rightarrow T = \frac{1}{15}\, s.$

imponemos $t_2 - t_1 = \frac{2\pi}{\omega}$

$$\Rightarrow \frac{2\omega R}{g} = \frac{2\pi}{\omega} \Rightarrow \boxed{R = \frac{\pi g}{\omega^2}}$$

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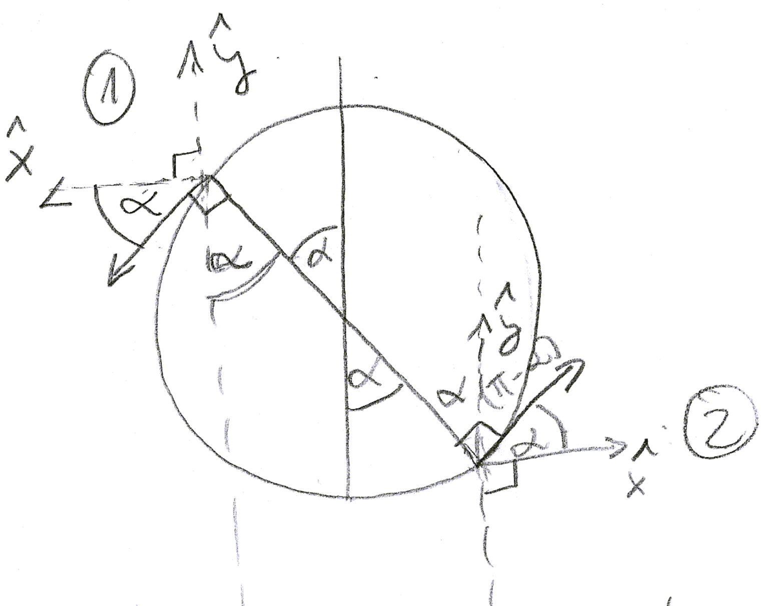
b)



$$y_1)\quad \Delta y = -\omega R \operatorname{sen}\alpha\, t_1 - g\frac{t_1^2}{2}$$

$$\Delta y = 0 - (R + R\cos\alpha) = -R(1+\cos\alpha)$$

$$\Rightarrow 0 = R(1+\cos\alpha) - \omega R \operatorname{sen}\alpha\, t_1 - g\frac{t_1^2}{2}$$

$$y_2)\quad \Delta y = \omega R \operatorname{sen}\alpha\, t_2 - g\frac{t_2^2}{2}$$

$$\Delta y = 0 - (R - R\cos\alpha) = -R(1-\cos\alpha)$$

$$\Rightarrow 0 = R(1-\cos\alpha) + \omega R \operatorname{sen}\alpha\, t_2 - \frac{g t_2^2}{2}.$$

Imponemos $t_1 = t_2 = t^*$

$$R(1+\cos\alpha) - \omega R \operatorname{sen}\alpha\, t^* - \cancel{\frac{g t^{*}}{2}} = R(1-\cos\alpha) + \omega R \operatorname{sen}\alpha\, t^* - \cancel{\frac{g t^{*}}{2}}.$$

$$\boxed{\cancel{2}\cancel{R}\cos\alpha = \cancel{2}\omega \cancel{R} \operatorname{sen}\alpha\, t^*.}$$

$$\frac{1}{\omega t^*} = \tan\alpha$$

Sumando la ecuacion y_1) e y_2)

$$\Rightarrow 0 = 2R - g t^{*2}$$

$$t^* = \sqrt{\frac{2R}{g}}$$

$$\tan\alpha = \frac{1}{\omega}\sqrt{\frac{g}{2R}} = \frac{\sqrt{2Rg}}{2\omega R}$$

$$\alpha = \operatorname{arctg}\left(\frac{\sqrt{2Rg}}{2\omega R}\right)$$