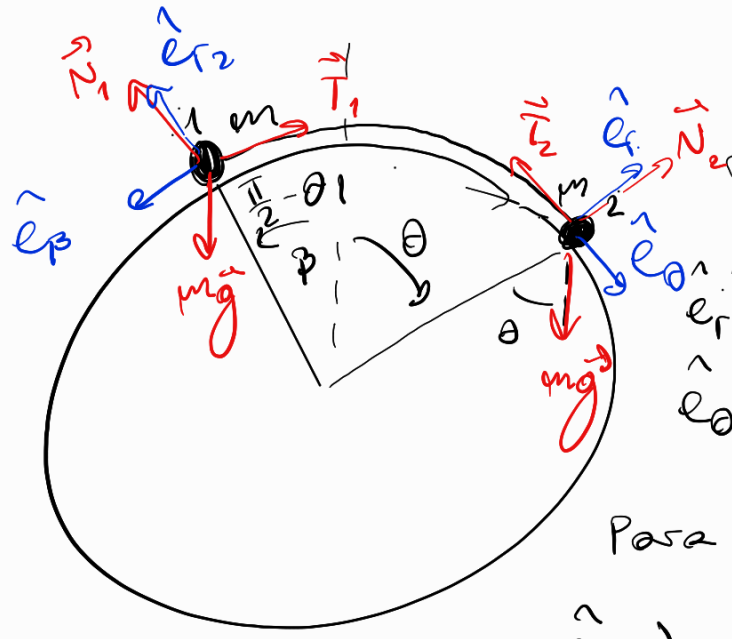
1)



Para la partícula 2

$\hat{e}_r$) $m(\cancel{\ddot{r}_2}^{\,0} - r_2\dot{\theta}^2) = N_2 - mg\cos\theta$

$\hat{e}_\theta$) $m(r_2\ddot{\theta} + 2\cancel{\dot{r}_2}^{\,0}\dot{\theta}) = mg\,\text{sen}\,\theta - T_2$

Para la partícula 1

$\hat{e}_r$) $m(\cancel{\ddot{r}_1}^{\,0} - r_1\dot{\beta}^2) = N_1 - mg\cos\beta$

$\hat{e}_\beta$) $m(r_1\ddot{\beta} + 2\cancel{\dot{r}_1}^{\,0}\dot{\beta}) = mg\,\text{sen}\,\beta - T_1$

$\beta = \frac{\pi}{2} - \theta \Rightarrow \dot{\beta} = -\dot{\theta},\ \ddot{\beta} = -\ddot{\theta}$

Además es $r_1 = r_2 = r$

$\cos\beta = \cos(\frac{\pi}{2} - \theta) = \text{sen}\,\theta$

$\text{sen}\,\beta = \text{sen}(\frac{\pi}{2} - \theta) = \cos\theta$

$T_1 = T_2 = T$ ya que el hilo es sin masa.

$\Rightarrow$ (I) $-mr\dot{\theta}^2 = N_2 - mg\cos\theta$

(II) $mr\ddot{\theta} = mg\,\text{sen}\,\theta - T$

(III) $-mr\dot{\theta}^2 = N_1 - mg\,\text{sen}\,\theta$

(IV) $-mr\ddot{\theta} = mg\cos\theta - T$

de (II) y (IV) es

$$2mr\ddot{\theta} = mg(\text{sen}\,\theta - \cos\theta)$$

$$\Rightarrow \ddot{\theta} = \frac{g}{2r}(\text{sen}\,\theta - \cos\theta) \quad \text{(V)}$$

b) de (II) es

$$T = mg\,\text{sen}\,\theta - mr\ddot{\theta} \underset{\text{(V)}}{=} mg\,\text{sen}\,\theta - \frac{mg}{2}(\text{sen}\,\theta - \cos\theta)$$

$$\Rightarrow T = \frac{mg}{2}(\text{sen}\,\theta + \cos\theta) = 0 \Rightarrow \theta = \frac{3}{4}\pi$$

(imposible si se desprenden)

c) de (I) es

$$N_2 = mg\cos\theta - mr\dot{\theta}^2$$

Pre integrando (V) es $\dot{\theta}\ddot{\theta} = \frac{d}{dt}\left(\frac{1}{2}\dot{\theta}^2\right) = \frac{g\dot{\theta}}{2r}(\operatorname{sen}\theta - \cos\theta)$

$$\Rightarrow \frac{1}{2}\dot{\theta}^2 - \frac{1}{2}\dot{\theta}_0^2 = -\frac{g}{2r}(\cos\theta + \operatorname{sen}\theta) + \frac{g}{2r}(\cos\theta_0 + \operatorname{sen}\theta_0)$$

pero como $\dot{\theta}_0 = 0$ y $\operatorname{sen}\theta_0 = \cos\theta_0 = \frac{\sqrt{2}}{2}$

$$\Rightarrow \dot{\theta}^2 = -\frac{g}{r}(\cos\theta + \operatorname{sen}\theta) + \frac{\sqrt{2}g}{r}$$

$$\Rightarrow N_2 = mg\cos\theta - mg\sqrt{2} + mg(\cos\theta + \operatorname{sen}\theta)$$

$$\Rightarrow N_2 = mg\left[2\cos\theta_D + \operatorname{sen}\theta_D - \sqrt{2}\right] = 0$$