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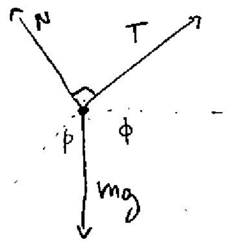
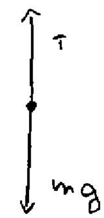
DCL

m_1:



m_2:



a) Para m_1 usamos coordenadas polares

$$m\ddot{\vec{r}}_1 = F$$

$$\Rightarrow m\left[(\cancel{\ddot{\rho}} - \rho\dot{\phi}^2)\hat{\rho} + (\rho\ddot{\phi} + 2\cancel{\dot{\rho}}\dot{\phi})\hat{\phi}\right] = (N - mg\sin\phi)\hat{\rho} + (T - mg\cos\phi)\hat{\phi}$$

Para m_2 usamos cartesianas

$$m\ddot{\vec{r}}_1 = F$$

$$\Rightarrow m\ddot{y}\hat{\jmath} = (T - mg)\hat{\jmath}$$

Separando en ecuaciones escalares

$\hat{\rho}$: $-mR\dot{\phi}^2 = N - mg\sin\phi$

$\hat{\phi}$: $mR\ddot{\phi} = T - mg\cos\phi$

$\hat{\jmath}$: $m\ddot{y} = T - mg$

$\boxed{2\ \text{Pt}}$

b) Como $y = -R\phi \Rightarrow \ddot{y} = -R\ddot{\phi}$

$\Rightarrow$ la ec para $\hat{j}$ es:

$$-mR\ddot{\phi} = T - mg$$

haciendo $\underline{\hat{\phi} - \hat{j}|}$ (Me refiero a restar las ecuaciones

$$\Rightarrow 2\cancel{m}R\ddot{\phi} = \cancel{m}g(1-\cos\phi) \Rightarrow \ddot{\phi} = \frac{g}{2R}\left(1-\cos\phi\right) = F(\phi)$$

Luego $\ddot{\phi} = \dot{\phi}\dfrac{d\dot{\phi}}{d\phi} = \dfrac{g}{2R}(\phi - \cos\phi) \Rightarrow \dfrac{\dot{\phi}^2}{2} = \dfrac{g}{2R}\left(\phi - \sin\phi\right) + C$

Imponiendo $\dot{\phi}(\phi = 0) = 0 \Rightarrow C = 0$

$$\Rightarrow \dot{\phi}^2 = \frac{g}{R}\left(\phi - \sin\phi\right) = G(\phi) \qquad \boxed{2pt}$$

c) $N = \cancel{m}\cancel{g}\sin\phi_0 - \cancel{m}\cancel{R}\dfrac{\cancel{g}}{\cancel{R}}\left(\phi_0 - \sin\phi_0\right) \stackrel{!}{=} 0$

$$\Rightarrow \sin\phi_0 = \frac{\phi_0}{2} \qquad \boxed{2pt}$$