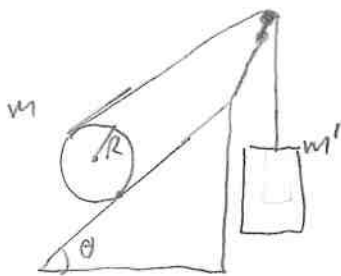


Moisés: Capítulo 12, exercício 12



$m' > m$

Massa m'



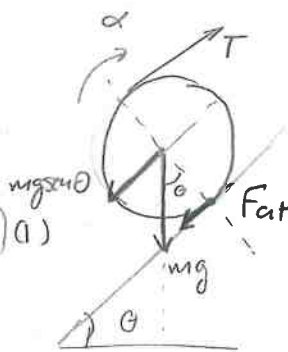
Forças: disco:

$$m a_{cm} = T - m g \sin \theta - F_{at} \quad (1)$$

Torques:

$$I_{cm} \alpha = T \cdot R + F_{at} R$$

$$\frac{m R^2}{2} \cdot \left(\frac{a_{cm}}{R} \right) = (T + F_{at}) R \Rightarrow m a_{cm} = 2(T + F_{at}) \quad (2)$$



Relações:

$$\begin{cases} v_{cm}(t) = R \omega(t) \\ a_{cm}(t) = R \alpha(t) \end{cases}$$

$$m' a_{cm} = m' g - T \Rightarrow T = m'(g - a_{cm}) \quad (3) \quad 2m'g - 2m'a_{cm}$$

Substituindo (3) em (2): $m a_{cm} = 2m'(g - a_{cm}) + 2F_{at}$

$$2F_{at} = a_{cm} \left(\frac{m}{2} + 2m' \right) - 2m'g \Rightarrow F_{at} = a_{cm} \left(\frac{m}{2} + m' \right) - m'g \quad (4)$$

de (3) e (4): $T - F_{at} = m'g - m'a_{cm} - \frac{m}{2} a_{cm} - m'a_{cm} + m'g$

$$T - F_{at} = 2m'g - \left(2m' + \frac{m}{2} \right) a_{cm} \quad (5)$$

Substitui (5) em (1): $m a_{cm} = (T - F_{at}) - m g \sin \theta$

$$m a_{cm} = 2m'g - \left(2m' + \frac{m}{2} \right) a_{cm} - m g \sin \theta \Rightarrow \left(m + \frac{m}{2} + 2m' \right) a_{cm} = g(2m' - m \sin \theta)$$

a) ou seja:

$$a_{cm} = \frac{g(2m' - m \sin \theta)}{\left(2m' + \frac{3}{2}m \right)} = \frac{g(m' - \frac{m}{2} \sin \theta)}{\left(m' + \frac{3}{4}m \right)}$$

b) $T = m'(g - a_{cm}) = m'g \left(1 - \frac{2(m' - \frac{m}{2} \sin \theta)}{2(m' + \frac{3}{4}m)} \right) = m'g \frac{(2m' + \frac{3}{2}m - 2m' + m \sin \theta)}{2m' + \frac{3}{2}m}$

$$T = m' m g \frac{\left(\frac{3}{2} + \sin \theta \right)}{\left(2m' + \frac{3}{2}m \right)}$$