4º Lista
Correção

1. Conservação do momento linear:

a)

eixo x
$P_i = P_f$
$m.u = M.v.\cos\theta$

eixo y
$P_i = P_f$
$0 = m\frac{u}{\sqrt{3}} + M.v.\sin\theta$

$$\begin{cases} mu = Mv\cos\theta \\ mu = -mv\sin\theta\sqrt{3} \end{cases} \Rightarrow \theta = -30°$$

b) Colisão Elástica: $\Delta E_c + \Delta E_{p\,elast} = 0$

$$\Rightarrow E_i = E_f \Rightarrow \frac{mu^2}{2} = \frac{1}{2}m\left(\frac{u}{\sqrt{3}}\right)^2 + \frac{Mv^2}{2}$$

$$\Rightarrow \frac{2mu^2}{3} = Mv^2 \quad (I)$$

elevando ao quadrado e somando ↑

Sendo:

$$\begin{cases} mu = Mv\cos\theta \\ mu = -Mv\sin\theta\sqrt{3} \end{cases} \Rightarrow M^2v^2 = \frac{4m^2u^2}{3}$$

Utilizando I:

$$\begin{cases} M^2v^2 = \frac{4m^2u^2}{3} \\ Mv^2 = \frac{2mu^2}{3} \end{cases} \Rightarrow \frac{M}{m} = 2 \;//$$

$\frac{M}{m} = 2$

$\cdot M v^2 = \frac{2mu^2}{3} \Rightarrow v = \frac{u}{\sqrt{3}}$ //

c) $V_{CM}^{i} = V_{CM}^{f}$

$V_{CM} = \frac{mu + M \cdot 0}{M+m} = \frac{1}{3} u \hat{i}$

$\vec{V}_{mf} = \left|\frac{u}{\sqrt{3}}\right| \cdot (\cos\theta \hat{i} + \sin\theta \hat{j}) = u\left(\frac{1}{2}\hat{i} - \frac{1}{2\sqrt{3}}\hat{j}\right)$

$\theta = -30°$

$\vec{V}_{mf} = \left(\frac{u}{\sqrt{3}}\right)\hat{j}$

No referencial do CM:

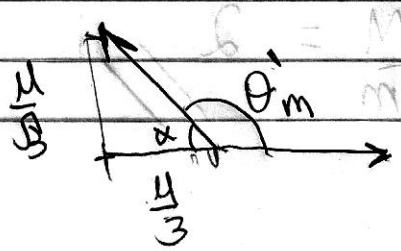
$\vec{V}'_{mf} = \vec{V}_{mf} - \vec{V}_{CM} = u\left(\frac{1}{6}\hat{i} - \frac{1}{2\sqrt{3}}\hat{j}\right)$

$\vec{V}'_{mf} = \vec{V}_{mf} - \vec{V}_{CM} = u\left(-\frac{1}{3}\hat{i} + \frac{1}{\sqrt{3}}\hat{j}\right)$

$\operatorname{tg}\alpha = \frac{C.O}{C.A} = \frac{\frac{1}{\sqrt{3}}}{\frac{1}{3}} = -\frac{3}{\sqrt{3}} \Rightarrow \alpha = 60°$

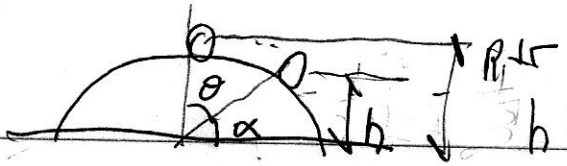
$\operatorname{tg}\theta'_m = \frac{C.O}{C.A} = -\frac{\frac{1}{2\sqrt{3}}}{\frac{1}{6}} = -\frac{3}{\sqrt{3}} \Rightarrow \theta'_m = 30°$

$\alpha + \theta'_m = 180 \Rightarrow \theta'_m = 120°$



$v = \frac{\omega}{R}$

$\omega = \frac{v}{R}$



$h = (R+r)\cos\theta$

2.] $\sum F_{cp} = P\cos\theta \Rightarrow \frac{m v^2}{(R+r)} = mg\cos\theta \Rightarrow$

$\Rightarrow v^2 = (R+r)g\cos\theta$

Conservação de energia

$I = \frac{2}{5} m R^2$

$E_i = E_f$

$mg(R+r) = mgh + \frac{m v^2}{2} + \frac{\omega^2 I}{2}$

$\Rightarrow \cos\theta = \frac{10}{17} \Rightarrow \theta \cong 54$ //

b] $v = \sqrt{g\cos 54 (R+r)} = \sqrt{\frac{10g}{17}(R+r)}$