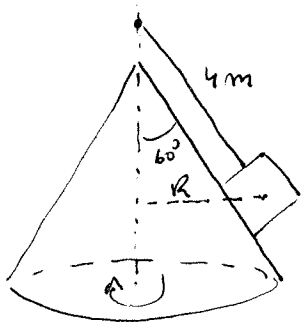
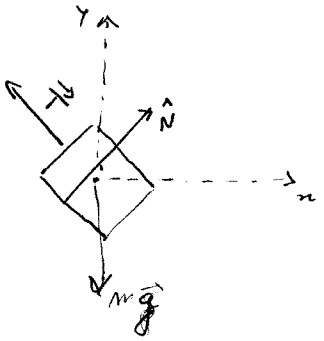
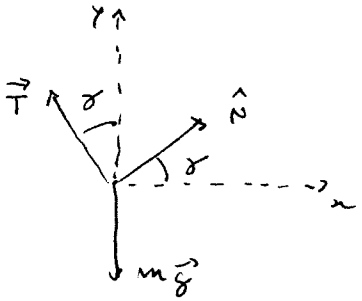
9



$\gamma = 60°$

Diagrama de Forças:





a) $\omega = \frac{2\pi}{P} = 2\pi f$

$= 2\pi \times \frac{10}{60}$

$= \frac{\pi}{3}$ rad/s

$= 1{,}04$ rad/s

Velocidade linear:

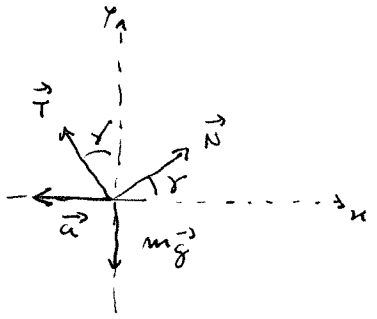
$V = R\omega = 4 \operatorname{sen}\gamma \times \omega$

$= 4 \cdot \frac{\sqrt{3}}{2} \cdot \frac{\pi}{3}$

$= \frac{2\pi}{\sqrt{3}}$ m/s

$\approx 3{,}63$ m/s

b) Reacção na superfície:



$$\vec{T} + \vec{N} + m\vec{g} = m\vec{a}_{cn}$$

Decompondo, Temos

$$\begin{cases} -T \operatorname{sen}\gamma + N \cos\gamma = -m\dfrac{v^2}{R} & xx \\ T\cos\gamma - mg + N \operatorname{sen}\gamma = 0 & yy \end{cases}$$

$$\Rightarrow \begin{cases} — \\ T = \dfrac{-N \operatorname{sen}\gamma + mg}{\cos\gamma} = -N \operatorname{tg}\gamma + \dfrac{mg}{\cos\gamma} \end{cases}$$

Vamos substituir $\gamma = 60°$, para simplificar

$$\begin{cases} -T\dfrac{\sqrt{3}}{2} + \dfrac{N}{2} = -m\dfrac{v^2}{R} \\ T = -N\sqrt{3} + 2mg \end{cases}$$

$$\Rightarrow \begin{cases} +N\dfrac{3}{2} - \sqrt{3}mg + \dfrac{N}{2} = -m\dfrac{v^2}{R} \\ — \end{cases}$$

$$\Rightarrow N = \frac{\sqrt{3}}{2}mg - \frac{mv^2}{2R}$$

$$= \frac{\sqrt{3}}{2} 6 \times 9.8 - \frac{\cancel{6}}{\cancel{2}\times\cancel{2}\sqrt{3}} \times \frac{\cancel{4}^{2}\pi^2}{3}$$

$$= 39,5 \text{ N}$$

c) Tensão:

$$T = -\sqrt{3}\,N + 2mg = 49{,}2\ N$$

d) Velocidade angular Tal que $N=0$:

$$\begin{cases} -T\frac{\sqrt{3}}{2} = -m\omega^2 R \\ T = 2mg \end{cases}$$

$$\Rightarrow \sqrt{3}\,\cancel{m}g = \cancel{m}\omega^2 R$$

$$\Rightarrow \omega^2 = \frac{\sqrt{3}\,g}{R}$$

$$\Rightarrow \omega = \sqrt{\frac{\sqrt{3}\,g}{4\times\frac{\sqrt{3}}{2}}} = \sqrt{\frac{g}{2}} = 2{,}21\ rad/s$$