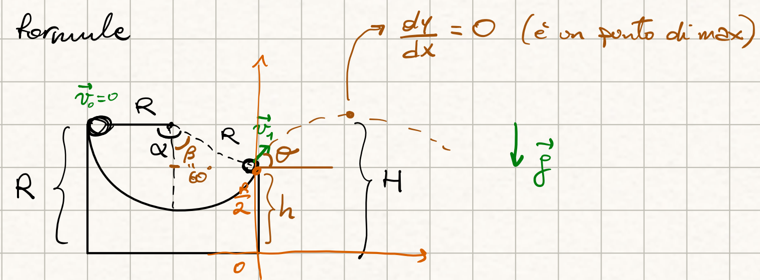
!

- Unità di misura (SI)
- Giustificazione dell' uso di formule



1) $v_0 = 0$

R

$\alpha = 150°$

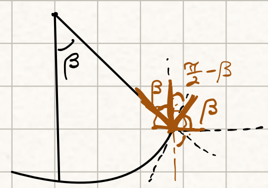
a) CONS. DI E_m : $\Delta E_m = 0$ (NO $\vec{F}_{nc}$)

$$h = R - R\cos\beta = R(1-\cos\beta) = \frac{R}{2}$$

$$\Rightarrow E_{k_f} - E_{k_i} + E_{p_f} - E_{p_i} = 0$$

$$\frac{1}{2}mv_1^2 - 0 + mg\frac{R}{2} - mgR = 0$$

$$v_1 = \sqrt{gR}$$



$\Rightarrow$ $\vec{v}_1$ è tang alla circonferenza

$\theta = \beta = 60°$

$$\begin{cases} v_{1x} = v_1\cos\theta \\ v_{1y} = v_1\sin\theta \end{cases}$$

$$\begin{cases} x(t) = \cancel{x_0} + v_1\cos\theta\, t \\ y(t) = \frac{R}{2} + v_1\sin\theta\, t - \frac{1}{2}g t^2 \end{cases}$$

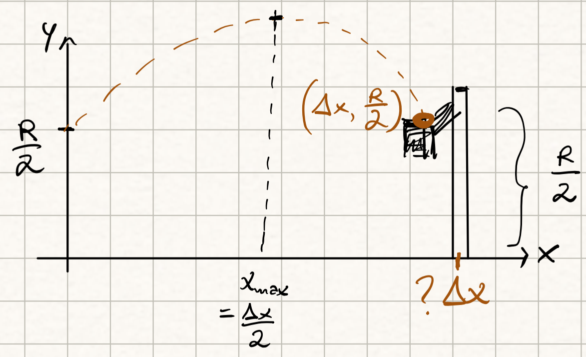
$$\rightarrow \begin{cases} t = \frac{x}{v_1\cos\theta} \\ y(x) = \frac{R}{2} + \frac{\sin\theta}{\cos\theta}x - \frac{1}{2}g\frac{x^2}{v_1^2\cos^2\theta} \end{cases}$$ EQ. traiettoria

$$\frac{dy}{dx} = tg\theta - \frac{g\,\cancel{2}x}{\cancel{2}v_1^2\cos^2\theta} = 0$$

$$\Rightarrow x_{max} = \frac{v_1^2}{g}\sin\theta\cos\theta = R\sin\theta\cos\theta$$

$$H = y(x_{max}) = \frac{R}{2} + R\sin^2\theta - \frac{1}{2}R\sin^2\theta = \frac{7}{8}R$$

b)



$$y = \frac{R}{2} + tg\theta\, x - \frac{1}{2}\frac{x^2}{R\cos^2\theta}$$

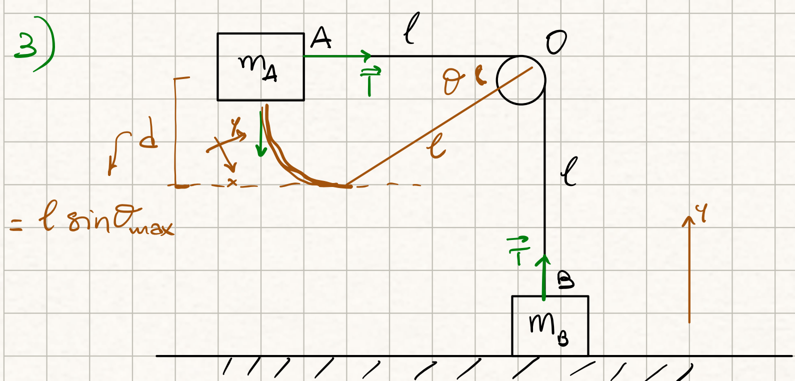
$$y(\Delta x) = \frac{R}{2}$$

$$\Rightarrow tg\theta\,\Delta x - \frac{1}{2}\frac{\Delta x^2}{R\cos^2\theta} = 0$$

$\Delta x = 0$

$\Delta x = 2R\sin\theta\cos\theta = \underline{\frac{\sqrt{3}R}{2}} = 2x_{max}$

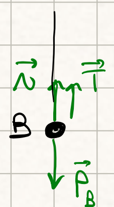
3)



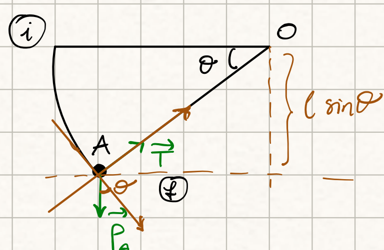
$m_A = 2kg$

$2\ell = 4m$

$m_B = 3kg$



B : $T + N - m_B g = 0$



A :
$$\begin{cases} x & m_A g\cos\theta = m_A a_T \\ y & T - m_A g\sin\theta = m_A a_c \end{cases}$$

MOTO CIRCOLARE
$a_c = \frac{v_A^2}{\ell}$

CONS. E_m : $\Delta E_m = 0$

inizio $\theta = 0$
fine θ

$$\frac{1}{2}\cancel{m_A}v_A^2 - 0 + \cancel{m_A}g\ell(1-\sin\theta) - \cancel{m_A}g\ell = 0$$

$$v_A(\theta) = \sqrt{2g\ell\sin\theta}$$

$$\Rightarrow T - m_A g\sin\theta = m_A\frac{v_A^2}{\ell} \quad\Rightarrow\quad T = 3m_A g\sin\theta$$

m_B si stacca da terra :

$$\Rightarrow N = 0 \; : \; T = m_B g \quad\Rightarrow\quad 3m_A g\sin\theta = m_B g \quad\Rightarrow\quad \theta = \arcsin\left(\frac{m_B}{3m_A}\right)$$

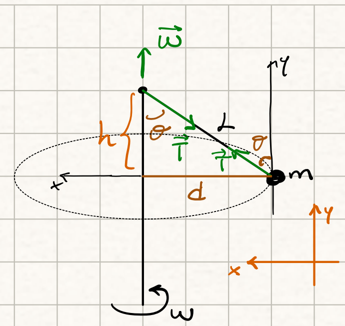
$$\Rightarrow d = \ell\frac{m_B}{3m_A} = \underline{1\,m}$$

4) $m = 5\,kg$

$L = 5\,m$

$\omega = 1,5\ rad/s$

$?\ d, T$



PENDOLO CONICO

! asse lungo l'accel. centripeta

$\hookrightarrow \omega$ cost $\Rightarrow$ MOTO CIRCOLARE UNIFORME : $a_c = \omega^2 d$

$$\begin{cases} x: & T\sin\theta = ma_c = m\omega^2 d \\ y: & T\cos\theta - mg = 0 \end{cases} \quad \rightarrow T = \frac{mg}{\cos\theta}$$

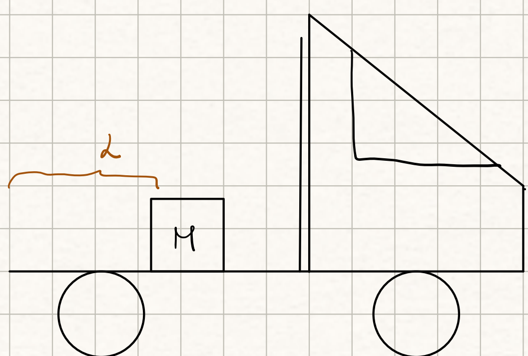
$$\rightarrow \cancel{m}g\,tg\,\theta = \cancel{m}\omega^2 d \quad \Rightarrow tg\,\theta = \frac{\omega^2 d}{g}$$

$$d = L\sin\theta \qquad h = L\cos\theta \quad \Rightarrow \frac{d}{h} = tg\,\theta \quad \rightarrow \frac{d}{h} = \frac{d}{\sqrt{L^2-d^2}}$$

$$\Rightarrow \frac{\cancel{d}}{h} = \frac{\omega^2 \cancel{d}}{g} \quad \Rightarrow \frac{\sqrt{L^2-d^2}}{d} = \frac{g}{\omega^2} \quad \Rightarrow d = \sqrt{L^2 - \frac{g^2}{\omega^4}} = 2,45\,m$$

$$T = \frac{m\omega^2 d}{\sin\theta} = m\omega^2 L = 56,25\,N$$

5)



(2)

$$W = \overset{0}{\overset{\shortparallel}{W_c}} + W_{nc} = \Delta E_k$$

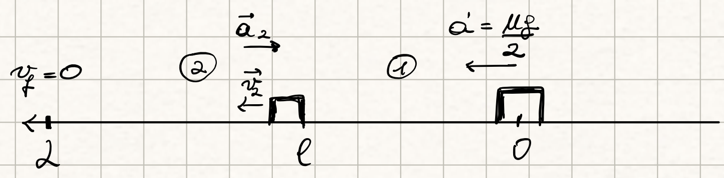
$$\Rightarrow W_{nc} = -\mu m g (L - l)$$

$$\Rightarrow E_{k_f} - E_{k_2} = -\mu m g (L - l)$$

$$-\frac{1}{2}\cancel{m} v_2^2 = -\mu \cancel{m} g (L - l)$$

$$L - l = \frac{v_2^2}{2\mu g} = \frac{(\mu g)^2 \tau^2}{8 \mu g} = \frac{\mu g}{8}\tau^2$$

$$l = L - \frac{\mu g}{8}\tau^2$$



(1) $x(t) = \frac{1}{2}a' t^2$; $v(t) = a' t$ $\rightarrow$ $v(\tau) = v_2 = \frac{\mu g}{2}\tau$

(2) $x(t) = l + v_2 t - \frac{1}{2}a_2 t^2$; $v(t) = v_2 - a_2 t$

(1) $l = \frac{1}{2}a' \tau^2 \Rightarrow$

$$\Rightarrow L - \frac{\mu g}{8}\tau^2 = \frac{1}{2}\frac{\mu g}{2}\tau^2 \Rightarrow \left(\frac{\mu g}{8} + \frac{\mu g}{4}\right)\tau^2 = L \Rightarrow \tau = \sqrt{\frac{8L}{3\mu g}}$$