Zad 3.3

Dane: L, M, m, v

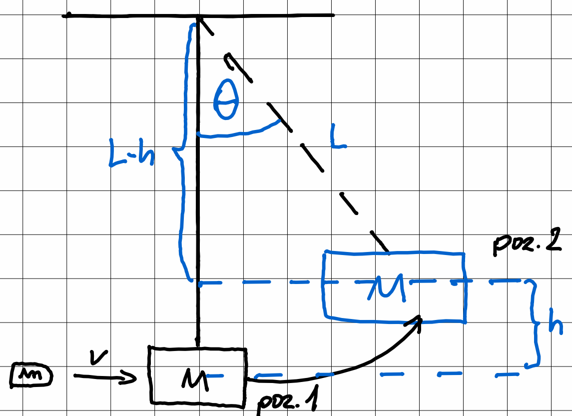
Szukane Θ?

Wzory

$\vec{p} = m\vec{v}$

$E_k = \frac{1}{2} m v^2$

Energia potencjalna ciała o masie, podniesionego na wys h = mgh



$\cos\Theta = \frac{L-h}{L}$

$L - h = \cos\Theta L$

$h = L - \cos\Theta L$

1) Z zasady zachowania pędu

$mv = (M+m)V \Rightarrow V = \frac{mv}{(M+m)}$

2) Energia kinetyczna bloku z kulą w poz 1 wynosi $\frac{1}{2}(M+m)V^2 \Rightarrow \frac{1}{2}(M+m)\cdot\left(\frac{mv}{(M+m)}\right)^2$

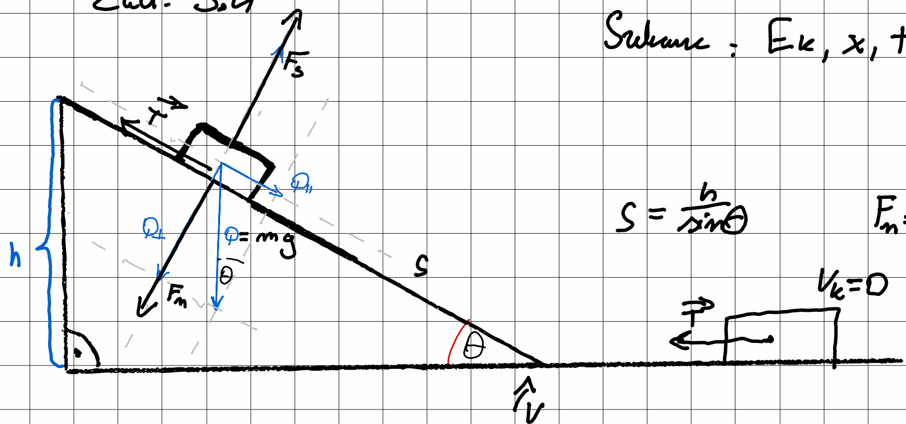
$= \frac{m^2v^2}{2(M+m)}$

3) E_p. w pozycji 2 wynosi $(M+m)\cdot g\cdot h \Rightarrow (M+m)\cdot g\cdot(L - L\cos\Theta)$

2. zas. zachowania energii $\frac{m^2v^2}{2(M+m)} = (M+m)\cdot g\cdot(L - L\cos\Theta) =$

$\Rightarrow \frac{m^2v^2}{2(M+m)} = (M+m)\cdot gL(1-\cos\Theta) \Rightarrow 1 - \cos\Theta = \frac{m^2v^2}{2gL(M+m)} \Rightarrow \underbrace{\cos\Theta = 1 - \frac{m^2v^2}{2gL(M+m)}}$

Zad. 3.4



Dane: h, θ, m, f

Szukane: E_k, x, t

Wzory

$E_k = \frac{1}{2} m v^2$

$W = F \cdot s$

$V_k = V_0 + a \cdot t,$

$S = \frac{h}{\sin\theta}$ $\qquad F_n = mg\cos\alpha$

1) $E_k = E_p - W_t = mgh - f \cdot mg\cos\theta \cdot \frac{h}{\sin\theta} \Rightarrow \underbrace{mg\left(h - f \cdot \cos\theta \cdot \frac{h}{\sin\theta}\right)}_{} \Rightarrow \underline{\underline{mgh\left(1 - f \cdot \operatorname{ctg}\theta\right)}}$

I NA RÓWNI

2) $\cancel{m}gh = \frac{1}{2}\cancel{m}v^2 + f \cdot \cancel{m}g\cos\theta \cdot \frac{h}{\sin\theta} \Rightarrow v^2 = 2g\left(h - f \cdot \frac{h}{\sin\theta}\right) \Rightarrow v = \sqrt{2g(h - f \cdot s}) \Rightarrow v = \sqrt{2gh(1 - f\operatorname{ctg}\theta)}$

$a = \frac{Q_{\parallel} - \mu F}{m} \Rightarrow \frac{\cancel{m}g\sin\theta - f \cdot \cancel{m}g\cos\theta}{\cancel{m}} \Rightarrow a = g(\sin\theta - f\cos\theta)$

$S = \frac{1}{2} a t^2$

$t^2 = \frac{2s}{a} \Rightarrow t = \sqrt{\frac{2s}{g(\sin\theta - f\cos\theta)}} \Rightarrow t = \sqrt{\frac{2h}{g\sin\theta(\sin\theta - f\cos\theta)}}$

$v_p = \sqrt{2gh\cdot(1 - f\,ctg\,\theta)}$ $\qquad a = gf$ $\qquad T_2$ - tarcie na płaskim $= mgf$

NA PŁASKIM

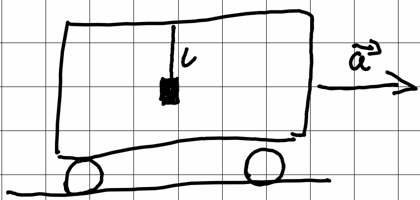
$$V_k = V_p + a\cdot t \Rightarrow V_k - V_p = at \Rightarrow t = \frac{V_k - V_p}{a} = \frac{\sqrt{2gh(1-f\,ctg\,\theta)}}{gf}$$

$$t_{czas\ całkowity} = \sqrt{\frac{2h}{g\sin\theta(\sin\theta - f\cos\theta)}} + \frac{\sqrt{2gh(1-f\,ctg\,\theta)}}{gf}$$

$$s = \frac{E_k}{T_2} \Rightarrow \frac{mgh(1-f\,ctg\,\theta)}{mgf} = \underline{\underline{\frac{h(1-f\,ctg\,\theta)}{f}}}$$

B

Zad. 3.6

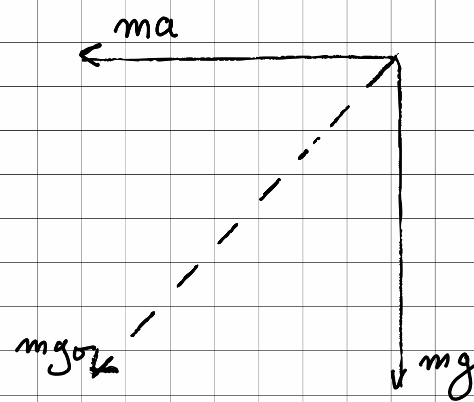


Dane a, l

Szukane T

Wzory

$T = 2\pi\sqrt{\frac{l}{g}}$

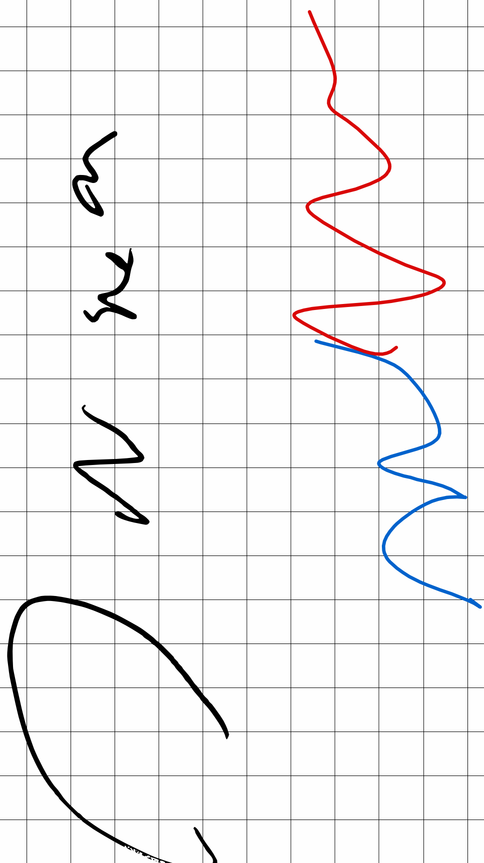


Na wahadło działa teraz siła wypadkowa mg_w. Żeby poznać T potrzebujemy znać g_w.

$\cancel{m}g_w = \cancel{m}\sqrt{a^2+g^2}$

$g_w = \sqrt{a^2+g^2}$

$$\boxed{T = 2\pi\sqrt{\frac{l}{\sqrt{a^2+g^2}}}}$$



DUPA

$$\begin{cases} u_m = \dfrac{u_{m-1} - 2u_m + u_{m+1}}{h^2} = 0 \\ u_1 = 1 \\ -3u_1 + 4u_2 - u_3 = 0 \end{cases} \Rightarrow \left| \begin{array}{l} u_m \cdot h^2 - u_{m-1} + 2u_m - u_{m+1} = 0 \\ -3 + 4u_2 - u_3 = 0 \quad = 4u_2 - u_3 = 3 \\ -u_{m-1} + u_m(h^2+2) - u_{m+1} = 0 \end{array} \right.$$

$$u_{m+1} = u_m(h^2+2) - u_{m-1}$$

(u mas $v[i] = v[i-1] \cdot h2 - v[i-2]$)