Treće demonstrature

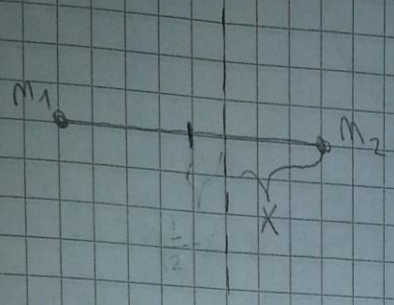
1. Dekanski 2012.

$L = 1\,m$

$\frac{m_2}{m_1} = 2$

$A(\omega_0)_{min} = ?$

$x = ?$



$E_1 + A = E_2$

$0 + A = \frac{1}{2} I \omega^2$

$I = m_2 x^2 + m_1 (L-x)^2$

$\frac{dI}{dx} = 2 m_2 x + 2 m_1 (L-x)\cdot(-1) = 0$

$2 m_2 x = 2 m_1 (L-x)$

$2x = L - x$

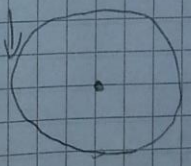
$x = \frac{L}{3}$

2. M1 2011

$m_1 = 45\,kg$ $r = 2m$

$v_0 = 5\,\frac{m}{s}$

$M_N = 2\,Nm$



$t_{stop} = ?$

$L_1 = m_1 v_1 l$

$L_2 = I \cdot \omega$

$L_1 = L_2$

$m_1 v_0 r = I \cdot \omega \qquad \omega = \frac{m_1 v_0 r}{I}$

$v = v_0 - a t = v_0 - \frac{F}{m} t$

$\omega = \omega_0 - \frac{M}{I} t$

$t_{stop} = \frac{\omega_0 I}{M} = \frac{I}{M} \frac{m_1 v_0 r}{I} = \frac{m_1 v_0 r}{M}$

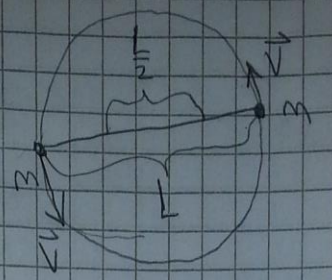
3.

$m = 100\ t$

$v = 10\ \frac{m}{s}$

$L \xrightarrow{?} \frac{L}{2}$

$A = ?$



$E_1 + A = E_2$

$A = E_2 - E_1$

$L_1 = mv\frac{L}{2} \cdot 2$

$L_2 = mv_2\frac{L}{4} \cdot 2$

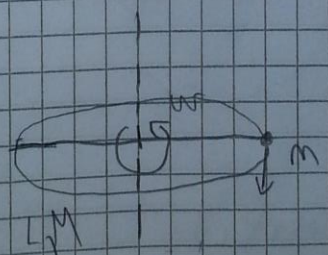
$L_1 = L_2$

$mv\frac{L}{2} = mv_2\frac{L}{2}$

$v_2 = 2v$

$A = m \cdot 4v^2 - mv^2 = 3mv^2$

4.



$\omega_2 = 2\omega_1$

prije eksplozije:

$L_1 = I \cdot \omega$

$I = I_s + I_m = \frac{1}{12}ML^2 + \left(\frac{L}{2}\right)^2 \cdot m$

poslije eksplozije:

$L_2 = I_s \cdot \omega_2 - I_m \frac{v}{\left(\frac{L}{2}\right)}$

$L_1 = L_2$

$\left(I_s + I_m\right)\omega = I_s \cdot 2\omega - I_m \cdot \frac{v}{\frac{L}{2}}$

$\omega I_s - \omega I_m = I_m v \cdot \frac{1}{\frac{L}{2}}$

$$v = \left(\omega \frac{I_s}{I_m} - \omega\right)\frac{L}{2}$$

$$v = \frac{L\omega}{2}\left(-1 + \frac{\frac{1}{12}ML^2}{m\frac{L^2}{4}}\right)$$

$$v = \frac{\omega L}{2}\left(-1 + \frac{M}{m}\frac{1}{3}\right)$$

$$v = \frac{\omega L}{2}\left(\frac{M}{3m} - 1\right)$$

$$v' = v + \omega_2 \frac{L}{2}$$

5. JR 2013 (Kulišić 6.6)

$v_0 = 1\ \frac{m}{s}$

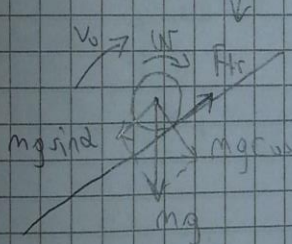
$\alpha = 30°$

?

u točki A

$v_t - \omega \cdot r = 0$

$v_t = \omega \cdot r$



$v = v_0 - at$

$F = mg\sin\alpha - F_{tr}$

$a = \frac{F}{m} = g\sin\alpha - \mu mg\sin\alpha$

$\omega = \omega_0 - \varepsilon t = \omega_0 - \frac{a}{r}t$

$\omega = \omega_0 r - at$

$= v_0 - at$

$\varepsilon = \frac{a}{r}$

$\varepsilon = \frac{M}{I} = \frac{rF_{tr}}{\frac{1}{2}mr^2} = \frac{2F_{tr}}{mr} = \frac{a}{r}$

$a = \frac{2F_{tr}}{m} = \frac{2\mu mg\cos\alpha}{m}$

$a = 2\mu g\cos\alpha$

$$a = g \sin\alpha - \frac{a}{2}$$

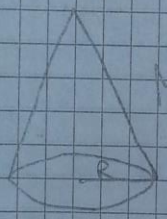
$$a = \frac{3}{2} g \sin\alpha$$

$$0 = v_0 - at$$

Nejako je krivo rješenje pogledati na materijalima

6.

R
M



$$dI = dm\, r^2 \quad / \int$$

$$I = \frac{1}{2} m r^2$$

$$dI = \frac{1}{2} \underbrace{\rho\, dm}_{dV}\, r^2$$

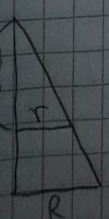
$$m_0 = \rho \cdot V$$

$$dI = \frac{1}{2} \rho\, dV \cdot r_0^2$$

plošak stošca: $dI = \frac{1}{2} \rho\, S_0\, dh_0\, r_0^2 = \frac{1}{2} \rho\, r_0^4\, \pi\, dh_0$

$S_0 = r_0^2 \pi$

$$\rho = \frac{m}{V} = \frac{M}{\frac{1}{3} R^2 \pi \cdot H}$$



$$r_0 = \frac{R}{H} \cdot h$$

$$I = \int dI = \int_0^H \frac{1}{2} \varrho r_0^4 \, dh$$

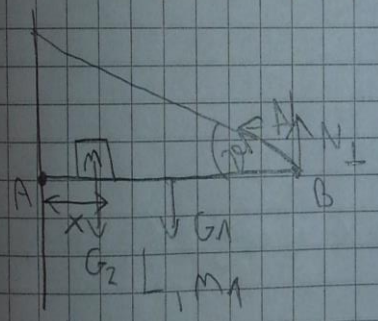
$$= \frac{1}{2} \varrho \left(\frac{R}{H}\right)^4 \int_0^H h^4 \, dh$$

$$= \frac{1}{2} \varrho \frac{R^4}{H^4} \frac{1}{5} h^5 \Big|_0^H$$

$$= \frac{1}{2} \frac{M}{\frac{1}{3} R^2 \pi H} \cdot \frac{R^4}{H^4} \frac{1}{5} H^5$$

$$= \frac{3}{10} R^2 M$$

7. MI 2011



$\Sigma F = 0$

$\Sigma M = 0$

$M_1 = m_1 g \frac{L}{2}$

$M_2 = m_2 g x$

$M_3 = N \times L = N \cdot L \cdot \sin\vartheta$

$M_1 + M_2 = M_N$

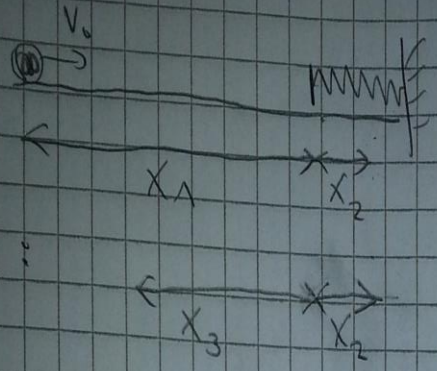
$m_1 g \frac{L}{2} + m_2 g x = N \cdot L \cdot \sin\vartheta$

$N = \frac{g}{L \sin\vartheta} \left(m_1 \frac{L}{2} + m_2 x\right)$

$N = 440\ N$

$x =$

8. M1, ?



$$D = x_1 + 2x_2 + x_3 = 200\,m$$

$$v_0 = 10\,\frac{m}{s}$$

$$E_{K_0} = x_1 \mu m g + x_2 \mu m g + \frac{1}{2} k x_2^2$$

$$\frac{1}{2} k x_2^2 = x_2 \mu m g + x_3 \mu m g$$

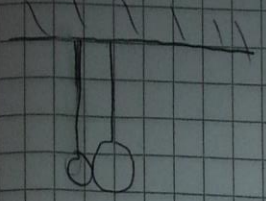
$$E_{K_0} = x_1 \mu m g + x_2 \mu m g + x_2 \mu m g + x_3 \mu m g$$

$$\frac{m v_0^2}{2} = \mu m g (x_1 + 2x_2 + x_3)$$

$$\frac{m v_0^2}{2} = \mu m g \cdot D$$

$$\mu = \frac{v_0^2}{2 \cdot g \cdot D}$$

9. MI, 2013. (sličan kolokvij 4.10.)



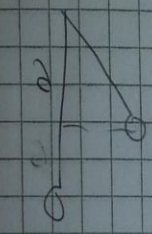
$m_1 = 0.3\ kg$

$m_2 = 0.2\ kg$

$\alpha = 50°$

$\beta = 25°$

Kuglica 1



$a = L\cos\alpha$

$h = L - a$

$h_1 = L(1 - \cos\alpha)$

$E_{p1} = m_1 g h_1 = \frac{m_1 v_1^2}{2}$

$v_1 = \sqrt{2gh_1}$

$h_2 = L(1 - \cos\beta)$

$v_2 = \sqrt{2gh_2}$

$m_1 v_1 - m_2 v_2 = (m_1 + m_2) V$

$V = \frac{\sqrt{2g}}{m_1 + m_2}\left(m_1\sqrt{h_1} + m_2\sqrt{h_2}\right)$

$E_p = M g H = M \frac{V^2}{2}$

$H = \frac{MV^2}{2Mg} = L(1 - \cos\beta)$

$\cos\beta = 1 - \frac{V^2}{L2 \cdot g}$

$\beta = \arccos\left(1 - \frac{}{L2 \cdot g}\right.$