F+F1 LS 2026 Náhradná písomka - Riešenie

1. $v(t) = v_0 - \alpha t + \beta t^2$

$x(t)$; $a(t)$

$$x = \int v\,dt = \int (v_0 - \alpha t + \beta t^2)\,dt = v_0 t - \frac{1}{2}\alpha t^2 + \frac{1}{3}\beta t^3 + C$$

$$x(0) = x_0 = C$$

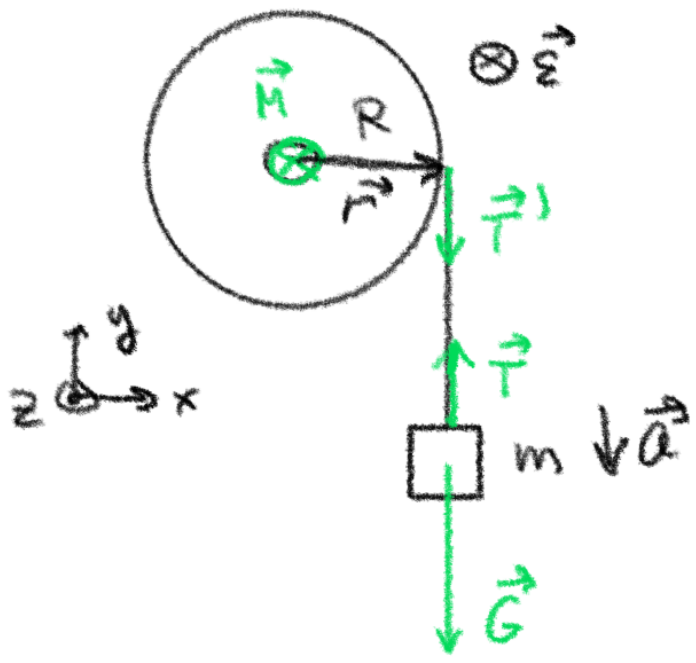
$$x = x_0 + v_0 t - \frac{1}{2}\alpha t^2 + \frac{1}{3}\beta t^3$$

$$a = \frac{dv}{dt} = \frac{d}{dt}(v_0 - \alpha t + \beta t^2) = -\alpha + 2\beta t$$

2. R, J, m

a;

$$m\vec{a} = \vec{G} + \vec{T}$$
$$J\vec{\varepsilon} = \vec{r} \times \vec{T}'$$



$$y: \; -ma = -mg + T$$

$$z: \; -J\varepsilon = -RT'$$

$$\varepsilon = \frac{a}{R}; \quad T' = T$$

$$ma = mg - T$$
$$J\frac{a}{R} = RT$$

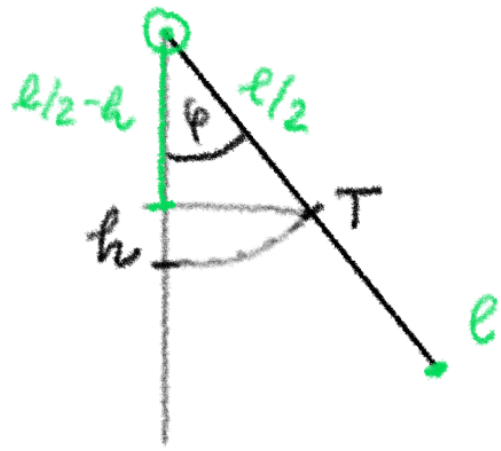
$$T = \frac{J}{R^2}a$$

$$ma = mg - \frac{J}{R^2}a$$

$$a + \frac{J}{mR^2}a = g$$

$$a\left(1 + \frac{J}{mR^2}\right) = g \quad \Rightarrow \quad a = \frac{mR^2}{J + mR^2}g$$

3. l, φ; $J_T = \frac{1}{12} m l^2$



v;

ZZME:

$$E_{p1} + E_{k1} = E_{p2} + E_{k2}$$

$$E_{p1} = mgh \qquad E_{k1} = 0$$

$$E_{p2} = 0 \qquad E_{k2} = \frac{1}{2} J \omega^2$$

$$mgh = \frac{1}{2} J \omega^2$$

$$\omega^2 = \frac{2mgh}{J} \quad ; \quad v = l\omega$$

$$J = J_T + m\left(\frac{l}{2}\right)^2 = \frac{1}{12} ml^2 + \frac{1}{4} ml^2 = \frac{1}{3} ml^2$$

$$\cos\varphi = \frac{l/2 - h}{l/2} = 1 - \frac{2h}{l}$$

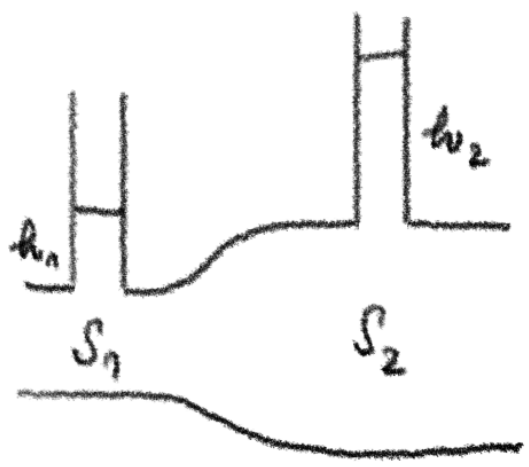
$$h = \frac{l}{2}(1 - \cos\varphi)$$

$$v^2 = l\omega^2 = l^2 \frac{2mgh}{J} = l^2 \frac{2mg \cdot \frac{l}{2}(1-\cos\varphi)}{\frac{1}{3} ml^2}$$

$$v^2 = 3lg(1 - \cos\varphi)$$

$$v = \sqrt{3lg(1-\cos\varphi)}$$

4. Δh, $S_1/S_2 = 1/2$



v_1, v_2;

$$S_1 v_1 = S_2 v_2 \Rightarrow \frac{v_2}{v_1} = \frac{S_1}{S_2} = \frac{1}{2} \Rightarrow v_2 = \frac{1}{2} v_1$$

$$\frac{1}{2}\rho v_1^2 + p_1 = \frac{1}{2}\rho v_2^2 + p_2$$

$$\frac{1}{2}\rho v_1^2 + \rho g h_1 = \frac{1}{2}\rho v_2^2 + \rho g h_2 \quad / \cdot \frac{2}{\rho}$$

$$v_1^2 + 2gh_1 = v_2^2 + 2gh_2$$

$$v_1^2 - v_2^2 = 2g(h_2 - h_1) = 2g\Delta h$$

$$v_1^2 - \frac{1}{4}v_1^2 = 2g\Delta h$$

$$\frac{3}{4}v_1^2 = 2g\Delta h$$

$$v_1^2 = \frac{8}{3}g\Delta h$$

$$v_1 = 2\sqrt{\frac{2}{3}g\Delta h}$$

$$v_2 = \sqrt{\frac{2}{3}g\Delta h}$$