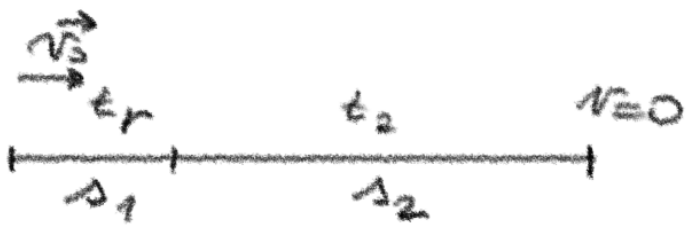
F1 LS 2026 P1 Riešenie

1. s, a, t_r

$v_0 j$



$s_1 = v_0 t_r$

$s_2 = v_0 t_2 - \frac{1}{2} a t_2^2$

$0 = v_0 - a t_2$

$s = s_1 + s_2$

$t_2 = \frac{v_0}{a} \Rightarrow s_2 = v_0 \frac{v_0}{a} - \frac{1}{2} a \frac{v_0^2}{a^2} = \frac{1}{2} \frac{v_0^2}{a}$

$s = v_0 t_r + \frac{1}{2} \frac{v_0^2}{a}$

$v_0^2 + 2 a t_r v_0 - 2 a s = 0$

$D = 4 a^2 t_r^2 + 8 a s$

$v_0 = \frac{-2 a t_r \pm 2\sqrt{a^2 t_r^2 + 2 a s}}{2} = -a t_r \pm a t_r \sqrt{1 + \frac{2s}{a t_r^2}}$

$v_0 > 0$

$v_0 = a t_r \left(\sqrt{1 + \frac{2s}{a t_r^2}} - 1 \right)$

2. $v = \sqrt{\xi t}$

v_1, t_1, r

$t_2;\ a_t(t), \varepsilon(t); [\xi]$

$v_1 = \sqrt{\xi t_1}$

$2 v_1 = \sqrt{\xi t_2} \Rightarrow 2\sqrt{\xi t_1} = \sqrt{\xi t_2} \quad / ^2$

$4 \xi t_1 = \xi t_2 \quad / \ 1/\xi$

$t_2 = 4 t_1$

$$\varepsilon = \frac{d\omega}{dt} \qquad \omega = \frac{v}{r} = \frac{1}{r}\sqrt{kt}$$

$$\varepsilon = \frac{d}{dt}\left(\frac{1}{r}\sqrt{kt}\right) = \frac{1}{r}\sqrt{k}\,\frac{d}{dt}t^{1/2} = \frac{\sqrt{k}}{r}\cdot\frac{1}{2}t^{-1/2}$$

$$\varepsilon(t) = \frac{1}{2r}\sqrt{\frac{k}{t}}$$

$$a_t = r\varepsilon = \frac{1}{2}\sqrt{\frac{k}{t}}$$

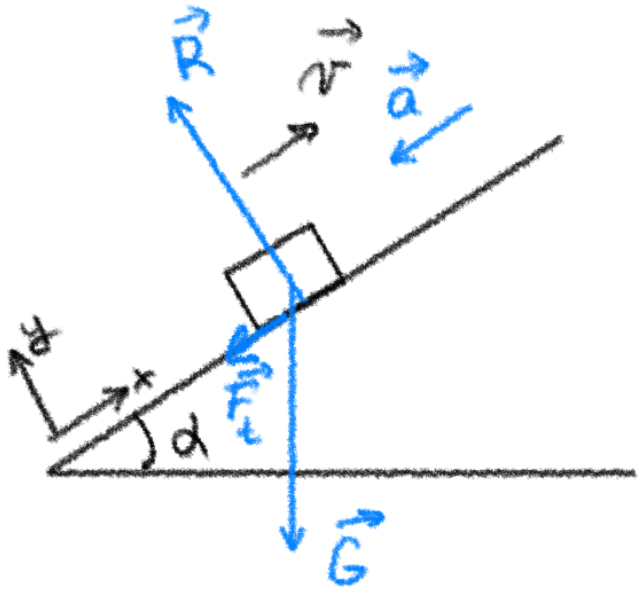
$$v^2 = kt$$

$$[v^2] = [k][t]$$

$$m^2 s^{-2} = [k]\cdot s \Rightarrow [k] = m^2 s^{-3}$$

3. α, μ

a



$$m\vec{a} = \vec{G} + \vec{R} + \vec{F_t}$$

$$\vec{a} = -a\vec{i}$$

$$\vec{G} = -(mg\sin\alpha)\vec{i} - (mg\cos\alpha)\vec{j}$$

$$\vec{R} = R\vec{j}$$

$$\vec{F_t} = -F_t\vec{i} = -\mu R\vec{i}$$

$$x: -ma = -mg\sin\alpha - \mu R$$

$$y: \quad 0 = -mg\cos\alpha + R$$

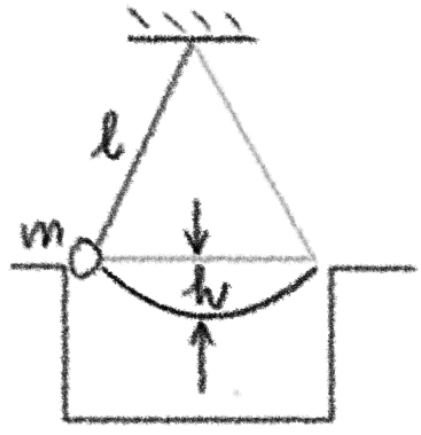
$$R = mg\cos\alpha$$

$$ma = mg\sin\alpha + \mu mg\cos\alpha$$

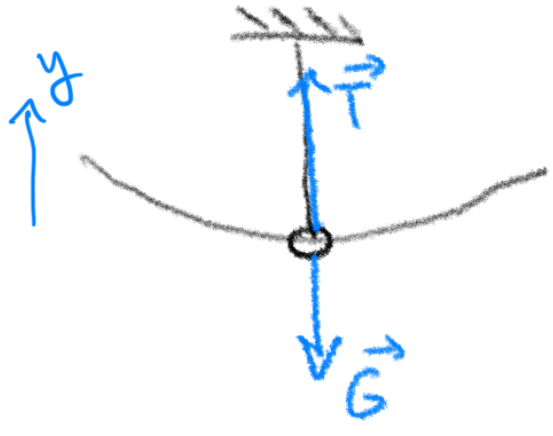
$$a = g(\sin\alpha + \mu\cos\alpha)$$

(4.) ℓ, h, m

T_m, F



Najväčšia sila pôsobí v mieste trajektórie



kružnica $\Rightarrow \vec{a} = \vec{a}_d$

$$m\vec{a}_d = \vec{T} + \vec{G}$$

$$y: \; m a_d = T - mg$$

$$m\frac{v^2}{\ell} = T - mg$$

$$T_m = m\left(g + \frac{v^2}{\ell}\right)$$

v^2 získame zo zákona zachovania mech. energie

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

$$E_{k1} = 0$$

$$E_{k2} = \frac{1}{2}mv^2 \qquad E_{p2} - E_{p1} = mgh$$

$$mgh = \frac{1}{2}mv^2 \Rightarrow v^2 = 2gh$$

$$T_m = m\left(g + \frac{2gh}{\ell}\right) = mg\,(1 + 2h/\ell)$$

Na Tarzana pôsobí sila $\vec{F} = \vec{T} + \vec{G}$

$$\Rightarrow F = T_m - mg = 2mgh/\ell$$