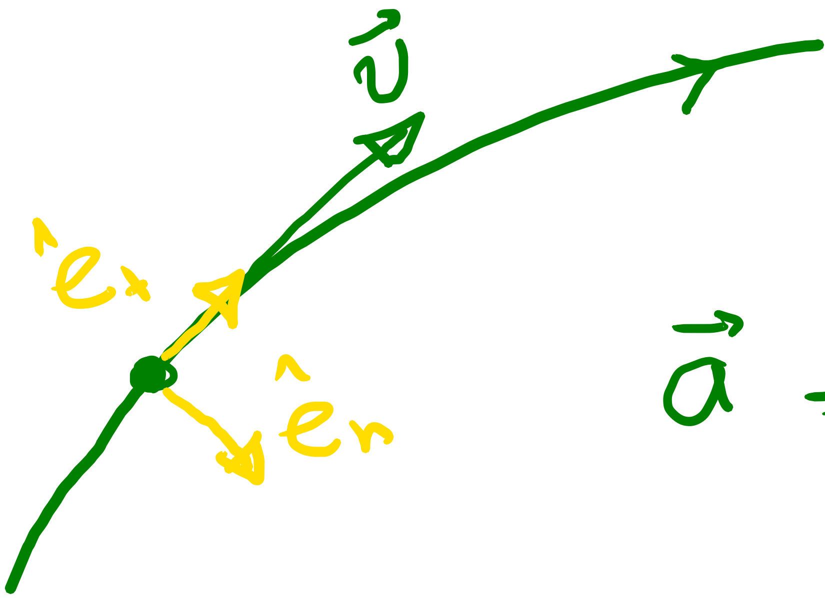


$$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d^2\vec{r}}{dt^2}$$

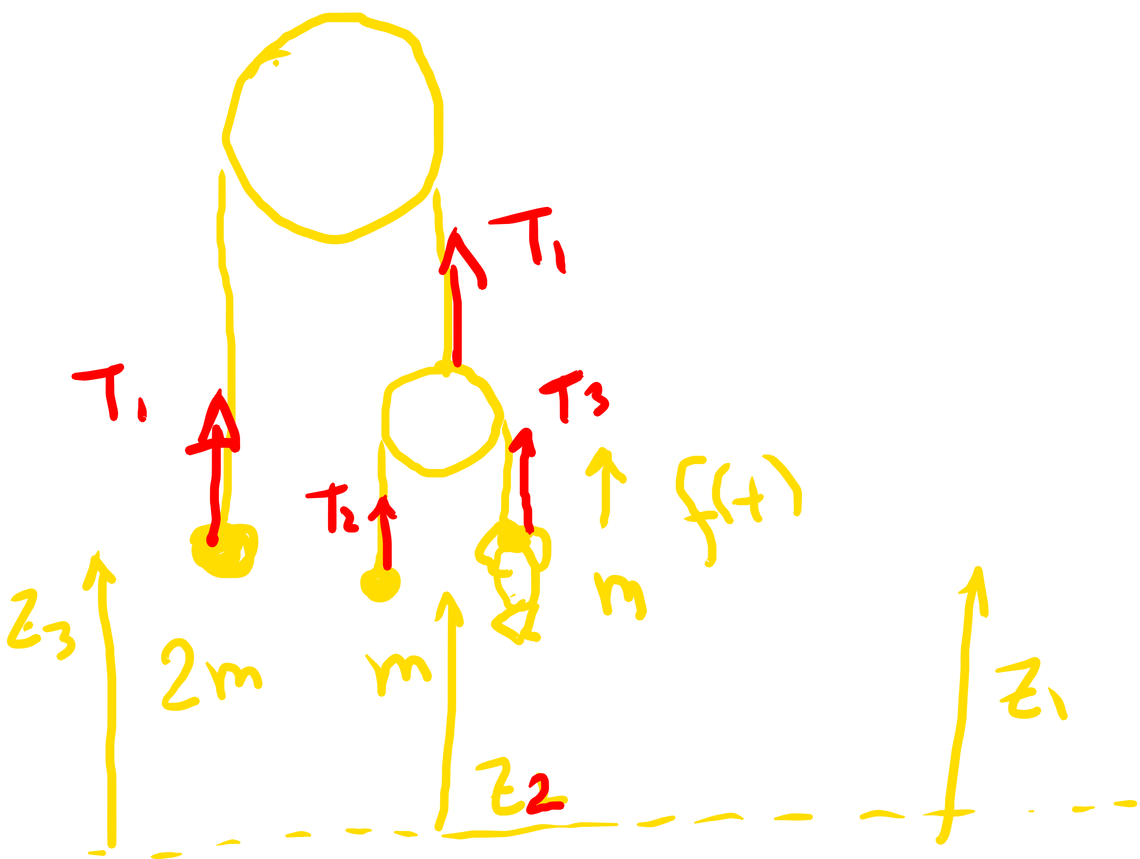
$$a_\varepsilon = \frac{dv}{dt}$$

$$\left.\right\} \quad \vec{a} = a_\varepsilon \hat{e}_t + a_\kappa \hat{e}_n$$

$$a_\kappa = v^2/R$$

$$a_\kappa \hat{e}_n = \vec{a} - \frac{dv}{dt}\hat{e}_t$$

$$a_\kappa = \left| \quad '' \quad \right|$$



$$T_1 = T_2 + T_3$$

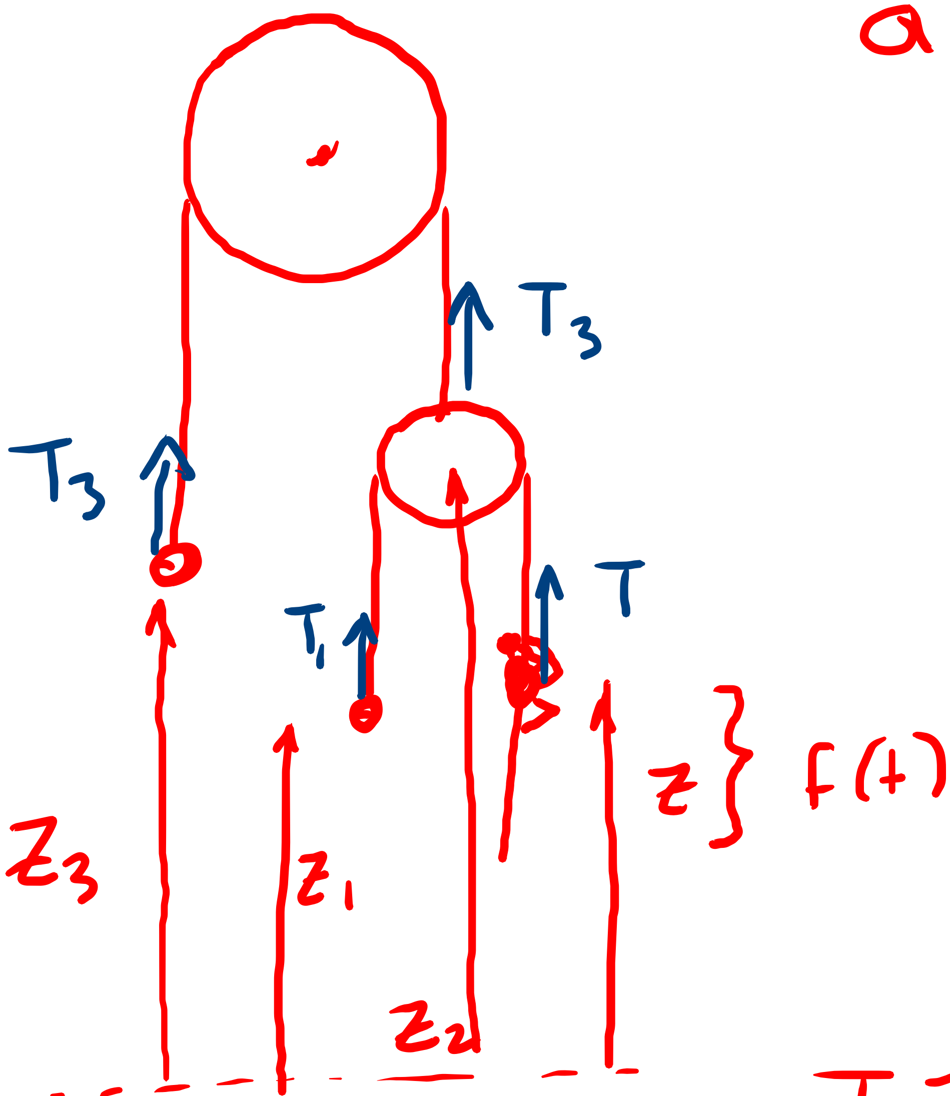
$$T_1 = 2m\,a_3$$

$$T_2 = m\,a_2$$

$$T_3 = m\,a_1$$

$$z_2 - z_1 = f(t) + C$$

$$z_3 - \left(\frac{z_2 + z_1}{2}\right) = C \quad ?$$



$$a = \frac{d^2 z}{dt^2} \quad a_3 = \frac{d^2 z_3}{dt^2} \;, \;\ldots\ldots$$

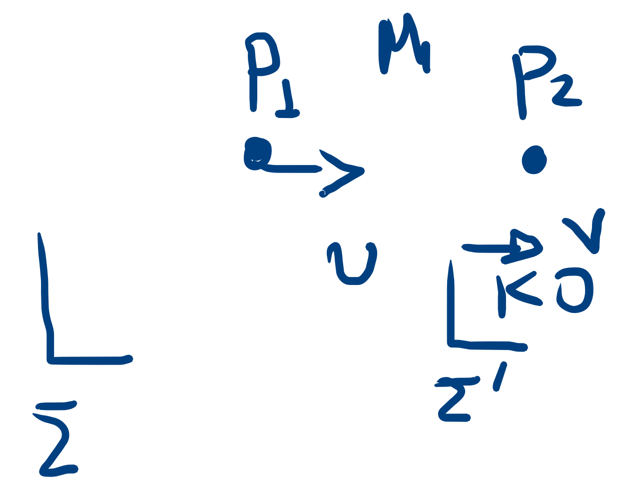
$$z_3 + z_2 = C_1$$

$$\frac{z_1 + (z - f)}{2} = z_2 + C_2$$

$$T_3 - 2mg = 2ma_3 \qquad T_1 - mg = ma_1 \qquad T - mg = ma$$

$$T_3 = T_1 + T$$

agr $T_1, T, T_3, z_1, z_2, z_3, z$



$$\vec{p}_1{}' + \vec{p}_2{}' = 0$$

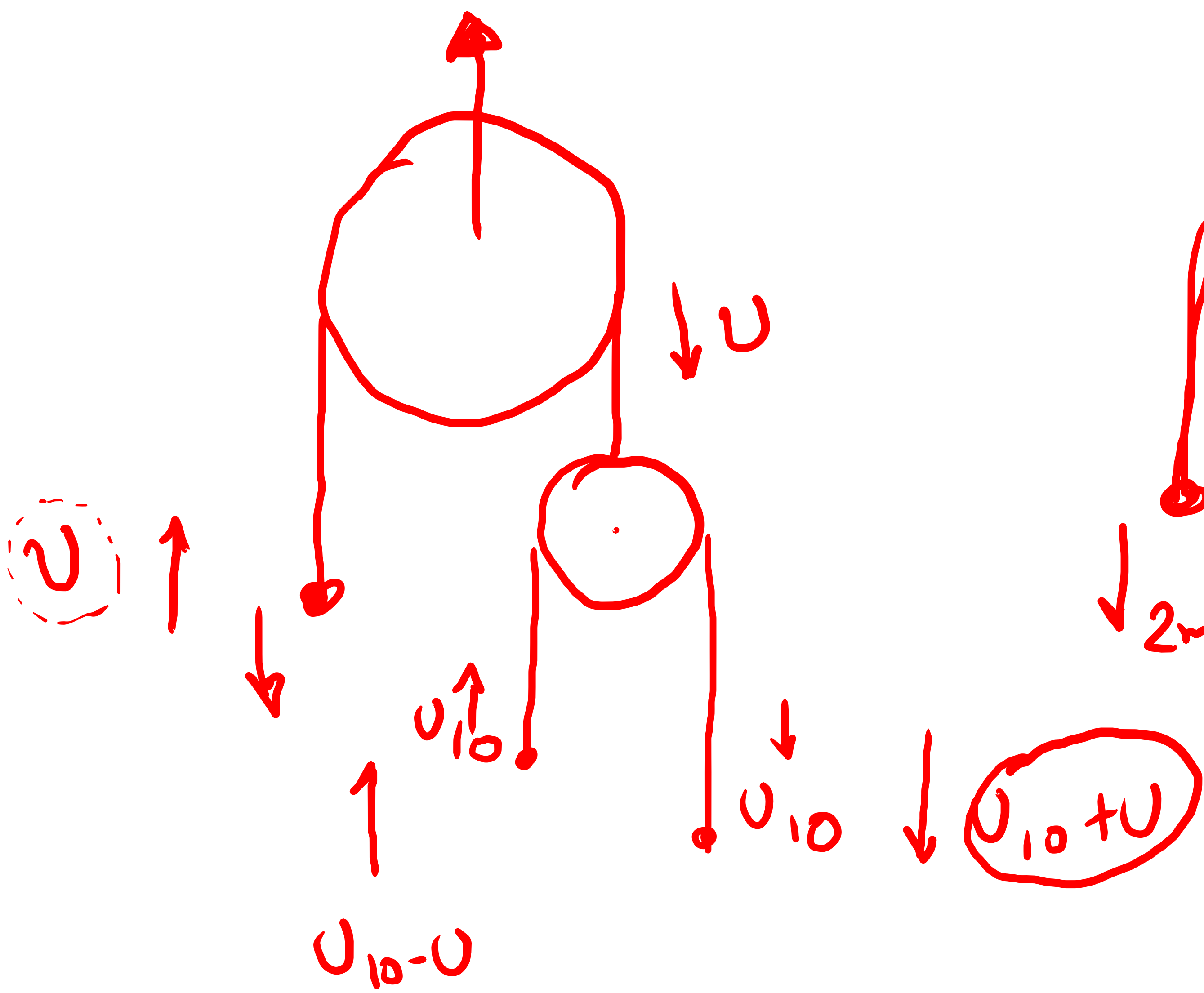
$$\vec{u}_1 = -\vec{u}_2 \qquad \vec{u}_2 = -\vec{V}_{ko}$$

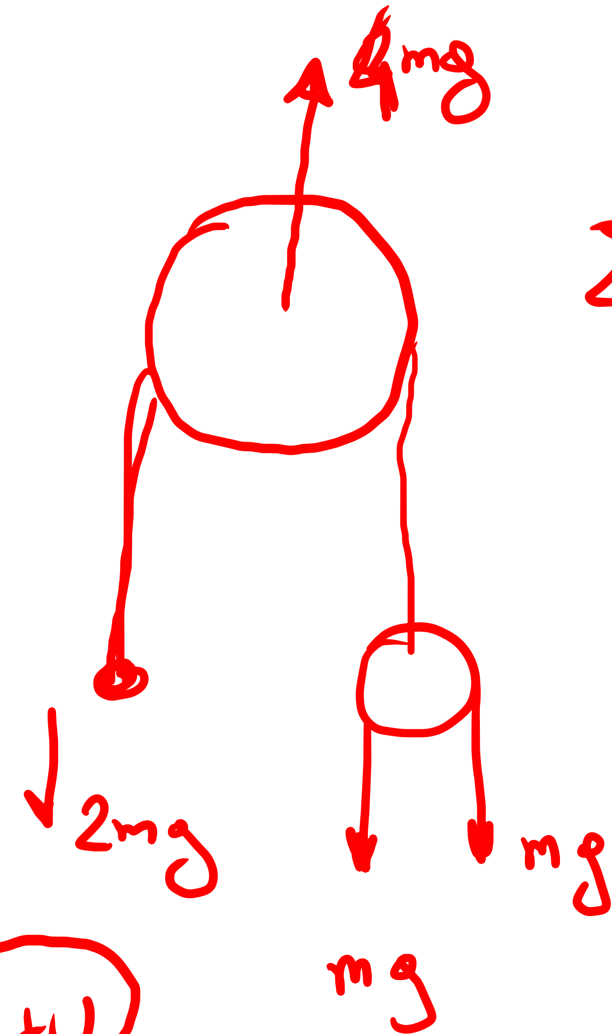
$$u_1 = \frac{u - V_{ko}}{1 - u V_{ko}/c^2} = V_{ko} \Rightarrow \ldots$$

$$\downarrow$$

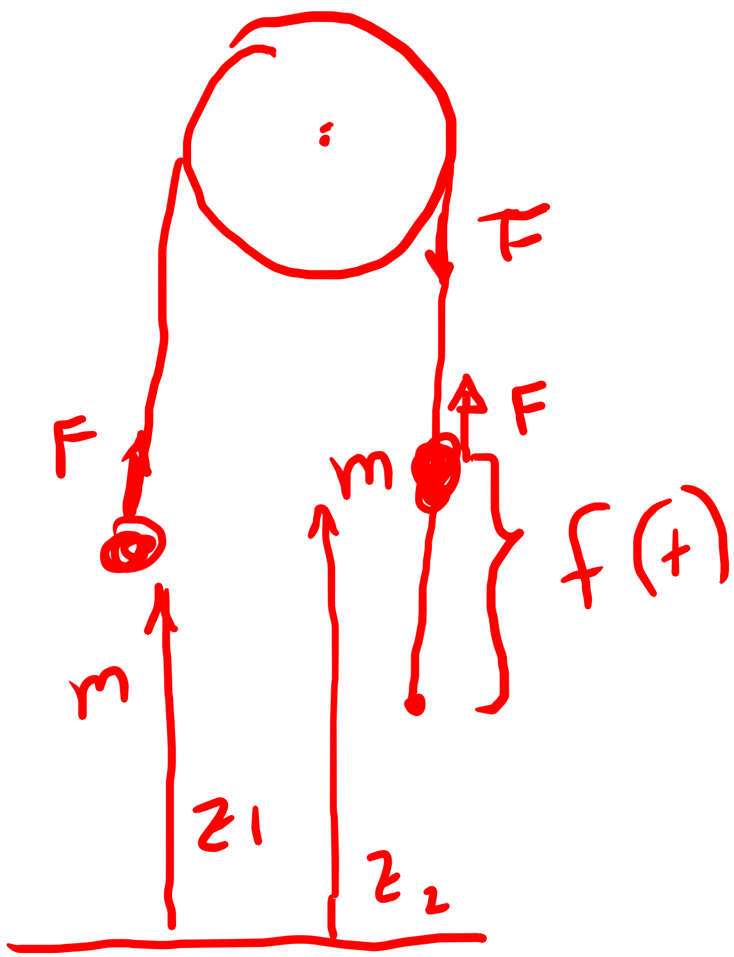
$$\Gamma\left(p_1 + \cancel{p_2}^{\,0} - V(\underset{\overset{\|}{mc^2}}{E_1} + E_2)\right) = 0 \Rightarrow V$$

$$\gamma_1 m u_1 \Big/ \gamma_1 m c^2 + \cancel{\gamma_2}^{\,1} m c^2$$





$$\Sigma F_{\xi} = 0$$



$$z_1 - (z_2 - f) = C$$

$$F - mg = m\frac{d^2 z_2}{dt^2}$$

$$F - mg = m\frac{d^2 z_1}{dt^2}$$

$$\frac{d^2}{dt^2}(z_2 - z_1) = 0$$

• $m = 100\ \mathrm{MeV}/c^2$

$\tau = 10^{-6}\,s \qquad H = 30\ \mathrm{km}$

$p_{min}\ (\mathrm{MeV}/c)\ ? \qquad v/c\ ?$

$\tau_r = 10^{-3}\,s$

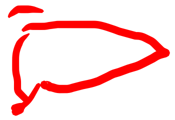
$t = \gamma\tau$

$\frac{H}{\tau} = \gamma v \qquad p = m\gamma v \qquad H/t = v$

$$p_{min} = m\,\frac{H}{\tau} = 100\,\frac{\mathrm{MeV}}{c^2}\ \frac{30\ \mathrm{km}}{\underbrace{10^{-6}\,s}_{3\times10^{7}\ \mathrm{km/s}\ =\ 3\times10^{10}\ \mathrm{m/s}}} = 100\cdot 100\,\frac{\mathrm{MeV}}{c}$$

$\gamma = 10^3 \rightarrow v/c = 1 - 10^{-6}$

$\bullet \longrightarrow V \leq c/5$



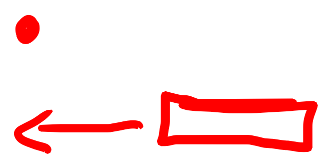
$\longrightarrow u = 3c/5$

$\longleftrightarrow$

L_0

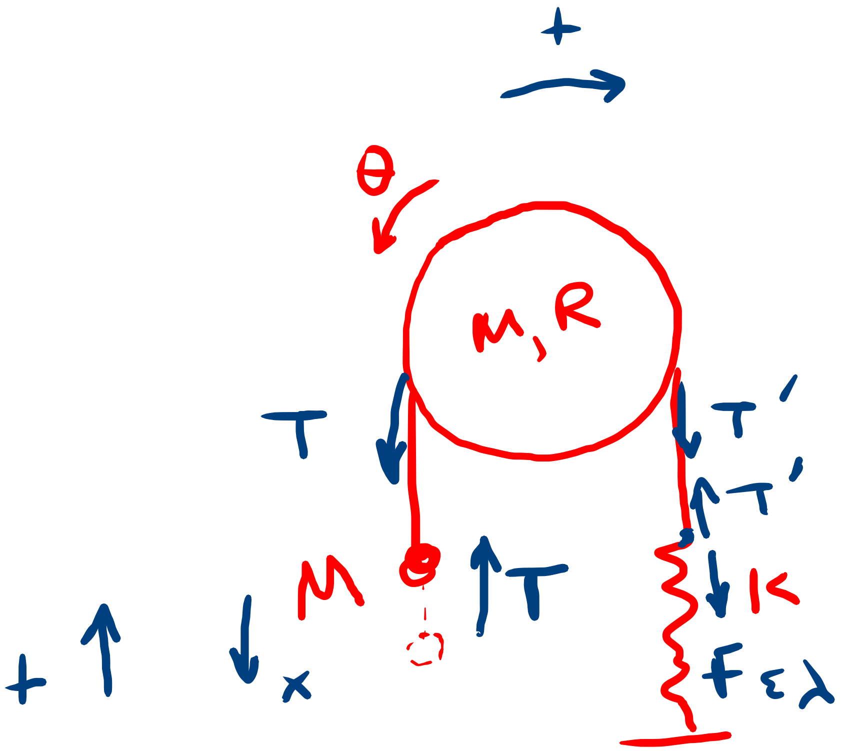
$V_{\text{объект}} = V_{\text{проход}} = V - u = \frac{c}{5}$

$$\left(\frac{V-u}{1-Vu/c^2}\right) = V_{\sigma}$$



$V_{\sigma x}$.

$$t = \frac{L}{V_{\sigma x}} = \frac{L_0/\gamma_{\sigma x}}{V_{\sigma x}}$$



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

$$T - Mg = Ma \qquad \alpha = \frac{a}{R}$$

$$R(T' - T) = \frac{1}{2} m R^2 \alpha$$

$$T - Mg = M \frac{d^2x}{dt^2}$$

$$T' - T = \frac{m}{2} a$$

$$T' - T = \frac{m}{2} \frac{d^2x}{dt^2}$$

$$T' = -kx$$

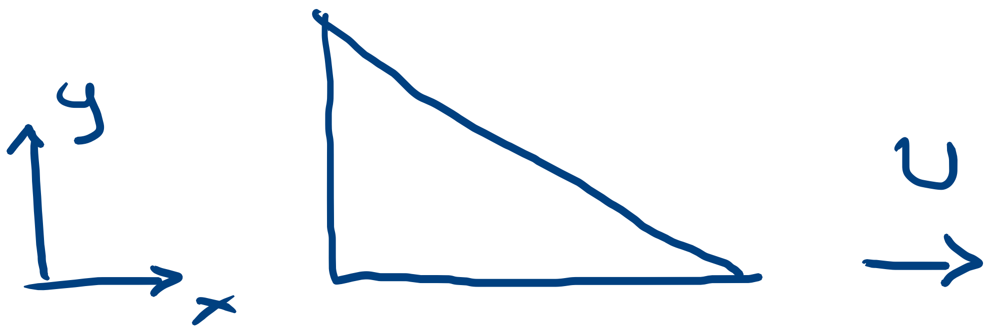
$$T' = -kx$$

$$\left\} \begin{array}{l} \underset{\underset{-kx}{\parallel}}{T'} - Mg = \dfrac{3m}{2} \dfrac{d^2x}{dt^2} \end{array} \right.$$

$$\frac{3M}{2}\frac{d^2x}{dt^2} + kx = Mg$$

$$\xi = x + \frac{Mg}{k}$$

$$\frac{3M}{2}\frac{d^2\xi}{dt^2} + k\xi = 0 \Rightarrow T = 2\pi\sqrt{\frac{\frac{3}{2}M}{k}}$$



$\boxed{\gamma = 2}$ επιφ. μιση

$$\sigma = \frac{dm_{\pi\rho}}{dx\,dy} = \frac{dm}{\frac{dx}{\gamma}\,dy'} = \gamma\sigma'$$

$$p_A = \rho g 2h$$

$$\updownarrow \delta z$$

$$-pS = F = ma$$

$$-\cancel{\rho} g 2h \cancel{S} = \cancel{\rho} \cancel{S} \delta z\, a$$

$$L a = \underline{\delta z\, a = -g 2h}$$

$$\|$$

$$L_0 - 2h$$

$$F_{ot} = -\rho g S 2x$$

$$M \frac{d^2x}{dt^2} = -\rho g S 2x$$

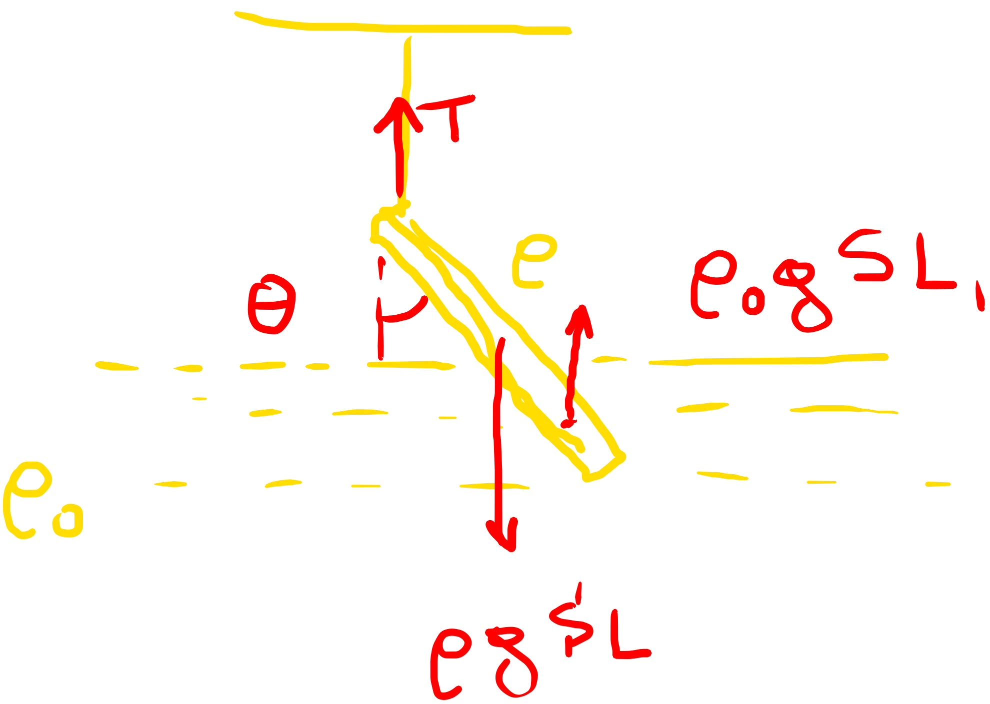
$$\omega^2 = \frac{2gS}{V} = \frac{2g}{L_0}$$

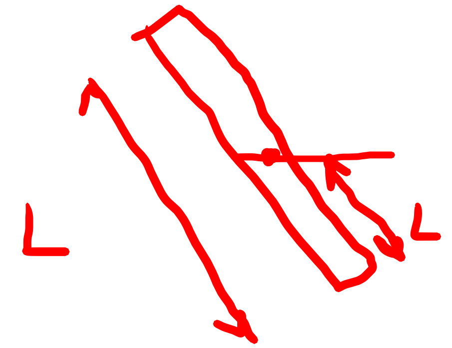
$$\frac{d^2x}{dt^2} + \frac{2\rho g S}{\rho V} x = 0$$

$$\delta S_1 = \delta S / \cos\theta_1$$

$$\rho g \underbrace{(h_2 - h_1)\delta S_\perp}_{\delta V}$$

$$ds \cos\theta = dS_\perp$$





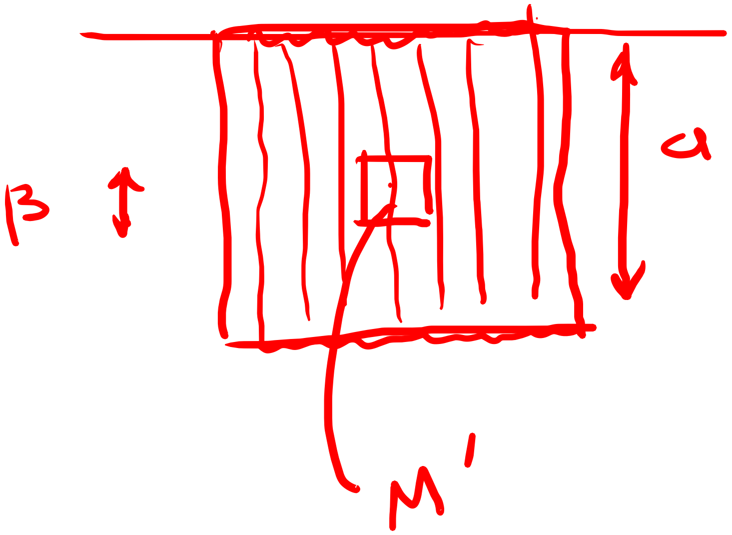
$$\underline{T + \rho_0 g S L_1} = \rho g S L$$

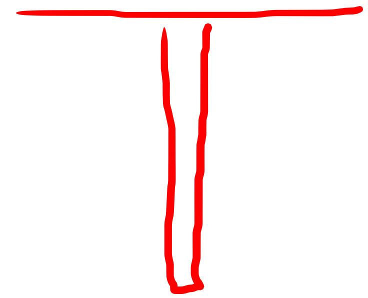
$$\rho g \cancel{S} L \frac{L}{2} \cancel{\sin\theta} = \rho_0 \cancel{g} S L_1 \left(L - L_1 + \frac{L_1}{2}\right) \cancel{\sin\theta}$$

$$\rho L^2 = \rho_0 L_1 (2L - L_1)$$

$$L_1^2 - 2 L L_1 + \frac{\rho}{\rho_0} L^2 = 0$$

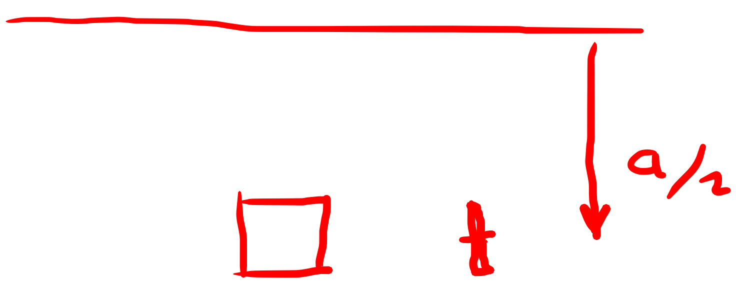
$$L_1 = \dots$$





$$\frac{ML^2}{3}$$

$$M'\left[\frac{\beta^2}{12} + \left(\frac{a}{2}\right)^2\right]$$

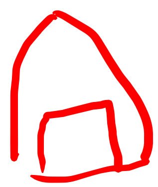


$$I_0 = \frac{Ma^2}{3} \qquad I' = M\frac{\beta^2}{a^2}\left[\quad\right]$$

$$\frac{I_0 - I'}{I_0} = \frac{a^2/3 - \beta^2/a^2\left[\quad\right]}{a^2/3} = 1 - \frac{3\beta^2}{a^2}\left[\quad\right]$$

$$\frac{dp}{dt} = \underline{M}\frac{du}{dt} + U_{rel}\frac{dM}{dt} = -\underline{M}g$$

t_0



$t_0 + \delta t$

$t \in [t_0, t_0 + \delta t]$

$$\boxed{F = ma}$$

$$p(t_0) = M v(t_0)$$

$$p(t_0 + \delta t) = (M - \delta M)(v + \delta v) + \delta M(v - v_{rel})$$

$$-M(t_0)\, g = F(t_0) = \frac{\delta p}{\delta t}$$

$$V = \frac{1}{2} m \omega^2 r^2$$

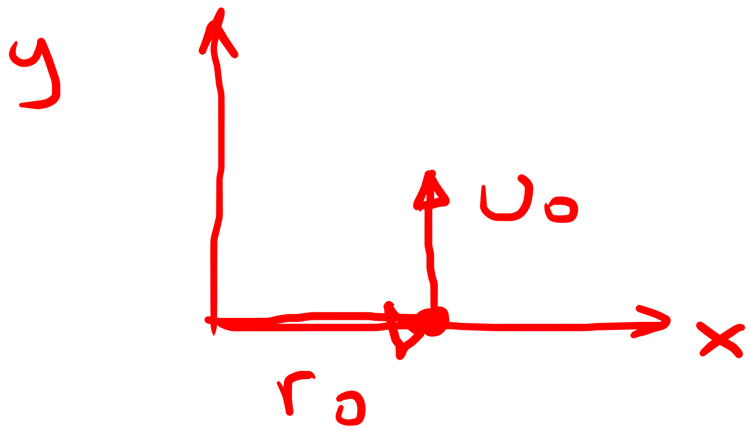
$$\vec{v}_0 \nparallel \vec{r}_0 \qquad r_0 < r < v_0/\omega$$

$$\vec{F} = -\vec{\nabla} V = -\frac{1}{\cancel{2}} m \omega^2 \underbrace{\vec{\nabla}(x^2 + y^2 + z^2)}_{\cancel{2}\vec{r}}$$

κεντρική $\quad \vec{F} \parallel \vec{r}$

→ διατηρ. στροφ.

→ διατηρ. επίπεδο τροχιάς



$$m\frac{d^2x}{dt^2} = -m\omega^2 x$$

$$m\frac{d^2y}{dt^2} = -m\omega^2 y$$

$$m\frac{d^2z}{dt^2} = -m\omega^2 z$$

$x(0) = r_0 \quad y(0) = 0 \quad z(0) = 0 \qquad z(t) = 0$

$v_x(0) = 0 \quad v_y(0) = v_0 \quad v_z(0) = 0$

$$x = r_0 \cos\omega t \qquad y = \frac{v_0}{\omega}\sin\omega t$$

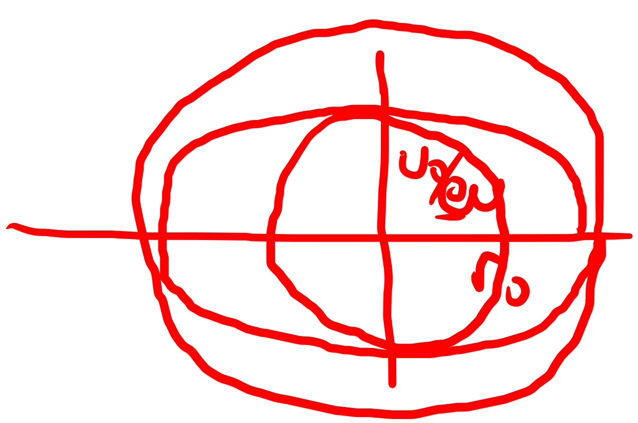
$$-r_0 \leq x \leq r_0 \quad -\frac{v_0}{\omega} < y < \frac{v_0}{\omega}$$

$$0 \leq \sqrt{x^2 + y^2} \leq \sqrt{r_0^2 + v_0^2/\omega^2}$$

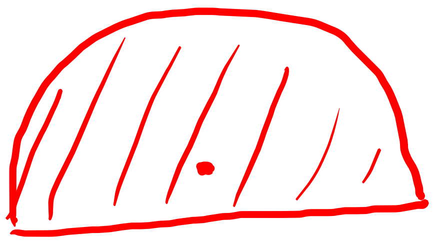
$$r = \sqrt{x^2+y^2} = \sqrt{r_0^2\cos^2\omega t + \left(\frac{v_0}{\omega}\right)^2 \sin^2\omega t}$$

$$\sqrt{r_0^2\left(1-\sin^2\right) + \frac{v_0^2}{\omega^2}\sin^2}$$

$$\sqrt{\frac{v_0^2}{\omega^2}} < \sqrt{r_0^2 - \underbrace{\left(r_0^2 - \frac{v_0^2}{\omega^2}\right)}_{\text{θετ.}} \underline{\sin^2}} < r_0$$



$$r_0 > \frac{v_0}{\omega}$$



KM → KM

$$I = MR^2\alpha$$

$$I' = M'R^2\alpha = \frac{110}{100}MR^2\alpha = \frac{110}{100}I$$