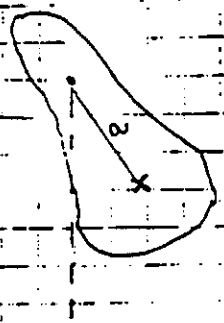
L1

$$I = I_0 + Ml^2 = M(l^2+\omega^2) \quad \text{(Steiner's law)}$$

$$I\alpha_z = N_z = -Mg\,a\sin\varphi \approx -Mg\,a\,\varphi$$



$$\frac{d^2\varphi}{dt^2} = -\frac{Mga}{I}\varphi = -\omega_0^2\varphi$$

$$T = \frac{2\pi}{\omega_0} = 2\pi\sqrt{\frac{I}{Mga}} = 2\pi\sqrt{\frac{l^2+a^2}{ga}}$$

b) $\quad T_A = 2\pi\sqrt{\frac{l^2+a^2}{ga}} \qquad T_B = 2\pi\sqrt{\frac{l^2+b^2}{gb}}$

$$T_A = T_B \Rightarrow (l^2+a^2)b = (l^2+b^2)a$$

$$l^2(b-a) = ab(b-a) \qquad \underline{l^2 = ab}$$

$$T_0 = T_A = T_B = 2\pi\sqrt{\frac{ab+a^2}{ga}} = 2\pi\sqrt{\frac{a+b}{g}} = 2\pi\sqrt{\frac{x_0}{g}}$$

$$\underline{g = 4\pi^2\frac{x_0}{T_0^2}}$$

L.2

a) $M\frac{d^2z}{dt^2} = M\frac{z}{L}g$ $\qquad \frac{d^2z}{dt^2} = \frac{g}{L}z = \alpha^2 z$

$z = Ae^{\alpha t} + Be^{-\alpha t}$

Gemäß: $z_0 = z(0) = A + B$

$v_0 = \left.\frac{dz}{dt}\right|_{t=0} = \alpha(A-B)$

$\Rightarrow \quad A = B = z_0/2$

$z(t) = z_0 \cos\alpha t \qquad v(t) = z_0\alpha \sin\alpha t \qquad \alpha = \sqrt{\frac{g}{L}}$

b) $(z/z_0)^2 - (v/z_0\alpha)^2 = \cos^2\alpha t - \sin^2\alpha t = 1 \quad \Rightarrow$

$z^2 - (v/\alpha)^2 = z_0^2 \qquad v = \alpha\sqrt{z^2 - z_0^2}$

Kontrolle: $z = z_0 \Rightarrow v = 0$.

Wir [illegible] bei $z = L$:

$v = \sqrt{\frac{g}{L}(L^2 - L_0^2)}$ (Fadenfall wieder)

c) $\frac{M}{L}(L-z_0)$ $\qquad \frac{M}{L}z_0 \Rightarrow$

$=$

Energieerhaltung: $K = -\Delta U \Rightarrow$

$\frac{1}{2}Mv^2 = \frac{M}{L}(L-z_0)\cdot\frac{1}{2}(L-z_0)\cdot g + \frac{M}{L}z_0\cdot(L-z_0)\cdot g$

$= \frac{Mg}{L}(L-z_0)\left[\underbrace{\frac{1}{2}(L-z_0)}_{\frac{1}{2}(L+z_0)} + z_0\right] = \frac{Mg}{2L}(L^2 - z_0^2)$

$v = \sqrt{\frac{g}{L}(L^2 - L_0^2)}$ usw. over