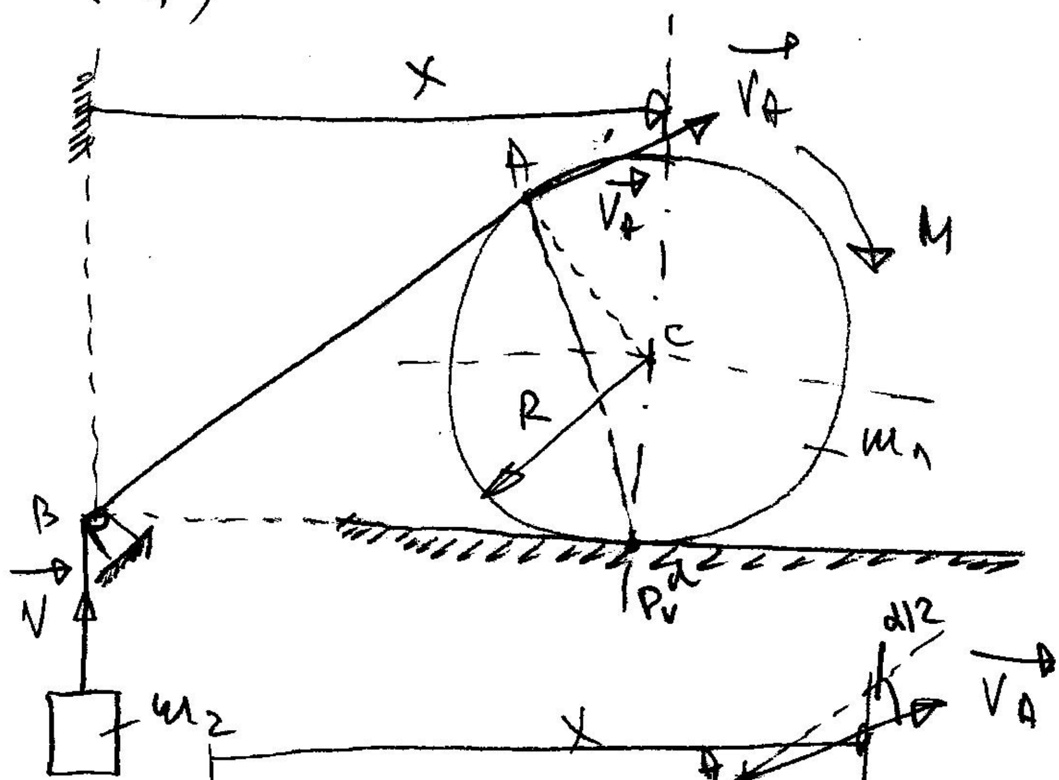
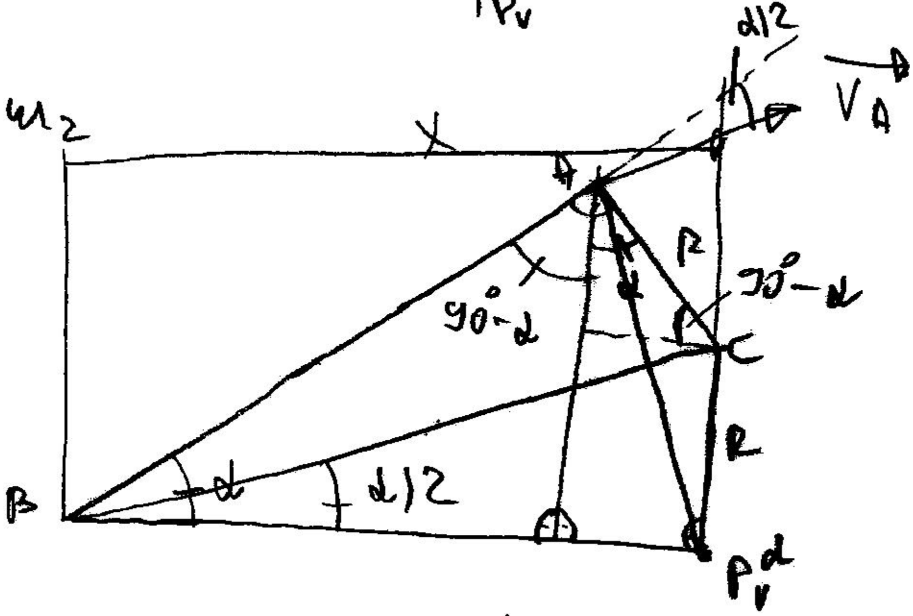
8.38 (*)

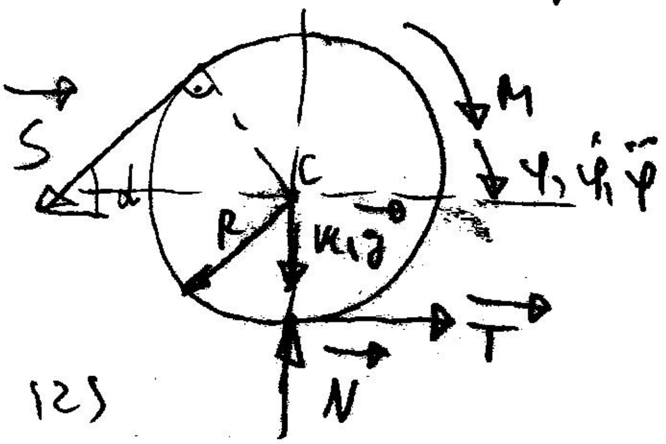
m_1
m_2
R
V

$M - ?$





$$\dot{\vec K} = m\vec g + \vec T + \vec S + \vec N$$
$$\dot{\vec L}_c = \sum_i \vec M(\vec F_i^{e})$$



x: $m_1\ddot x = +T - S\cos\alpha$ (1)

y: $0 = N - m_1 g - S\sin\alpha$ (2)

z: $\frac{1}{2}m_1R^2\ddot\varphi = M - TR - SR$ (3)

$x = R\varphi \;\Big|\; \frac{d}{dt}$

$\dot x = R\dot\varphi \;\Big|\; \frac{d}{dt}$

$\ddot x = R\ddot\varphi \Rightarrow \ddot\varphi = \frac{\ddot x}{R}$

$$(3) \Rightarrow \frac{1}{2} m_1 R^{\cancel{2}} \frac{\ddot{x}}{\cancel{R}} = M - TR - SR \quad | : R$$

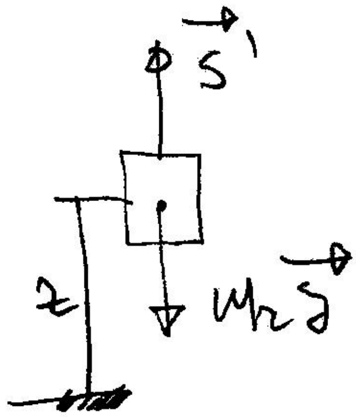
$$\frac{1}{2} m_1 \ddot{x} = \frac{M}{R} - T - S \quad (3')$$

$$(1) \Rightarrow T = m_1 \ddot{x} + S \cos\alpha$$

$$\frac{1}{2} m_1 \ddot{x} = \frac{M}{R} - m_1 \ddot{x} - S\cos\alpha - S$$

$$\frac{3}{2} m_1 \ddot{x} = \frac{M}{R} - S(1+\cos\alpha) \quad | R$$

$$M = \frac{3}{2} m_1 R \ddot{x} + SR(1+\cos\alpha)$$



$$m_2 \ddot{z} = S' - m_2 g, \quad \dot{z} = V = \text{const.}$$

$$\boxed{S' = m_2 g = S} \quad \ddot{z} = 0$$

$$M = \frac{3}{2} m_1 R \ddot{x} + R m_2 g (1 + \cos\alpha)$$

$$\ddot{x}, \alpha - ?$$

$$\frac{R}{x} = tg\frac{\alpha}{2} \Rightarrow x = \frac{R}{tg\frac{\alpha}{2}}$$

$$tg\frac{\alpha}{2} = \frac{\sin\frac{\alpha}{2}}{\cos\frac{\alpha}{2}} = \sqrt{\frac{1-\cos\alpha}{1+\cos\alpha}} \quad |^2 \quad tg^2\frac{\alpha}{2} = \frac{1-\cos\alpha}{1+\cos\alpha}$$

$$(1+\cos\alpha)\,tg^2\frac{\alpha}{2} = 1 - \cos\alpha$$

$$tg^2\frac{\alpha}{2} + \cos\alpha\, tg^2\frac{\alpha}{2} = 1 - \cos\alpha$$

$$\cos\alpha\left(1 + tg^2\frac{\alpha}{2}\right) = 1 - tg^2\frac{\alpha}{2}$$

$$\boxed{\cos\alpha} = \frac{1 - tg^2\frac{\alpha}{2}}{1 + tg^2\frac{\alpha}{2}} = \frac{1 - \frac{R^2}{x^2}}{1 + \frac{R^2}{x^2}} = \boxed{\frac{x^2 - R^2}{x^2 + R^2}}$$

$$M = \frac{3}{2} m_1 R\ddot{x} + m_2 g R\left(1 + \frac{x^2 - R^2}{x^2 + R^2}\right)$$

$$M = \frac{3}{2} m_1 R\ddot{x} + m_2 g R\left(\frac{x^2 + \cancel{R^2} + x^2 - \cancel{R^2}}{x^2 + R^2}\right)$$

$$M = \frac{3}{2} m_1 R\ddot{x} + \frac{2 m_2 g R x^2}{x^2 + R^2}$$

$$\ddot{x} - ?$$

$$x = \frac{R}{tg\frac{\alpha}{2}} \quad \Big| \frac{d}{dt}$$

$$\dot{x} = -R\frac{\frac{\dot{\alpha}/2}{\cos^2\frac{\alpha}{2}}}{tg^2\frac{\alpha}{2}} = -\frac{1}{2}\frac{R\dot{\alpha}}{tg^2\frac{\alpha}{2}\cos^2\frac{\alpha}{2}} = -\frac{1}{2}\frac{R\dot{\alpha}}{\sin^2\frac{\alpha}{2}}$$

$$\dot{x} = -\frac{1}{2}\frac{R\dot{\alpha}}{\frac{1-\cos\alpha}{2}} = -\frac{R\dot{\alpha}}{1 - \frac{x^2 - R^2}{x^2 + R^2}} = -\frac{R(x^2 + R^2)\dot{\alpha}}{\cancel{x^2} + R^2 - \cancel{x^2} + R^2}$$

$$\dot{x} = -\frac{1}{2}\frac{x^2 + R^2}{R}\dot{\alpha}$$

$$V_A = \overline{P_v^\alpha A}\,\dot\varphi$$

$$\overline{P_v^\alpha A}^2 = R^2 + R^2 - 2R^2\cos(180^\circ - \alpha) =$$

$$= 2R^2 + 2R^2\cos\alpha = 2R^2(1+\cos\alpha) =$$

$$= 4R^2\,\frac{1+\cos\alpha}{2}$$

$$\boxed{\overline{P_v^\alpha A} = 2R\cos\frac{\alpha}{2}}$$

$$V_A = 2R\cos\frac{\alpha}{2}\,\dot\varphi = 2\cancel{R}\cos\frac{\alpha}{2}\,\frac{\dot x}{\cancel{R}} = 2\cos\frac{\alpha}{2}\,\dot x$$

$$V = V_A\cos\frac{\alpha}{2}$$

$$V = 2\dot x\cos^2\frac{\alpha}{2} \qquad \dot x = \frac{V}{2\cos^2\frac{\alpha}{2}}$$

$$\dot x = \frac{V}{\cancel{2}\,\frac{1+\cos\alpha}{\cancel{2}}} = \frac{V}{1+\cos\alpha} = \frac{V}{1+\frac{x^2-R^2}{x^2+R^2}} =$$

$$= V\,\frac{x^2+R^2}{2x^2} \quad \Big|\ \frac{d}{dt}$$

$$\boxed{\ddot x} = V\,\frac{2x\dot x\cdot 2x^2 - (x^2+R^2)\cdot 4x\dot x}{4x^4} =$$

$$= V\,\frac{\cancel{4}x^{\cancel{3}\,2} - \cancel{4}\cancel{x}(x^2+R^2)}{\cancel{4}\,x^{\cancel{4}\,3}}\,\dot x = V\,\frac{\cancel{x^2}-\cancel{x^2}-R^2}{x^3}\,\dot x =$$

$$= -\frac{VR^2}{x^3}\,V\,\frac{x^2+R^2}{2x^2} = \boxed{-\frac{V^2R^2}{2x^5}(x^2+R^2)}$$

$$M = -\frac{3}{2} m_1 R \frac{V^2 R^2}{2x^5}(x^2+R^2) + \frac{2m_2 g R x^2}{x^2+R^2} =$$

$$= \frac{2Rx^2}{x^2+R^2}\left[m_2 g - \frac{3m_1 V^2 R^2}{8x^7}(x^2+R^2)^2\right]$$

$$\lim_{\frac{x}{R}\to\infty} M(x) = \lim_{x\to\infty} \frac{2Rx^2}{x^2+R^2}\left[m_2 g - \frac{3m_1 V^2 R^2}{8x^7}(x^2+R^2)^2\right] =$$

$$= \lim_{\frac{x}{R}\to\infty}\left[\frac{2Rm_2 g}{1+\underbrace{\left(\frac{R}{x}\right)^2}_{\to 0}} - \frac{3}{4}m_1 V^2\left(\underbrace{\left(\frac{R}{x}\right)^3}_{\to 0} + \frac{1}{x}\underbrace{\left(\frac{R}{x}\right)^5}_{\to 0}\right)\right] =$$

$$= 2Rm_2 g$$

II) Применом $\frac{dT}{dt} = \frac{dA}{dt}$

$$T = \frac{1}{2}m_1 V_c^2 + \frac{1}{2}J_c\dot\varphi^2 = \frac{1}{2}m_1\dot x^2 + \frac{1}{2}\frac{1}{2}m_1\cancel{R^2}\frac{\dot x^2}{\cancel{R^2}} =$$

$$= \frac{3}{4}m_1\dot x^2$$

$$\frac{dT}{dt} = \frac{3}{2}m_1\dot x\ddot x$$

$$d'A = -m_2 g\,dz + M\,d\varphi$$

$$\frac{d'A}{dt} = -m_2 g\dot z + M\dot\varphi = M\frac{\dot x}{R} - m_2 g V$$

$$\frac{3}{2}m_1\dot x\ddot x = \frac{M}{R}\dot x - m_2 g V \;\Big|\cdot\frac{R}{\dot x} \Rightarrow M = \frac{3}{2}m_1 R\ddot x + \frac{m_2 g R V}{\dot x}$$

8.39

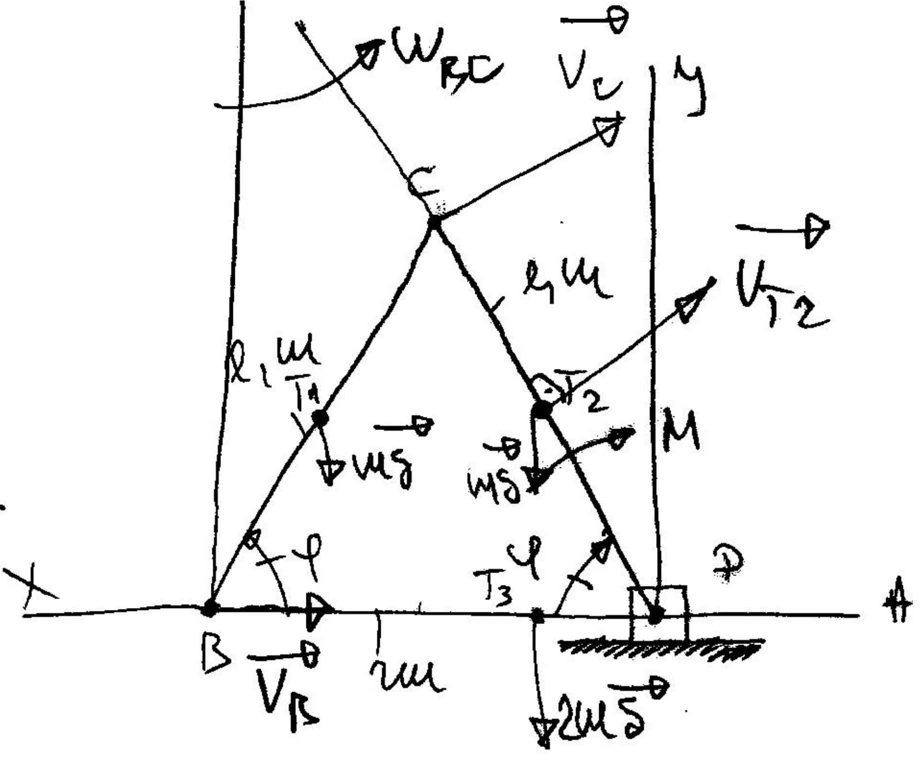
AB: $2m$

BC: m, $\overline{BC}=l$

CD: m, l

$\omega_{CD}=\omega=const.$

M-?



$$\frac{dT}{dt}=\frac{d'A}{dt}$$

$$T=T_{AB}+T_{BC}+T_{CD}$$

$$T_{AB}=\frac{1}{2}2mV_B^2=mV_B^2$$

$$\overline{BD}=2l\cos\varphi,\quad \dot{\overline{BD}}=-2l\dot\varphi\sin\varphi=V_B$$

$$T_{AB}=4ml^2\dot\varphi^2\sin^2\varphi$$

$$T_{BC}=\frac{1}{2}mV_{T1}^2+\frac{1}{2}J_{T1}\omega_{BC}^2=$$

$$=\frac{1}{2}mV_{T1}^2+\frac{1}{2}\frac{1}{12}ml^2\omega_{BC}^2=\frac{1}{2}mV_{T1}^2+\frac{1}{24}ml^2\omega_{BC}^2$$

$$x_{T1}=\frac{3}{2}l\cos\varphi,\quad y_{T1}=\frac{l}{2}\sin\varphi$$

$$\dot x_{T1}=-\frac{3}{2}l\dot\varphi\sin\varphi,\quad \dot y_{T1}=\frac{l}{2}\dot\varphi\cos\varphi$$

$$V_{T1}^2=\dot x_{T1}^2+\dot y_{T1}^2=\frac{9}{4}l^2\dot\varphi^2\sin^2\varphi+\frac{l^2}{4}\dot\varphi^2\cos^2\varphi=$$

$$=2l^2\dot\varphi^2\sin^2\varphi+\frac{1}{4}l^2\dot\varphi^2$$

$$V_{T2} = \frac{l}{2}\omega_{CD} = \frac{l}{2}\omega \Rightarrow \omega_{CD} = \omega$$

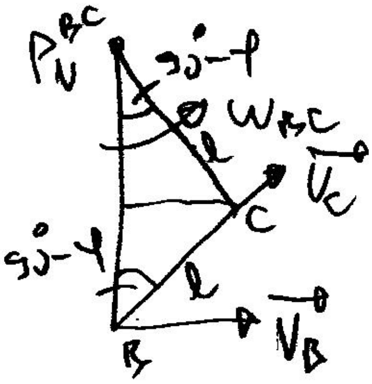
$$x_{T2} = \frac{l}{2}\cos\varphi, \quad y_{T2} = \frac{l}{2}\sin\varphi$$

$$\dot{x}_{T2} = -\frac{l}{2}\dot{\varphi}\sin\varphi, \quad \dot{y}_{T2} = \frac{l}{2}\dot{\varphi}\cos\varphi$$

$$V_{T2}^2 = \frac{l^2}{4}\dot{\varphi}^2 \Rightarrow V_{T2} = \frac{l}{2}\dot{\varphi} = \frac{l}{2}\omega$$

$$\boxed{\dot{\varphi} = \omega}$$

$$V_{T1}^2 = 2l^2\omega^2\sin^2\varphi + \frac{l^2}{4}\omega^2$$



$$V_C = l\omega$$

$$V_C = l\omega_{BC} \Rightarrow \boxed{\omega_{BC} = \omega}$$

$$T_{BC} = \frac{1}{2} m l^2\omega^2\left(2\sin^2\varphi + \frac{1}{4}\right) + \frac{1}{24} m l^2\omega^2 =$$

$$= m l^2\omega^2\left(\frac{1}{6} + \sin^2\varphi\right)$$

$$T_{CD} = \frac{1}{2} J_D \omega^2 = \frac{1}{2}\,\frac{1}{3} m l^2\omega^2 = \frac{1}{6} m l^2\omega^2$$

$$T_{AB} = 4 m l^2\omega^2\sin^2\varphi$$

$$T = m l^2\omega^2\left(4\sin^2\varphi + \frac{1}{6} + \sin^2\varphi + \frac{1}{6}\right) =$$

$$= m l^2\omega^2\left(5\sin^2\varphi + \frac{1}{3}\right)$$

$$\frac{dT}{dt} = ml^2 w^2 \, 10 \sin\varphi \cos\varphi \, \dot{\varphi} =$$

$$= 10\, ml^2 w^3 \sin\varphi \cos\varphi$$

$$d'A = M\delta\varphi - mg\, dy_{T1} - mg\, dy_{T2}$$

$$dy_{T1} = \frac{l}{2}\cos\varphi\, d\varphi, \quad dy_{T2} = \frac{l}{2}\cos\varphi\, d\varphi$$

$$d'A = M\, d\varphi - \frac{l}{2} mg\cos\varphi\, d\varphi - \frac{l}{2} mg\cos\varphi\, d\varphi =$$

$$= M\, d\varphi - mgl\cos\varphi\, d\varphi, \quad \dot{\varphi} = w$$

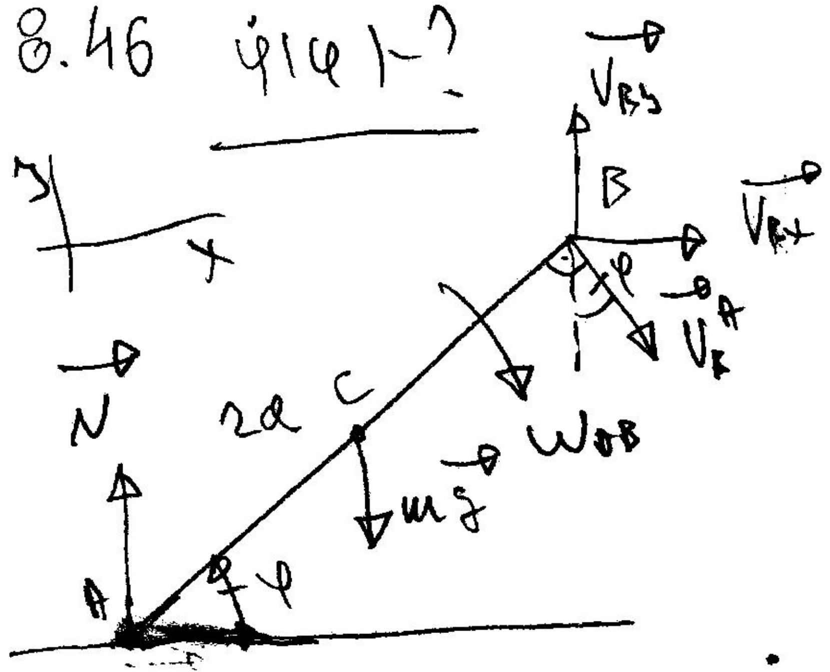
$$\frac{d'A}{dt} = M\dot{\varphi} - mgl\cos\varphi\,\dot{\varphi} = Mw - mgl\cos\varphi\, w$$

$$10\, ml^2 w^3 \sin\varphi\cos\varphi = Mw - mgl\cos\varphi\, w \; | : w$$

$$M = 10\, ml^2 w^2 \sin\varphi\cos\varphi + mgl\cos\varphi =$$

$$= 5\, ml^2 w^2 \sin 2\varphi + mgl\cos\varphi$$

8.46 $\dot\varphi(\varphi)$ - ?



$$X_A = a\left(\frac{1}{2} - \cos\varphi\right) \Rightarrow \dot X_A = a\dot\varphi\sin\varphi$$

$$X_B = a\left(\frac{1}{2} + \cos\varphi\right) \Rightarrow \dot X_B = -a\dot\varphi\sin\varphi$$

$$y_B = 2a\sin\varphi \Rightarrow \dot y_B = 2a\dot\varphi\cos\varphi$$

$$\vec V_B = \vec V_A + \vec V_B^A$$

$$x: V_{Bx} = \dot X_B = -a\dot\varphi\sin\varphi = a\dot\varphi\sin\varphi + 2a\omega_{AB}\sin\varphi$$

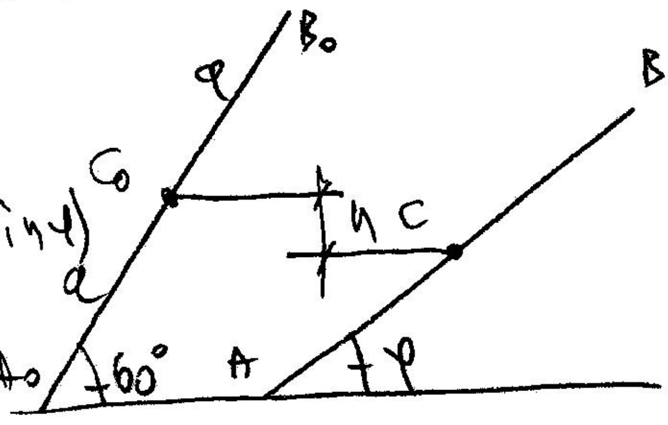
$$-\cancel{2}a\dot\varphi\,\cancel{\sin\varphi} = \cancel{2}a\omega_{AB}\,\cancel{\sin\varphi} \Rightarrow \boxed{\omega_{AB} = -\dot\varphi}$$

$$y: V_{By} = \dot y_B = +2a\dot\varphi\cos\varphi = 0 - 2a\omega_{AB}\cos\varphi \;u$$

$$T - \underbrace{T_0}_{0} = \sum_i A_i$$

$$\frac{1}{2}mV_c^2 + \frac{1}{2}J_c\dot\varphi^2 = mga(\sin 60^\circ - \sin\varphi)$$

$$\frac{1}{2}\cancel{m}V_c^2 + \frac{1}{2}\frac{1}{12}\cancel{m}4a^2\dot\varphi^2 = \cancel{m}ga\left(\frac{\sqrt3}{2} - \sin\varphi\right)$$



$$\frac{1}{2}V_c^2 + \frac{1}{6}a^2\dot{\varphi}^2 = ga\left(\frac{\sqrt{3}}{2} - \sin\varphi\right) \Big|\cdot 6$$

$$\vec{V_c} = \vec{V_A} + \vec{V_c^A}$$

$$x:\quad V_{cx} = \dot{x}_A + aW_{AB}\sin\varphi = a\dot{\varphi}\sin\varphi + aW_{AB}\sin\varphi$$

$$= a\dot{\varphi}\sin\varphi - a\dot{\varphi}\sin\varphi = 0$$

$$y:\quad V_{cy} = 0 - aW_{AB}\cos\varphi = a\dot{\varphi}\cos\varphi$$

$$V_c^2 = a^2\dot{\varphi}^2\cos^2\varphi$$

$$3a^2\dot{\varphi}^2\cos^2\varphi + a^2\dot{\varphi}^2 = 6ga\left(\frac{\sqrt{3}}{2} - \sin\varphi\right)$$

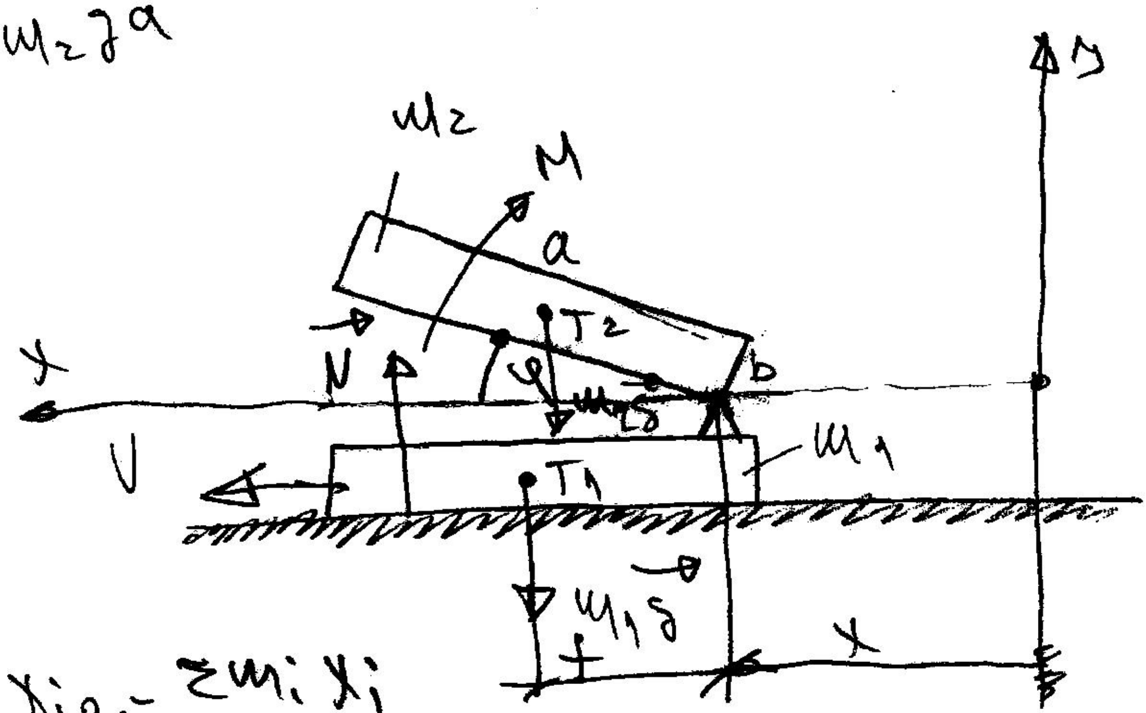
$$a^{\cancel{2}}\dot{\varphi}^2(3\cos^2\varphi + 1) = 3g\cancel{a}(\sqrt{3} - 2\sin\varphi)$$

$$\dot{\varphi}^2 = \frac{3g(\sqrt{3} - 2\sin\varphi)}{a(1 + 3\cos^2\varphi)}$$

$$\dot{\varphi} = -\sqrt{\frac{\sqrt{3} - 2\sin\varphi}{1 + 3\cos^2\varphi}\,\frac{3g}{a}} = -W_{AB}$$

8.47

$M = m_2 g a$



$$\sum m_i x_{i0} = \sum m_i x_i$$

$$m_1 \cancel{f} + m_2 \frac{a}{2} = m_1 (x + \cancel{f}) + m_2 \left(x + \frac{a}{2}\cos\varphi - \frac{b}{2}\sin\varphi\right)$$

$$x(m_1 + m_2) = m_2 \frac{a}{2} - m_2 \frac{a}{2}\cos\varphi + m_2 \frac{b}{2}\sin\varphi$$

$$x(m_1 + m_2) = \frac{m_2}{2}\left[a(1-\cos\varphi) + b\sin\varphi\right]$$

$$\boxed{x = \frac{m_2}{2(m_1+m_2)}\left[a(1-\cos\varphi) + b\sin\varphi\right]}$$

$$\Delta x = x\left(\varphi = \frac{\pi}{2}\right) = \frac{m_2}{2(m_1+m_2)}(a+b)$$

$$\dot{x} = \frac{m_2}{2(m_1+m_2)}\left[a\dot{\varphi}\sin\varphi + b\dot{\varphi}\cos\varphi\right] =$$

$$= \frac{m_2\,\dot{\varphi}}{2(m_1+m_2)}\left(a\sin\varphi + b\cos\varphi\right)$$

$$\dot{x}_1 = \dot{x}(\varphi=\pi/2) = \frac{m_2\dot{\varphi}_1\,a}{2(m_1+m_2)}$$

$$\underbrace{T - T_0}_{T_0 = 0} = \sum_i A_i$$

$$T = T_1 + T_2$$

$$T_1 = \frac{1}{2}m_1\dot{x}^2 = \frac{1}{2}m_1\frac{m_2^2\dot{\varphi}^2}{4(m_1+m_2)^2}(a\sin\varphi + b\cos\varphi)^2$$

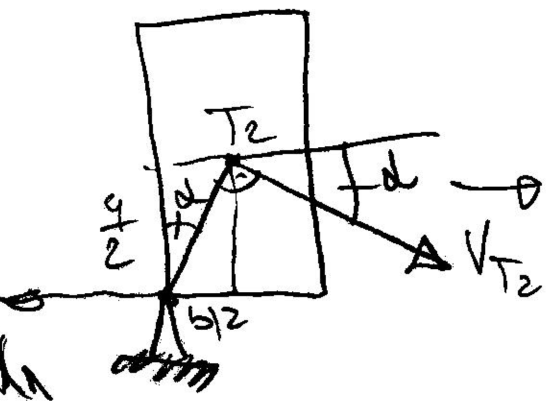
$$= \frac{m_1 m_2^2\dot{\varphi}^2}{8(m_1+m_2)^2}(a\sin\varphi + b\cos\varphi)^2,\quad T_1(t_1) = \frac{m_1 m_2^2\dot{\varphi}_1^2 a^2}{8(m_1+m_2)^2}$$

$$T_2 = \frac{1}{2}m_2 V_{T_2}^2 + \frac{1}{2}J_{T_2}\dot{\varphi}^2,\quad J_{T_2} = \frac{m_2}{12}(a^2+b^2)$$

$$\vec{V}_{T_2} = \vec{V}_A + \vec{V}_{T_2}^A$$

$$V_{T_2x}(t_1) = \dot{x}_1 - \frac{a}{2}\dot{\varphi}_1$$

$$V_{T_2y}(t_1) = -\frac{b}{2}\dot{\varphi}_1$$



$$T_2(t_0) = \frac{1}{2} m_2 \left[(\dot{x}_1 - \frac{a}{2}\dot{\varphi}_1)^2 + \frac{b^2}{4}\dot{\varphi}_1^2 \right] +$$

$$+ \frac{m_2}{24}(a^2+b^2)\dot{\varphi}_1^2 =$$

$$= \frac{m_2}{2}\left[\left(\frac{m_2 a}{2(m_1+m_2)}\dot{\varphi}_1 - \frac{a}{2}\dot{\varphi}_1 \right)^2 + \frac{b^2}{4}\dot{\varphi}_1^2 \right] +$$

$$+ \frac{m_2}{24}(a^2+b^2)\dot{\varphi}_1^2 =$$

$$= \frac{m_2}{2}\left[\frac{a^2\dot{\varphi}_1^2}{4}\left(\frac{m_2}{m_1+m_2} - 1 \right)^2 + \frac{b^2}{4}\dot{\varphi}_1^2 \right] +$$

$$+ \frac{m_2}{24}(a^2+b^2)\dot{\varphi}_1^2 =$$

$$= \frac{m_2}{8}\dot{\varphi}_1^2 \left(a^2 \frac{m_1^2}{(m_1+m_2)^2} + b^2 \right) + \frac{m_2}{24}(a^2+b^2)\dot{\varphi}_1^2$$

$$= \frac{m_2}{24}\dot{\varphi}_1^2 \left[\frac{3a^2 m_1^2}{(m_1+m_2)^2} + \underline{\underline{3b^2}} + \underline{a^2} + \underline{\underline{b^2}} \right] =$$

$$= \frac{m_2 \dot{\varphi}_1^2}{24}\left[a^2\left(1 + \frac{3m_1^2}{(m_1+m_2)^2} \right) + 4b^2 \right] =$$

$$= \frac{m_2 \dot{\varphi}_1^2}{24}\left[a^2 \left(\frac{4m_1^2 + 2m_1 m_2 + m_2^2}{(m_1+m_2)^2} \right) + 4b^2 \right]$$

$$T(t_a) = T_1(t_1) + T_2(t_2) =$$

$$= \frac{m_1 m_2^2 \dot{\varphi}_1^2 a^2}{8(m_1+m_2)^2} + \frac{m_2 \dot{\varphi}_1^2}{24}\left[a^2\left(\frac{4m_1^2 + 2m_1m_2 + m_2^2}{(m_1+m_2)^2}\right) + 4b^2\right] =$$

$$= \frac{5}{24}\frac{m_1 m_2^2 \dot{\varphi}_1^2 a^2}{(m_1+m_2)^2} + \frac{m_2 \dot{\varphi}_1^2}{24}\left[a^2\left(\frac{4m_1^2 + m_2^2}{(m_1+m_2)^2}\right) + 4b^2\right]$$

$$A_{0,1}(m_2 \vec{g}) = -m_2 g\left(\frac{a}{2} - \frac{b}{2}\right) = -\frac{m_2 g}{2}(a-b)$$

$$A_{0,1}(M) = M\varphi_1 = m_2 g a \frac{\pi}{2}$$

$$\sum_i A_i = m_2 g\left(\frac{a\pi}{2} - \frac{a}{2} + \frac{b}{2}\right) =$$

$$= \frac{m_2 g}{2}(a\pi - a + b)$$

$$\frac{5}{24}\frac{m_1 m_2^2 \dot{\varphi}_1^2 a^2}{(m_1+m_2)^2} + \frac{m_2 \dot{\varphi}_1^2}{24}\left[a^2\left(\frac{4m_1^2 + m_2^2}{(m_1+m_2)^2}\right) + 4b^2\right] = \frac{m_2 g}{2}(a\pi - a + b) \quad \Big| \cdot 2$$

$$\frac{5}{12}\frac{m_1 m_2 a^2}{(m_1+m_2)^2}\dot{\varphi}_1^2 + \frac{1}{12}\left[a^2\left(\frac{4m_1^2 + m_2^2}{(m_1+m_2)^2}\right) + 4b^2\right]\dot{\varphi}_1^2 = g(a\pi - a + b)$$

$$\frac{\dot{\varphi}_1^2}{12(m_1+m_2)^2}\left[5m_1m_2a^2 + a^2(4m_1^2 + m_2^2) + 4b^2(m_1+m_2)^2\right] = g(a\pi - a + b)$$

$$\dot{x}_1 = \frac{m_2 \dot{\varphi}_1 a}{2(m_1+m_2)} \quad \Big|^2$$

$$\dot{x}_1^2 = \frac{m_2^2 \dot{\varphi}_1^2 a^2}{4(m_1+m_2)^2} \Rightarrow \frac{\dot{\varphi}_1^2}{4(m_1+m_2)^2} = \frac{\dot{x}_1^2}{m_2^2 a^2}$$

$$\frac{\dot{x}_1^2}{3 m_2^2 a^2}\left[5 m_1 m_2 a^2 + a^2(4m_1^2 + m_2^2) + 4b^2(m_1+m_2)^2\right] = g(a\pi - a + b)$$

$$\dot{x}_1 = \sqrt{\frac{3 g m_2^2 a^2 \left[a(\pi-1)+b\right]}{(m_1+m_2)\left[4b^2(m_1+m_2) + a^2\left(\frac{5m_1m_2 + 4m_1^2 + m_2^2}{m_1+m_2}\right)\right]}}$$

$$= \sqrt{\frac{3 g m_2^2 a^2 \left[a(\pi-1)+b\right]}{(m_1+m_2)\left[4b^2(m_1+m_2) + a^2\left(\frac{4m_1m_2 + 4m_1^2 + m_1m_2 + m_2^2}{m_1+m_2}\right)\right]}}$$

$$= \sqrt{\frac{3 g m_2^2 a^2 \left[a(\pi-1)+b\right]}{(m_1+m_2)\left[4(a^2+b^2)(m_1+m_2) - 3m_2 a^2\right]}}$$

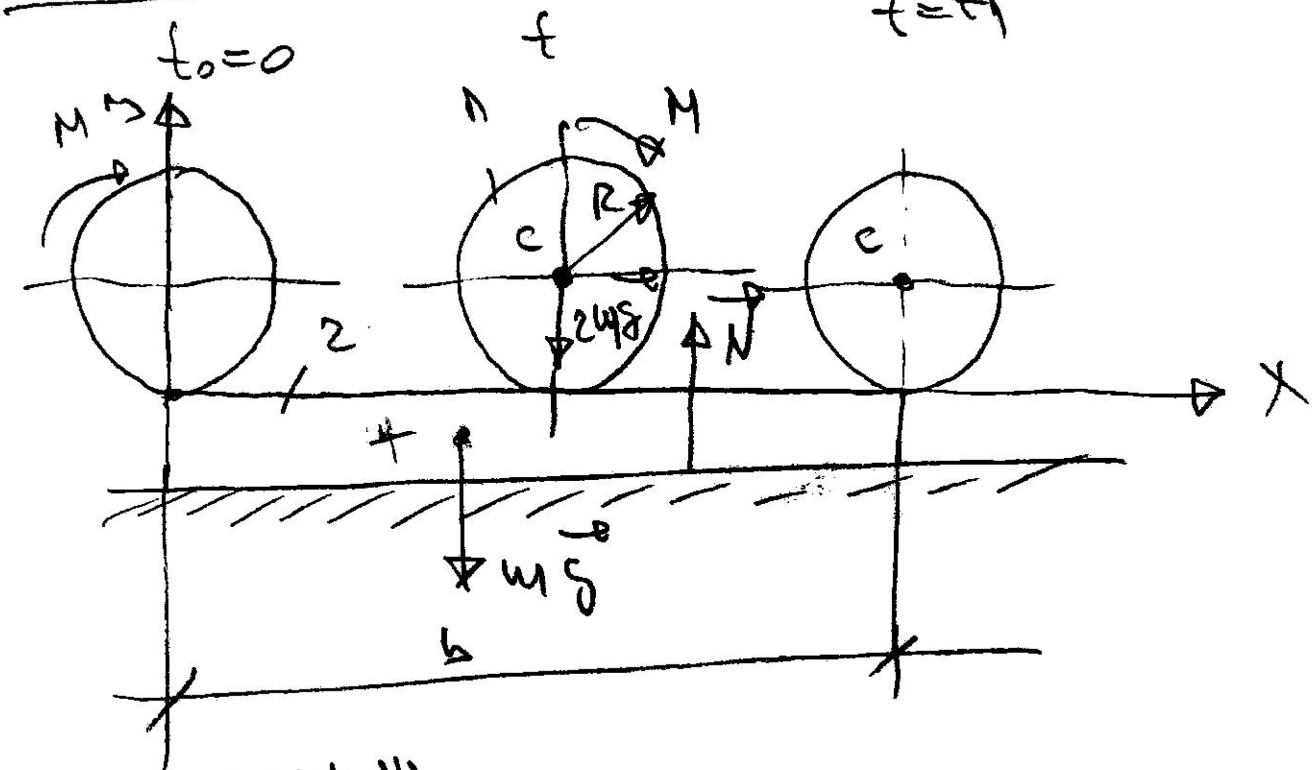
8.57

1: R, $2m$

2: m, b

$M = const.$

$t_0 = 0$ сис. е мирува



$$\sum m_i x_{i0} = \sum m_i x_i$$

$$\underbrace{2m\cdot 0}_{=0} + \cancel{m\frac{b}{2}} = 2m(R\varphi + x) + m\left(x + \cancel{\frac{b}{2}}\right)$$

$$3mx + 2mR\varphi = 0 \quad |:m$$

$$3x = -2R\varphi \Rightarrow \boxed{x = -\frac{2}{3}R\varphi}$$

$$x_1 = x(R\varphi = b) = -\frac{2}{3}b$$

$$\dot{x} = -\frac{2}{3}R\dot{\varphi} \Rightarrow \dot{\varphi}_1 = -\frac{3}{2}\frac{\dot{x}_1}{R}$$

$$T_1 - \underbrace{T_0}_{=0} = \sum_i A_i$$

$$T_1 = T_1^{(1)}(t_1) + T_2(t_1)$$

$$T_1(t_1) = \frac{1}{\cancel{2}}\cancel{2}m V_{C1}^2 + \frac{1}{2}J_C\dot{\varphi}_1^2 =$$

$$= m V_{C1}^2 + \frac{1}{2}\frac{1}{\cancel{2}}\cancel{2}m R^2\dot{\varphi}_1^2 = m V_{C1}^2 + \frac{1}{2}m R^2\dot{\varphi}_1^2$$

$$V_{C1} = \dot{x}_1 + R\dot{\varphi}_1 = \dot{x}_1 + \cancel{R}\left(-\frac{3}{2}\frac{\dot{x}_1}{\cancel{R}}\right) = -\frac{1}{2}\dot{x}_1$$

$$T_1(t_1) = m\frac{1}{4}\dot{x}_1^2 + \frac{1}{2}m\cancel{R^2}\frac{9}{4}\frac{\dot{x}_1^2}{\cancel{R^2}} = \frac{11}{8}m\dot{x}_1^2$$

$$T_2(t_1) = \frac{1}{2}m\dot{x}_1^2$$

$$T_1(t_1) = \frac{11}{8}m\dot{x}_1^2 + \frac{1}{2}m\dot{x}_1^2 = \frac{15}{8}m\dot{x}_1^2$$

$$\sum_i A_i = M\varphi_1 = M\frac{b}{R}$$

$$\frac{15}{8}m\dot{x}_1^2 = M\frac{b}{R} \Rightarrow \dot{x}_1 = -\sqrt{\frac{8Mb}{15mR}}$$