Μοριοδότηση 2019

Ενδεικτικές απαντήσεις και από γραπτά μαθητών

Θέμα Α

A1 - β ⑤

A2 - γ ⑤

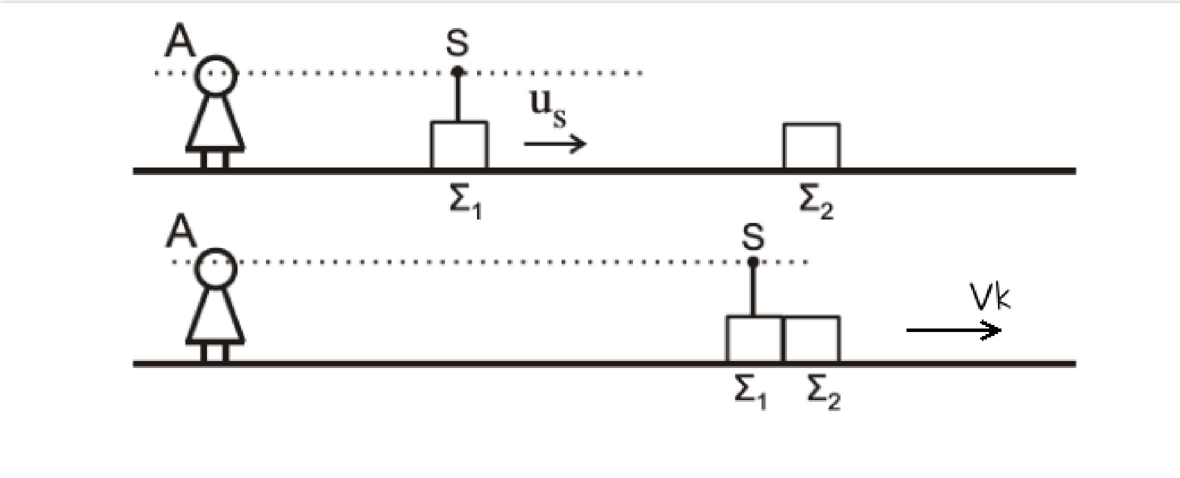
A3 - α ⑤

A4 - γ ⑤

A5: $\Lambda - \Sigma - \Lambda - \Sigma - \Sigma$ ⑤

Θέμα Β

B1-(ii) ②



$$\Sigma \overrightarrow{F_{\varepsilon\xi}} = 0 \Rightarrow \text{Α.Δ.Ο.} \quad \vec{p}_{\pi\rho\iota\nu} = \vec{p}_{\mu\varepsilon\tau\alpha}$$

$$m \cdot u_s = (m+m) \cdot V_k \Rightarrow V_k = \frac{m \cdot u_s}{2 \cdot m} \Rightarrow V_k = \frac{u_H}{40}$$

②

$$f_1 = \frac{u_H}{u_H + u_s} \cdot f_s$$

①

$$f_2 = \frac{u_H}{u_H + V_k} \cdot f_s$$

①

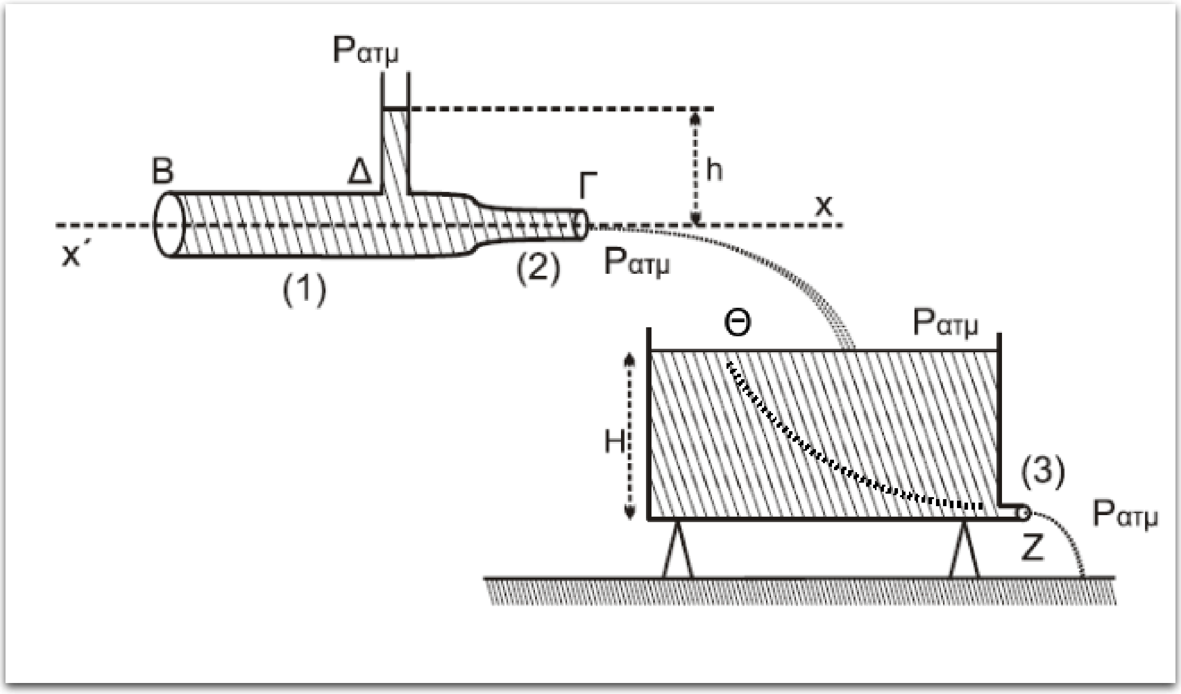
$$\frac{f_1}{f_2} = \frac{u_H + V_k}{u_H + u_s} = \frac{u_H + \frac{u_H}{40}}{u_H + \frac{u_H}{20}} = \frac{\frac{41u_H}{40}}{\frac{21u_H}{20}} = \frac{41}{42}$$

②

άρα σωστό το ii

Β2 - (iii)

②



Όταν σταθεροποιείται το ύψος στο δοχείο

$$\Pi_2 = \Pi_3 \Rightarrow A_2 \cdot \upsilon_2 = A_3 \cdot \upsilon_3 \overset{A_3 = \frac{A_2}{2}}{\Longrightarrow} \upsilon_2 = \frac{\upsilon_3}{2}$$

①

Εξίσωση Bernoulli για μια ρευματική γραμμή $(\Theta \rightarrow Z)$

$$P_\Theta + \frac{1}{2}\rho \cdot \upsilon_H^2 + \rho \cdot g \cdot h = P_Z + \frac{1}{2}\rho \cdot \upsilon_3^2 \Rightarrow P_{\alpha\tau\mu} + \rho \cdot g \cdot h = P_{\alpha\tau\mu} + \frac{1}{2}\rho \cdot \upsilon_3^2$$

$$\upsilon_3 = \sqrt{2 \cdot g \cdot H}$$

①

Εξίσωση συνέχειας $(\Delta \rightarrow \Gamma)$

$$\Pi_1 = \Pi_2 \Rightarrow A_1 \cdot \upsilon_1 = A_2 \cdot \upsilon_2 \overset{A_1=2A_2}{\Longrightarrow} \upsilon_2 = 2\upsilon_1$$

①

Εξίσωση Bernoulli για μια οριζόντια ρευματική γραμμή $(\Delta \rightarrow \Gamma)$

$$P_\Delta + \frac{1}{2}\rho \cdot \upsilon_1^2 = P_2 + \frac{1}{2}\rho \cdot \upsilon_2^2$$

$$P_\Delta = P_{\alpha\tau\mu} + \rho \cdot g \cdot h$$

②

$$P_{\alpha\tau\mu} + \rho \cdot g \cdot h + \frac{1}{2}\rho \cdot \upsilon_1^2 = P_{\alpha\tau\mu} + \frac{1}{2}\rho \cdot \upsilon_2^2 \Rightarrow \rho \cdot g \cdot h = \frac{1}{2} \cdot (\upsilon_2^2 - \upsilon_1^2)$$

$$g \cdot h = \frac{3}{8} \cdot \upsilon_2^2 \overset{\upsilon_2=\frac{\upsilon_3}{2}}{\Longrightarrow} g \cdot h = \frac{3}{8} \cdot \frac{\upsilon_3^2}{4}$$

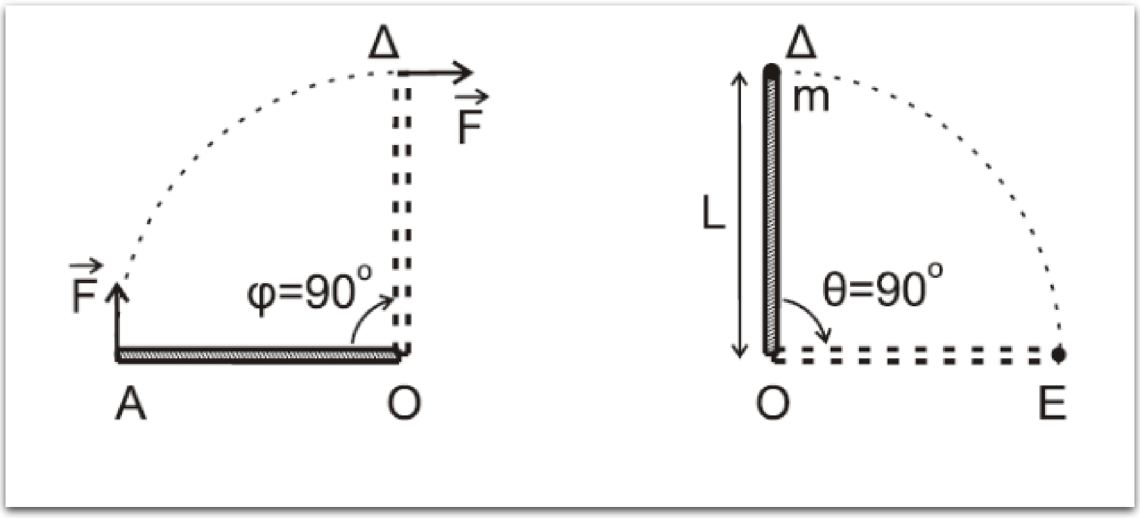
$$\upsilon_3^2 = \frac{32}{3} \cdot g \cdot h \overset{\upsilon_3=\sqrt{2 \cdot g \cdot H}}{\Longrightarrow} 2 \cdot g \cdot H = \frac{32}{3} \cdot g \cdot h \Rightarrow \frac{h}{H} = \frac{3}{16}$$

①

άρα σωστό το iii

B3 - (ii)

②



α)τρόπος

$$\Sigma\tau = I \cdot \alpha_{\gamma\omega\nu} \Rightarrow F \cdot L = \frac{1}{3} \cdot M \cdot L^2 \cdot \alpha_{\gamma\omega\nu} \Rightarrow \alpha_{\gamma\omega\nu} = \frac{3F}{ML}$$

$$\varphi = \frac{1}{2} \cdot \alpha_{\gamma\omega\nu} \cdot t^2 \Rightarrow \frac{\pi}{2} = \frac{1}{2} \cdot \alpha_{\gamma\omega\nu} \cdot t_{A\Delta} \Rightarrow t_{A\Delta} = \sqrt{\frac{\pi \cdot M \cdot L}{3F}}$$

$$\omega = \alpha_{\gamma\omega\nu} \cdot t_{A\Delta} = \frac{3F}{ML} \cdot \sqrt{\frac{\pi \cdot M \cdot L}{3F}} \Rightarrow \omega = \sqrt{\frac{3 \cdot Fcdot\pi}{M \cdot L}} \Rightarrow \omega = 3\pi\frac{rad}{s}$$

3

β)τρόπος

$$\Theta\text{ΜΚΕ}(\text{Α} \rightarrow \Delta) \quad \text{K}_\Delta - \text{K}_\text{A} = \Sigma W_\tau \Rightarrow \frac{1}{2} \cdot \text{I}_\rho \cdot \omega^2 - 0 = \tau_F \cdot \theta$$

$$\frac{1}{2} \cdot \text{I}_\rho \cdot \omega^2 = F \cdot L \cdot \frac{\pi}{2} \Rightarrow \frac{M}{3} \cdot L^2 \cdot \omega^2 = F \cdot L \cdot \pi$$

$$\omega = \sqrt{\frac{3 \cdot F \cdot \pi}{\text{M} \cdot L}} = \sqrt{9 \cdot \pi^2}$$

$$\omega = 3\pi \frac{rad}{s}$$

3

$$\Sigma\tau_{\varepsilon\xi} = 0 \Rightarrow A.\Delta.\Sigma\tau\rho_0 \Rightarrow \vec{L}_{\pi\rho\iota\nu} = \vec{L}_{\mu\varepsilon\tau\acute{\alpha}} \Rightarrow I_\rho \cdot \omega = (\text{I}_\rho + m \cdot L^2) \cdot \omega_k$$

$$\frac{1}{3} \cdot M \cdot L^2 \cdot \omega = (\frac{1}{3} \cdot M \cdot L^2 + m \cdot L^2) \cdot \omega_k \Rightarrow \omega = 2 \cdot \omega_k \Rightarrow \omega_k = \frac{\omega}{2}$$

2

Ομαλή στροφική κίνηση

$$\Delta\theta = \omega_k \cdot \Delta t \Rightarrow \Delta t = \frac{\Delta\theta}{\omega_k} = \frac{\Delta\theta}{\frac{\omega}{2}} = \frac{2\Delta\theta}{\omega} = \frac{2 \cdot \frac{\pi}{2}}{\omega} = \frac{\pi}{\omega}$$

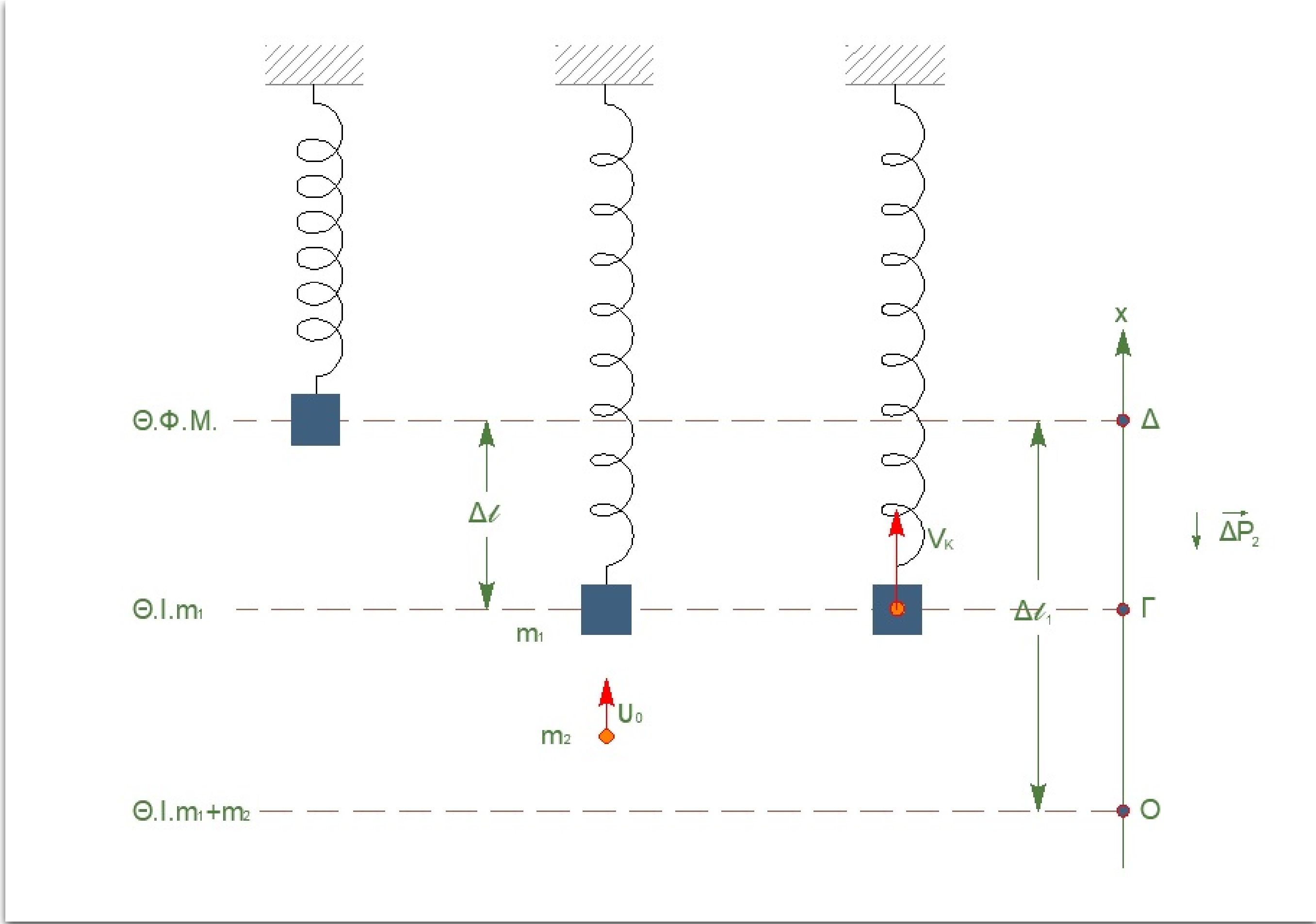
$$\Delta t = \frac{1}{3} s$$

2

άρα σωστό το ii

Θέμα Γ

Γ1



①

$$(\Theta \mathrm{I}_{m_1}) \quad \Sigma F = 0 \Rightarrow$$
$$F_{\varepsilon\lambda} = m_1 \cdot g \Rightarrow$$
$$k \cdot \Delta l = m_1 \cdot g \Rightarrow$$
$$k = \frac{m_1 \cdot g}{\Delta l} = 200\frac{N}{m}$$

②

$$(\Theta \mathrm{I}_{m_1, m_2}) \quad \Sigma F = 0 \Rightarrow$$
$$F'_{\varepsilon\lambda} = (m_1 + m_2) \cdot g \Rightarrow$$
$$k \cdot \Delta l_1 = (m_1 + m_2) \cdot g \Rightarrow$$
$$\Delta l_1 = \frac{(m_1 + m_2) \cdot g}{k} \Rightarrow$$
$$\Delta l_1 = 0.1m$$

②

Στην ακραία θέση $\upsilon_{\tau\alpha\lambda} = 0 \Rightarrow A = 0.1m$

①

Γ2

$$\Sigma \vec{F}_{\varepsilon\xi} = 0 \Rightarrow \mathrm{A.\Delta.O.} \quad \vec{p}_{\pi\rho\iota\nu} = \vec{p}_{\mu\varepsilon\tau\alpha}$$

$$m_2 \cdot u_o = (m_1 + m_2) \cdot V_k \Rightarrow V_k = \frac{m \cdot u_s}{2 \cdot m} \Rightarrow V_k = \frac{u_H}{40}$$

②

$$\mathrm{A\Delta E}_{\tau\alpha\lambda}(\Gamma \rightarrow \Delta)$$

$$K_\Gamma + U_{\tau\alpha\lambda\Gamma} = K_\Delta + U_{\tau\alpha\lambda\Delta} \Rightarrow \frac{1}{2} \cdot (m_1 + m_2) \cdot V_k^2 + \frac{1}{2} \cdot D \cdot (\Delta l_1 - \Delta l)^2 = 0 + \frac{1}{2} \cdot D \cdot A^2$$

$$2V_k^2 + 200 \cdot 0.05^2 = 200 \cdot 0.01 \Rightarrow V_k^2 + 0.25 = 1 \Rightarrow V_k = \sqrt{0.75} \Rightarrow |V_k| = 0.5\sqrt{3}\frac{m}{s}, V_k > 0$$

③

$$K_2 = \frac{1}{2} \cdot m_2 \cdot u_o^2 \Rightarrow K_2 = 1.5J$$

①

Γ3

$$\Delta\vec{p_2} = \vec{p}_{\tau\varepsilon\lambda} - \vec{p}_{\alpha\rho\chi} \Rightarrow \Delta p_2 = m_2 \cdot V_k - m_2 \cdot u_o \Rightarrow \Delta p_2 = 0.5\sqrt{3} - \sqrt{3} \Rightarrow \Delta p_2 = -0.5\sqrt{3}$$

②

$$|\Delta\vec{p_2}| = 0.5\sqrt{3}kg \cdot \frac{m}{s}$$

②

$$\Delta p_2 = -0.5\sqrt{3}$$

Το πρόσημο δηλώνει την κατεύθυνση του διανύσματος. (Βλέπε σχήμα)

②

Γ4

$$D = k = (m_1 + m_2) \cdot \omega^2 \Rightarrow \omega = \sqrt{\frac{k}{m_1 + m_2}} \Rightarrow \omega = 10\frac{rad}{s}$$

②

$$t_o = 0, \quad y = +\frac{A}{2}, \quad \upsilon > 0$$

$$y = A \cdot \eta\mu(\omega t + \varphi_o) \Rightarrow \frac{A}{2} = A \cdot \eta\mu\varphi_o$$

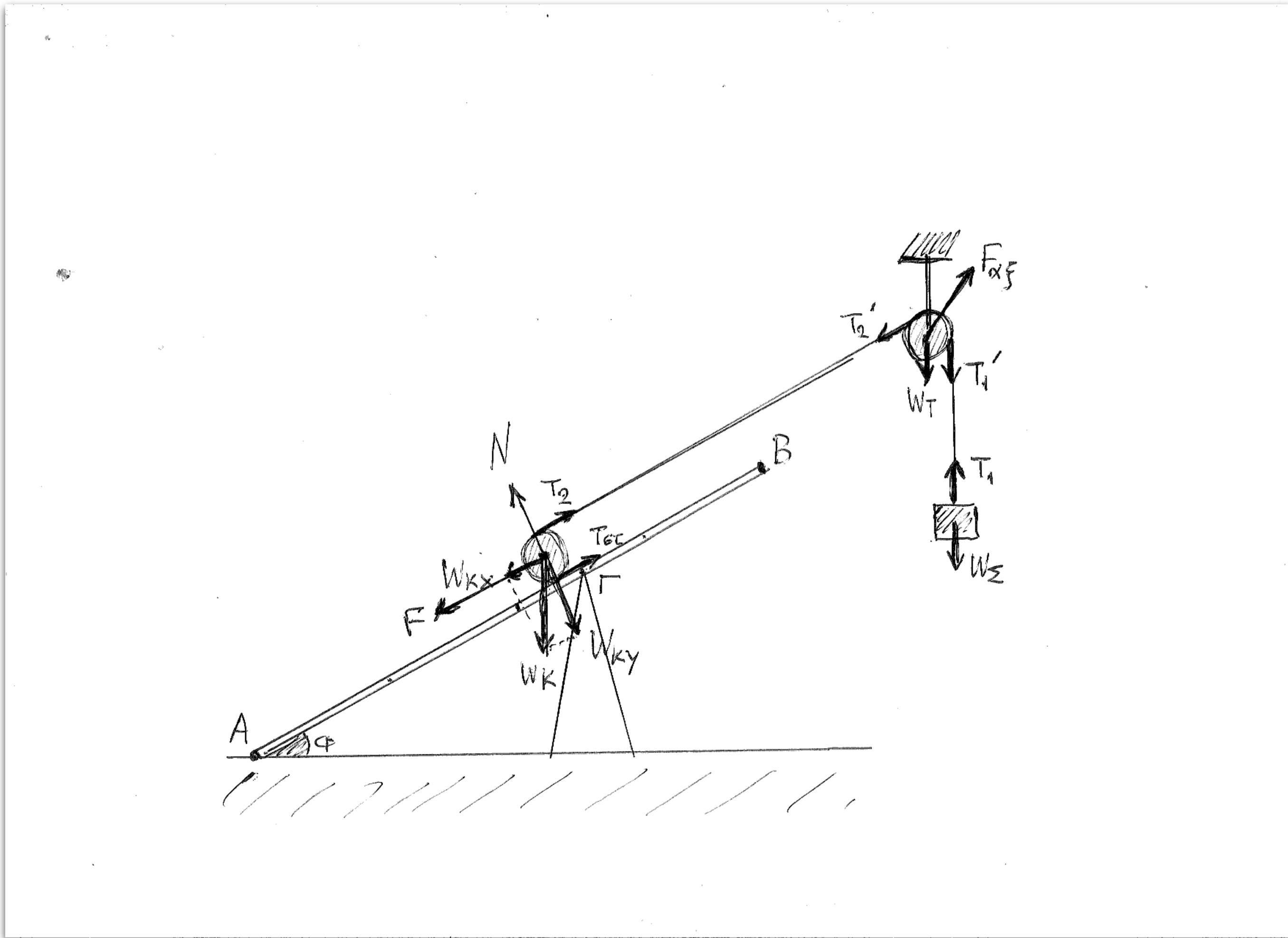
$$\eta\mu\varphi_o = \frac{1}{2} \Rightarrow \eta\mu\varphi_o = \eta\mu\frac{\pi}{6} \Rightarrow \varphi_o = \begin{cases} 2k\pi + \frac{\pi}{6}, & k = 0 \Rightarrow \varphi_o = \frac{\pi}{6} \quad \sigma\upsilon\nu\varphi_o > 0 \\ 2k\pi + \frac{5\pi}{6}, & k = 0 \Rightarrow \varphi_o = \frac{5\pi}{6} \quad \sigma\upsilon\nu\varphi_o < 0, \alpha\pi o\rho\rho\acute{\iota}\pi\tau\varepsilon\tau\alpha\iota \end{cases}$$

③

$$y = 0.1 \cdot \eta\mu(10t + \frac{\pi}{6}), \quad S.I.$$

①

Θέμα Δ



Δ1

$$M_{\Sigma},\quad \text{ισορροπία}, \Rightarrow \Sigma F = 0 \Rightarrow T_1 = \mathrm{M}_{\Sigma} \cdot g \Rightarrow T_1 = 20N$$

①

$$M_{T},\quad \text{ισορροπία}, \Rightarrow \Sigma \tau = 0 \Rightarrow T_1 \cdot R_T = T_1 \cdot R_T \Rightarrow T_2 = 20N$$

①

α)<u>τρόπος</u>

$$M_{K},\quad \text{ισορροπία}, \Rightarrow \Sigma \tau_{(K)} = 0 \Rightarrow T_2 \cdot R_K = T_{\sigma\tau} \cdot R_{\mathrm{K}} \Rightarrow T_2 = \mathrm{T}_{\sigma\tau}$$

$$\Sigma F = 0 \Rightarrow T_2 + \mathrm{T}_{\sigma\tau} = F + \mathrm{M}_{\mathrm{K}} \cdot g \cdot \eta\mu\varphi \Rightarrow 2T_2 = F + 10 \Rightarrow F = 30N$$

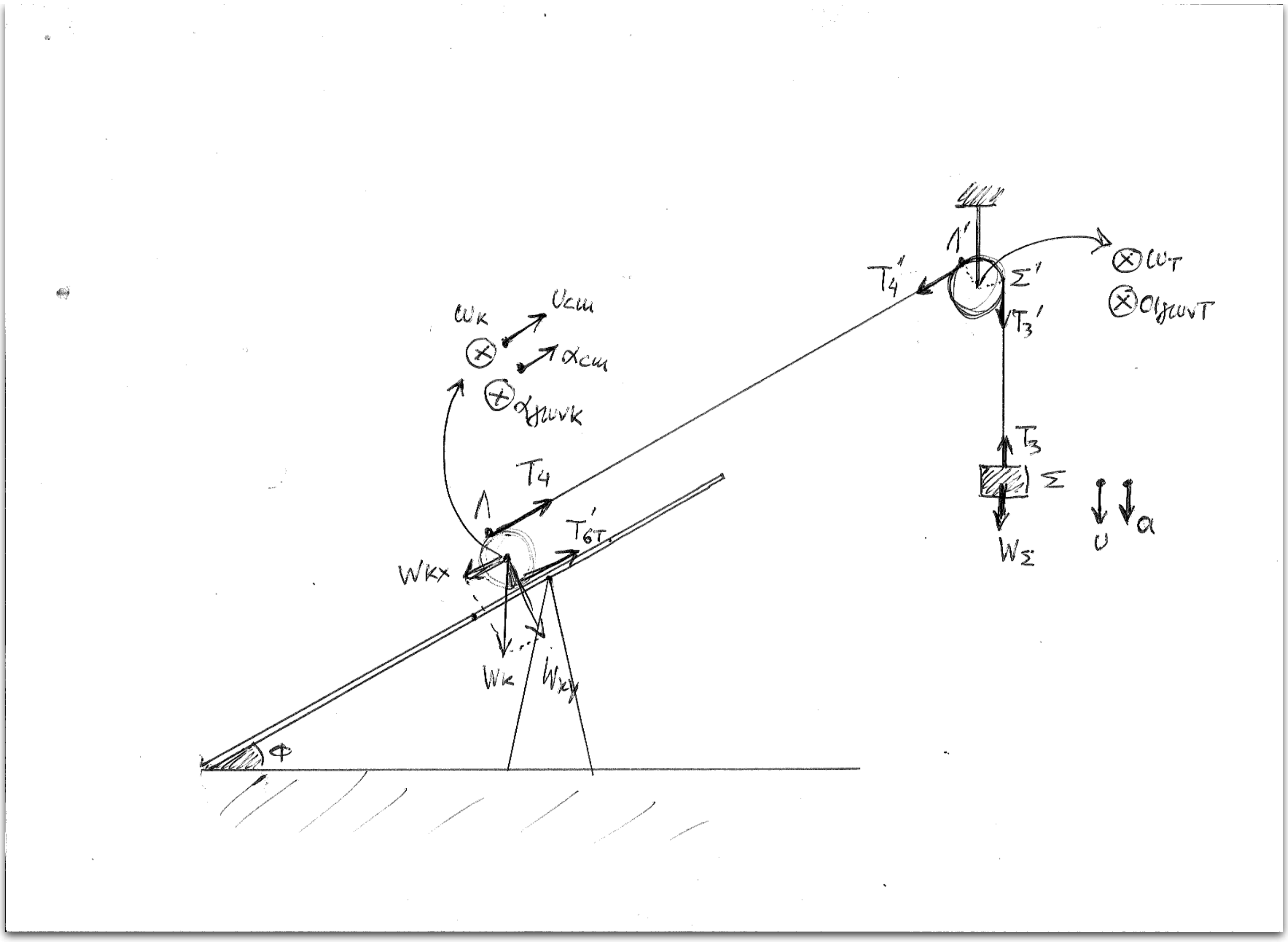
②

β)<u>τρόπος</u>

$$M_{K},\quad \text{ισορροπία}, \Rightarrow \Sigma \tau_{(\Delta)} = 0 \Rightarrow T_2 \cdot 2 \cdot R_K = (F + \mathrm{M}_{\mathrm{K}} \cdot g \cdot \eta\mu\varphi) \cdot R_K \Rightarrow 40 = F + 10 \Rightarrow F = 30N$$

②

Δ2



$$M_\Sigma : \quad ΜΕΤΑΦΟΡΙΚΗ$$

$$\Sigma F = \mathrm{M}_\Sigma \cdot g - T_3 = M_\Sigma \cdot \alpha_\Sigma \quad (1)$$

①

$$M_T : \quad ΣΤΡΟΦΙΚΗ$$

$$\Sigma\tau = \mathrm{I}_T \cdot \alpha_{\gamma\omega\nu_T} \Rightarrow T_3 \cdot R_T - T_4 \cdot R_T = \frac{1}{2} \cdot M_T \cdot R_T^2 \cdot \alpha_{\gamma\omega\nu_T} \Rightarrow T_3 - T_4 = \frac{1}{2} \cdot M_T \cdot R_T \cdot \alpha_{\gamma\omega\nu_T} \quad (2)$$

①

νήμα αβαρές, μη εκτατό

$$\alpha_\Sigma = \alpha'_\Sigma = \alpha_{\gamma\rho} = \alpha_{\gamma\omega\nu_T} \cdot R_T \quad (3)$$

①

$$(2)\Lambda(3) \Rightarrow T_3 - T_4 = \alpha_\Sigma \quad (4)$$

$$M_K : \quad ΜΕΤΑΦΟΡΙΚΗ$$

$$\Sigma F = \mathrm{M}_K \cdot \alpha_{cm}$$

$$T_4 + T_{\sigma\tau} - \mathrm{M}_K \cdot g \cdot \eta\mu\varphi = \mathrm{M}_K \cdot \alpha_{cm} \Rightarrow T_4 + T_{\sigma\tau} - 10 = 2 \cdot \alpha_{cm} \quad (5)$$

①

$$M_K : \quad ΣΤΡΟΦΙΚΗ$$

$$\Sigma\tau = I_K \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_4 \cdot R_K - T_{\sigma\tau} \cdot R_K = \frac{1}{2} \cdot M_K \cdot R_K^2 \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_4 - T_{\sigma\tau} = \frac{1}{2} \cdot M_K \cdot R_K \cdot \alpha_{\gamma\omega\nu_K}$$

$$\text{K.X.O.}\ \upsilon_A = 0 \Rightarrow \upsilon_{cm} = \omega \cdot R_K \Rightarrow \alpha_{cm} = \alpha_{\gamma\omega\nu_K} \cdot R_K$$

$$T_4 - T_{\sigma\tau} = \frac{1}{2} \cdot M_K \cdot R_K \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_4 - T_6 = \alpha_{cm} \quad (6)$$

①

νήμα αβαρές, μη εκτατό

$$\alpha_\Lambda = \alpha'_\Lambda = \alpha_{\gamma\rho} = \alpha_{\gamma\omega\nu_T} \cdot R_T$$

①

$$\upsilon_\Lambda = \upsilon_{cm} + \omega \cdot R_K \Rightarrow \upsilon_\Lambda = 2 \cdot \upsilon_{cm} \Rightarrow \alpha_\Lambda = 2 \cdot \alpha_{cm}$$

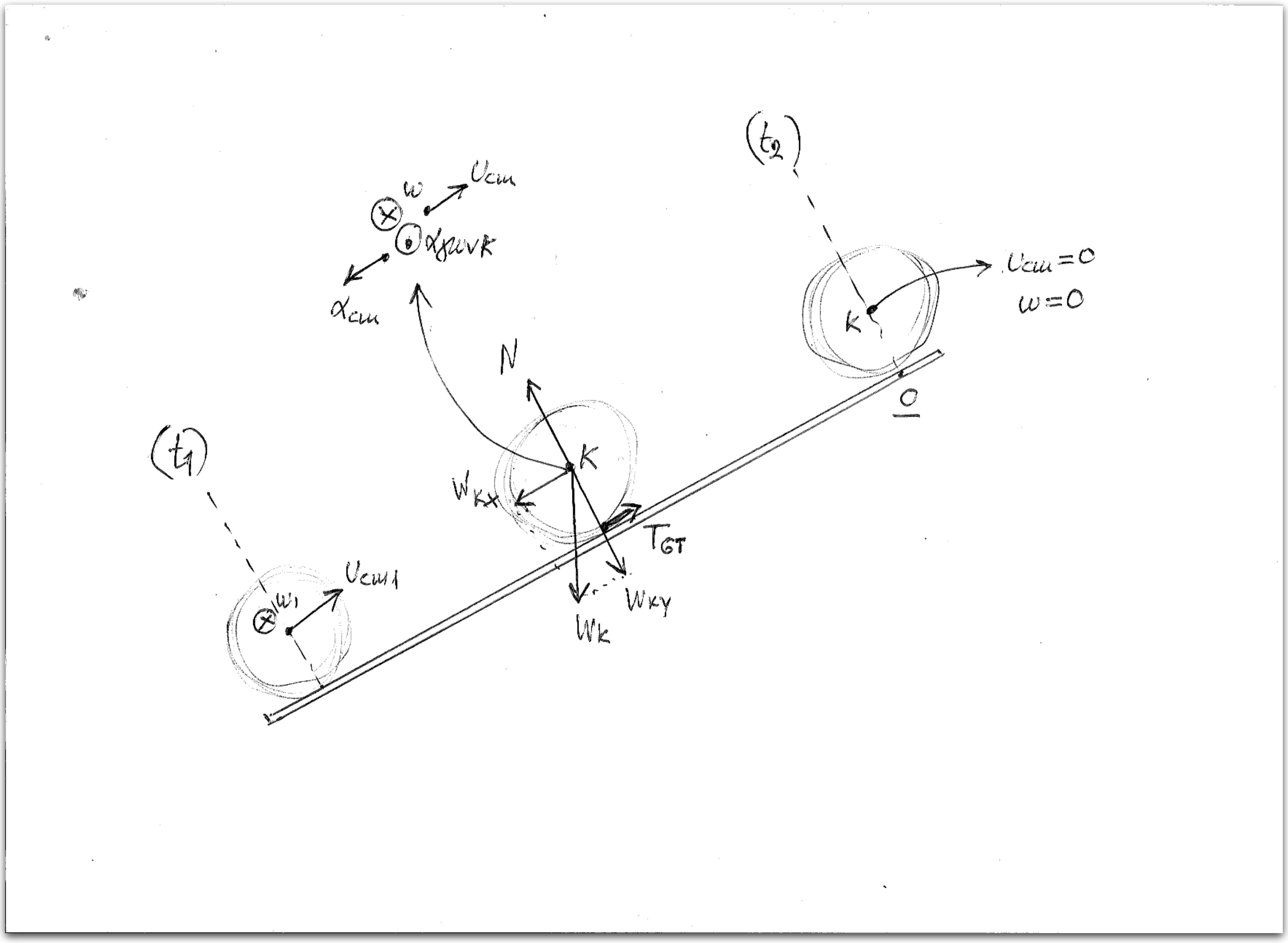
$$2 \cdot \alpha_{cm} = \alpha_{\gamma\omega\nu_T} \cdot R_T \Rightarrow 2 \cdot \alpha_{cm} = \alpha_\Sigma \quad (7)$$

①

Λύση του συστήματος $\alpha_\Sigma = 4\frac{m}{s^2}$

①

Δ3



$$M_K : \text{ΜΕΤΑΦΟΡΙΚΗ}, \quad 0 - t_1$$

$$\upsilon_{cm1} = \alpha_{cm} \cdot t_1 \Rightarrow \upsilon_{cm1} = 1\frac{m}{s}$$

①

$$M_K : \quad METAΦOPIKH$$

$$\Sigma F = M_K \cdot \alpha_{cm}$$

$$M_K \cdot g \cdot ημφ - T_{στ} = M_K \cdot \alpha_{cm} \Rightarrow 10 - T_{στ} = 2\alpha_{cm}, \text{επιβραδυνόμενη}$$

①

$$M_K : \quad ΣTPOΦIKH$$

$$\Sigma\tau = I_K \cdot \alpha_{γων_K} \Rightarrow T_{στ} \cdot R_K = \frac{1}{2} \cdot M_K \cdot R_K^2 \cdot \alpha_{γων_K} \Rightarrow T_{στ} = R_K \cdot \alpha_{γων_K} \Rightarrow T_{στ} = \alpha_{cm}, \text{επιβραδυνόμενη}$$

①

$$10 - \alpha_{cm} = 2 \cdot \alpha_{cm} \Rightarrow \alpha_{cm} = \frac{10}{3}\frac{m}{s^2}$$

①

$$\upsilon_{cm} = \upsilon_{cm1} - \alpha_{cm} \cdot \Delta t \Rightarrow 0 = 1 - \frac{10}{3} \cdot \Delta t \Rightarrow \Delta t = 0.3s$$

$$t_2 = t_1 + \Delta t \Rightarrow t_2 = 0.8s$$

②

Δ4

$$M_K : METAΦOPIKH, \quad 0 - t_1$$

$$x_{cm1} = \frac{1}{2} \cdot \alpha_{cm} \cdot t_1^2 \Rightarrow x_{cm1} = 0.25m$$

①

$$M_K : METAΦOPIKH, \quad t_1 - t_2$$

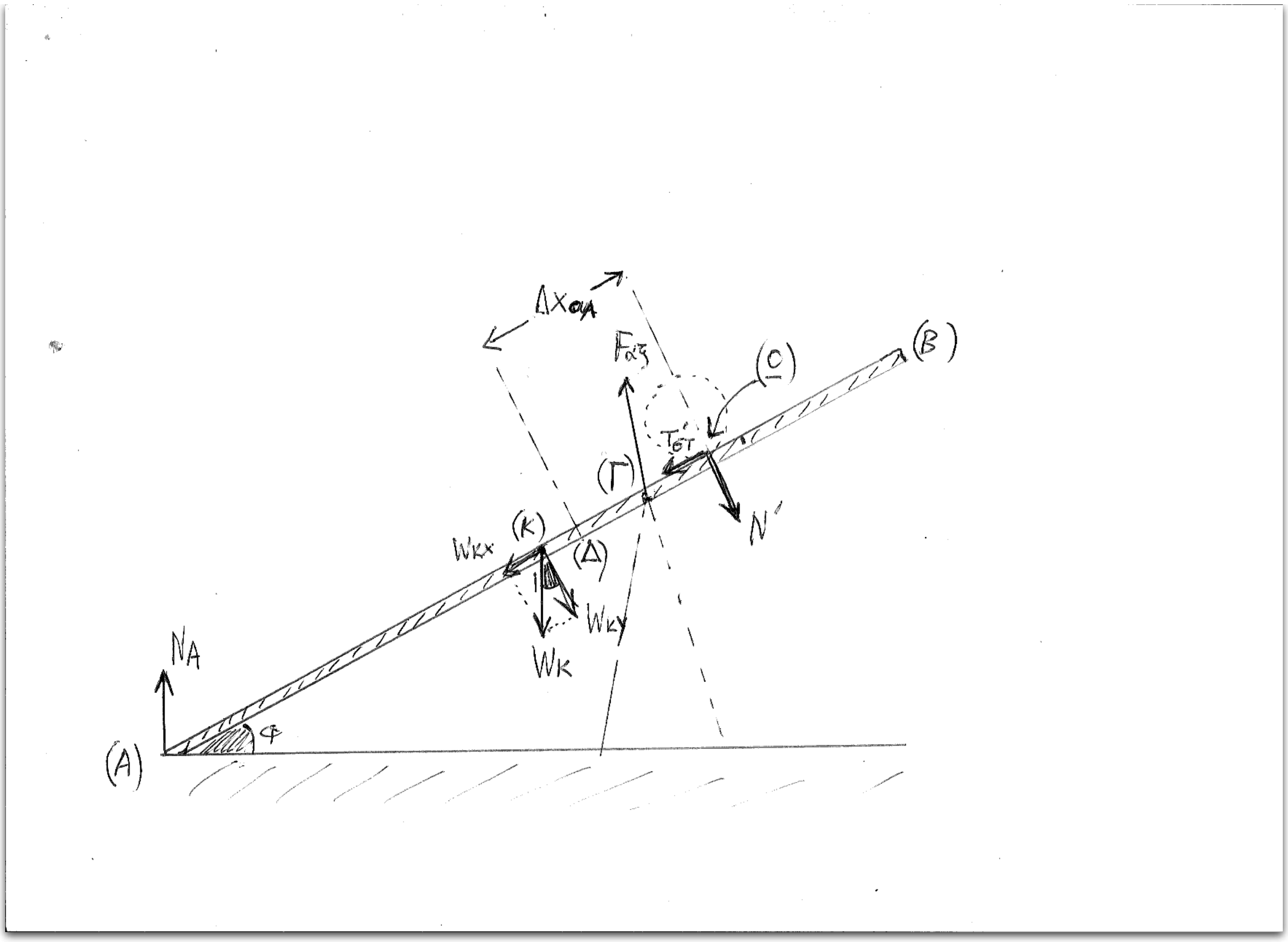
$$\Delta x_{cm} = \upsilon_{cm1} \cdot \Delta t - \frac{1}{2} \cdot \alpha_{cm} \cdot \Delta t^2 \Rightarrow \Delta x_{cm} = 0.15m$$

①

$$x_{ολ} = x_{cm1} + \Delta x_{cm} \Rightarrow x_{ολ} = 0.4m$$

①

Δ5



$$(\Gamma\Delta) = 0.2m, \quad (\mathrm{K}\Gamma) = 0.5m, \quad (\Gamma\Omega) = x_{o\lambda} - (\Gamma\Delta) \Rightarrow (\Gamma\Omega) = 0.2m$$

①

$$|\tau_{W_\rho}| = \mathrm{M}_\rho \cdot g \cdot \sigma\upsilon\nu\varphi \cdot (\mathrm{K}\Gamma) \Rightarrow |\tau_{W_\rho}| = 5\sqrt{3}N \cdot m$$

①

$$|\tau'_N| = \mathrm{M}_\rho \cdot g \cdot \sigma\upsilon\nu\varphi \cdot (\mathrm{K}\Gamma) \Rightarrow |\tau'_N| = 2\sqrt{3}N \cdot m$$

①

$$|\tau_{W_\rho}| > |\tau'_N|$$

άρα η σανίδα δεν ανατρέπεται

①

Μπορείτε να εκτυπώσετε τις λύσεις σε μορφή pdf από εδώ και τα θέματα από εδώ