Διαγώνισμα *Γ Τάξης Ενιαίου Λυκείου*

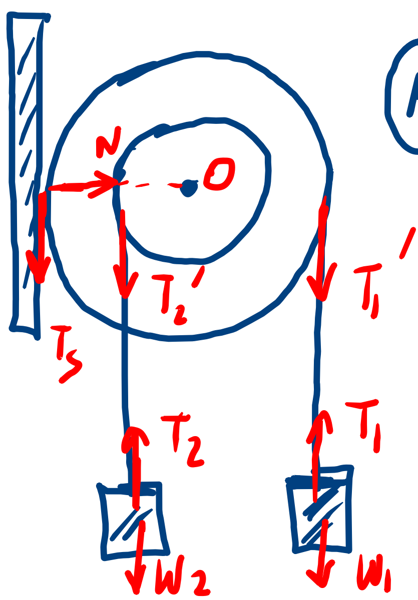
Κρούσεις - Μηχανική Στερεού Σώματος

Σύνολο Σελίδων: Δέκα (10) - Διάρκεια Εξέτασης: 3 ώρες

Σάββατο 27 Ιουλίου 2024

Θέμα Α → (δ), (γ), (δ), (γ) / Σ, Λ, Λ, Λ, Σ

Β.1 → Α: (γ) / Β: (γ)



(Α) για το Σ_1 : $\Sigma F = 0 \Rightarrow T_1 = m_1 g = 2mg$

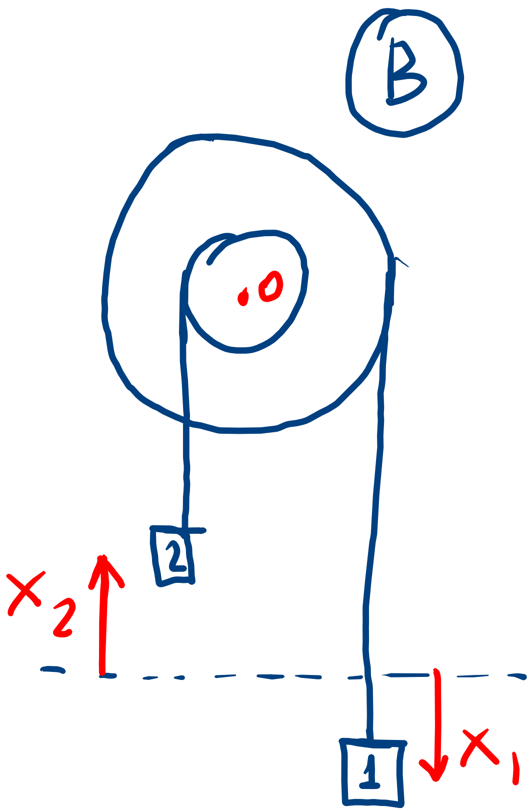
για το Σ_2 : $\Sigma F = 0 \Rightarrow T_2 = m_2 g = mg$

αβαρές μη εκτατό νήμα } $T_1 = T_1'$ και $T_2 = T_2'$

για την τροχαλία : $\Sigma\tau_{(O)} = 0 \Rightarrow -T_1'\cdot 2R + T_2'\cdot R + T_s\cdot 2R = 0$

$$2T_s = 2T_1' - T_2' = 2\cdot 2mg - mg$$

$$2T_s = 3mg \Rightarrow \underline{T_s = 3mg/2}$$



Η κατακόρυφη απόσταση θα είναι ίση με

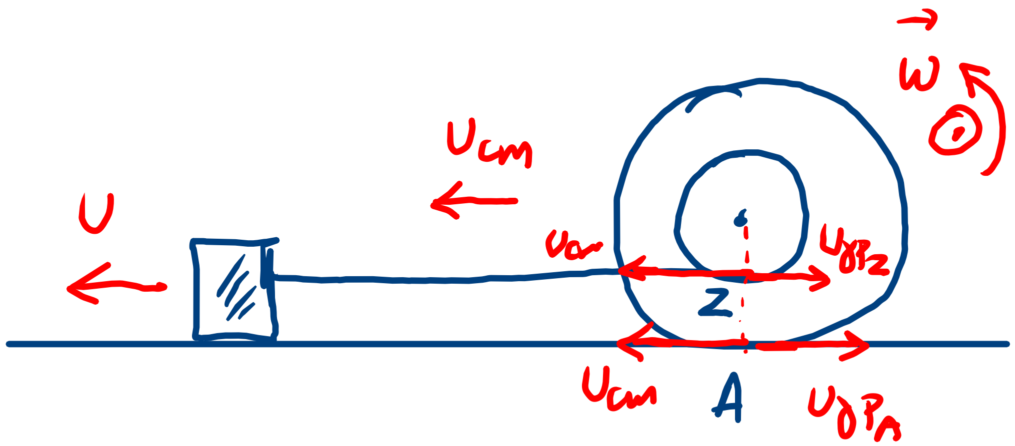
$d = x_1 + x_2$. Αφού τα νήματα δεν ολισθαίνουν

$x_1 = R_1\theta$ και $x_2 = R_2\theta$

Άρα $d = 2R\theta + R\theta = 3R\theta = 3\cdot R\cdot N\cdot 2\pi$

$$\Rightarrow \underline{d = 6NR\pi}$$

B.2 → (γ)



$$K.X.O \Rightarrow \upsilon_A = 0$$

$$\Rightarrow \upsilon_{cm} - \upsilon_{\gamma\rho_A} = 0 \Rightarrow$$

$$\underline{\upsilon_{cm} = \omega \cdot R}$$

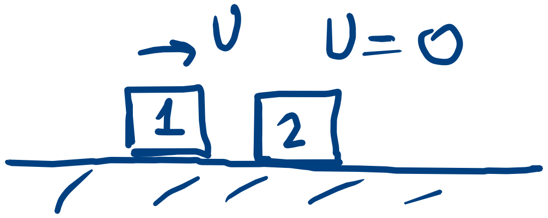
Αφού το νήμα είναι τεντωμένο και δεν ολισθαίνει στην εγκοπή

$$\upsilon = \upsilon_Z \Rightarrow \upsilon = \upsilon_{cm} - \upsilon_{\gamma\rho_Z} \Rightarrow \upsilon = \upsilon_{cm} - \omega \cdot r$$

$$\overset{(1)}{\Rightarrow} \upsilon = \omega R - \omega \frac{R}{2} \Rightarrow \upsilon = \frac{\omega R}{2}$$

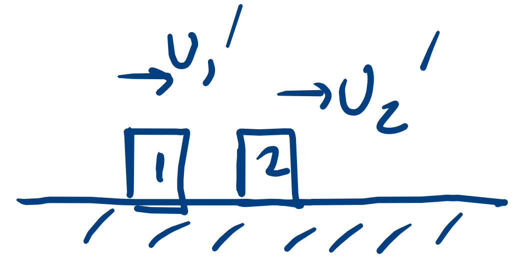
$$a = \frac{d\upsilon}{dt} = \frac{R}{2}\frac{d\omega}{dt} \Rightarrow a = a_{\gamma\omega\nu} \cdot \frac{R}{2} \Rightarrow a_{\gamma\omega\nu} = \frac{2a}{R}$$

B.3 → (β)



(πριν)

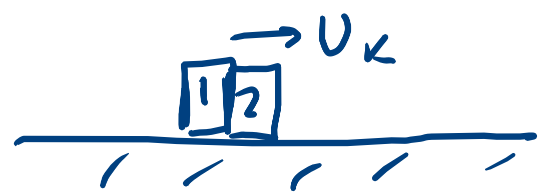
✓ ελαστική



(μετά)

$$\upsilon_2' = \frac{2m_1}{m_1+m_2}\upsilon \quad (1) \quad \text{και} \quad K_2 = \frac{1}{2} m_2 \upsilon_2'^2$$

✓ πλαστική



(μετά)

ΑΔΟ $\vec{p}_{ολ}^{\,πριν} = \vec{p}_{ολ}^{\,μετά} \Rightarrow m_1 \upsilon = (m_1+m_2)\upsilon_K \Rightarrow$

$$\upsilon_K = \frac{m_1 \upsilon}{m_1+m_2} \quad (2)$$

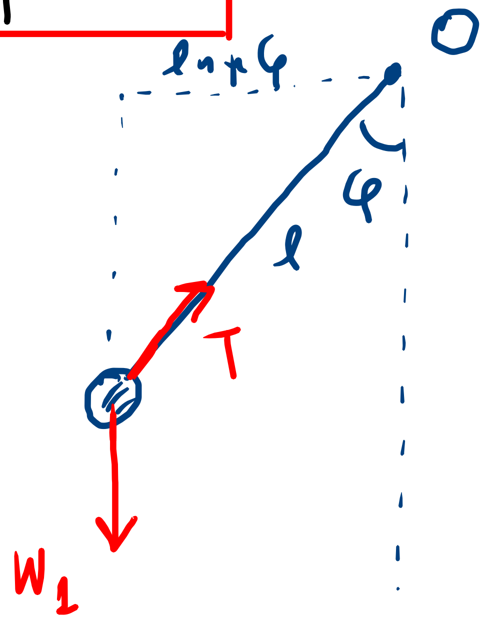
Από (1),(2) $\Rightarrow$ $\underline{\upsilon_2' = 2\upsilon_K}$

$$K = \frac{1}{2}(m_1+m_2)\upsilon_K^2 = K_2 \Rightarrow \frac{1}{2}(m_1+m_2)\upsilon_K^2 = \frac{1}{2} m_2 (2\upsilon_K)^2$$

$$\Rightarrow m_1 + m_2 = 4m_2 \Rightarrow m_1 = 3m_2 \Rightarrow \frac{m_1}{m_2} = 3$$

Θέμα Γ

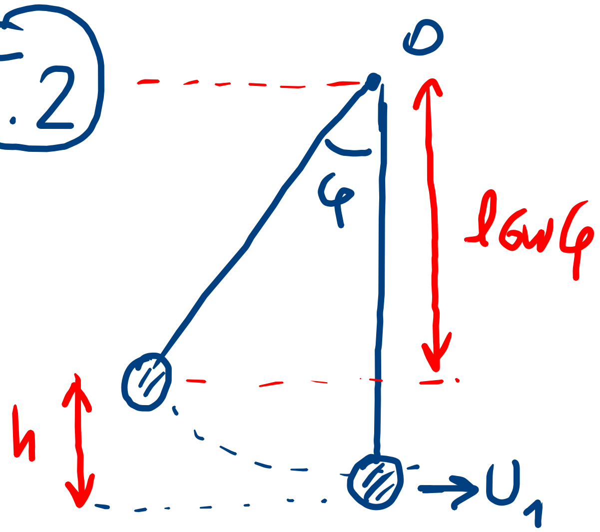
Γ.1



$$\frac{dL}{dt} = \Sigma\tau_{(O)} = \tau_{w_1(O)} + \cancel{\tau_{T(O)}}^{\,0}$$

$$= m_1 g \cdot l\eta\mu\varphi \Rightarrow \frac{dL}{dt} = 8\sqrt{3}\ kg\cdot m^2/s^2$$

Γ.2

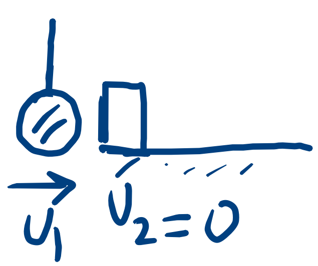


ΘΜΚΕ για την κάθοδο $\quad \Delta K = \Sigma W = W_w + \cancel{W_T}^{\,0}$

$$\frac{1}{2} m_1 v_1^2 - 0 = m_1 g h \Rightarrow v_1 = \sqrt{2gh}$$

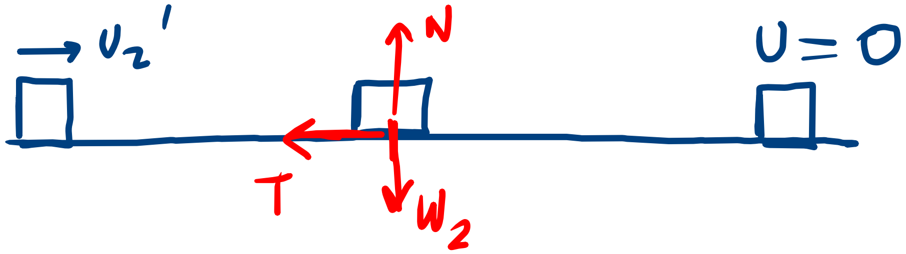
$$h = l - l\sigma\upsilon\nu\varphi = \frac{l}{2} \quad \Rightarrow v_1 = 4\,m/s$$

Γ.3



Κεντρική ελαστική

$$v_2' = \frac{2 m_1 v_1}{m_1 + m_2} \Rightarrow v_2' = 2\,m/s$$



θηκε κατα την ολισθηση

$$\Delta K = W_T + W_N^{\nearrow 0} + W_w^{\nearrow 0}$$

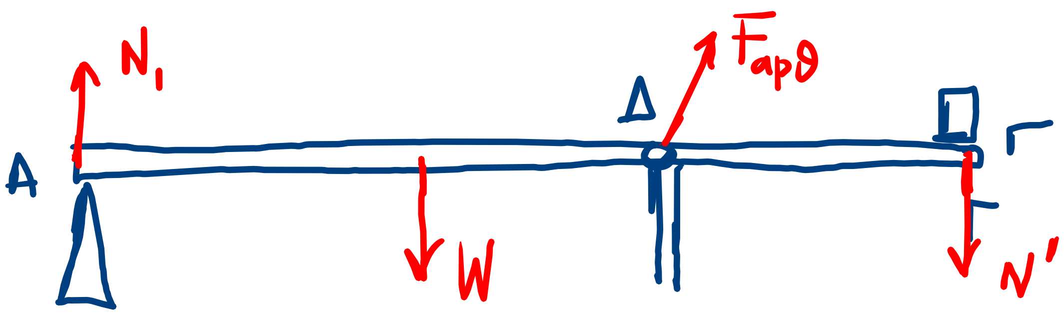
$$0 - \frac{1}{2} m_2 \upsilon_2'^2 = - T \cdot S' = - \mu m_2 g \cdot S'$$

$$\Sigma F_y = 0 \Rightarrow N = m_2 g$$

$$T = \mu N$$

$$\Rightarrow \underline{\underline{S' = 1m}}$$

Γ.4 Το Σ_2 σταματάει στο άκρο Γ της δοκού



Η δοκός ισορροπεί

$$\Sigma \tau_{(\Delta)} = 0$$

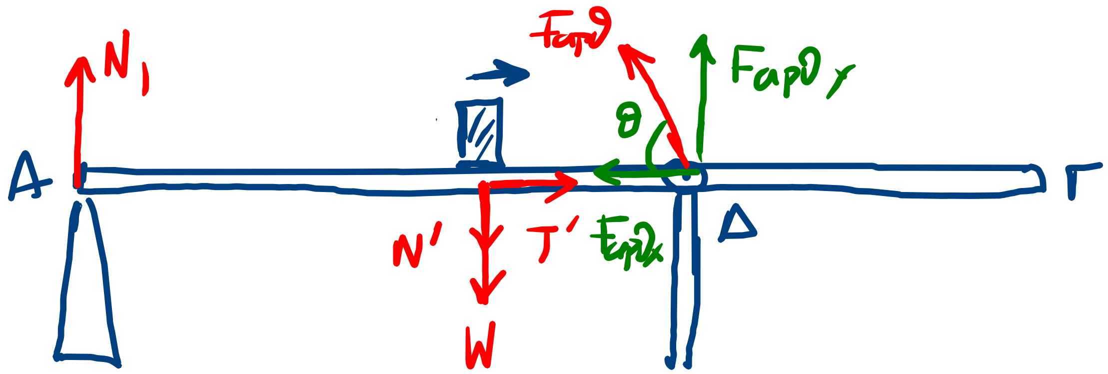
$N' = N = m_2 g$

$$\Rightarrow -N' \cdot (\Delta\Gamma) + 0 + Mg \cdot \left(\frac{L}{2} - (\Delta\Gamma)\right) - N_1 \cdot (L - (\Delta\Gamma)) = 0$$

Δεν ανατρέπεται όσο $N_1 \geq 0$ } οριακά $N_1 = 0$ } $N' \cdot (\Delta\Gamma) = Mg\left(\frac{L}{2} - (\Delta\Gamma)\right)$

$$\Rightarrow \underline{\underline{M = 3kg}}$$

Γ.5



$T' = T = \mu N$ Δράση

$N' = N$ Αντίδραση

Δοκός ισορροπεί

$$\Sigma\tau_{(\Delta)} = 0 \Rightarrow -N_1(l - \Delta\Gamma) + (N' + W)\left(\frac{l}{2} - \Delta\Gamma\right) + 0 + 0 = 0$$

$$\Rightarrow N_1 = 20N$$

$$\Sigma F_x = 0 \Rightarrow F_{αρθx} = T' = 6\,N$$

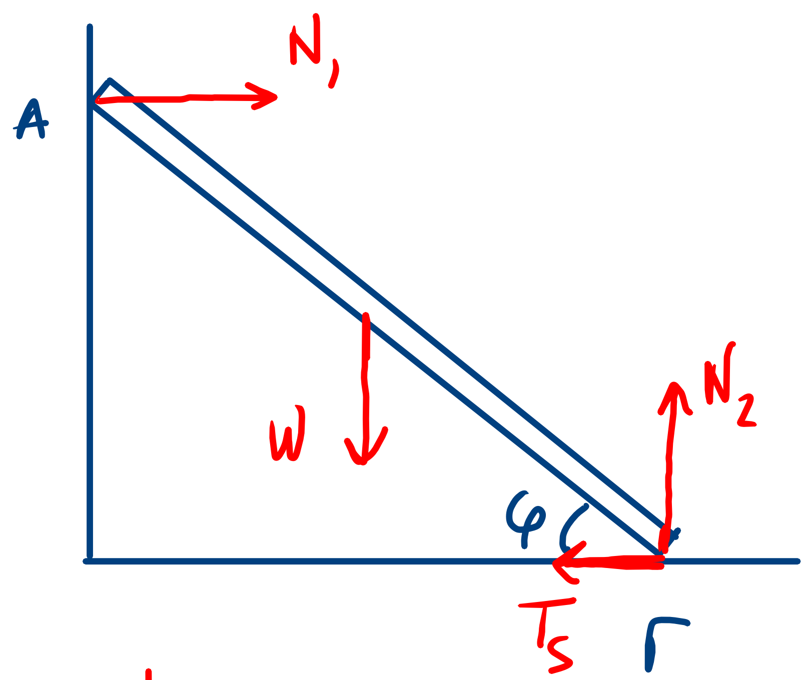
$$\Sigma F_y = 0 \Rightarrow F_{αρθy} + N_1 = N' + W \Rightarrow F_{αρθy} = 40N$$

άρα $F_{αρθ} = \sqrt{F_{αρθx}^2 + F_{αρθy}^2} = \sqrt{1636} \Rightarrow F_{αρθ} \simeq 40{,}45\,N$

$$\varepsilon\varphi\theta = \frac{F_{αρθy}}{F_{αρθx}} = \frac{20}{3}$$

Θέμα Δ

Δ.1



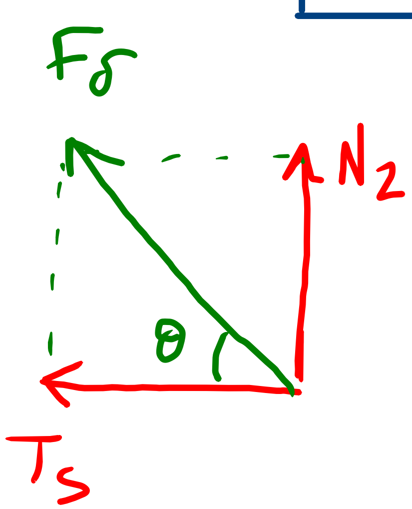
Ισορροπία σανίδας

$$\Sigma\tau_{(\Gamma)}=0 \Rightarrow -N_1 L\,\eta\mu\varphi + Mg\frac{L}{2}\,\sigma\upsilon\nu\varphi = 0$$

$$\Rightarrow \underline{N_1 = 10N}$$

$$\Sigma F_x = 0 \Rightarrow T_s = N_1$$

$$\Sigma F_y = 0 \Rightarrow N_2 = w = Mg$$



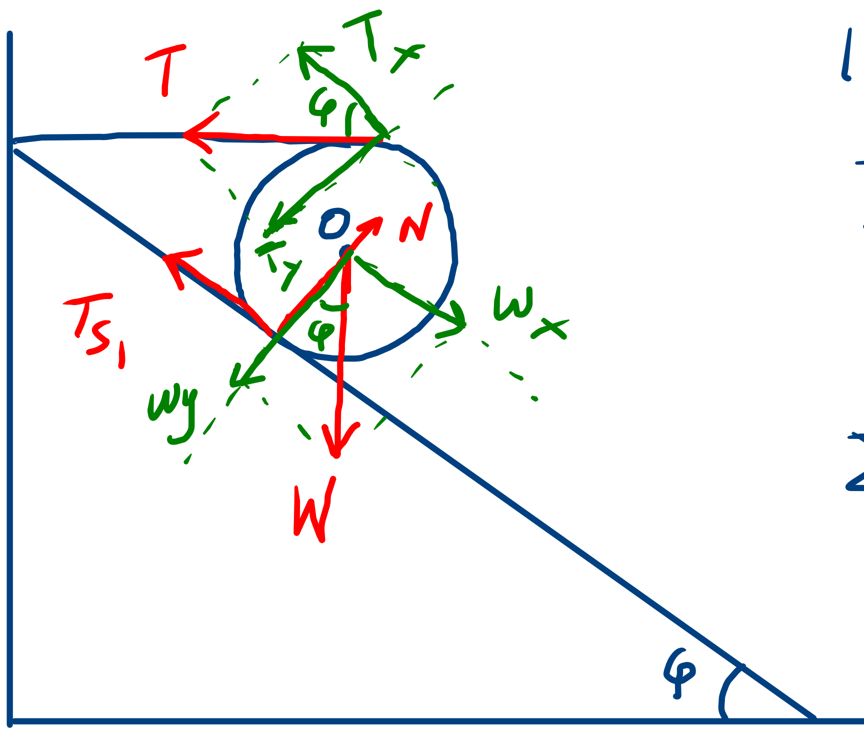
$$F_\delta = \sqrt{N_2^2 + T_s^2} \Rightarrow \underline{F_\delta = 10\sqrt{5}\,N} \text{ και } \varepsilon\varphi\theta = \frac{N_2}{T_s} = 2$$

Δ.2 Δεν ολισθαίνει

$$T_s \le T_{s(max)} \Rightarrow T_s \le \mu_s N_2$$

$$\Rightarrow \mu_s \ge 0,5 \Rightarrow \underline{\mu_{s(min)} = 0,5}$$

Δ.3



Ισορροπία δίσκου

$\Sigma\tau_{(O)}=0 \Rightarrow T\cdot R - T_{s_1}R = 0$

$\Rightarrow T = T_{s_1}$

$\Sigma F_x = 0 \Rightarrow T_x + T_{s_1} = w_x$

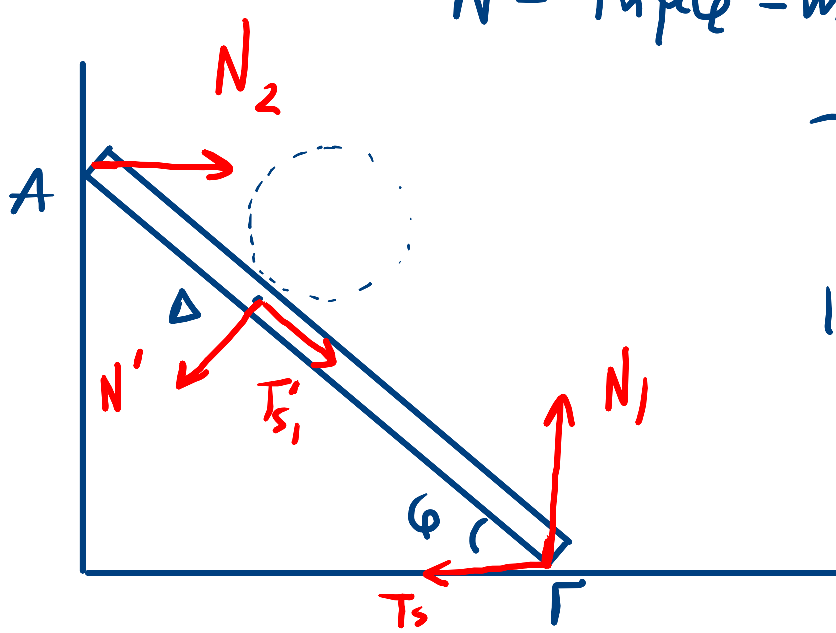
$T\cdot \sigma\upsilon\nu\varphi + T_{s_1} = mg\,\eta\mu\varphi$

$\xRightarrow{T=T_{s_1}} T_{s_1} = \frac{20}{3} N$

$\Sigma F_y = 0 \Rightarrow N - T_y - w_y = 0$

$N - T\eta\mu\varphi - mg\,\sigma\upsilon\nu\varphi = 0 \Rightarrow N = 20N$

Δ.4



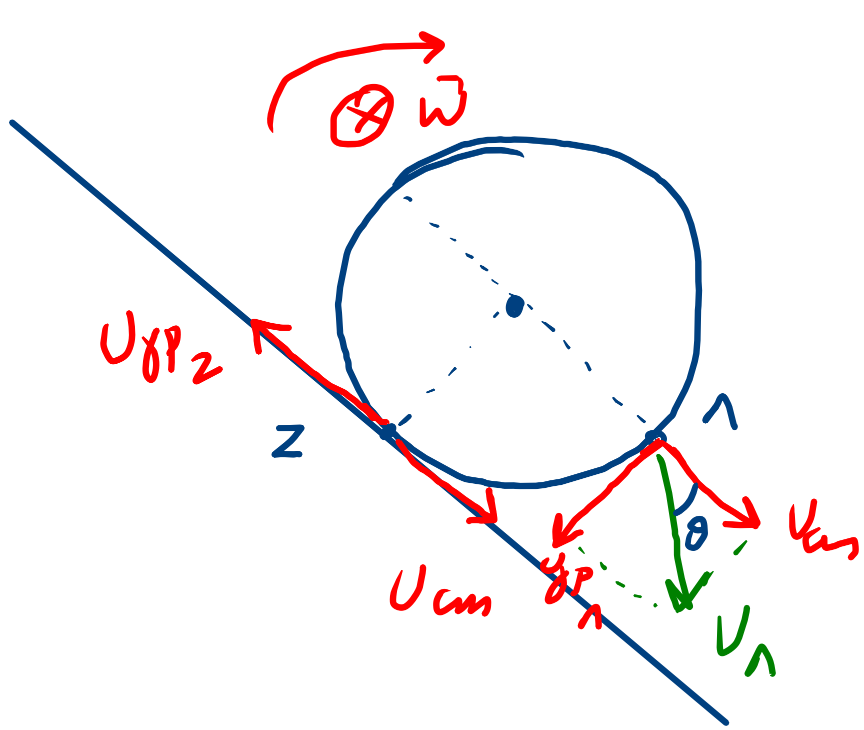
$T_{s_1}' = T_{s_1}$ / $N' = N$ (δράση - αντίδραση)

Ισορροπία σανίδας } $\Sigma\tau_{(\Gamma)} = 0 \Rightarrow$

$-N_2\cdot L\eta\mu\varphi + N'(\Delta\Gamma) + Mg\frac{L}{2}\sigma\upsilon\nu\varphi = 0$

$N_2 = \frac{115}{3} N$

Δ.5



Κ.Χ.Ο. $\quad u_Z = 0$

$$u_{cm} - u_{\gamma\rho_Z} = 0 \Rightarrow \underline{u_{cm} = \omega R}$$

$$u_\Lambda = \sqrt{u_{cm}^2 + u_{\gamma\rho_\Lambda}^2}$$

$$u_\Lambda = \sqrt{u_{cm}^2 + (\omega R)^2} = \sqrt{2}\cdot u_{cm}$$

$$\Rightarrow u_\Lambda = \sqrt{2}\cdot a_{cm}\cdot t_1$$

$$u_\Lambda = 4\sqrt{2}\ m/s$$

και $\varepsilon\varphi\theta = \dfrac{\omega R}{u_{cm}} = 1$

perifysikhs.com