ΕΠΩΝΥΜΟ: .....
ΟΝΟΜΑ .....
ΤΜΗΜΑ .....
ΗΜΕΡΟΜΗΝΙΑ: .....
ΜΑΘΗΜΑ: .....

Θέμα Α'

A_1 (δ).

A_2 (δ)

A_3 (γ)

A_4 (β)

A_5. α. Λ
β. Λ.
γ. Σ.
δ. Σ.
ε. Λ.

ΕΠΩΝΥΜΟ:
ΟΝΟΜΑ:
ΤΜΗΜΑ:
ΗΜΕΡΟΜΗΝΙΑ:
ΜΑΘΗΜΑ:

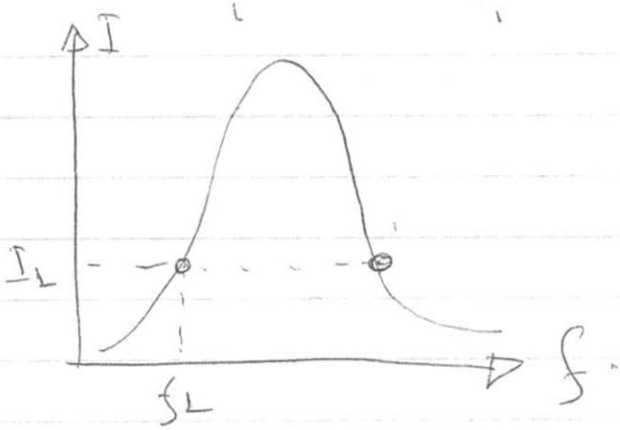
Θεμα Β.

B_1] Γνωριζουμε ότι η $f_0 = \frac{1}{2\pi\sqrt{LC}}$

άρα σε αυτην την ονχνότητα θα γινεται συντονισμός.

Εχουμε όμως $f_L = \frac{1}{4\pi\sqrt{LC}} < \frac{1}{2\pi\sqrt{LC}}$.

άρα την γραφική παράσταση



(ii) Σωστο.

B_2.]

$$\frac{K_\mu}{K_{ol}} = \frac{5}{7} \Rightarrow$$

$$\frac{K_\mu}{K_\mu + K_n} = \frac{5}{7} \rightarrow 7K_\mu = 5K_\mu + 5K_n \Rightarrow$$

$$\Rightarrow 2K_\mu = 5K_n \Rightarrow 2 \cdot \frac{1}{2} m v_{cm}^2 = 5 \cdot \frac{1}{2} I_{cm} \omega^2 \Rightarrow$$

$$\Rightarrow 2 m v_{cm}^2 = 5 \cdot a \cdot m R^2 \omega^2 \Rightarrow \text{(επειδη κυλησ χωρις ολισθ)}$$

$$\Rightarrow 2 v_{cm}^2 = 5 a R^2 \omega^2 \Rightarrow a = \frac{2}{5}$$

σωστ iii)

$y = 5\sin 2\pi t$ $\quad \omega = 2\pi f \Rightarrow 2\pi = 2\pi f \Rightarrow f = 1\,Hz$ (4)

B_3].

$$v_k = \lambda f \Rightarrow 1 = \lambda \cdot 1 \Rightarrow \lambda = 1\,m.$$

ο χρόνος για να φτάσει κύμα το σημείο B

$$x_B = v_k t_{αφ} \Rightarrow 1 = 1 \cdot t_{αφ} \Rightarrow t_{αφ} = 1\,sec.$$

άρα $t_1 = 9,5\,sec$ δηλ έχει φτάσει το κύμα στο B

άρα $y_1 = 0\,m$

και $v_2 = \omega \cdot A \cdot \sigma\upsilon\nu 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) =$

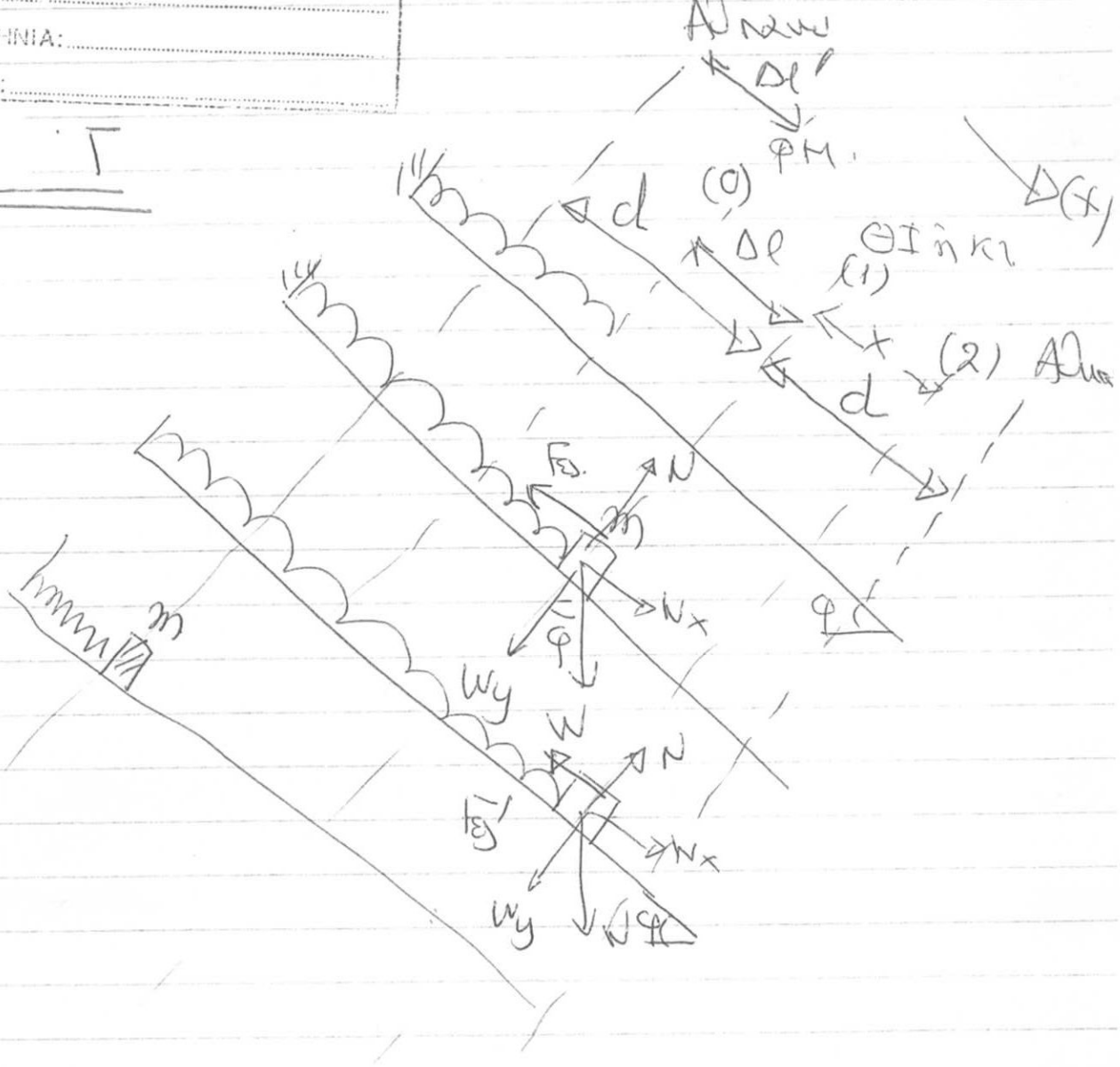
$$= 2\pi \cdot \frac{5}{100} \cdot \sigma\upsilon\nu 2\pi\left(\frac{2}{1} - \frac{1}{1}\right) =$$

$$= \frac{10\pi}{100} \cdot \sigma\upsilon\nu 2\pi = 0,1\pi\,m/s.$$

δηλ. (ii)

ΕΠΩΝΥΜΟ:
ΟΝΟΜΑ:
ΤΜΗΜΑ:
ΗΜΕΡΟΜΗΝΙΑ:
ΜΑΘΗΜΑ:

Θεμα Γ



α) Θεμ (1) $\vec{\Sigma F_x} = 0 \Rightarrow$ $W_x - F_{ελ} = 0 \Rightarrow W_x - kΔl = 0$.

Θεμ (2) $\Sigma F_x = W_x - F_{ελ}' = W_x - k(Δl + x) =$

$= \underbrace{W_x - kΔl}_{0} - k \cdot x =$

$= -k \cdot x$ άρα α.α.τ

$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{200}{2}} = \sqrt{100} = 10\ rad/s$ $\quad \omega = 2\pi f \Rightarrow f = \frac{\omega}{2\pi} = \frac{10}{2\pi} = 5/\pi\ Hz$

Γ2). $\frac{K}{E} = \frac{1}{4} \Rightarrow K = \frac{E}{4}$

ΑΔΕΤ $K + U = E \Rightarrow \frac{E}{4} + U = E \Rightarrow U = \frac{3}{4}E$

$\Rightarrow \frac{1}{2}Kx^2 = \frac{3}{4}\frac{1}{2}Kd^2 \Rightarrow x^2 = \frac{3}{4}d^2 \Rightarrow$

$\Rightarrow x = \pm\frac{\sqrt{3}}{2}d \Rightarrow x = \pm\frac{\sqrt{3}}{2}0{,}1\,m.$

Γ3) $\frac{F_{ελ}}{F_{επαν}} = \frac{\frac{1}{2}K\,\Delta l'^2}{\frac{1}{2}K\,x'^2} = \frac{(d-\Delta l_1)^2}{d^2} = \left(\frac{d-\Delta l_1}{d}\right)^2 = \left(\frac{0{,}1-0{,}05}{0{,}1}\right)^2 = \left(\frac{0{,}05}{0{,}1}\right)^2 = \frac{1}{4}.$

στην ΘΙ η κ.τ $\Sigma F_x = 0 \Rightarrow F_{ελ} = W_x \Rightarrow K\Delta l = mg\eta\nu\varphi.$

$\Rightarrow 200\,\Delta l = 2 \cdot 10 \cdot \frac{1}{2} \Rightarrow \Delta l = \frac{10}{200}\,m. = 0{,}05\,m$

Γ4) $t=0$
$x=0$

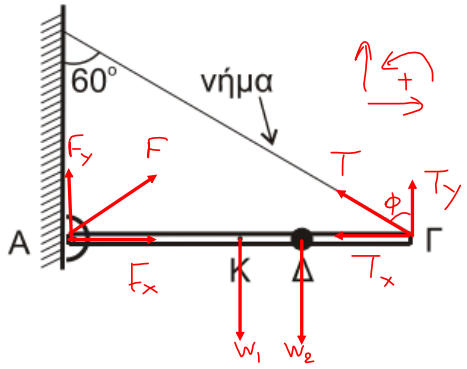
στο πρώτο σκέλος Φ.Μ
δηλ. έχει $x = \Delta l = 0{,}05\,m.$
και $U > 0$.

$\sigma\upsilon\nu\varphi = \frac{0{,}05}{0{,}1} = \frac{1}{2} \Rightarrow \varphi = 60^\circ$ ή $\frac{\pi}{3}$ rad

άρα $\Delta\theta = \frac{\pi}{2} - \frac{\pi}{3} = \frac{\pi}{6}$ rad.

$\omega = \frac{\Delta\theta}{\Delta t} \Rightarrow \Delta t = \frac{\Delta\theta}{\omega} \Rightarrow \Delta t = \frac{\frac{\pi}{6}}{10} \Rightarrow \Delta t = \frac{\pi}{60}\,sec$

άρα την $t = \frac{\pi\,sec}{60}$ για πρώτη.



Δ.1. $I_{(A)}^{\text{ολ}} = I_{(A)}^{\text{ραβδ}} + I_{(A)}^{m} = 30\ \text{kg}\cdot\text{m}^2$

Θ. Steiner: $I_{(A)}^{\text{ραβδ}} = I_{cm} + M(AK)^2$

$\Rightarrow I_{(A)}^{\rho} = \frac{1}{12}M\ell^2 + \frac{1}{4}M\ell^2 = \frac{1}{3}M\ell^2 = 18\ \text{kg}\,\text{m}^2$

$I_{(A)}^{m} = m(A\Delta)^2 = m\left(\frac{2\ell}{3}\right)^2 = \frac{4}{9}m\ell^2 = 12\ \text{kg}\,\text{m}^2$

Δ2 Ισορροπία: $\Sigma\tau_{(A)} = 0 \Rightarrow T_y(A\Gamma) - W_1(AK) - W_2(A\Delta) = 0$

$\Rightarrow T\eta\mu 60^\circ \cdot \ell - Mg\frac{\ell}{2} - mg\frac{2\ell}{3} = 0 \Rightarrow$

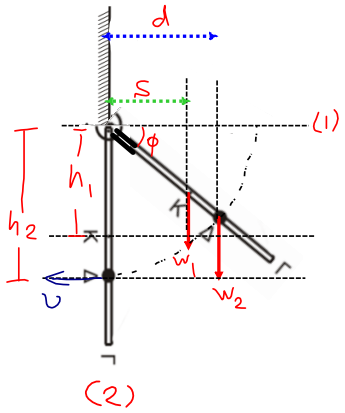
$T = 100\,\text{N}$

$\Sigma F_x = 0 \Rightarrow F_x - T_x = 0 \Rightarrow F_x = T\sigma\upsilon\nu 60^\circ$

$F_x = 50\sqrt{3}\,\text{N}$

$\Sigma F_y = 0 \Rightarrow F_y - W_1 - W_2 = 0 \Rightarrow F_y = 90\,\text{N}$

$F = \sqrt{F_x^2 + F_y^2} \Rightarrow F = 160\,\text{N}$



Δ3. ΘΝΣΚ

$$\sum_{(A)} \tau = I_{(A)} \cdot \alpha_y \Rightarrow$$

$$\alpha_y = \frac{w_1 s + w_2 d}{I_{(A)}} \Rightarrow$$

$$\alpha_y = \frac{Mg\frac{\ell}{2}\sin\varphi + mg\frac{2\ell}{3}\sin\varphi}{I_{(A)}}$$

$$\Rightarrow \alpha_y = 1{,}5 \ m/s^2$$

Δ.4 . Θ.Ε.Ε (1) → (2)

$$K_2 - K_1 = W_{w_1} + W_{w_2} \Rightarrow$$

$$\frac{1}{2} I_{(A)} \omega_2^2 = Mg\frac{\ell}{2} + mg\frac{2\ell}{3} \Rightarrow$$

$$\omega^2 = 10 \Rightarrow \omega = \sqrt{10} \ rad/s$$

άρα $\upsilon = \omega \frac{2\ell}{3} = 2\sqrt{10} \ m/s$