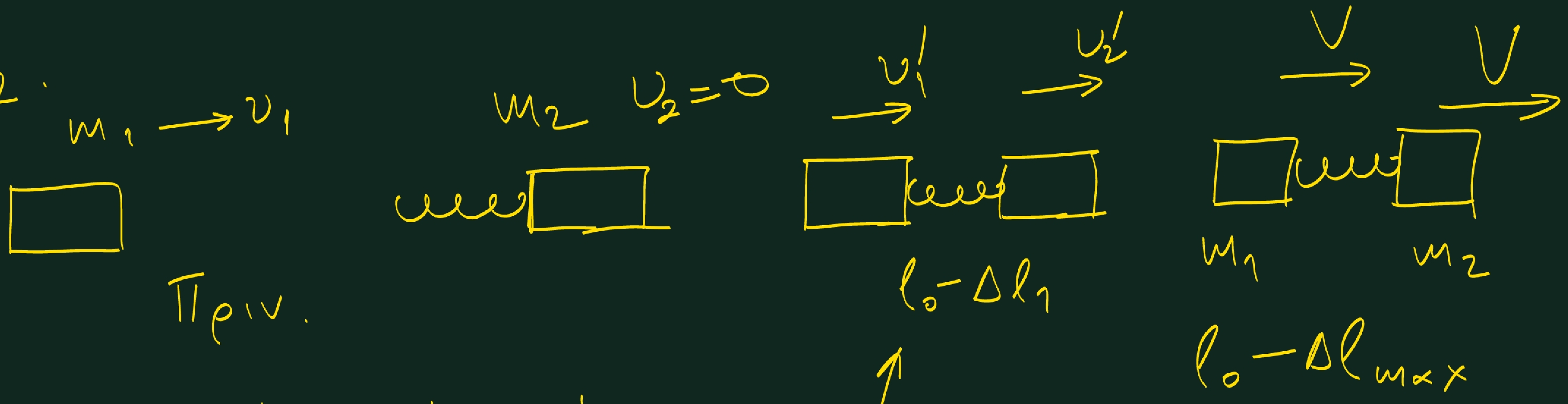
B_2:

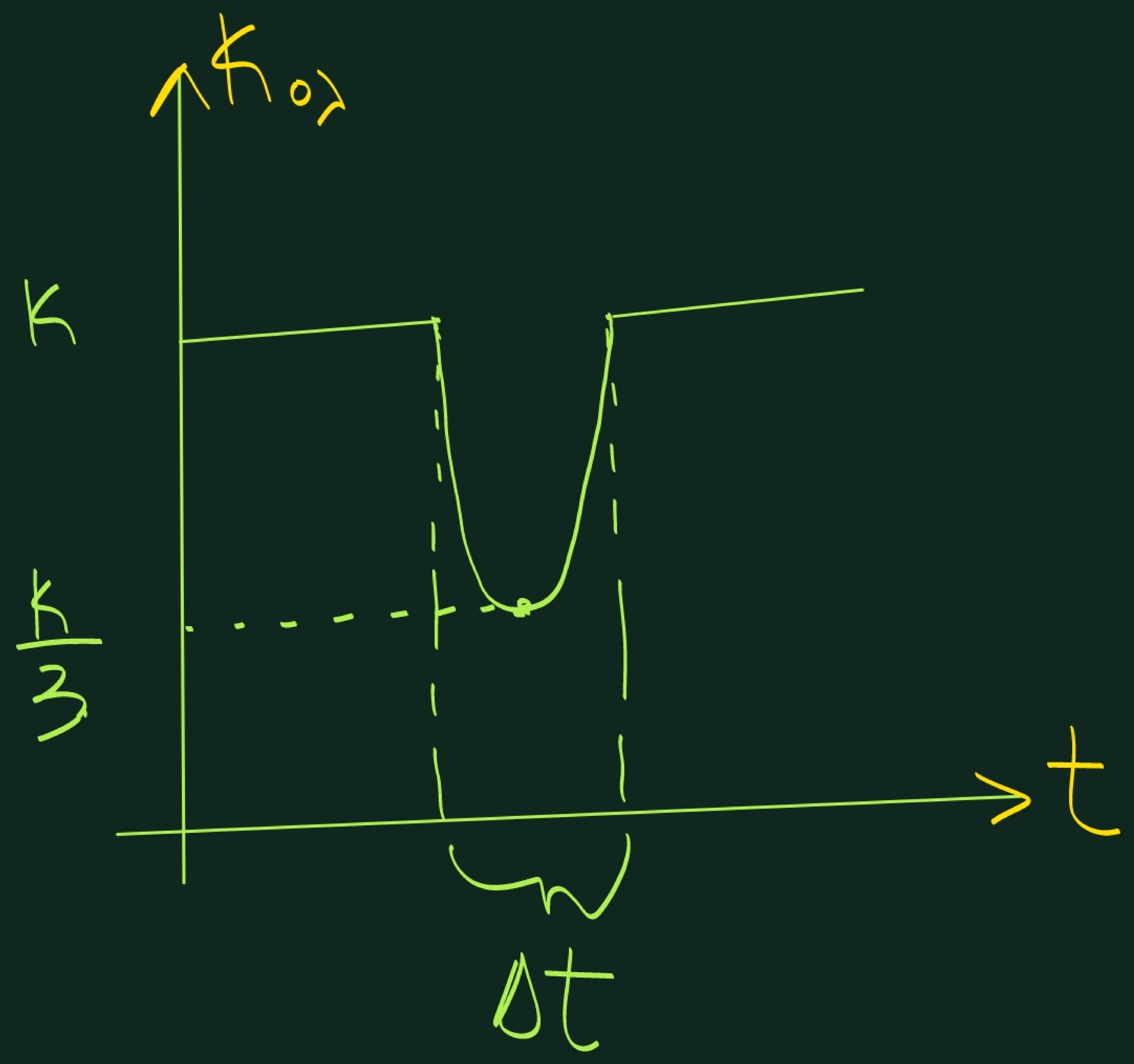


Στην ανελαστική κρούση.

$$\frac{1}{2}m_1v_1^2=\frac{1}{2}m_1v_1'^2+\frac{1}{2}m_2v_2'^2+\frac{1}{2}k\Delta\ell_1^2$$

Στην πλαστική κρούση:

$$\frac{1}{2}m_1v_1^2=\frac{1}{2}(m_1+m_2)V^2+\frac{1}{2}k\cdot\Delta\ell_{max}^2$$



$$\frac{K}{3} = \frac{1}{2}(m_1+m_2)V^2$$ (κινητική ενέργεια συσσωματώματος)

$$K = \frac{1}{2} m_1 v_1^2$$

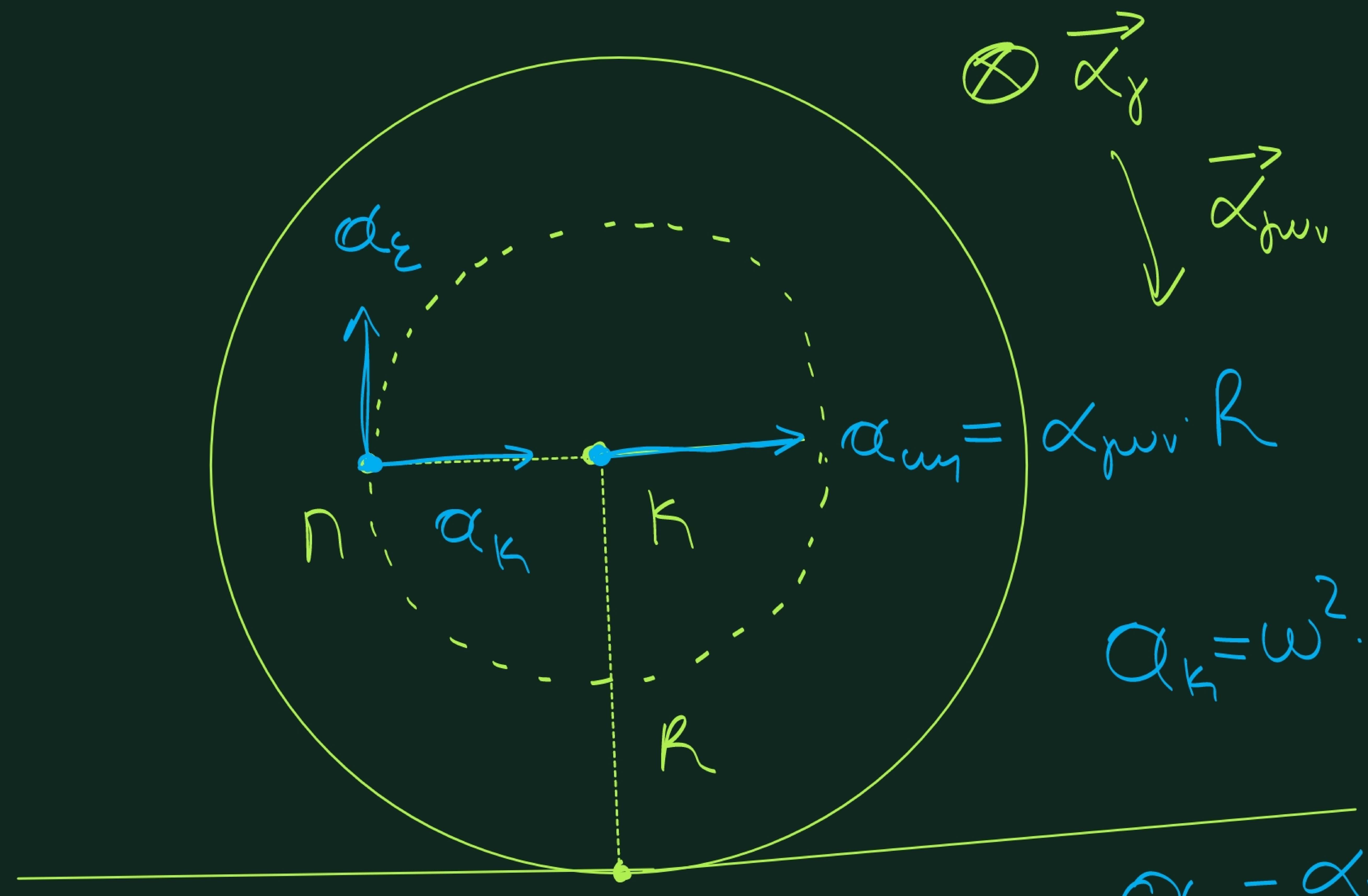
και: $m_1 v_1 = (m_1+m_2)V$ (διατήρηση ορμής)

Άρα: $$\frac{1}{3}\cdot\cancel{\frac{1}{2}} m_1 v_1^2 = \cancel{\frac{1}{2}}(m_1+m_2)V^2 \Rightarrow \frac{1}{3}\,\frac{\cancelto{1}{(m_1 v_1)^2}}{m_1} = \frac{\cancelto{1}{\left((m_1+m_2)V\right)^2}}{m_1+m_2} \Rightarrow$$

$$3m_1 = m_1 + m_2 \Rightarrow 2m_1 = m_2 \Rightarrow$$

$$\boxed{\frac{m_1}{m_2} = \frac{1}{2}}$$ Σωστό το (γ)

A3.



$a_{\kappa} = \omega^2 \cdot r$

$a_{\varepsilon} = \alpha_{\gamma\omega\nu} \cdot r$

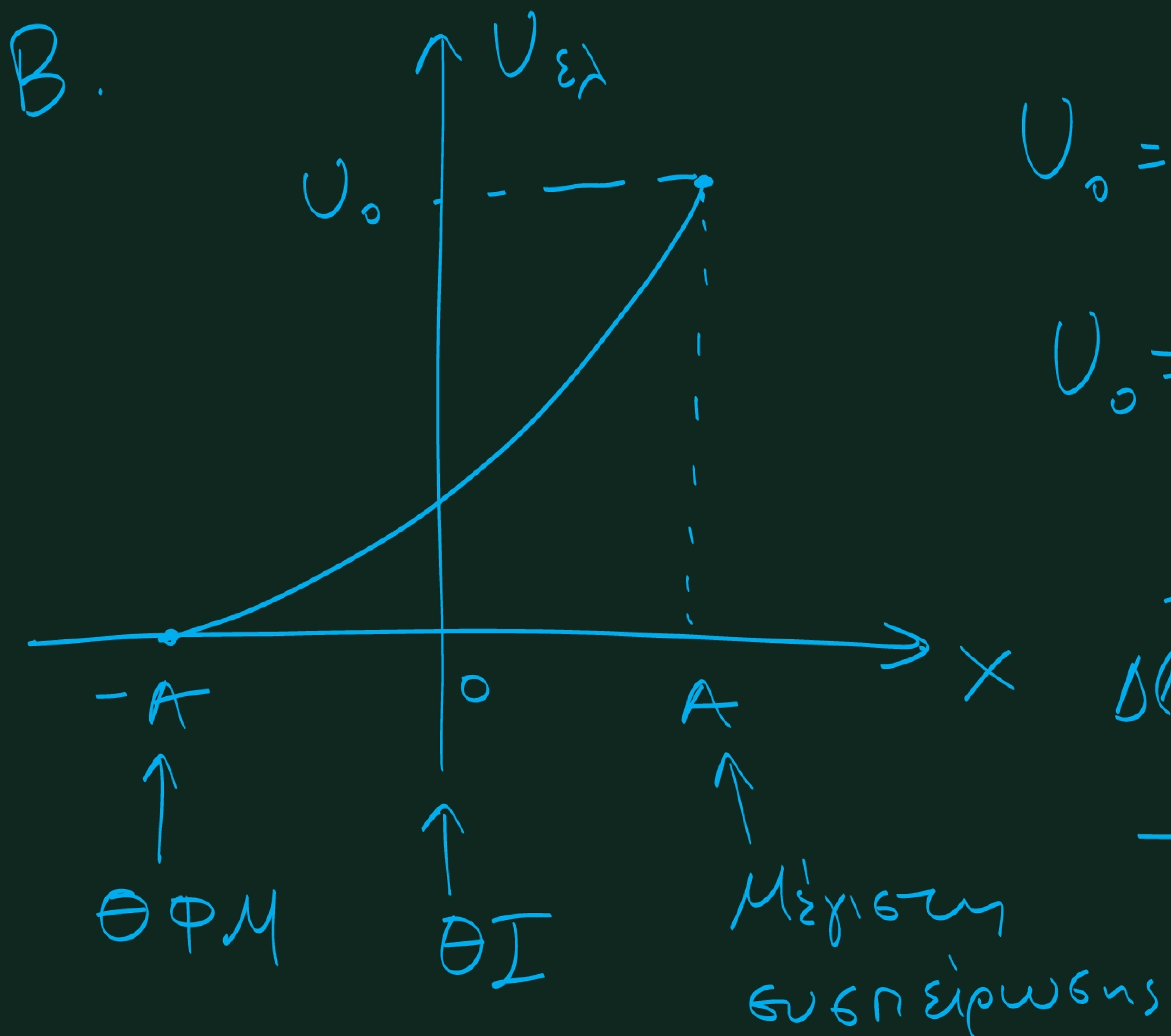
$v_{\gamma\rho} = \omega \cdot r \Rightarrow \dfrac{dv_{\gamma\rho}}{dt} = \dfrac{d\omega}{dt} \cdot r$

$a_{\Pi}^2 = (a_{\kappa} + a_{cm})^2 + a_{\varepsilon}^2 \Rightarrow$

$a_{\Pi}^2 = (\omega^2 r + \alpha_{\gamma} R)^2 + (\alpha_{\gamma} \cdot r)^2$

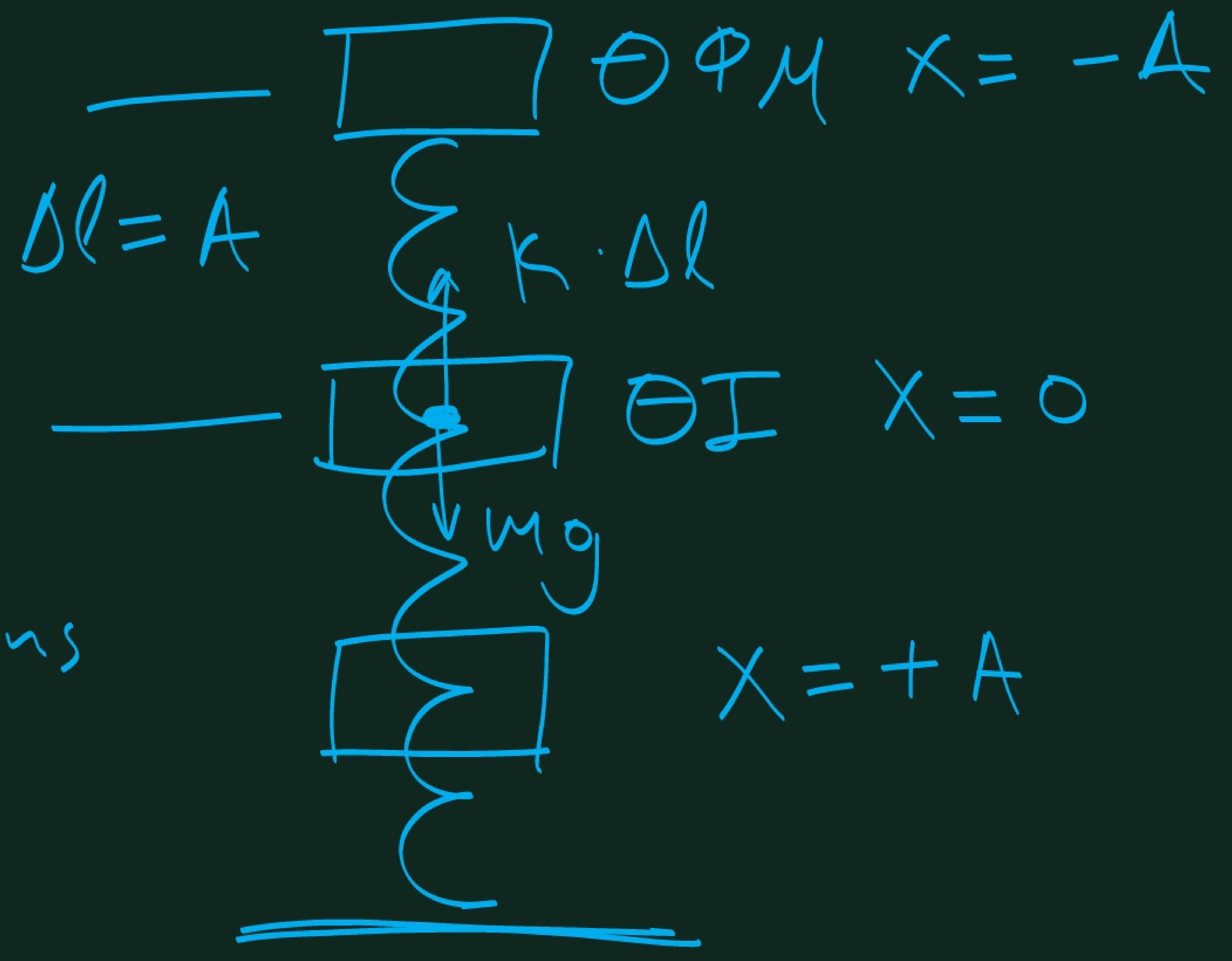
Σωστό το (γ).

B.



$$U_0 = \frac{1}{2}k(2A)^2 \Rightarrow$$

$$U_0 = 2kA^2 \Rightarrow k = \frac{U_0}{2A^2}$$



Στη ΘΙ έχουμε:

$$mg = k\cdot\Delta l \Rightarrow$$

$$mg = kA \Rightarrow \frac{m}{k} = \frac{g}{A}$$

Άρα: $T = 2\pi\sqrt{\frac{k}{m}} = 2\pi\sqrt{\frac{A}{g}}$.

A1. α

A2. β

A3. γ

A4. α

A5. α) Σ

β) Σ

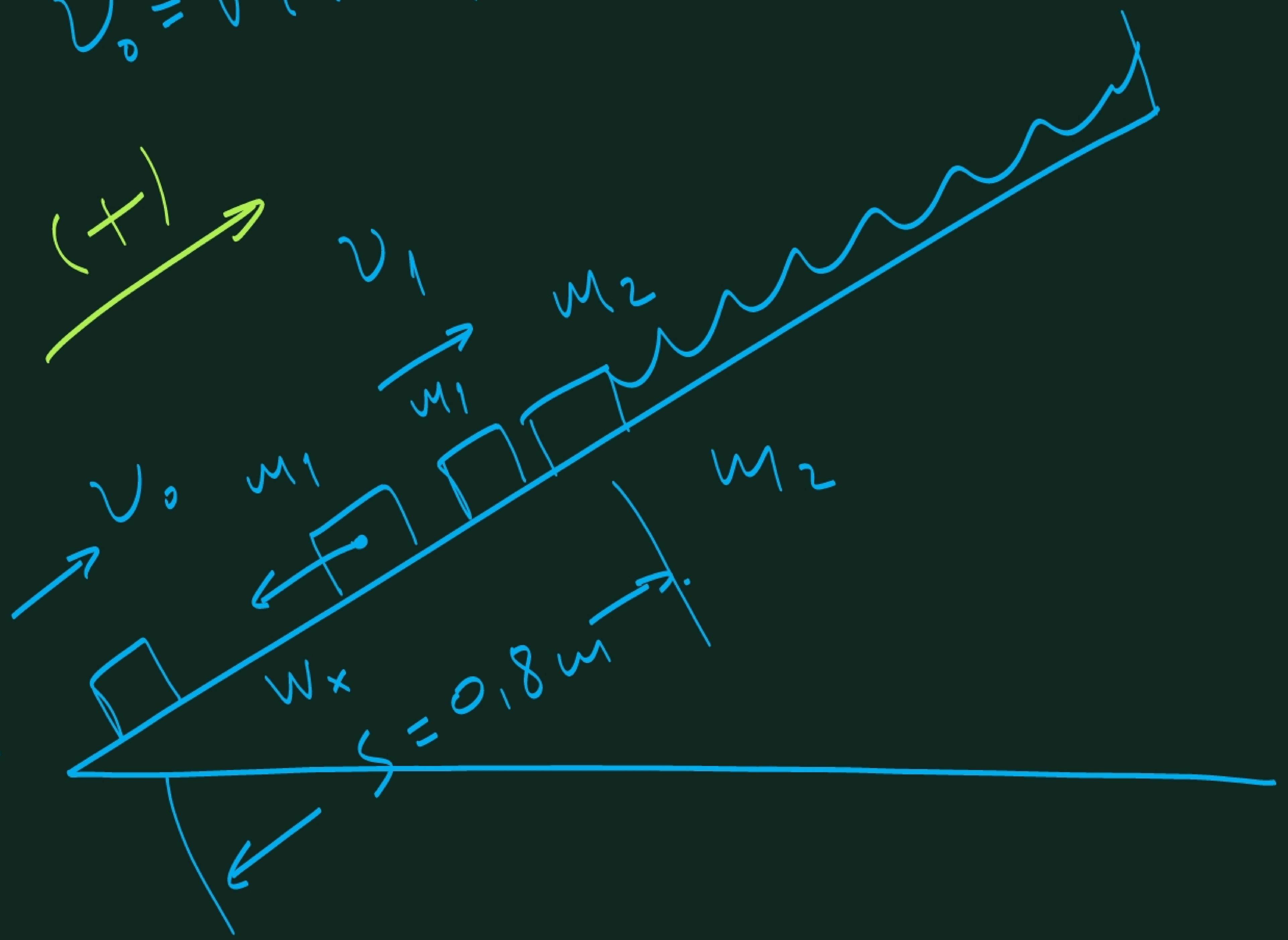
γ) Σ

δ) Λ

ε) Λ

ΘΕΜΑ Δ

$\upsilon_0 = \sqrt{17}\ m/s$.



$W_x = mg\,\eta\mu\varphi$

Δ1. ΘΜΚΕ για το m_1.

$$\frac{1}{2}m_1\upsilon_1^2 - \frac{1}{2}m_1\upsilon_0^2 = -m_1 g\,\eta\mu\varphi \cdot s \Rightarrow$$

$$\upsilon_1^2 - \upsilon_0^2 = -2gs\,\eta\mu\varphi \Rightarrow$$

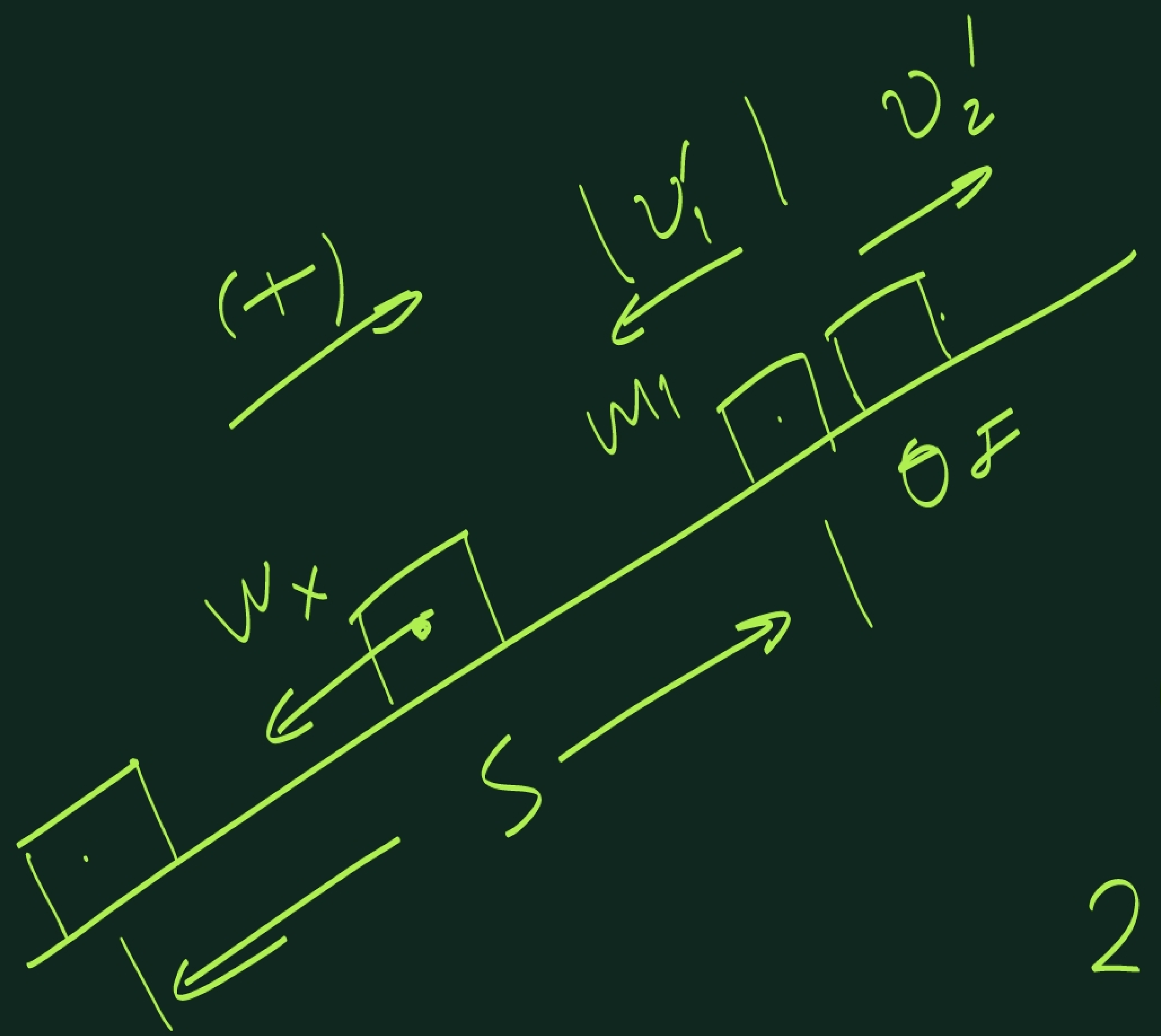
$$\upsilon_1^2 - 17 = -2\cdot 10\cdot 0{,}8\cdot\frac{1}{2} \Rightarrow$$

$$\upsilon_1^2 - 17 = -8 \Rightarrow \upsilon_1^2 = 9 \Rightarrow \upsilon_1 = 3\ m/s.$$

$$\upsilon_2' = \frac{2m_1}{m_1+m_2}\upsilon_1 = \frac{2\cdot 1}{1+2}\cdot 3 \Rightarrow$$

$$\boxed{\upsilon_2' = 2\ m/s}$$

Δ2. $\upsilon_1' = \frac{m_1 - m_2}{m_1+m_2}\upsilon_1 = \frac{1-2}{1+2}\cdot 3 = -1\ m/s$



$ma = mg\,ημφ \Rightarrow$

$a = g\,ημφ$

$S = |v_1'|\,t + \frac{1}{2} a t^2 \Rightarrow$

$0,8 = t + \frac{1}{2} \cdot 10 \cdot \frac{1}{2} t^2 \Rightarrow$

$2,5t^2 + t - 0,8 = 0$

$\Delta = 1 - 4 \cdot 2,5 \cdot (-0,8) = 1 + 8 = 9$

$t = \frac{-1 \pm 3}{5} \Rightarrow t = \frac{2}{5}\, sec$

Άρα: $t = \frac{5T}{4} \Rightarrow$

$\frac{2}{5} = \frac{5T}{4} \Rightarrow T = \frac{8}{25}\, sec$

$\omega = \frac{2\pi}{T} = \frac{2\pi}{\frac{8}{25}} = \frac{50\pi}{8} \Rightarrow$

$\omega = \frac{25\pi}{4}\, rad/sec$

Έχουμε ΘΙ άρα:

$v_2' = v_{max} = \omega A \Rightarrow 2 = \frac{25\pi}{4} A \Rightarrow$

$A = \frac{8}{25\pi} = \frac{32}{100\pi} = \frac{0,32}{\pi}\, m$

Δ3. Για $t = 0$ έχουμε:

$x(0) = 0$

$v(0) = +v_{max}$

$\Rightarrow \varphi_0 = 0$

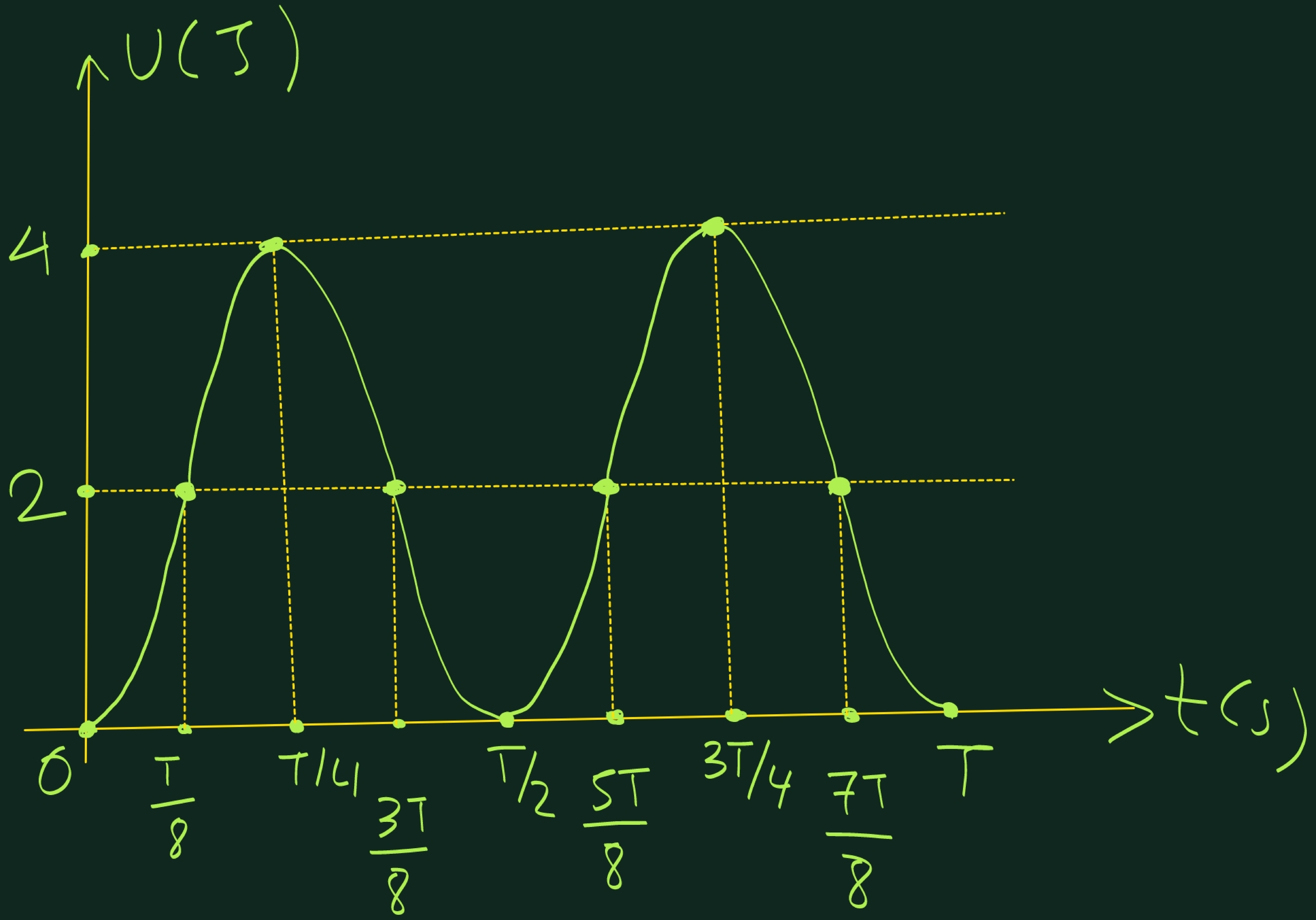
Άρα: $x = A\,ημ(\omega t + \varphi_0) \Rightarrow$

$x = \frac{0,32}{\pi}\, ημ\left(\frac{25\pi}{4} t\right)$ (SI)

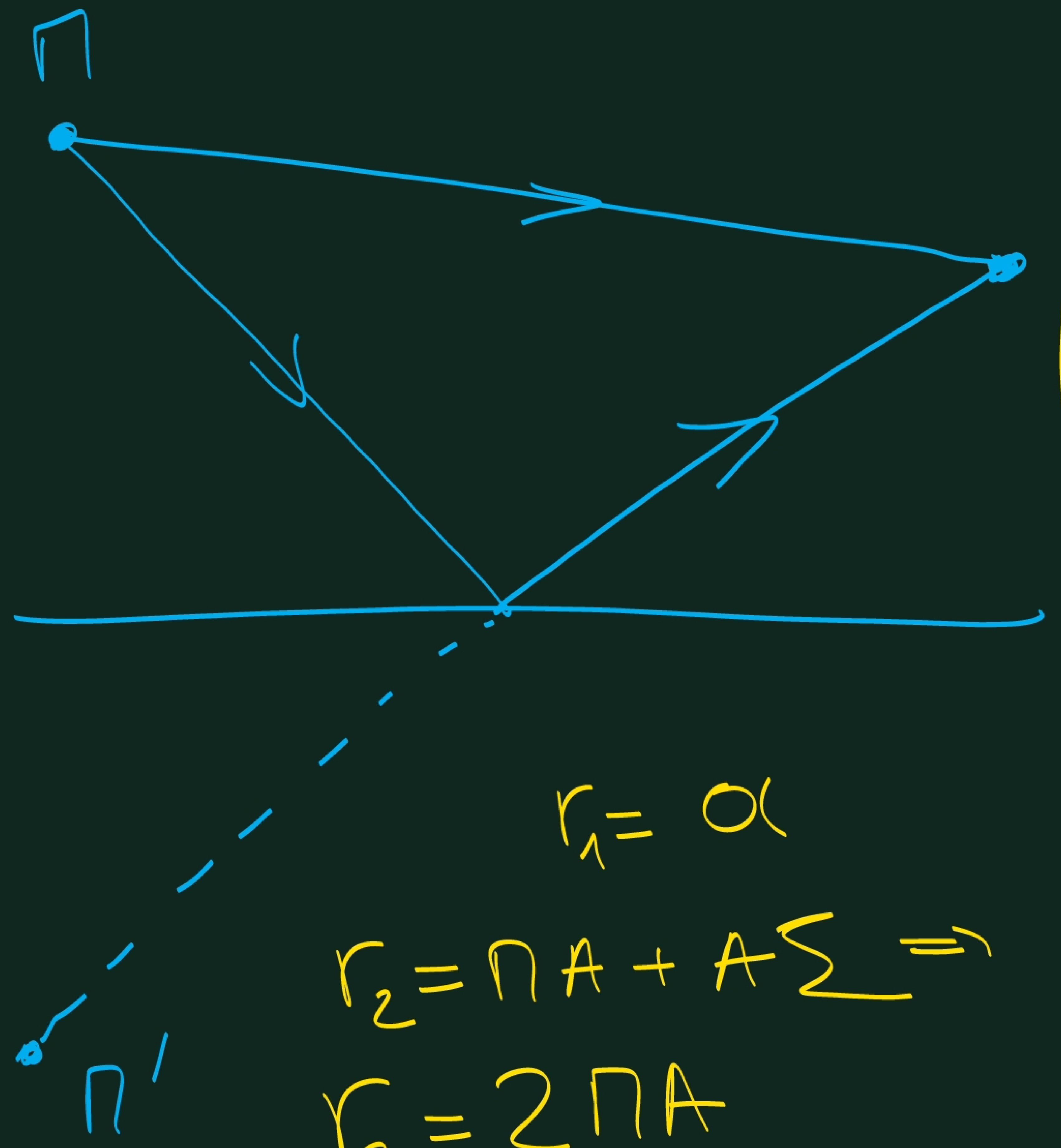
D4: $U = \frac{1}{2}kx^2 = \frac{1}{2}kA^2\cos^2\omega t = \frac{1}{2}m_2 v_{max}^2 \cdot \cos^2\omega t =$

$$= \frac{1}{2}\cdot 2\cdot 2^2\cdot \cos^2\left(\frac{25\pi}{4}t\right) \Rightarrow$$

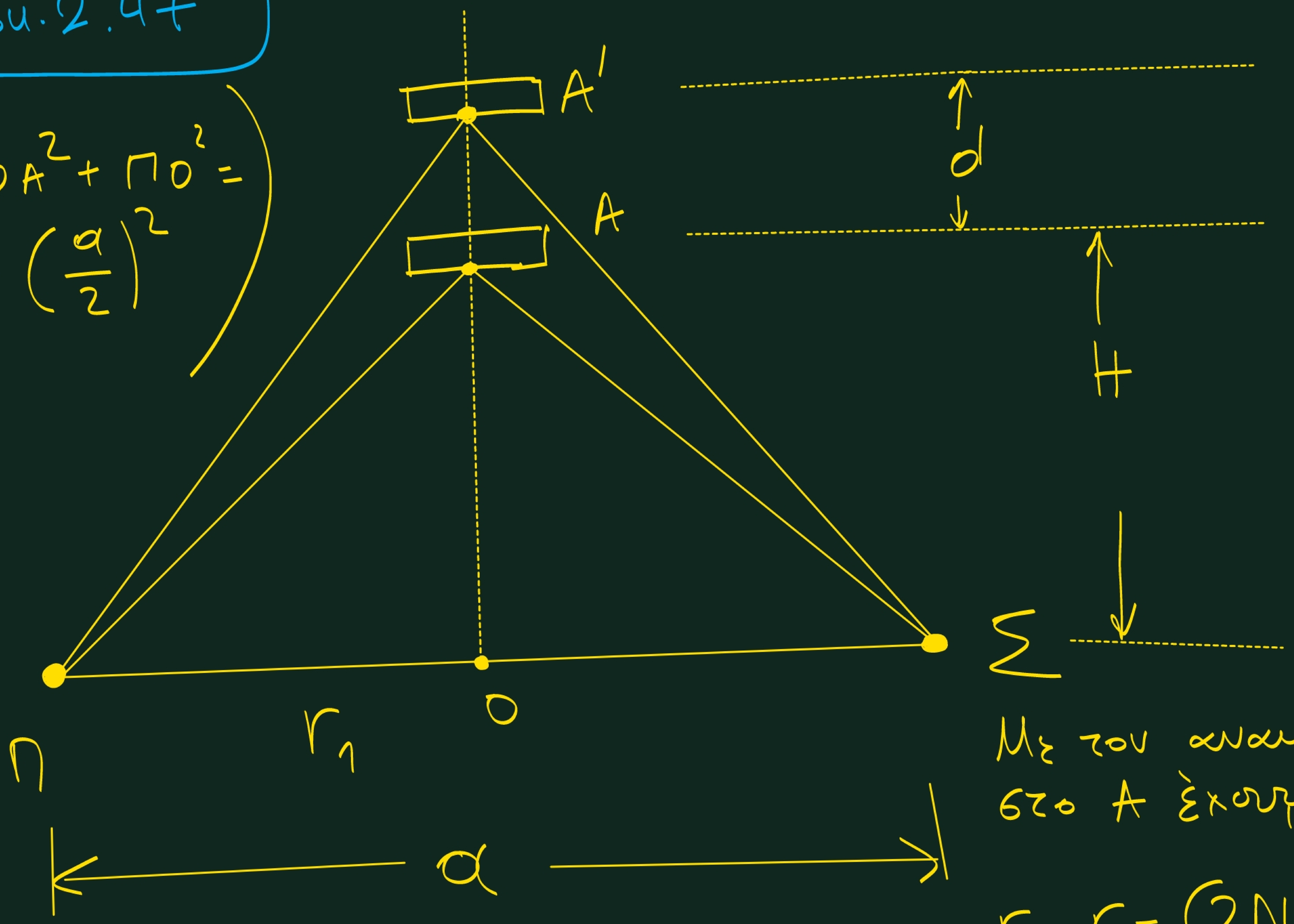
$$\boxed{U(t) = 4\cos^2\left(\frac{25\pi}{4}t\right)} \text{ (SI)}$$



Ασκ. 2.47



$$\Pi A^2 = OA^2 + \Pi O^2 = H^2 + \left(\frac{\alpha}{2}\right)^2$$



$r_1 = \alpha$

$r_2 = \Pi A + A\Sigma \Rightarrow$

$r_2 = 2\Pi A$

και $r_2' = 2\Pi A'$

$$\Pi A = \sqrt{H^2 + \left(\frac{\alpha}{2}\right)^2} \qquad \Pi A' = \sqrt{(H+d)^2 + \left(\frac{\alpha}{2}\right)^2}$$

Με τον ανακλαστήρα στο Α έχουμε απόσβεση

$$r_2 - r_1 = (2N+1)\frac{\lambda}{2}$$

Με τον ανακλαστήρα στο Α' έχουμε την αμέσως επόμενη ενίσχυση.

$$r_2' - r_1 = (2N+2)\frac{\lambda}{2}$$

Άρα: $(r_2' - r_1) - (r_2 - r_1) = (2N+2)\frac{\lambda}{2} - (2N+1)\frac{\lambda}{2} \Rightarrow$

$$r_2' - r_2 = \lambda - \frac{\lambda}{2} \Rightarrow r_2' - r_2 = \frac{\lambda}{2} \Rightarrow 2ΠΑ' - 2ΠΑ = \frac{\lambda}{2} \Rightarrow$$

$$2\sqrt{(H+d)^2 + \left(\frac{\alpha}{2}\right)^2} - 2\sqrt{H^2 + \left(\frac{\alpha}{2}\right)^2} = \frac{\lambda}{2} \Rightarrow$$

$$\sqrt{4(H+d)^2 + \alpha^2} - \sqrt{4H^2 + \alpha^2} = \frac{\lambda}{2} \Rightarrow \lambda = 2\left(\sqrt{4(H+d)^2 + \alpha^2} - \sqrt{4H^2 + \alpha^2}\right)$$