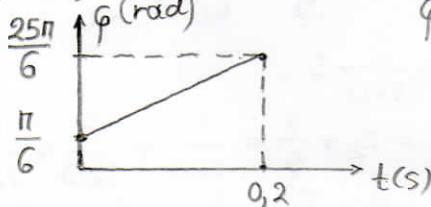


Αηάννηση

α) Σε χρόνο $T \rightarrow 2$ φορές από $\theta \cdot I$ } $6000 T = 600 \Rightarrow T = 0,1 \text{ s}$
 $300 \text{ s} \rightarrow 6000$

$$f = \frac{1}{T} = 10 \text{ Hz}, \quad \frac{d\phi}{dt} = \omega = 2\pi f = 20\pi \frac{\text{rad}}{\text{s}}$$

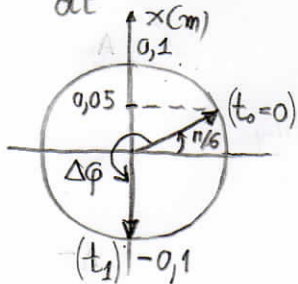
β) $\phi = 20\pi t + \frac{\pi}{6}$



t	0	0,2
ϕ	π/6	4π + π/6

γ) $3 \cdot 4 A = 1,2 \Rightarrow 12 \cdot A = 1,2 \Rightarrow A = 0,1 \text{ m}$

δ) $\frac{dv}{dt} = a = +a_{\max}$ που αντιστοιχεί σε $x_1 = -A = -0,1 \text{ m}$



$t_0 = 0 \Rightarrow x_0 = 0,1 \cdot \sin \frac{\pi}{6} = 0,05 \text{ m}$

$$\Delta\phi = \frac{3\pi}{2} - \frac{\pi}{6} = \frac{8\pi}{6} = \frac{4\pi}{3} \text{ rad}$$

$$\Delta\phi = \omega \cdot t_1 \Rightarrow t_1 = \frac{4\pi/3}{20\pi} = \frac{4\pi}{60} = \frac{\pi}{15} \text{ s}$$

ε) $s = 0,05 + 2 \cdot 0,1 = 0,25 \text{ m}, \quad \Delta x = x_1 - x_0 = -0,1 - 0,05 = -0,15 \text{ m}$

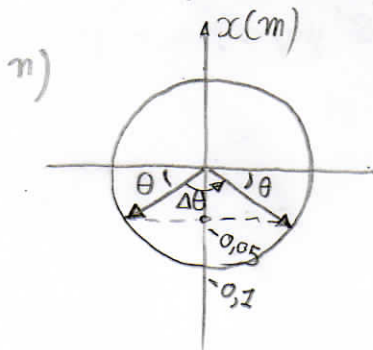
στ) $A \Delta E_T : \frac{1}{2} m v^2 + \frac{1}{2} m \omega^2 x^2 = \frac{1}{2} m \omega^2 A^2 \Rightarrow |v| = \omega \sqrt{A^2 - x^2} \Rightarrow$

$$\Rightarrow |v| = 20\pi \sqrt{0,1^2 - 0,05^2} = 20\pi \cdot 0,05 \cdot \sqrt{3} = \pi\sqrt{3} \frac{\text{m}}{\text{s}}$$

Για 2^η φορά $v < 0$, άρα $v = -\pi\sqrt{3} \frac{\text{m}}{\text{s}}$

ζ) $v = A\omega \cdot \sin\phi \Rightarrow v = 0,1 \cdot 20\pi \cdot \sin \frac{31\pi}{6} \Rightarrow v = 2\pi \cdot \sin \left(4\pi + \frac{7\pi}{6} \right)$

$$\Rightarrow v = 2\pi \cdot \sin \left(\pi + \frac{\pi}{6} \right) \Rightarrow v = 2\pi \cdot \left(-\frac{\sqrt{3}}{2} \right) \Rightarrow v = -4\pi\sqrt{3} \text{ m/s}$$



$\eta\mu\theta = \frac{0,05}{0,1} = \frac{1}{2} \Rightarrow \theta = \frac{\pi}{6} \text{ rad}$

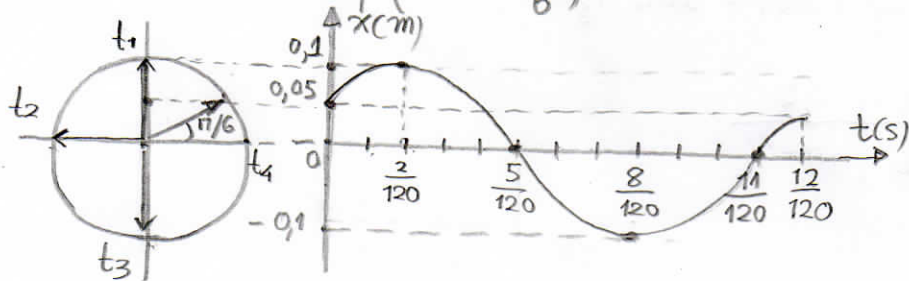
$$\Delta\theta = \pi - \frac{\pi}{3} = \frac{2\pi}{3} \text{ rad}$$

$$\Delta\theta = \omega \cdot \Delta t \Rightarrow \Delta t = \frac{2\pi/3}{20\pi} = \frac{2}{60} = \frac{1}{30} \text{ s}$$

$$\theta) \quad x = 0,1 \cdot \eta \mu \left(20\pi t + \frac{\pi}{6} \right), \quad v_{\max} = A\omega = 0,1 \cdot 20\eta = 2\eta \text{ m/s}$$

$$v = 2\eta \cdot \sigma \nu \nu \left(2\pi t + \frac{\pi}{6} \right), \quad \alpha_{\max} = A\omega^2 = 0,1 \cdot 400\eta^2 = 400 \text{ m/s}^2$$

$$\alpha = -400 \cdot \eta \mu \left(2\pi t + \frac{\pi}{6} \right)$$

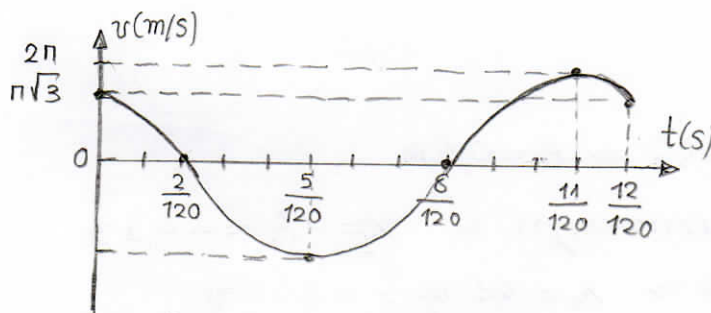


$$\frac{\pi}{3} = 20\eta \cdot t_1 \Rightarrow t_1 = \frac{1}{60} \text{ s} = \frac{2}{120} \text{ s}$$

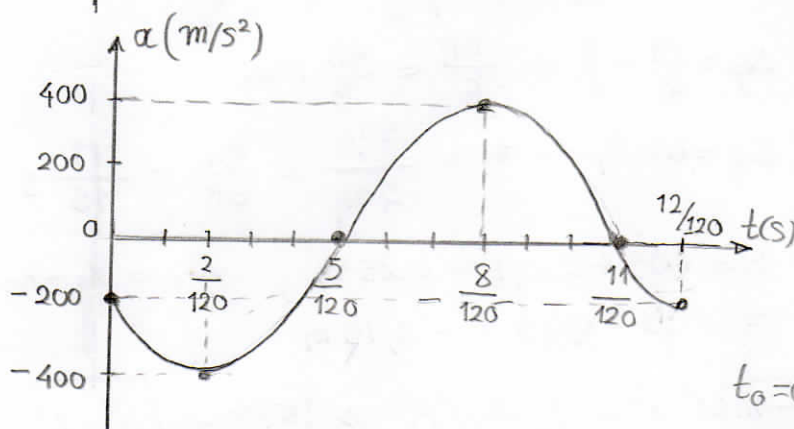
$$t_2 = t_1 + \frac{T}{4} = \frac{1}{60} + \frac{1}{40} = \frac{5}{120} \text{ s}$$

$$t_3 = t_2 + \frac{T}{4} = \frac{5}{120} + \frac{3}{120} = \frac{8}{120} \text{ s}$$

$$t_4 = t_3 + \frac{T}{4} = \frac{8}{120} + \frac{3}{120} = \frac{11}{120} \text{ s}$$



$$t_0 = 0 \Rightarrow v = 2\eta \cdot \frac{\sqrt{3}}{2} = \eta\sqrt{3} \text{ m/s}$$



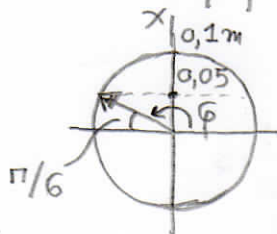
$$t_0 = 0 \Rightarrow \alpha = -200 \frac{\text{m}}{\text{s}^2}$$

$$\iota) \quad W_{\text{Fext}} = W_{\Sigma F} = \Delta K = -\Delta U = U_{\text{apx}} - U_{\text{tej}} = \frac{1}{2} m\omega^2 (x_0^2 - x_1^2) = \frac{1}{2} \cdot 2 \cdot 400\eta^2 (0,05^2 - 0,1^2) = 4000 \cdot (-0,0075) = -30 \text{ J}$$

$$\kappa) \quad K = \frac{3}{4} E_T \Rightarrow E_T - U = \frac{3}{4} E_T \Rightarrow U = \frac{1}{4} E_T \Rightarrow \frac{1}{2} Dx^2 = \frac{1}{4} \cdot \frac{1}{2} DA^2 \Rightarrow$$

$$x = \pm \frac{A}{2} \Rightarrow x = \pm 0,05 \text{ m} \xrightarrow{\text{β' φορά}} x = +0,05 \text{ m} (\text{β' φορά}) \Rightarrow$$

$$\text{Από το στρεφόμενο διάνυσμα} \quad \varphi = \pi - \frac{\pi}{6} = \frac{5\pi}{6} \text{ rad}$$



$$1) K = \frac{1}{8} U \Rightarrow E_T - U = \frac{1}{8} U \Rightarrow \frac{9}{8} U = E_T \Rightarrow$$

$$\frac{9}{8} \cdot \frac{1}{2} D x^2 = \frac{1}{2} D A^2 \Rightarrow \frac{9}{8} x^2 = A^2 \Rightarrow x^2 = \frac{8}{9} A^2 \Rightarrow$$

$$\Rightarrow |x| = \frac{2\sqrt{2}}{3} A \Rightarrow |x| = \frac{0,2\sqrt{2}}{3} \text{ m}$$

$$\text{Total energy } A \Delta E_T: \frac{1}{2} m v^2 + \frac{1}{2} D x^2 = \frac{1}{2} D A^2 \Rightarrow$$

$$\Rightarrow |v| = \omega \sqrt{A^2 - x^2} = 20\pi \sqrt{A^2 - \frac{8}{9} A^2} = 20\pi \sqrt{\frac{1}{9} A^2} =$$

$$= 20\pi \frac{A}{3} = \frac{2\pi}{3} \text{ m/s}$$

$$\left| \frac{dK}{dt} \right| = |P_{\Sigma F}| = |\Sigma F \cdot v| = |-D \cdot x \cdot v| = m \omega^2 \cdot |x| \cdot |v| =$$

$$= 2 \cdot 400\pi^2 \cdot \frac{0,2\sqrt{2}}{3} \cdot \frac{2\pi}{3} = 8000 \cdot \frac{0,4\pi\sqrt{2}}{9} = 355,5\sqrt{2} \text{ J/s}$$

$$\left| \frac{dU}{dt} \right| = \left| \frac{dK}{dt} \right| = 355,5\sqrt{2} \text{ J/s}$$