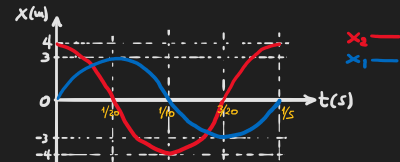


Δε 24.1.2022



$$\begin{cases} x_1 = 3 \cdot \sin 10\pi t \\ x_2 = 4 \cdot \sin(10\pi t + \pi/2) \rightarrow x_2 = 4 \cdot \cos 10\pi t \end{cases} \begin{cases} A_1 = 3 \text{ m} \\ A_2 = 4 \text{ m} \\ \phi = \pi/2 \text{ rad} \\ \omega = 10\pi \text{ rad/s} \rightarrow T = \frac{1}{5} \text{ sec} \end{cases}$$



$$x = x_1 + x_2 = A \cdot \sin(\omega t + \theta) \Rightarrow A = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\phi} \Rightarrow A = 5 \text{ m}$$

$$\cos\theta = \frac{A_1 + A_2\cos\phi}{A} \Rightarrow \cos\theta = \frac{3}{5} \Rightarrow \theta = 53.13^\circ \approx 0.917 \text{ rad}$$

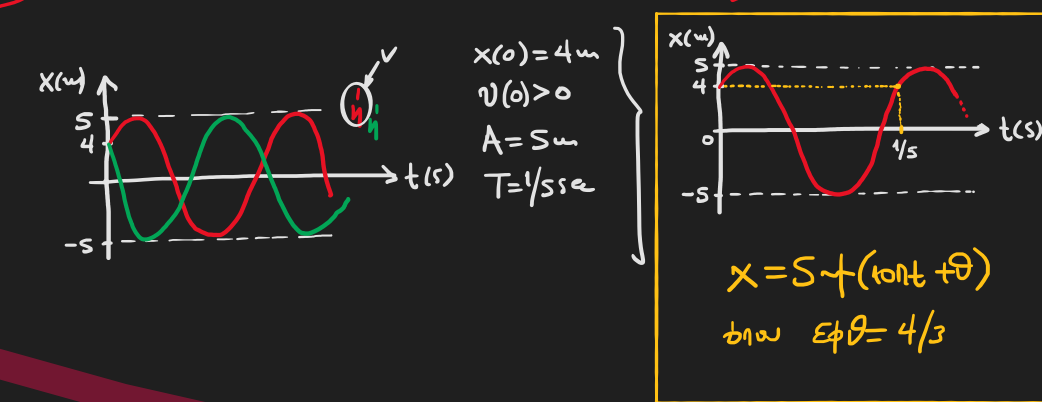
$$x = 5 \cdot \sin(10\pi t + \theta)$$

$$t=0: x = 5 \cdot \sin(\theta) = 3 \Rightarrow \sin\theta = \frac{3}{5} \Rightarrow \theta = \arcsin\left(\frac{3}{5}\right)$$

$$\begin{aligned} v_1 &= \omega A_1 \cos \omega t = 10\pi \cdot 3 \cdot \cos 10\pi t = 30\pi \cos 10\pi t \\ v_2 &= \omega A_2 \cos(\omega t + \phi) = 10\pi \cdot 4 \cdot \cos(10\pi t + \pi/2) = -40\pi \sin 10\pi t \end{aligned}$$

$$v = v_1 + v_2 \Rightarrow v(t) = 30\pi \cos 10\pi t - 40\pi \sin 10\pi t$$

$$v(0) = 30\pi \cdot 1 - 40\pi \cdot 0 = 30\pi \text{ m/s} > 0$$



Άσκηση:

$$\begin{cases} x_1 = 10 \cdot \sin 2\pi t \\ x_2 = A_2 \cdot \sin(2\pi t + \phi) \end{cases} \Rightarrow x = x_1 + x_2$$

$$A = 10\sqrt{3} \text{ m}, \quad \theta = \frac{3\pi}{2} \text{ rad}$$

$$A = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\phi} \Rightarrow 10\sqrt{3} = \sqrt{10^2 + A_2^2 + 2 \cdot 10 \cdot A_2 \cdot \cos\phi}$$

$$\Rightarrow 300 = 100 + A_2^2 + 20A_2\cos\phi \Rightarrow 200 = A_2^2 + 20A_2\cos\phi \quad (1)$$

$$\cos\theta = \frac{A_1 + A_2\cos\phi}{A} \Rightarrow \cos\frac{3\pi}{2} = \frac{10 + A_2\cos\phi}{10\sqrt{3}} \Rightarrow \frac{0}{\infty} = \frac{10 + A_2\cos\phi}{10\sqrt{3}} \Rightarrow 10 + A_2\cos\phi = 0 \Rightarrow A_2\cos\phi = -10 \quad (2)$$

$$\cos\frac{3\pi}{2} = \frac{\sin\frac{3\pi}{2}}{\sin\frac{3\pi}{2}} = \frac{-1}{-1} = 1 \quad (\text{δεν ορίστηκε})$$

$$(1), (2): 200 = A_2^2 + 20 \cdot (-10) \Rightarrow 200 = A_2^2 - 200 \Rightarrow A_2^2 = 400 \Rightarrow A_2 = 20 \text{ m}$$

$$(2): 20 \cdot \cos\phi = -10 \Rightarrow \cos\phi = -\frac{1}{2} \Rightarrow \phi = \frac{2\pi}{3} \text{ or } \frac{4\pi}{3}$$

$$\sin\phi = \frac{1}{2} \Rightarrow \phi = \frac{\pi}{6} \text{ or } \frac{5\pi}{6}$$

$$\phi = \frac{2\pi}{3} \text{ or } \frac{4\pi}{3}$$