

(1990, Q6, (a) [5 marks])

Find ω

$$T = 6\pi \Rightarrow \frac{2\pi}{\omega} = 6\pi$$

$$\Rightarrow \omega = \frac{2\pi}{6\pi} \Rightarrow \omega = \frac{\pi}{3\pi}$$

Find v_{\max} Position of max velocity is where $x=0$.

$$v^2 = \omega^2(A^2 - x^2)$$

$$x=0 \Rightarrow v_{\max}^2 = \omega^2 A^2$$

$$\Rightarrow v_{\max} = \omega A$$

Find x $v = \frac{v_{\max}}{2} = \frac{\omega A}{2}$

$$\therefore v^2 = \omega^2(A^2 - x^2)$$

$$\Rightarrow \left(\frac{\omega A}{2}\right)^2 = \omega^2 A^2 - \omega^2 x^2$$

$$\Rightarrow \frac{\omega^2 A^2}{4} = \omega^2 A^2 - \omega^2 x^2$$

$$\Rightarrow \frac{A^2}{4} - A^2 = -x^2$$

$$\Rightarrow \frac{3A^2}{4} = x^2$$

$$\Rightarrow \sqrt{\frac{3A^2}{4}} = x \Rightarrow x = \frac{\sqrt{3}}{2} A$$

Find t , Time

$$x = A \sin \omega t \quad (\text{starts at } x=0)$$

$$\frac{\sqrt{3}}{2} A = A \sin \omega t$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \sin \omega t$$

$$\Rightarrow \frac{\pi}{3} = \omega t$$

$$\Rightarrow \frac{\pi}{3} = \frac{\pi}{3\pi} t$$

$$\Rightarrow 1 = \frac{1}{\pi} t$$

$$t = \pi$$

qed.