Problem 2 (a)

$$\frac{d^2x(t)}{dt^2} = -\omega^2 x(t)$$

let $\tau = \omega t$

$$\left(\frac{\partial^2 x(\tau)}{\partial \tau^2}\right)\left(\frac{\partial \tau}{\partial t}\right)^2 = -\omega^2 x(\tau)$$

$$\frac{\partial \tau}{\partial t} = \omega$$

$$\Rightarrow \frac{\partial^2 x(\tau)}{\partial \tau^2}\,\omega^2 = -\omega^2 x(\tau)$$

$$\Rightarrow \boxed{\frac{\partial^2 x(\tau)}{\partial \tau^2} = -x(\tau)}$$