Physics 4610 Quantum Mechanics
Quiz 3

NAME: Key

An electron is bound to an infinite square well potential. The state of this electron at time t = 0 is given as,

$$\psi(x,0) = \sqrt{\frac{1}{3}}\psi_1(x) + \sqrt{\frac{2}{3}}\psi_2(x)$$

a) Write the state of the electron $\psi(x,t)$ at a later time t.

$$\psi(x,t) = \sqrt{\frac{1}{3}}\psi_1(x)\, e^{-iE_1 t/\hbar} + \sqrt{\frac{2}{3}}\psi_2(x)\, e^{-iE_2 t/\hbar}$$

b) Is the state $\psi(x,t)$ a stationary state? Explain your reasoning.

Check the Prob. density:

$$\rho = |\psi(x,t)|^2 = \frac{1}{3}|\psi_1(x)|^2 + \frac{2}{3}|\psi_2(x)|^2$$

$$+ \sqrt{\frac{1}{3}}\sqrt{\frac{2}{3}}\,\psi_1(x)\psi_2(x)\cdot 2\cos\frac{E_1 - E_2}{\hbar}t$$

As a result, ρ depends on t. The state $\psi(x,t)$ is not a stationary state.