Qualifying Exam 2011
Engineering Physics, Shanhui Fan

As a reminder, the time-dependent Schodinger equation of electrons:

$$i\hbar\frac{\partial\phi}{\partial t}=-\frac{\hbar^2}{2m}\frac{\partial^2\phi}{\partial x^2}+V(x)\phi$$

and the time-independent Schodinger equation of electrons:

$$E\phi=-\frac{\hbar^2}{2m}\frac{\partial^2\phi}{\partial x^2}+V(x)\phi$$

(a) Suppose an electron is confined in an infinite potential well

$$V(x)=\begin{cases}0,\ 0<x<a\\ \infty,\ \text{everywhere else}\end{cases}$$

sketch the ground state $\phi_0(x)$ and the first excited state $\phi_1(x)$ for the electron in the potential well. Provide the eigen-energy of these two states.

(b) Suppose at $t=0$, the electron has a wavefunction $\phi_0(x)$, what is the electron wavefunction at a time *t* later?