1. Boas Chapter 13: 6.6 The book problem asked you to calculate only the energy levels but I want you to calculate the full time dependence $\psi(x, y, t)$ with initial conditions corresponding to the particle having equal probability of being anywhere in the domain. Choose the normalization of $\psi$ so that the integrated probability of finding the particle is unity.

Hint: you will need two distinct eigenvalues corresponding to the x and y directions.

2. Consider the oscillation of a circular membrane of radius $R$ that is described by the wave equation with $\partial/\partial \phi = 0$. The oscillation amplitude $u(r, t)$ is zero at the boundary. The initial displacement at $t = 0$ is uniform, $u(r, t = 0) = u_0$ with $\dot{u}(r; t = 0) = 0$. Construct the basis functions $R_n(r)$ for the motion and determine the eigenfrequency $\omega_n$ for each value of $n$. Determine the full time dependence $u(r, t)$.

3. Consider the time-dependent Schroedinger equation in a box of length $L$ with $\psi$ equal to zero at $x = 0$ and $x = L$ and $V = 0$. The goal is to show that the form of the equation guarantees that the integrated probability of the particle being in the box is a constant in time. To demonstrate this consider the local probability $P(x, t) = \psi^*\psi$. Take the time derivative of $P$ and use the Schroedinger equation to evaluate $\dot{\psi}$. The time derivative of $\psi^*$ can be obtained by taking the complex conjugate of the Schroedinger equation. Integrate the equation for $\dot{P}$ over the entire domain and integrate by parts. You will then find that the integral of $P$ is constant in time.