1. Rework example 4.3 for a magnetic field that points in the y-direction. Find A) the wavefunction at a later time $t$, assuming the same generic initial condition as the example, and B) the probabilities of both possible outcomes of a measurement $Sz$ at a later time $t$.

2. Consider an operator $Q = \begin{pmatrix} 0 & 0 & -2i \\ 0 & 1 & 0 \\ 2i & 0 & 0 \end{pmatrix}$, in a 3D Hilbert space. In this same space the Hamiltonian is $H = \begin{pmatrix} E_0 & 2 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. $E_0$ and $B$ are positive and real.

A) Find the eigenvalues and normalized eigenvectors of $Q$.

B) If at $t=0$ the unnormalized state is $\psi = A \begin{pmatrix} i \\ 1 \\ 1 + i \end{pmatrix}$, find $\langle Q \rangle$. (Start by normalizing $\psi$.)

C) If at $t=0$ the unnormalized state is $\psi = A \begin{pmatrix} i \\ 1 \\ 1 + i \end{pmatrix}$, find the probability that one would measure $Q=2B$ at later time $t=T$. (Start by normalizing and evolving $\psi$.)

D) At time $t=0$, one measures $Q$ and gets a negative number for a result. Calculate the probability that another measurement of $Q$ at time $t=T$ will yield a positive number.

3. Use equation 4.201 to answer parts b,c, and d of problem 4.56. (You can build your matrices by combining 4.200 with 4.201, in that same problem, without proving the results of part a or part e.)

4. Problem 4.36 (The one with parts a and b: "A particle of spin 1 and a particle of spin 2 are at rest...")