FALL 2009 PHYSICS 827 DUE Friday 9^{th} October

2.1) (6 points) Find the eigenvalues and eigenvectors of

$$\begin{pmatrix} 5 & 12 \\ 4 & 3 \end{pmatrix}.$$

Are the eigenvectors orthogonal? Find a row vector that is orthogonal to the eigenvector corresponding to the largest eigenvalue. Can you find any interesting property that this row vector obeys? If you cannot find one just say so.

2.2)(10 points) Consider a matrix which is perturbed slightly from the matrix Ω considered in the text on page 38, *Example 1.8.5* but still keeping it Hermitian

$$\Omega_\epsilon = \begin{pmatrix} 1 & 0 & 1-\epsilon \\ 0 & 2 & 0 \\ 1-\epsilon & 0 & 1 \end{pmatrix}.$$

Find its eigenvalues. Are they distinct? (What do you obtain when $\epsilon \to 0$)? Do you expect Ω_ϵ to possess orthogonal eigenvectors? Why? Find the eigenvectors of Ω_ϵ and determine the limit $\epsilon \to 0$.
What exactly does this calculation show? Please provide a brief but precise answer.
Construct the unitary matrix that diagonalizes ω_ϵ. State exactly what this means. You do not have to carry out any matrix multiplications.

2.3)(6 points) *Exercise 1.8.5* on page 42.

2.4) (8 points) *Exercise 1.8.12* on page 54.

2.5) (10 points) *Exercise 1.10.4* on page 73.

2.0) You need not submit these: *Exercises 1.10.1-1.10.3* on page 63. These results will be needed in the rest of the course. You should remember them.