Phys 3810, Spring 2011
Problem Set #6, Hints

1. *Griffiths*, **4.23** Apply the (analytic) raising operator to $Y_2^1(\theta, \phi)$ but also show from (4.120) and (4.121)

$$L_+ Y_2^1 = 2\hbar Y_2^2$$

2. *Griffiths*, **4.26** Multiply a lot of little matrices.
Show that if $j \neq k$ then

$$\sigma_j \sigma_k = i \sum_l \epsilon_{jkl} \sigma_l$$

and if $j = k$ then $\sigma_j \sigma_k = \sigma_j^2 = \mathbf{1}$. But results are contained in

$$\sigma_j \sigma_k = \delta_{jk} + i \sum_l \epsilon_{jkl} \sigma_l$$

3. *Griffiths*, **4.27** Normalizaton should be easy. Remember that the condition is $\chi^\dagger \chi = 1$ and for $\chi^\dagger$ you have to do a complex conjugation. In part (b) you should get

$$\langle S_x \rangle = 0 \qquad \langle S_y \rangle = -\frac{12}{25}\hbar \qquad \langle S_z \rangle = -\frac{7}{50}\hbar$$

On (c) you should get

$$\sigma_{S_z} = \frac{12}{25}\hbar$$

4. *Griffiths*, **4.29** Show that the eigenvectors of S_y (well, one choice for them) are

$$\chi_+^{(y)} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ i \end{pmatrix} \qquad\qquad \chi_-^{(y)} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -i \end{pmatrix}$$

5. *Griffiths*, **4.35** This one is a short easy (?) answer. Recall that spins s_1 and s_2 can "add" to give all spins from

$$s_1 + s_2 \qquad \text{down to} \qquad |s_1 - s_2|$$