AQM-2013f HW3

1. 4.27.
2. 4.29.
3. 4.30.
4. 4.31.
5. Let us choose the $|+\rangle$ and $|-\rangle$ basis states of the spin ½ system which are the eigenstates of S^2 and S_z. If $|+\rangle_x$ and $|-\rangle_x$ be the eigenstates of S^2 and S_x. Express $|+\rangle_x$ and $|-\rangle_x$ in terms of $|+\rangle$ and $|-\rangle$ basis states.

   By definition, a projection operator P_{+x} will have the property

   $$P_{+x}\ |+\rangle_x = 1\ |+\rangle_x$$

   $$P_{+x}\ |-\rangle_x = 0\ |-\rangle_x = 0$$

   (a) Express the operator P_{+x} in the basis set of $|+\rangle_x$ and $|-\rangle_x$. It is a matrix.

   (b) Express the operator P_{+x} in the basis set of $|+\rangle$ and $|-\rangle$.

   (c) Show that the operator $P_{+x} = |+\rangle_x \langle+|_x$. Note that $\langle+|_x$ is the bra of the ket $|+\rangle_x$. To prove (c) calculate the matrix of $|+\rangle_x \langle+|_x$ is the same as in (a) and in (b) above.