Assignment #6. Due Thurs 4/23.

1. Why can't we mathematically represent the quantum spin property of "Hardness" as a function on a classical phase space?

2. (a) Suppose two electrons are in the entangled state $|\Psi^{+}\rangle = \sqrt{½}(|0\rangle_1|0\rangle_2 + |1\rangle_1|1\rangle_2)$, where $|0\rangle$ and $|1\rangle$ are eigenstates of Hardness that represent the values hard and soft, respectively. According to the Eigenvalue-Eigenvector Rule, do the electrons have a definite value of Hardness?
   (b) Suppose we measure the Hardness of electron #1 above and get hard. According to the Projection Postulate, what is the post-measurement state of the two electrons? In this post-measurement state, according to the Eigenvalue-Eigenvector Rule, does electron #2 have a value of Hardness? If so, what is it?
   (c) Suppose the two electrons above were separated by a huge distance prior to the measurement of electron #1's Hardness. In what sense does the Eigenvalue-Eigenvector result above suggest what Einstein referred to as "spooky action at a distance"?

3. In what sense does a qubit encode an infinite amount of information? In what sense can only a single bit's worth of information be accessed from a qubit?

4. What does the No-Cloning Theorem say? In what sense does quantum teleportation *not* violate the No-Cloning Theorem?