Physics 214 **Quiz 5-2 [20 points]** **Week 6**

An electron is prepared in a superposition of two energy eigenstates, $\psi \propto (3\psi_1 + 2\psi_2)$.
ψ_1 and ψ_2 are individually normalized and have energies of $E_1 = 2$ eV, $E_2 = 5$ eV, respectively.

a) [4 points] Suppose you measure the electron's energy. What result or results might you obtain?

2 eV or 5 eV

b) [7 points] Write an expression for the normalized wave function. What is the probability of finding energy E_1?

ψ = 1/Sqrt(13) $(3\psi_1 + 2\psi_2)$

P(E1) = 9/13

c) [5 points] Consider the time dependence. At $t = 0$, the probability density is $P(x,0)$. When is the next time that the probability density $P(x,t)$ returns to its $t = 0$ value (i.e., $P(x,t) = P(x,0)$)? You should give a numerical answer, in seconds.

The interference term goes like $e^{i(w1-w2)t}$ so we get back to the origina P(x,t) when t = 2 π/(w1-w2) = h/(E2-E1) = 1.38×10^{-15} sec.

d) [4 points] If the energy E_2 is measured, write the complete *normalized* state, ψ, *after* the measurement, in terms of ψ_1 and ψ_2.

$\psi = \psi_2$