Homework #1 (due date: Thursday, March 21)

1. Solve the following exercises in Shankar.
   (a) Exercise 4.2.1
   (b) Exercise 4.2.2
   (c) Exercise 4.2.3
   (d) Exercise 5.1.2

2. Consider a wavefunction in the position space of the form $\psi(x) = Ae^{-\alpha|x|}$.
   (a) Determine A so that $\psi(x)$ is properly normalized.
   (b) Find the wavefunction in the momentum space $\psi(p)$.
   (c) Find $<X>$, $<P>$, ΔX and ΔP. Is the Heisenberg uncertainty relation satisfied?

3. Consider a wavepacket for photons which are massless so that $E = pc$. Does such a wavepacket spread as time goes on?