Problem 1
Do Problem 3.2 in HSO.

Problem 2
Do Problem 4.1 in HSO. Note that there’re typos in the equations. Please see the following corrections:

\[ A(k, t) = (4\pi L^2)^{1/4} e^{-L^2(k-k_0)^2/2} e^{-i\omega(k)t} \]
\[ \psi(x) = \frac{1}{(\pi L^2)^{1/4}} e^{-\frac{(x-vt)^2}{2L^2}} e^{i(k_0 x - \omega(k_0)t)} \]

In part (a), use x-space wavefunction to calculate \( \langle x \rangle \). The purpose of this problem is not so much about the math but to show what happens physically under the linear approximation.

Problem 3
Do Problem 4.6 in HSO

Problem 4
Do Problem 4.4 in HSO