Problems

1. **Matter Waves**. Show that the group velocity (v_{group}) of matter waves is related to the phase velocity (v_{phase}) by the following expression: $v_{group} = \dfrac{c^2}{v_{phase}\big|_{k_0}}$.

2. Show that a monochromatic plane wave wavefunction $\Psi(x,t) = Ae^{i(kx-wt)}$ satisfies the time-dependent Schrödinger equation, $-\dfrac{\hbar^2}{2m}\dfrac{\partial^2 \Psi}{\partial x^2} + U(x)\Psi = i\hbar\dfrac{\partial \Psi}{\partial t}$, assuming that $U(x) = 0$.

3. **SMM, Chapter 5, problem 1.**

4. **SMM, Chapter 5, problem 2.**

5. **SMM, Chapter 5, problem 5.**

6. **SMM, Chapter 5, problem 9.**

7. **SMM, Chapter 5, problem 16.**