Phys 448 HW 1

1) Briefly describe the following experiments and their significance for demonstrating the quantum nature of matter: e/m expt, Rutherford scattering, spectrum of hydrogen, photoelectric effect.

2) Read Phys. Rev. Lett. 56, 2797 (1986). How does Fig. 2 demonstrate the quantum nature of atoms and light?

3) Use Mathematica to evaluate the integral \( \int_{-\infty}^{\infty} e^{2\pi i \Delta t^2} \, dt, \ \Delta > 0. \)

4) Plot \( \sum_{k=-n}^{n} \text{Im} \left[ \sin \left( \frac{k\pi}{8} \right) \text{sinc}(\pi k q) e^{ik\theta} \right] \) for \( q = 0.8, \) and \( n = 4, 40, \) and \( 400. \) Show all three plots on the same graph. Review Fourier series from your calculus text.

5-8) BD Chapter 1 #1-4