PHYS 621: grad Quantum Mechanics I
Due date: Thursday, October 29, 2026 (in class)

Problem Set #4
Harmonic Oscillator and other 1D Potentials

Question 1: Expectation values for the 1D harmonic oscillator
Sakurai & Napolitano problem 2.16

Question 2: Correlation function
Sakurai & Napolitano problem 2.18

Question 3: 1D harmonic oscillator time evolution
Sakurai & Napolitano problem 2.19

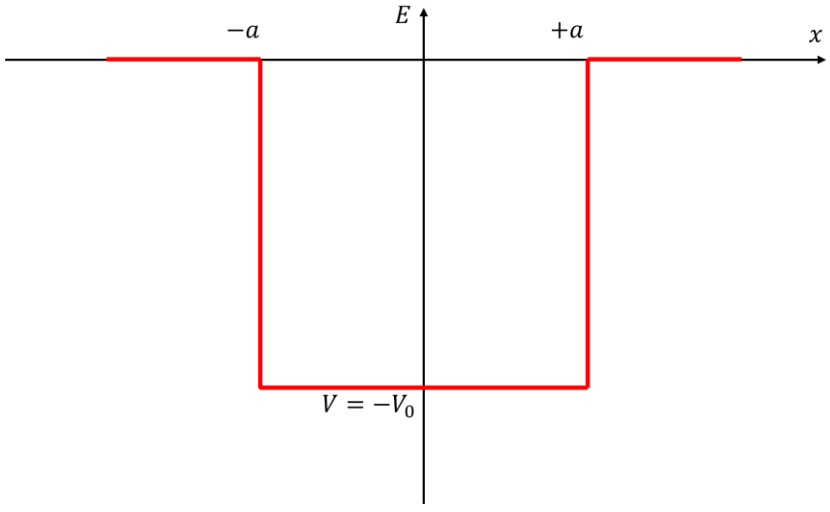
Question 4: Coherent states
Sakurai & Napolitano problem 2.21

Question 5: Half of a harmonic oscillator
Sakurai & Napolitano problem 2.27

Question 6: Infinite square well potential
Sakurai & Napolitano problem 2.28

Question 7: Delta function well potential
Sakurai & Napolitano problem 2.29

Question 8: Finite square well potential
Consider a particle of mass m in the following the square well potential:



Starting from the Schrodinger equation, show that for there to be at least one odd bound state, then the potential must satisfy:

$$V_0 \geq \frac{\pi^2 \hbar^2}{8ma^2}$$