

# Quantum Mechanics 2025 HW3 — part I

Due 09/25 in Class

September 16, 2025

## Problem 1. A quantum particle in an infinitely deep potential well

Consider a quantum particle with the mass  $m$  moving in a quantum well with the potential of

$$V(x) = \begin{cases} +\infty, & |x| \geq L/2, \\ 0, & |x| < L/2. \end{cases} \quad (1)$$

- 1) Solve the eigen-energies  $E_n^\pm$  and the associated normalized eigen-wavefunctions  $\psi_n^\pm(x)$ .  $\pm$  are the parity number;  $E_1^+ < E_2^+ < E_3^+ < \dots$  and  $E_1^- < E_2^- < E_3^- < \dots$
- 2) Consider an initial state

$$\psi(t=0) = \frac{1}{\sqrt{2}} (\psi_1^+(x) + \psi_1^-(x)). \quad (2)$$

Please calculate its time-evolution  $\psi(t)$ .

- 3) Calculate  $\sqrt{(\Delta x)^2}$  and  $\sqrt{(\Delta p)^2}$  in each state. Check whether they satisfy  $\sqrt{(\Delta x)^2} \sqrt{(\Delta p)^2} \geq \hbar/2$ .