

Week 2 Worksheet 2

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July 1, 2026

Exercise 1. Consider the “even” infinite square well: $V(x) = 0$ for $x \in (-a, a)$.

- a) Solve the Schrödinger equation for this potential and obtain the complete basis of solutions.
- b) Explain how you could have gotten the solutions from the usual infinite square well ($V(x) = 0$ for $x \in (0, a)$) by a change of coordinates. Check that this gives the same answer as (a).

Exercise 2 (Introduction to Coherent States). In this problem, we will study minimum uncertainty states, also called coherent states. Consider the ground state of the harmonic oscillator,

$$\psi_0(x) = Ae^{-m\omega x^2/2\hbar}.$$

- a) Normalize $\psi_0(x)$.
- b) Show that this state has $\langle x \rangle = \langle p \rangle = 0$.
- c) Show that this state also has $\sigma_x \sigma_p = \hbar/2$, so it has **minimum uncertainty**. It is called a **coherent state**.