

731 Homework set 3 (due Sept.30)

1. A particle of mass m is confined in between one-dimensional perfectly rigid walls, with a potential

$$V(x) = \begin{cases} 0 & \text{for } 0 < x < a \\ \infty & \text{for } x < 0, x > a. \end{cases}$$

If the particle is in a state $|\psi\rangle$ specified in the coordinate representation

$$\langle x|\psi\rangle = \frac{2}{\sqrt{a}} \cos \frac{\pi}{2a}x \sin \frac{3\pi}{2a}x,$$

find the possible values for measuring its energy and the corresponding probabilities (10 points). [Hint: The energy eigenfunctions are $\langle x|n\rangle = \psi_n(x) = \sqrt{\frac{2}{a}} \sin \frac{n\pi}{a}x$ ($n = 1, 2, 3, \dots$) with the corresponding eigenvalues $E_n = \frac{\pi^2 \hbar^2 n^2}{2ma^2}$.]

2. Sakurai's p.61, Problem 9 (20 points). [Hint: You may use the explicit representation for the operators S_x , S_y , S_z in the S_z diagonal basis. An overall phase factor is irrelevant for a state vector.]

3. Sakurai's p.62, Problem 12 (10 points).

Please do comment on your result for the cases $\gamma = 0$, $\pi/2$, and π .