Phys 511 Prof. P. Berman
Quantum Mechanics I Fall, 2003

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Review Questions

These are review questions which can be used as a study guide. They are **not** *questions which will necessarily appear on the exam.*

Recitation on Thursday, October 16, in Room 4246 Randall

Midterm Exam: Monday, October 20 5:30-7:00, Room 340 West Hall

1. State three properties of eigenvalues or eigenvectors of Hermitial operators.

2. Of what use are commuting operators in quantum mechanics?

3. Calculate the average force that a particle exerts on the wall of an infinite one dimensional potential well.

4. Show how one can get the energy levels in a one-dimensional, finite potential well.

5. Write down equations that can be used to get the transmission coefficient for a one-dimensional barrier. Without solving the equations, indicate how you would go about finding the transmission coefficient.

6. The initial state of a particle moving in a one-dimensional simple harmonic potential is $\psi(\xi,0) = 1/\sqrt{6}$ for $|\xi| < 3$ and is zero otherwise. Estimate the maximum number of eigenstates that enter into the expansion of this wave function.

7. A particle moves in a potential $V(x) = \alpha x^4$. For large quantum number n, does the energy grow linearly with n? Explain.

8. Prove that, on average, a particle moving in a potential $V(\mathbf{r})$ obeys Newton's equations of motion.

9. Give some general arguments as to why a symmetry in nature is connected with energy degeneracy of the energy eigenfunctions.

10. Find an integral expression for the eigenfunctions of a particle moving in the potential $V(x) = \alpha x$ for $x > 0$ and $V(x) = \infty$ for $x < 0$.

11. Prove that the wave function for a particle moving in an infinite potential well is periodic, and find its period.

12. The initial state of an harmonic oscillator is $\psi(\xi,0) = \left(3\xi^2 + 2\xi\right) e^{-\xi^2/2}$. Find $\left|\psi(\xi,t)\right|^2$.