Physics 8.321, Fall 2002
Homework #7

Due **Monday, October 28** by 4:30 PM in the 8.321 homework box in 4-339B.

1. Sakurai: Problem 21, Chapter 2 (page 148)

2. Sakurai: Problem 23, Chapter 2 (page 148)

3. Sakurai: Problem 24, Chapter 2 (page 148)

4. Use the WKB approximation to calculate the spectrum of energies for a particle in the following 1D potentials (in units $\hbar = m = 1$):

   (a) Harmonic oscillator potential $V(x) = \frac{1}{2}x^2$.

   (b) Box potential $V(x) = 0$ for $0 \leq x \leq L$, $V(x) = \infty$ otherwise.

   (c) $V(x) = |kx^\alpha|$, with $\alpha, k > 0$.

   (d) Compare with the exact values for the ground state and first excited state in each case (set $k = 1/4, \alpha = 4$ in case (c), and compare with the results $E_0 = 0.4208, E_1 = 1.5079$ from problem set 5). In which case does the WKB approximation do the worst? Why?

5. This problem not included for copyright reasons.