Physics 195a
Problem set number 7
Due 2 PM, Thursday, November 21, 2002

Notes about course:

- Homework should be turned in to the TA's mail slot on the first floor of East Bridge.

- Collaboration policy: OK to work together in small groups, and to help with each other's understanding. Best to first give problems a good try by yourself. Don't just copy someone else's work – whatever you turn in should be what you think you understand.

- There is a web page for this course, which should be referred to for the most up-to-date information. The URL:
  http://www.hep.caltech.edu/~fcp/ph195/

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- If you think a problem is completely trivial (and hence a waste of your time), you don't have to do it. Just write "trivial" where your solution would go, and you will get credit for it. Of course, this means you are volunteering to help the rest of the class understand it, if they don't find it so simple...

READING: Read sections 1-5 of the "Solving the Schrödinger Equation: Resolvents" course note.

PROBLEMS:

35. Harmonic oscillator in three dimensions: Exercise 2 of the Harmonic Oscillator course note.

36. Resolvent mathematics: Exercise 1 of the Resolvent course note.

37. More resolvent mathematics: Exercise 2 of the Resolvent course note.

38. Still more resolvent mathematics: Exercise 3 of the Resolvent course note.

39. Green's function solution of the infinite square well: Exercise 4 of the Resolvent course note.

40. The one-electron atom (review?): We have had a couple of examples of looking at the qualitative features of wave functions. Now apply the same reasoning to the one-electron atom. Thus, sketch the effective potential and the lowest three radial wave functions (do both $R(r)$ and $u(r) = rR(r)$) for the 1-electron atom for $\ell = 0$. Now do the same for the qualitative solutions for $\ell = 1$. Pay attention to the turning points, and to the dependence at $r = 0$. Since you have already computed the actual wave functions, you may produce graphs of the functions you obtained. If you do this, however, you should look carefully at your graphs and make sure you understand at a physically intuitive level the qualitative features.