# Homework 3, due 9-15

1. Consider the one-dimensional potential well

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

discussed in class. Compute the expectation values of $x, x^2, p, p^2$. Remember that $\hat{p} = -i\hbar d/dx$.

2. The energy eigenstates of the one-dimensional potential well are

$$E_n = \frac{\hbar^2 \pi^2 n^2}{2ma}, \qquad (n > 0).$$

What is the ground state energy of a 0.1 kg billiard plan which is confined between two walls 1m apart? What is the corresponding (classical) velocity? What is the quantum number $n$ corresponding to the billiard ball moving at $v = 0.1$ m/s?