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 \( x, x^2, p, \dot{p}^2 \). Remember that \( \dot{p} = -i\hbar d/dx \).

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

\[ E_n = \frac{\hbar^2 \pi^2 n^2}{2ma}, \quad (n > 0). \]

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?