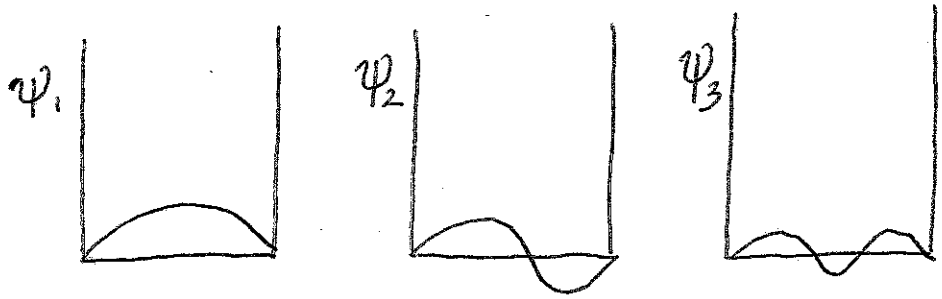
Name:

Quiz 2

1. Sketch the lowest three energy eigenstates, $\psi_0(x)$, $\psi_1(x)$, and $\psi_2(x)$, for a particle in an infinite square well of width a.



2. A wave function, $\psi(x,0)$, for an infinite square well between $0 < x < 1$ at $t = 0$ is equal to $\sqrt{3}$ for $1/3 < x < 2/3$ and 0 otherwise. $\psi(x,0)$ may be expressed in terms of the eigenstates of the infinite square well as

$$\psi(x,0) = \sum_{n=1}^{\infty} c_n \psi_n(x). \tag{1}$$

Based on your sketches in part 1, which of the c_n to you expect to be zero?

even n

3. Derive an expression for the c_n by evaluating an integral.

$$c_n = \int_{1/3}^{2/3} \sqrt{3}(\sin(n\pi x)\sqrt{2})\,dx$$

$$= \sqrt{6}\,\frac{-\cos(n\pi x)}{n\pi}\Big|_{1/3}^{2/3} = \frac{\sqrt{6}}{n\pi}\left(\cos\left(\frac{n\pi}{3}\right) - \cos\left(\frac{2n\pi}{3}\right)\right)$$

$\frac{n\pi}{2} - \frac{n\pi}{6}$ $\qquad$ $\frac{n\pi}{2} + \frac{n\pi}{6}$

$$= \frac{\sqrt{6}}{n\pi}\, 2\sin\left(\frac{n\pi}{2}\right)\sin\left(\frac{n\pi}{6}\right)$$

$\swarrow$ vanishes for $n = 2, 4, 6, \ldots$