UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Physics

Physics 115A
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Midterm (continued)

2. Continued...

(b) At the time $t = 0$ what is the probability, $dP(\frac{a}{2})$, of measuring the position $x = \frac{a}{2}$ within the interval dx?

$$dP(\tfrac{a}{2}) = |\psi(a/2)|^2 dx = \tfrac{1}{2}\left|\sqrt{\tfrac{2}{a}}\sin\tfrac{\pi}{a}\tfrac{a}{2} + \sqrt{\tfrac{2}{a}}\sin\tfrac{2\pi}{a}\tfrac{a}{2}\right|^2$$

$\sin\frac{\pi}{a}\frac{a}{2} = 1$ $\qquad$ $\sin\frac{2\pi}{a}\frac{a}{2} = 0$

$$dP(\tfrac{a}{2}) = \frac{dx}{a}$$

(c) At $t = 0$ what is the probability that a measurement of the energy yields the value $\frac{1}{2m}\left(\frac{\hbar 3\pi}{a}\right)^2$? Prob = 0.

This is the energy associated with $n=3$.

$\psi(x) = \sum_n C_n \phi_n$. For our case

$C_1 = \frac{1}{\sqrt{2}}$, $C_2 = \frac{1}{\sqrt{2}}$ all other C_n's are zero.

So $P_3 = |C_3|^2 = 0$

(d) A measurement of the energy yields the value $E = \frac{1}{2m}\left(\hbar\frac{\pi}{a}\right)^2$. Write an expression for $|\psi\rangle$ which is valid immediately after this measurement.

After measure E_1 the system is in the $n=1$ energy eigenstate.

$$\psi(x) = \sqrt{\tfrac{2}{a}}\sin\tfrac{\pi x}{a}.$$