

Name: _____

1. Let ψ_j be a j th eigenstate for a particle in a one-dimensional box $[0, L]$
 - (a) Sketch ψ_1 , ψ_2 , and ψ_3 .
 - (b) How many zeroes does ψ_j have? (The ones at the endpoints don't count.)

(over)

2. Let $0 < E_1 < E_2 \leq E_3 \leq E_4 \leq \cdots$ be the energy levels for a particle in a two-dimensional box $[0, a] \times [0, b]$. Find a and b such that $E_3 = E_4$.

Solutions:

1. (a) 

(b) $j - 1$ zeroes.

2. The energy levels are, up to an overall constant, $m^2/a^2 + n^2/b^2$, where m and n run over the positive integers. Taking $a \geq b$ for definiteness, the first energy level is $m = n = 1$ and the second is $m = 2, n = 1$. Let's arrange a and b such that $m = 3, n = 1$ equals $m = 1, n = 2$. That means

$$\frac{9}{a^2} + \frac{1}{b^2} = \frac{1}{a^2} + \frac{4}{b^2},$$

or $8b^2 = 3a^2$, so we may take $b = \sqrt{3}$ and $a = \sqrt{8}$.