

7. (8, 12 c) 2D rigid square box in $n_x=4, n_y=3$ state

$$\psi(x,y) = A \sin\left(\frac{4\pi x}{a}\right) \sin\left(\frac{3\pi y}{a}\right)$$

$$\text{so } |\psi(x,y)|^2 = A^2 \underbrace{\sin^2\left(\frac{4\pi x}{a}\right)} \underbrace{\sin^2\left(\frac{3\pi y}{a}\right)}$$

max where

$$\frac{4\pi x}{a} = \frac{\pi}{2}, \frac{3\pi}{2}, \dots$$

$$\Rightarrow x = \frac{a}{8}, \frac{3a}{8}, \frac{5a}{8}, \frac{7a}{8}$$

max where

$$\frac{3\pi y}{a} = \frac{\pi}{2}, \frac{3\pi}{2}, \dots$$

$$\Rightarrow y = \frac{a}{6}, \frac{3a}{6}, \frac{5a}{6}$$

so there are 12 points where $|\psi(x,y)| = \text{max}$:

$$(x,y) = \left(\left\{ \frac{a}{8}, \frac{3a}{8}, \frac{5a}{8}, \frac{7a}{8} \right\}, \left\{ \frac{a}{6}, \frac{3a}{6}, \frac{5a}{6} \right\} \right)$$

contour map:

