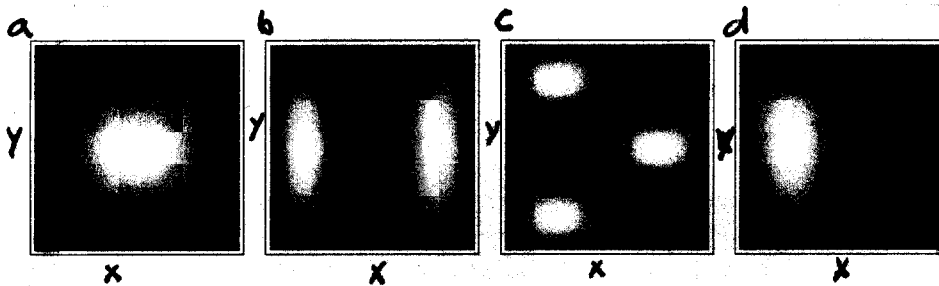
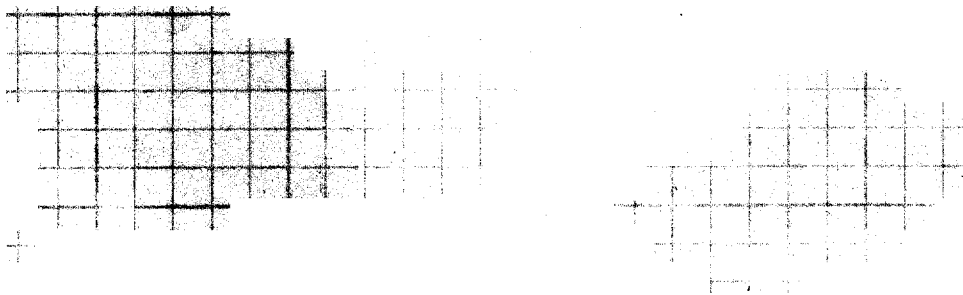


① The following are density plots of the wavefunction for a particle in a 2D box. Identify these wavefunctions.



a _____ b _____ c _____ d _____

② Calculate $\langle L_z \rangle$ for a particle on a ring. ($\psi_m = \frac{1}{\sqrt{2\pi}} e^{im\phi}$, $L_z = -i\hbar \frac{\partial}{\partial \phi}$)



③ Derive an expression for the spectrum of the rigid rotor ($E_l = l(l+1)B_e$, $B_e = \frac{\hbar^2}{8\pi^2 I}$)

④ Show the superposition $\psi = \sum a_n \psi_n$ is not an eigenfunction of \hat{H} even when $\hat{H}\psi_n = E_n\psi_n$.