

Assignment 7

1. For a simple harmonic oscillator, show that the wavefunction corresponding to $n = 1$ is given by

$$\psi_1 = A_1 u e^{-u^2/2},$$

and the wavefunction for $n = 2$ takes the form

$$\psi_2 = A_2 (1 - 2u^2) e^{-u^2/2}.$$

2. Consider a one-variable function $\psi(r)$ for $r = \sqrt{x^2 + y^2 + z^2}$, and derive the relation below.

$$\frac{\partial^2 \psi}{\partial x^2} = \frac{1}{r} \frac{\partial \psi}{\partial r} + \frac{x^2}{r} \frac{\partial}{\partial r} \left(\frac{1}{r} \frac{\partial \psi}{\partial r} \right)$$