# PHY 6645 - Quantum Mechanics I - Fall 2018
# Homework #9, due October 24

1. a) Show that

$$\begin{aligned} [\frac{d}{dy}, (y - \frac{d}{dy})^n] &= n(y - \frac{d}{dy})^{n-1} \qquad \text{and} \\ [(y - \frac{d}{dy})^n, y] &= -n(y - \frac{d}{dy})^{n-1} \quad . \end{aligned}$$

b) Show that the Hermite polynomials

$$H_n(y) = e^{\frac{1}{2}y^2}(y - \frac{d}{dy})^n e^{-\frac{1}{2}y^2} \tag{0.1}$$

satisfy the recursion relations

$$\begin{aligned} \frac{dH_n(y)}{dy} &= 2nH_{n-1}(y) \\ H_{n+1}(y) &= 2yH_n(y) - 2nH_{n-1}(y) \quad . \end{aligned} \tag{0.2}$$

2. Problems 7.3.6, 7.4.2, 7.4.3, 7.4.4 and 7.4.6 in Shankar's book.