PHY 6645 - Quantum Mechanics I - Fall 2018
Homework set # 3, due September 12

1. If X and P are canonically conjugate observables, we have $X = X^\dagger$, $P = P^\dagger$ and $[X, P] = \hbar i$. Using these equations, show that

a. $[X, F(P)] = \hbar i \frac{dF}{dP}$, where $F(P)$ is any function of the operator P.

b. $< x|P^n|\Psi > = \left(\frac{\hbar}{i}\right)^n \frac{d^n}{dx^n} < x|\Psi >$ where the $|x>$ are the eigenstates of X.

c. $< x|p > = Ne^{ixp/\hbar}$ where the $|p>$ are the eigenstates of P and N is a normalization constant.

2. Problems 4.2.1, 4.2.3, 5.1.1, 5.1.2 and 5.1.3 in Shankar's book.