

CHM102
Assignment 2 (17-1-2017)

1. Shown below are a few functions. Which of them are eigenfunctions of the operator (d/dx) .
 - a) $\sin(3x)$
 - b) $\exp(-3ix)$
 - c) $\exp(\alpha x^2)$
2. Is the function $[(1/\pi)\sin(3x)]$ an eigenfunction of the operator: $[(-\hbar^2/8\pi^2m)d^2/dx^2]$. If so, what is its eigenvalue?
3. The lowest energy electrons in a carbon nanotube can be described by the wavefunction given by $[\sin(\pi x/L)]$, where L is the length of the nanotube. (We will later learn in class as to how to arrive at this wavefunction.) For now,
 - a) Normalize this wavefunction.
 - b) Using the normalized wavefunction, calculate the probability of finding an electron between $x=L/4$ and $x=L/2$?
 - c) Using the normalized wavefunctions, calculate the expectation value for the **kintetic energy** of the electron.
4. Which of the following operators given below are Hermitian:
 - a) $-(d^2/dx^2)$
 - b) $-i(d/dx)$
 - c) (d/dx)
5. Check if the two operators (d^2/dx^2) and (x^2) commute.