Lab-15

1. Consider the following potential in 1D: V(x) = xexp($-x^2$).

   Find the ground and first excited state energies and the correspoinding wave functions using the shooting method. You may use RK-2 as the basic ODE solver and Secant Method for root finding part.

   A few points to note:

   Take $\hbar^2/(2m)$ to be 1 The function whose root is to be determined (with E as the parameter) is f(E) = $\psi_R(x_m, E)\psi'_L(x_m, E) - \psi_L(x_m, E)\psi'_R(x_m, E)$ (Later, do worry about why this is the appropriate choice!) For the 'evolution' from right to left ($\psi_R(x_m, E)$) remember that the increments are such that x has to decrease (with the ususal notion that x increases from left to right) Secant method has the following update rule: $x_{i+1} = x_i - f_i \frac{(x_i - x_{i-1})}{(f_i - f_{i-1})}$