I. Start by construct a python program using a) the Euler algorithm and b) the Euler Richardson Algorithm which includes a velocity dependent damping as well as the height dependent gravitational field of the earth. Give the result for a drag force of the form kv^2 with $k=2*10^{-4}kg/m$ and for a body of mass $m=2kg$ falling from height of $5000m$. Plot the results.

II. Jacobi Approach: potential within rectangular region

1. Use the Jacobi approach to determine the potential $V(x,y)$ in a rectangular region with linear dimension $L_x=10$, $L_y=15$. The boundary of the rectangle is that a potential $V = 2$. Choose the grid $\Delta x = \Delta y = 1$. Before you run the program guess the exact form of $V(x,y)$ and set the initial value 30% lower than the exact answer. How many iterations are necessary to achieve 1% accuracy?
2. Consider the same geometry as in part 1), but set the initial potential at interior sites equal to zero except for the central sites whose potential is set equal to five. Does the potential distribution evolve to the same values as in part 1)?
3. Modify the initial values so that the value of the potential at the four sides is 1,2,1,2 respectively (larger values at long sides). Sketch the equipotential surfaces. What happens if the potential is 2 on three sides and 0 on the fourth? Iterate until 1% accuracy is obtained.

III. Gauss-Seidel and SOR Approach: potential within rectangular region

1. Modify the Program constructed in Question II so that potential at each site is updated sequentially. That is, after the average potential of the nearest neighbor sites of site *i* is computed, update the potential at *i* immediately. The new potential is computed using the most recently determined values of its nearest neighbor potentials. How many iterations are necessary to achieve *1%* accuracy for the data given in Question II?
2. Implement the successive over-relaxation approach (SOR) and compare the convergence rate to the Jacobi and the Gauss-seidel methods for three different system configurations and initial conditions of your choice.