Computational Physics Course

Exercise 3:

1- Solve the equation $\frac{dT(t)}{dt} = -k(T(t) - T_R)$ for $k = constant$ and $k = k(T, t)$. T_R is the temperature of the reservoir.
Plot $\sum_{i=1}^{N} \left| T(i)_{theory} - T(i)_{numeric} \right|$ versus h and find the optimum value for h.

2- Do the same procedure as the problem 1 for the equation $\frac{dT(t)}{dt} = -k|T(t) - T_R|$ and check the behavior of the answer around T_R.

3- Solve the equation in problem 1 with the:
   a) Euler-Cromer method.
   b) RK F45

4- Electric Dipole:
Consider an electric dipole in a uniform electric field. Find the $\Theta(t)$ if the initial angular displacement is Θ_0.

5- Simple Pendulum:
Consider a simple pendulum with small initial angular displacement Θ_0. Solve the equation of motion and find $\Theta(t)$ using Euler and Euler-Cromer method. Check the behavior of your answer from the Euler method for large t.

6- Calculate the derivative of a 1000 number of the data sets of the Exercise 1.