

# Assignment – 7 ODE

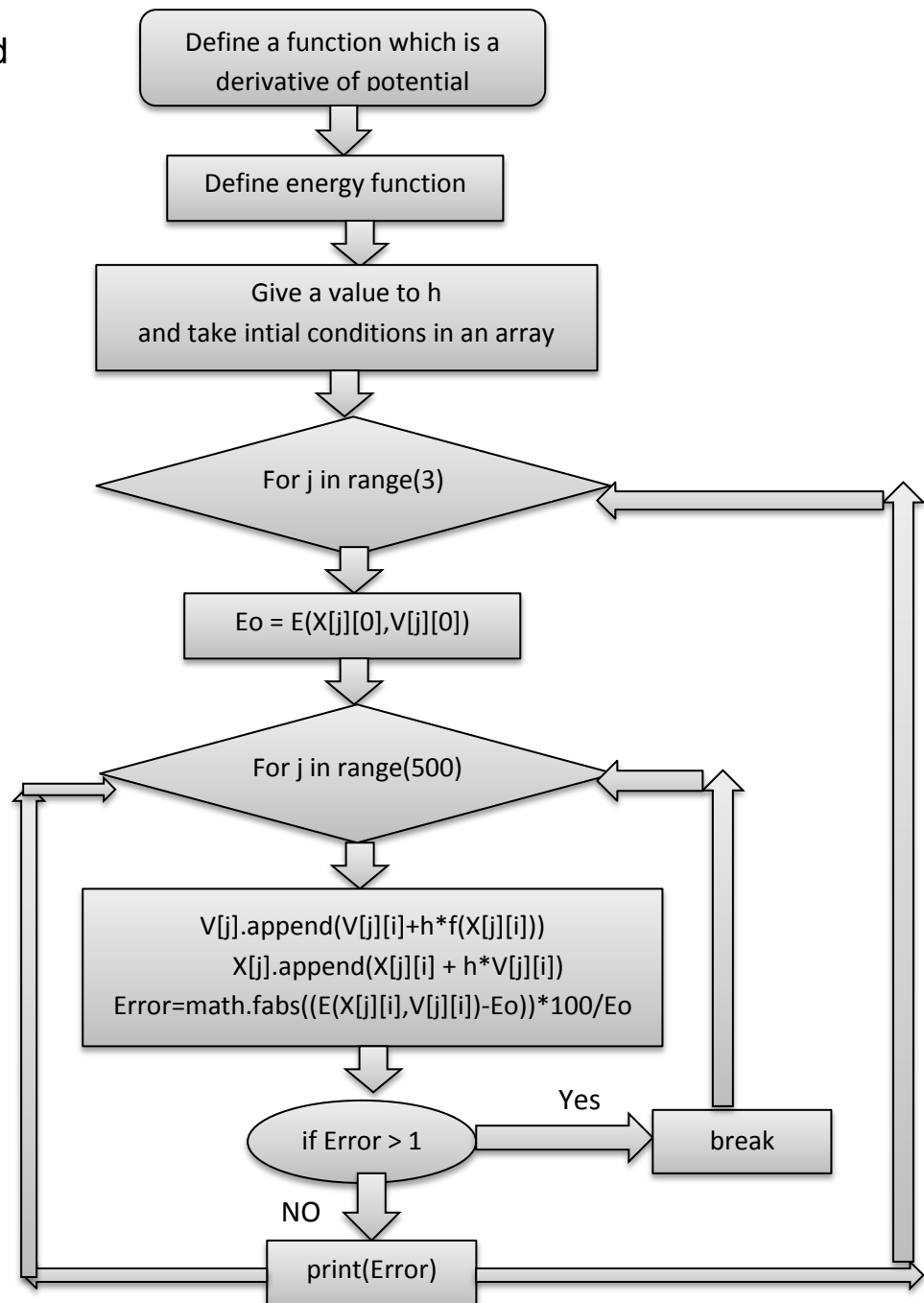
Name : Jigar

Roll no. : 14PH20010

## Problem – 1

### Method :

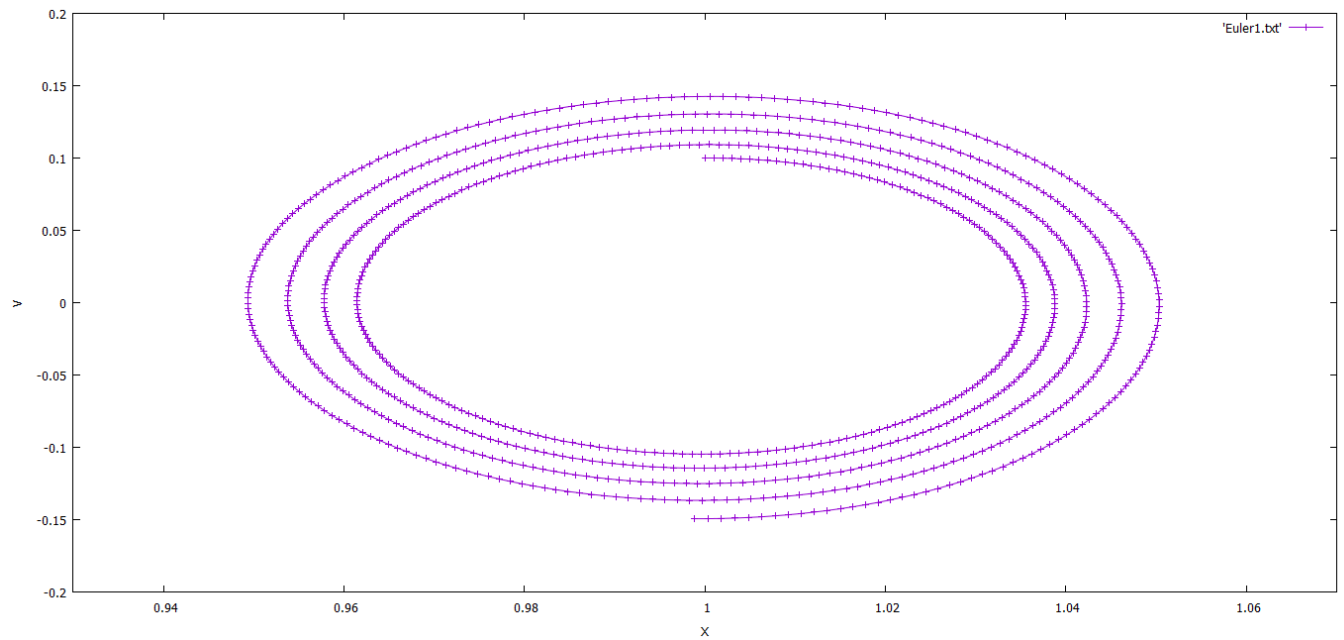
#### 1. Euler's method



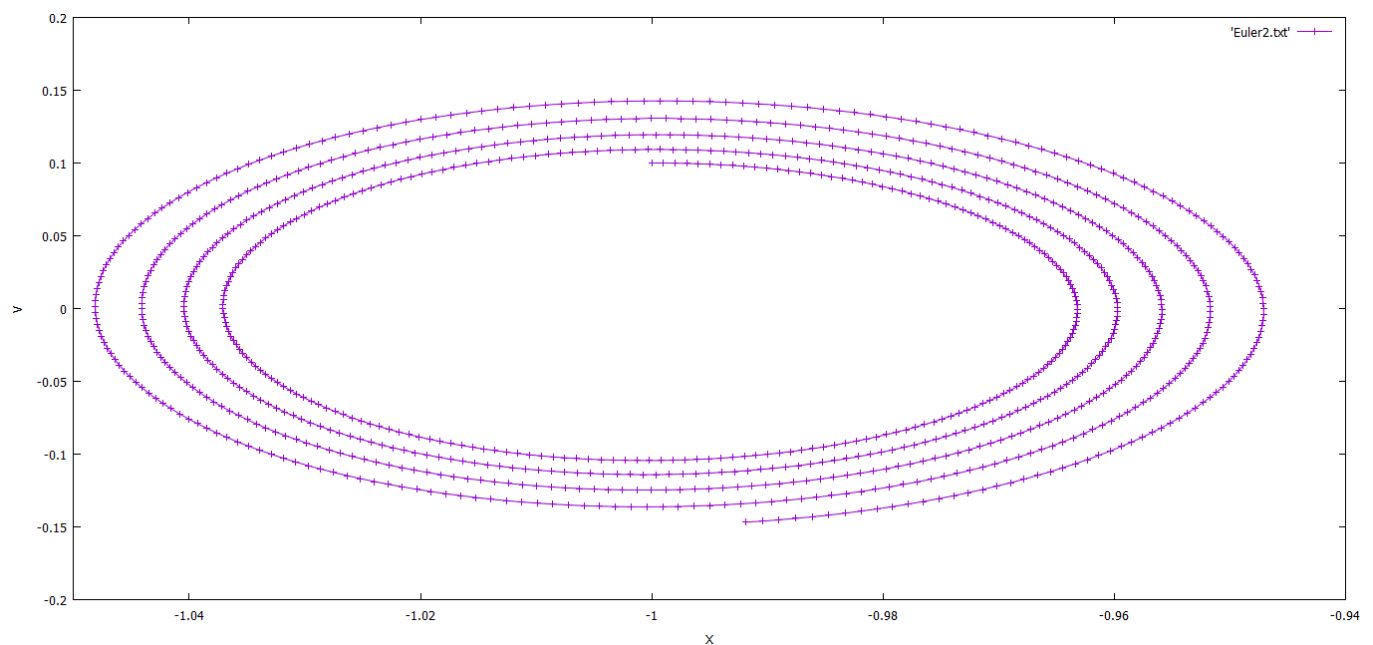
## Result and Graph :

We run a loop for large number of times and got x,v points and plotting we got following graphs.

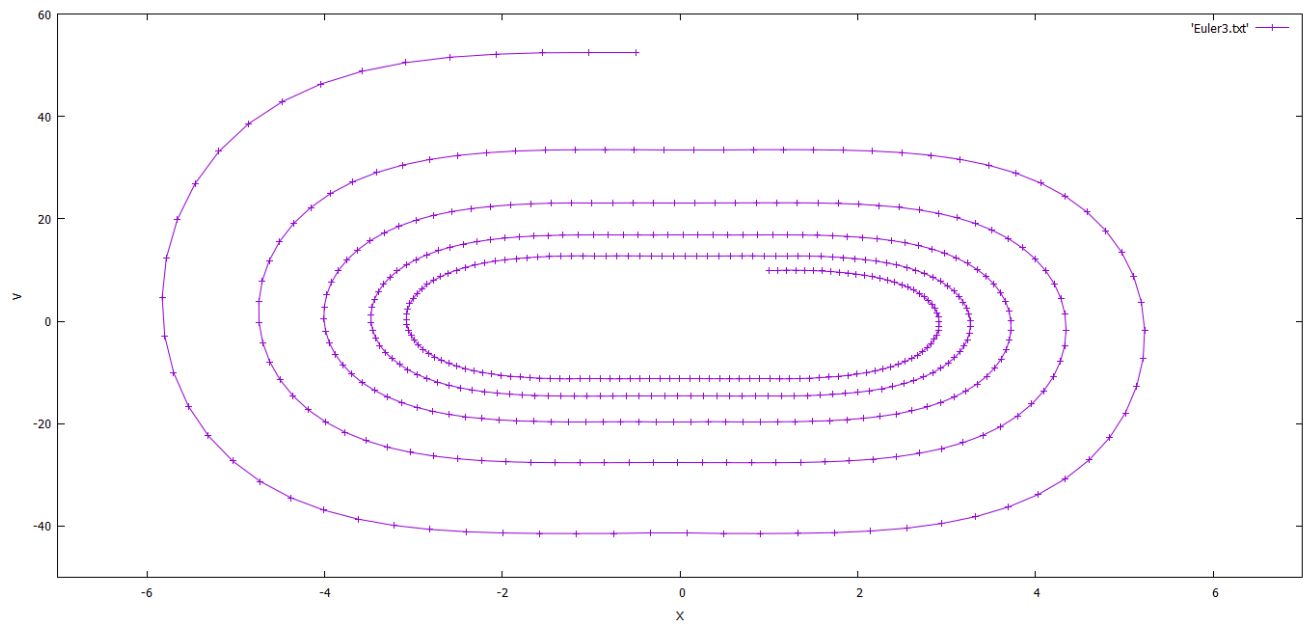
$x = 1.0, P_x = 0.1$



$x = -1.0, P_x = 0.1$



$x = 1.0, P_x = 10$



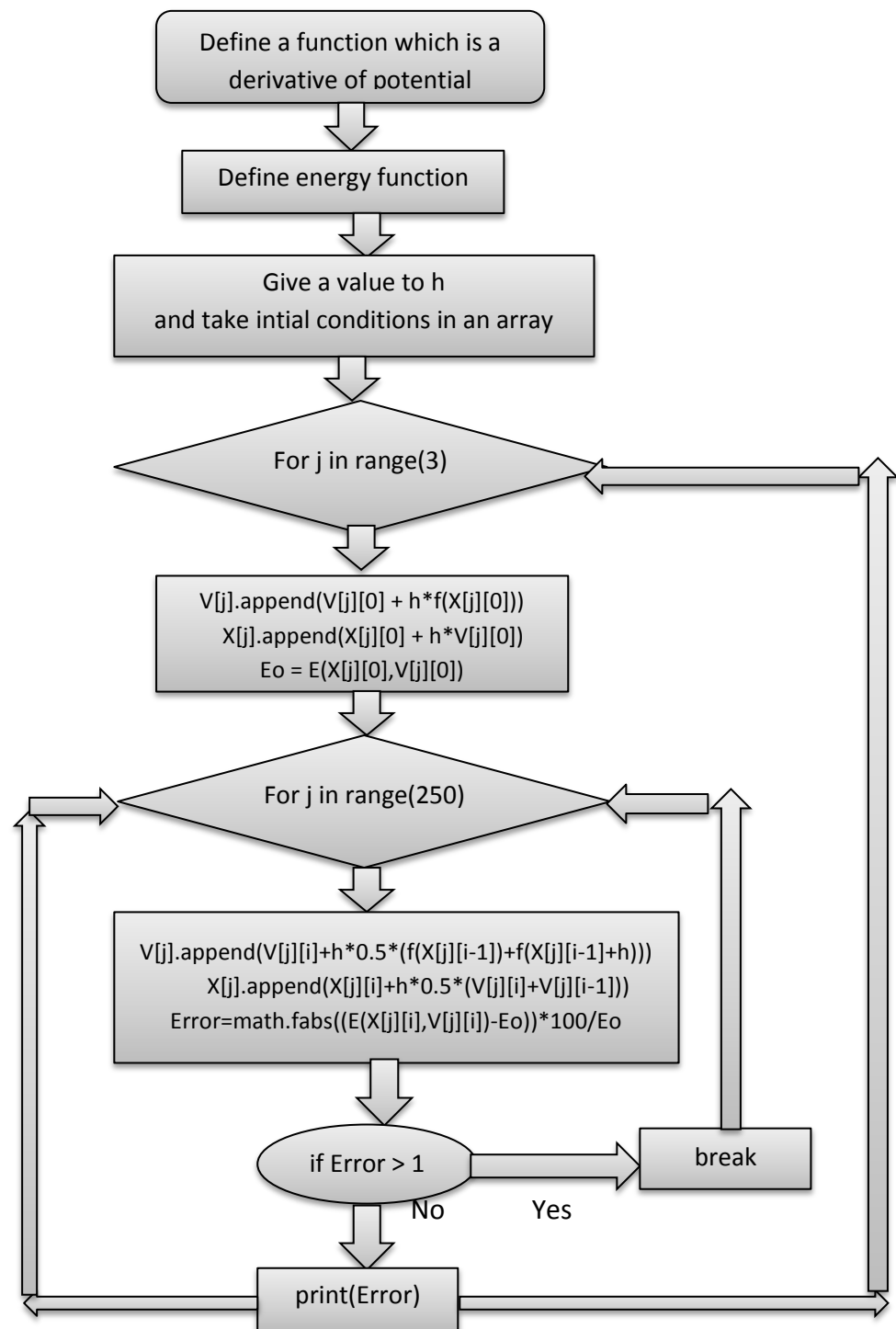
Finally for the conservation of energy within 1%, we got the value of step length as following

For first initial condition 0.0015

For Second initial condition 0.0016

For Third initial condition 0.00062

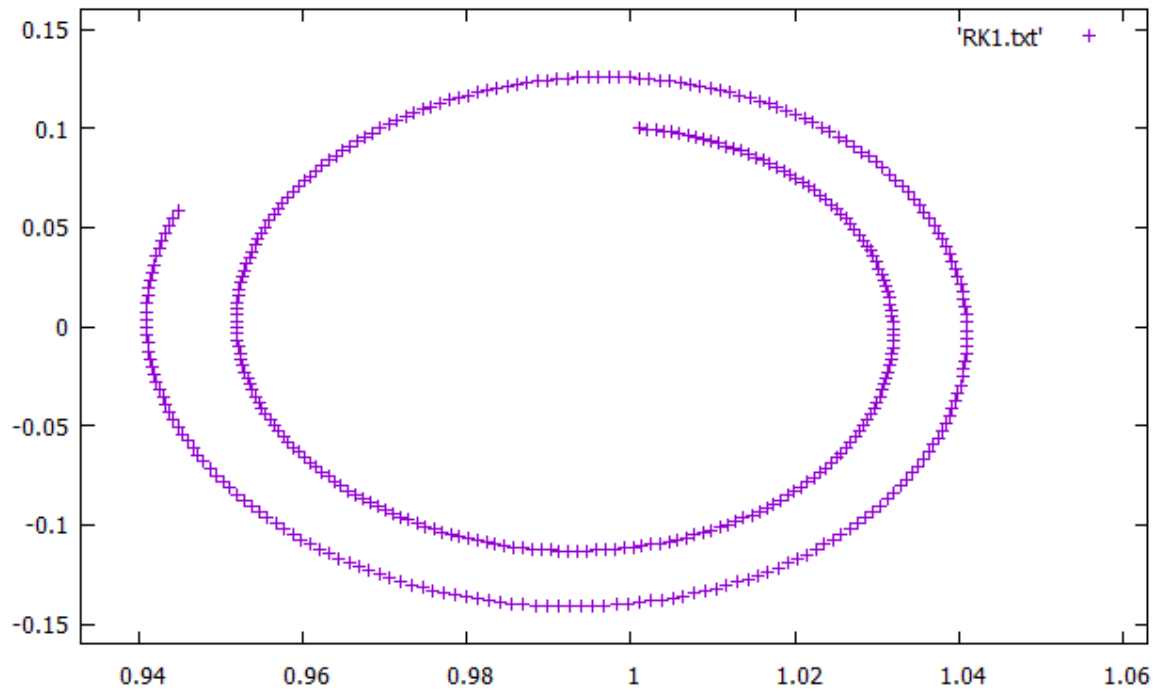
## 2. Runge-Kutta method (2<sup>nd</sup> order)



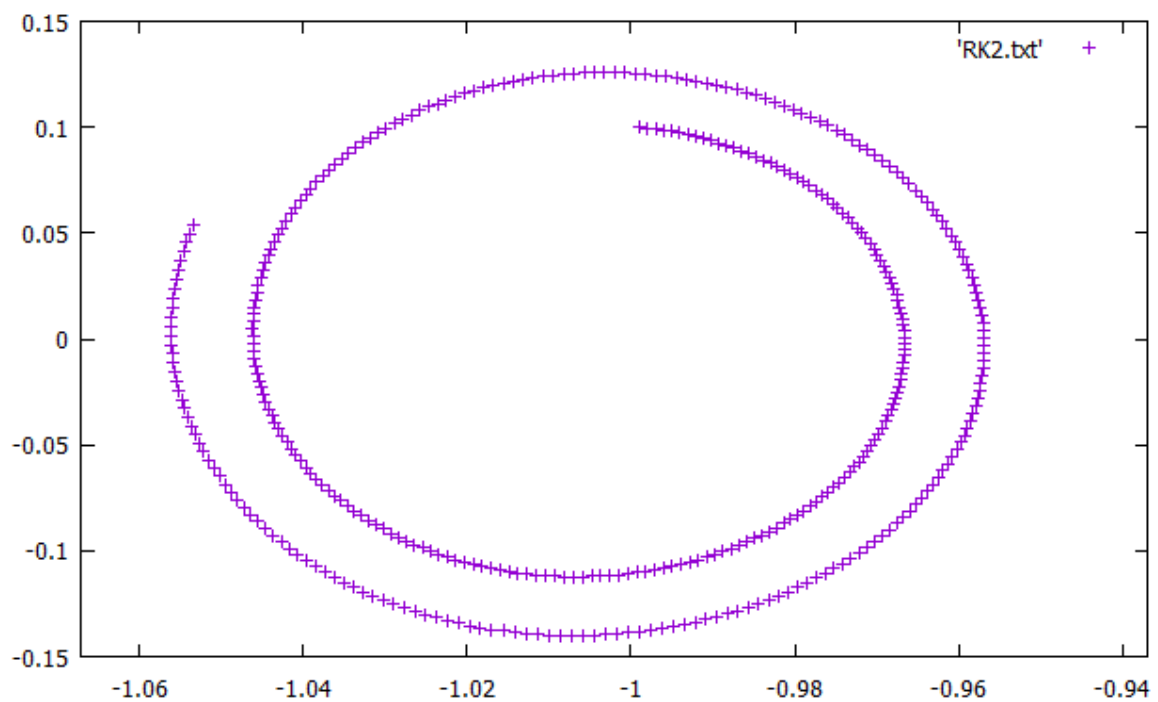
Result and Graph :

We run a loop for large number of times and got x,v points and plotting we got following graphs.

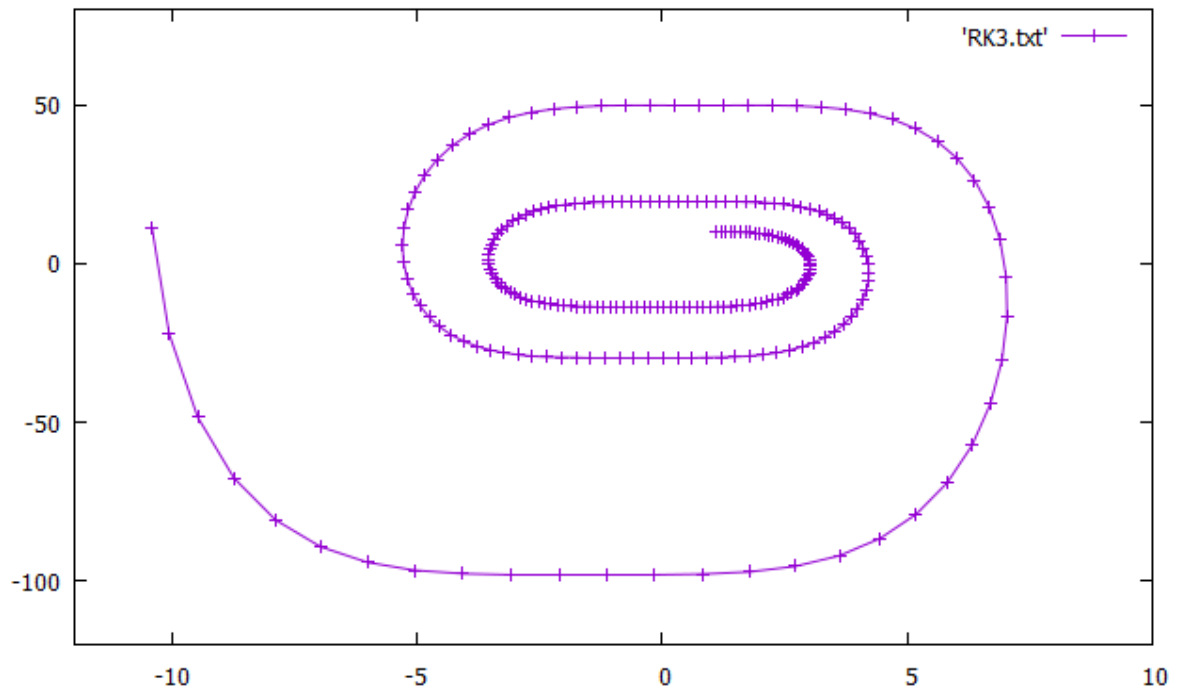
$X = 1.0, P_x = 0.1$



$x = -1.0, P_x = 0.1$



$X = 1.0, P_x = 10$



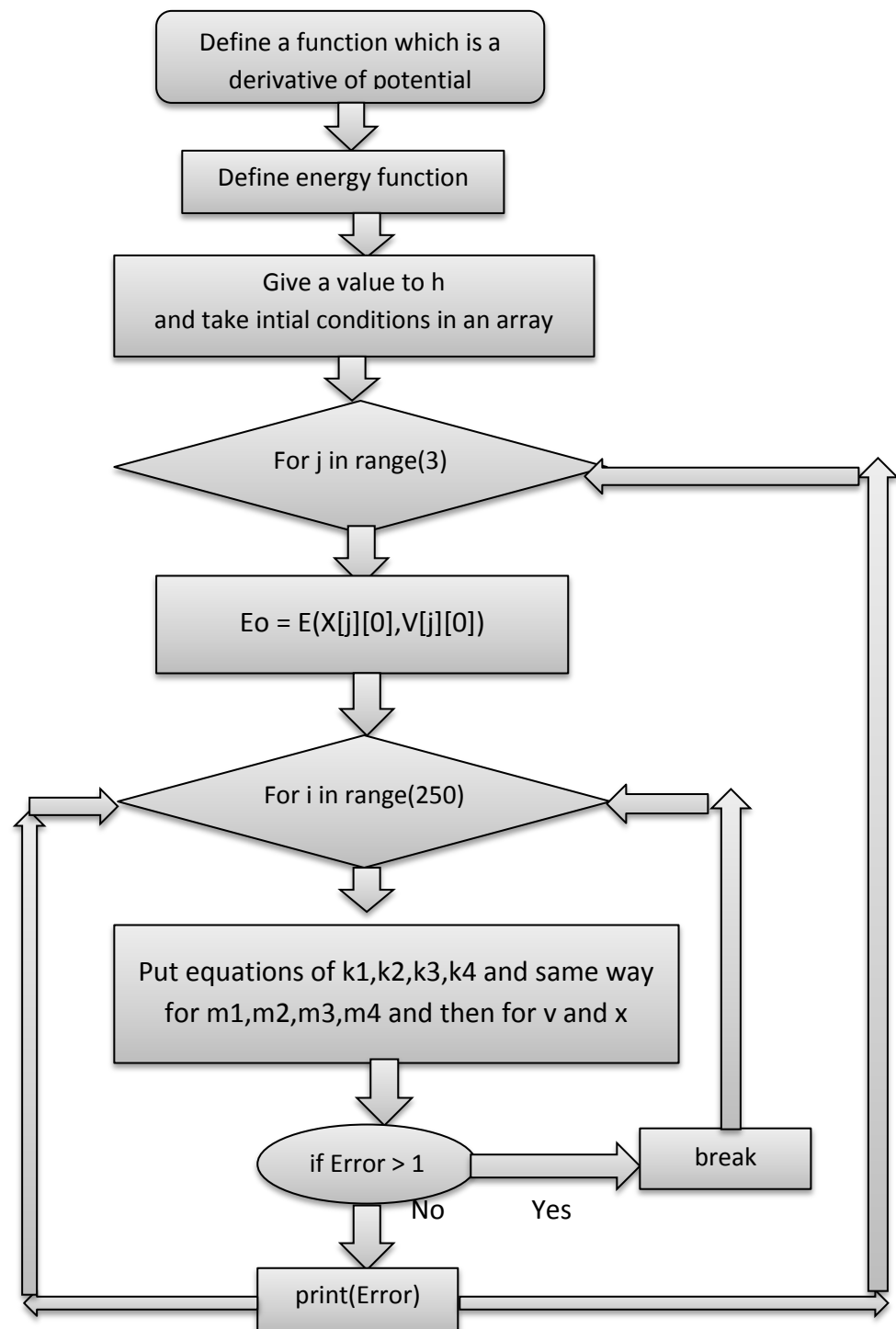
Finally for the conservation of energy within 1%, we got the value of step length as following

For first initial condition 0.00086

For Second initial condition 0.00089

For Third initial condition 0.00065

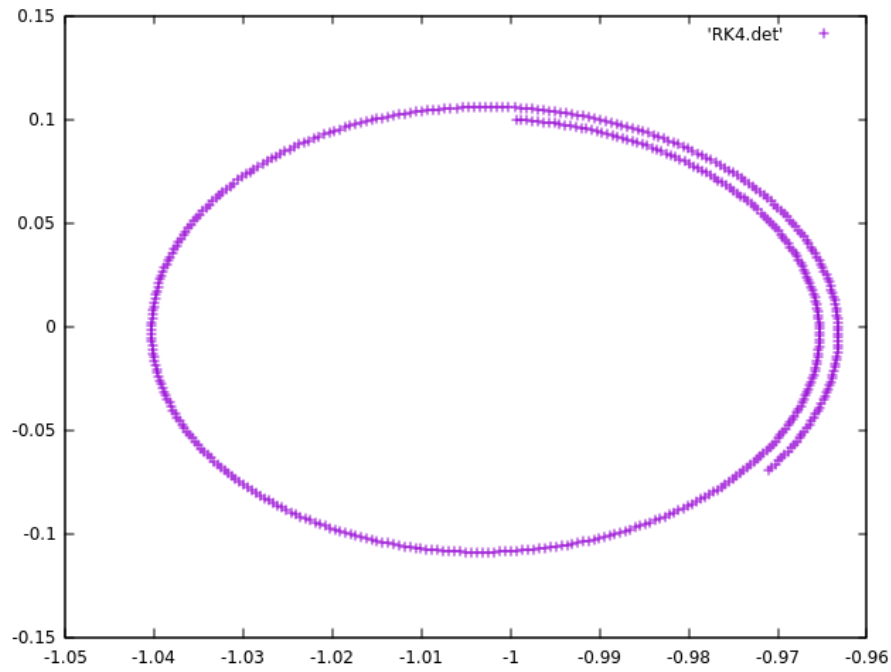
### 3. Runge-Kutta method (4<sup>th</sup> order)



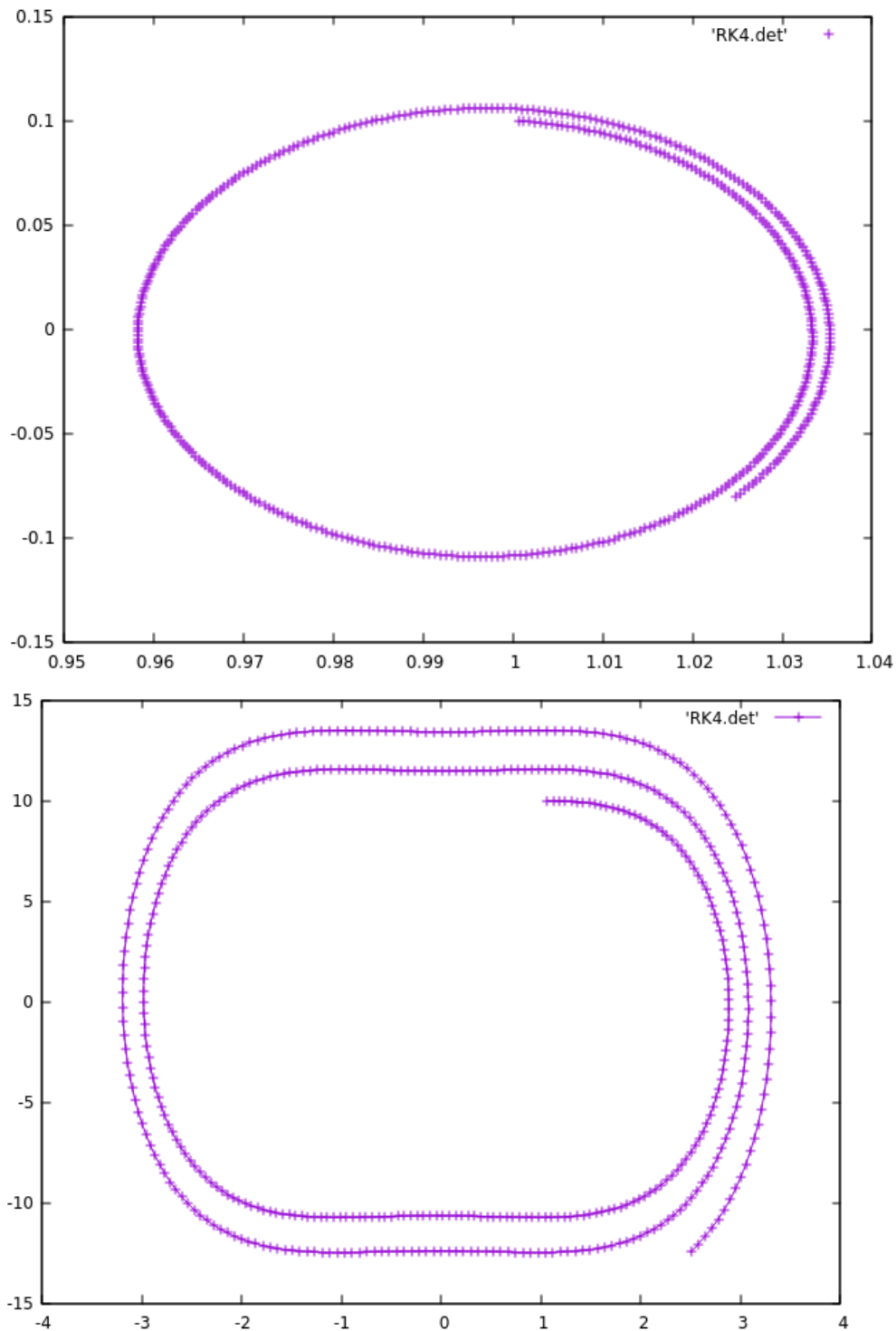
Result and Graph :

We run a loop for large number of times and got x,v points and plotting we got following graphs.

$X = 1.0$ ,  $P_x = 0.1$







## Discussion and Conclusion :

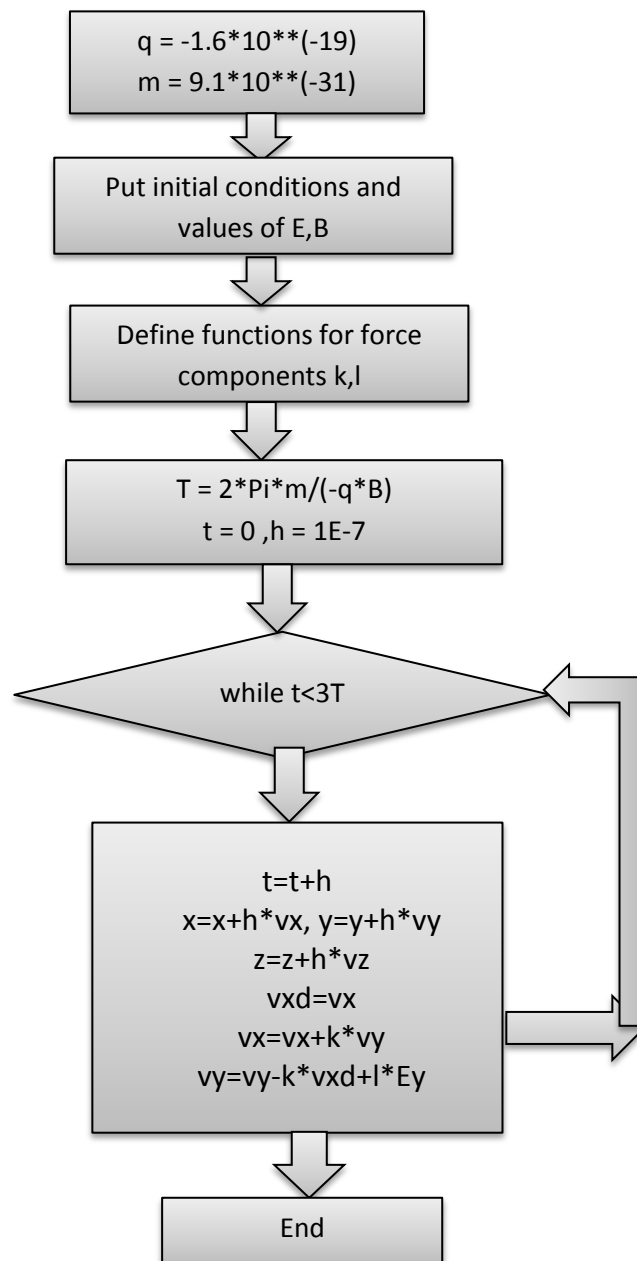
Problem was actually a second order differential problem. But we solved it using two first order differential equations.

Rather than taking three initial conditions individually we defined an array of them.

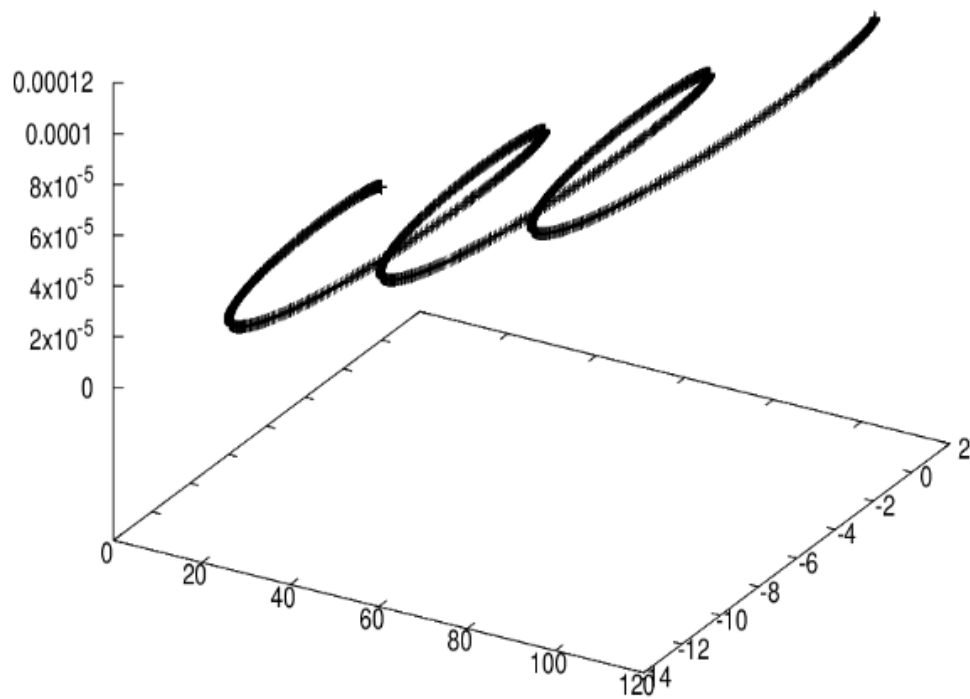
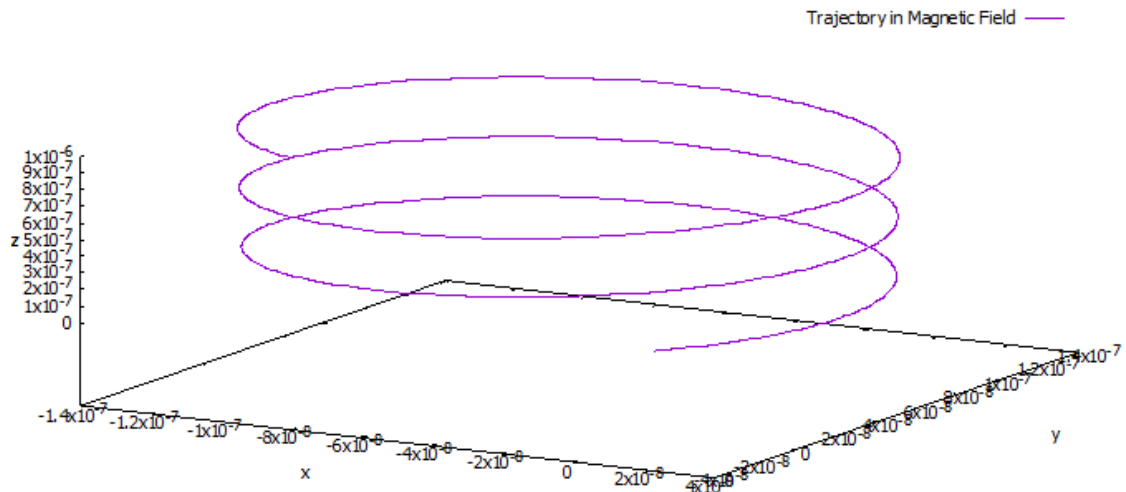
we vary the value of step length (h) manually and take the maximum h for which error is less than 1%.

## Problem – 2

### Method :



### Result and Graphs :



## Discussion and Conclusion :

Problem was actually a second order differential problem. But we solved it using two first order differential equations.

We used Spolt for 3d plotting.