REPORT : ASSIGNMENT 7 FOUCAULT PENDULUM

GROUP: 2H

Description of C-Code :

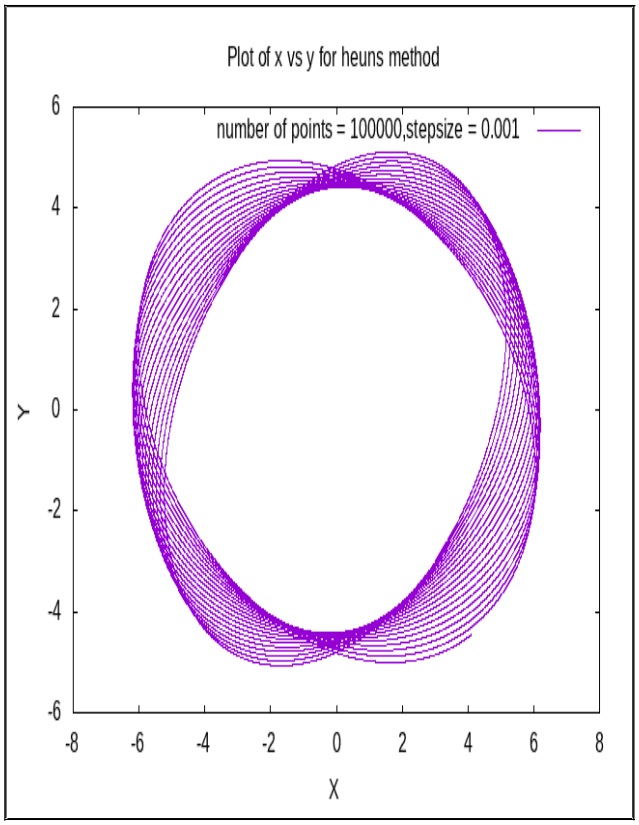
- The C code uses 4 different methods to solve ordinary differential equations i.e., euler, heuns,runge-kutta,rk45 methods.
- The second derivatives are taken as derivatives of 2 new variables and now 4 different first order differential equations can to solved to obtain the equations of foucault pendulum.
- Inputs are constants of the equations of foucault pendulum,intial coordinates and velocities,stepsize and number of points to be generated. And the method to solve differential equations.
- Output is the graph oh x vs y for a foucault pendulum.
- Compilation : cc foucault.c -lm

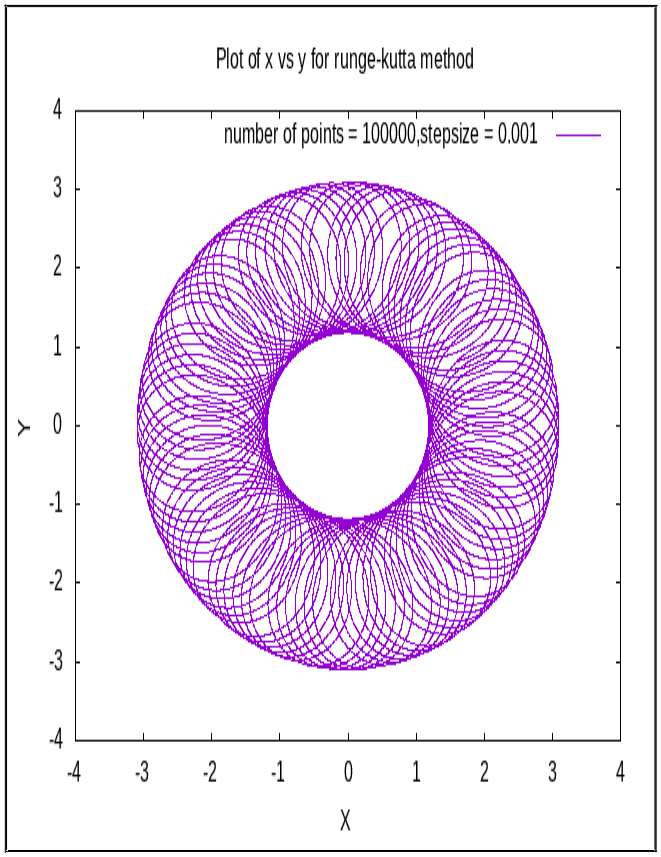
Learning outcomes:

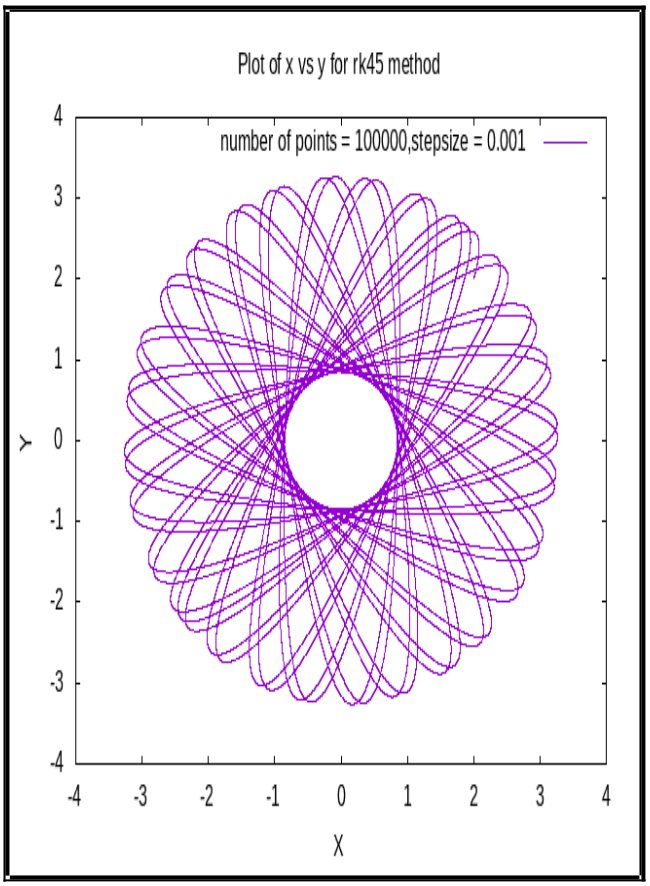
- Use of arrays
- Use of functions in a c code.
- Calling gnuplot from the c code.
- Use of switches.
- Methods to solve ordinary differential equations numerically
- Writing data into file.

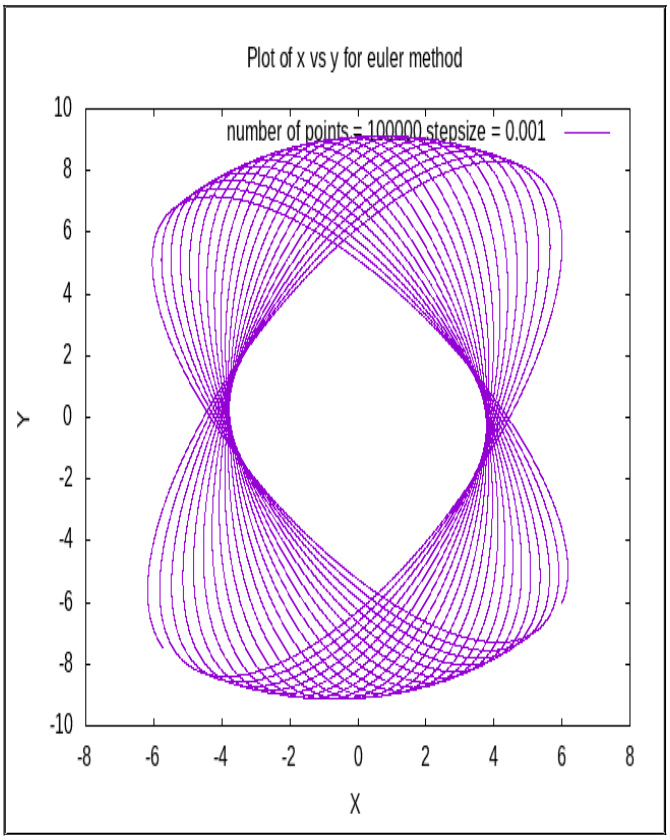
Inferences:

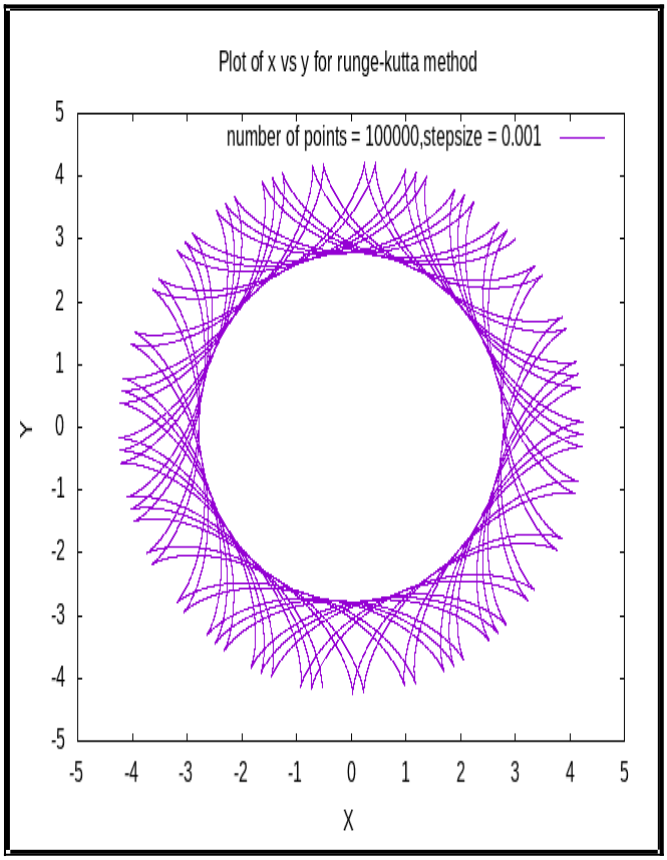
- The following lissago figures are obtained for various initial conditions.

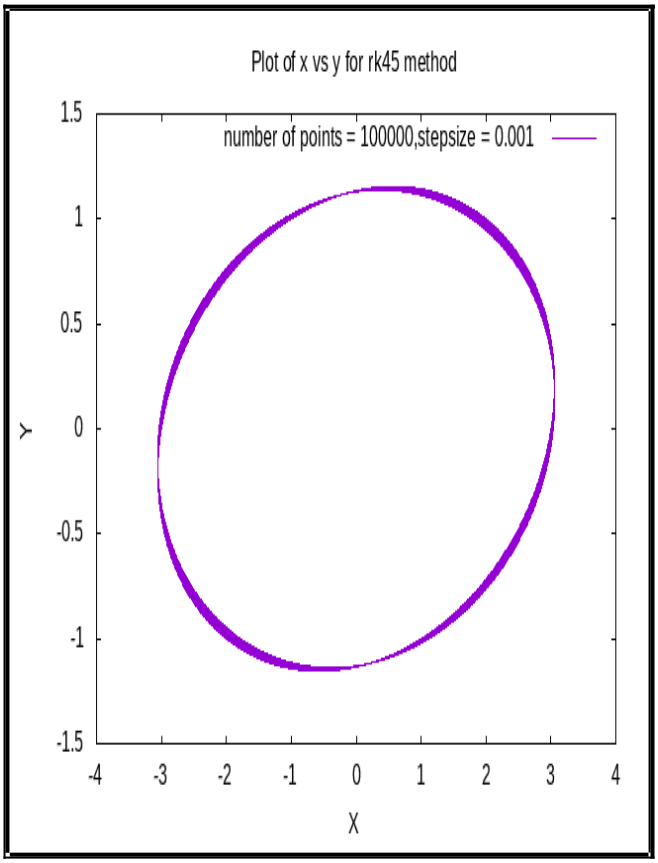

Plot of x vs y for heuns method
number of points = 100000,stepsize = 0.001
Y
X
6
4
2
0
-2
-4
-6
-8
-6
-4
-2
0
2
4
6
8


Plot of x vs y for runge-kutta method
number of points = 100000,stepsize = 0.001
Y
X
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4

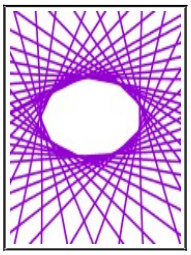

Plot of x vs y for rk45 method
number of points = 100000,stepsize = 0.001
Y
X
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4


Plot of x vs y for euler method
number of points = 100000,stepsize = 0.001
Y
X
10
8
6
4
2
0
-2
-4
-6
-8
-10
-8
-6
-4
-2
0
2
4
6
8



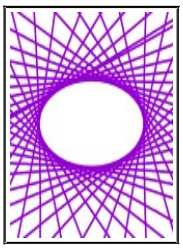


- For a given step size the graphs of rk45 method are smoother when compared to other methods.

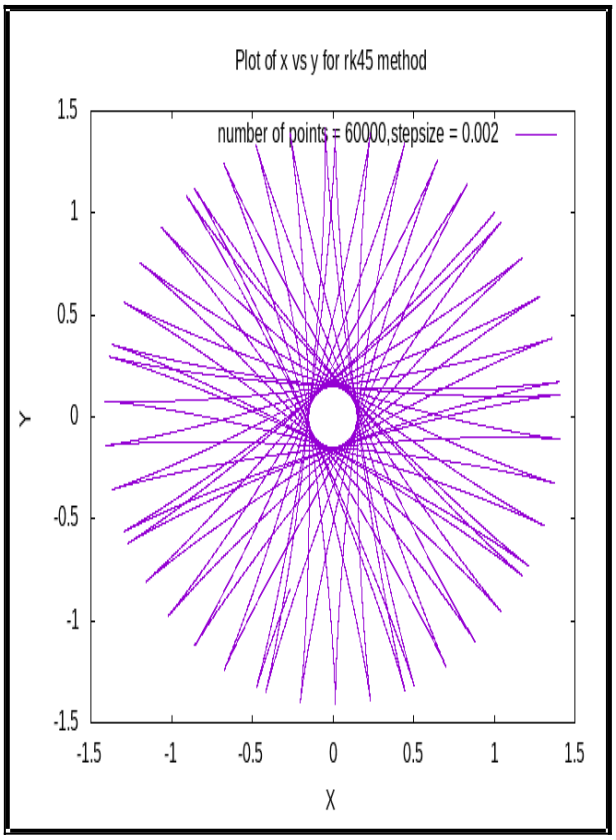


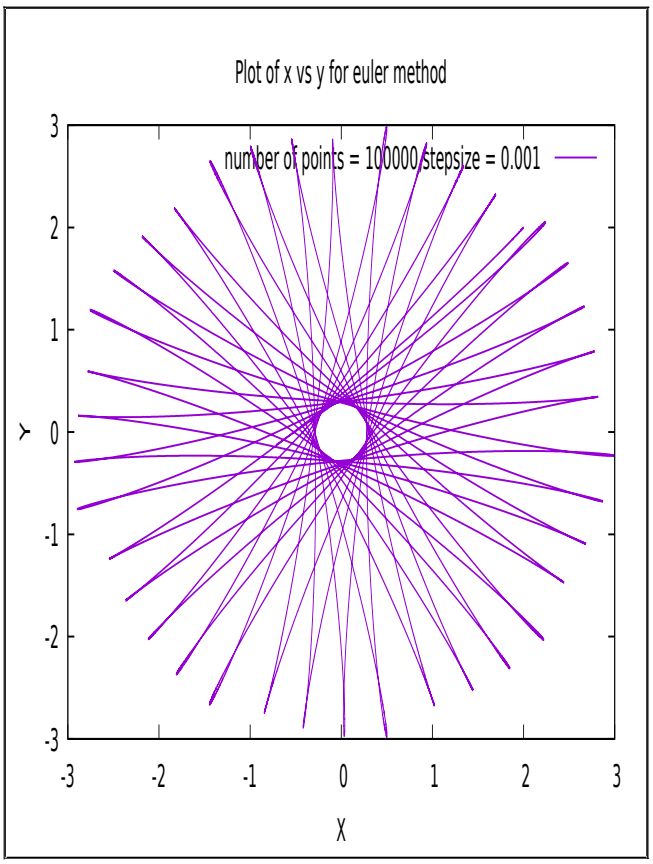
Euler method

rk45 method



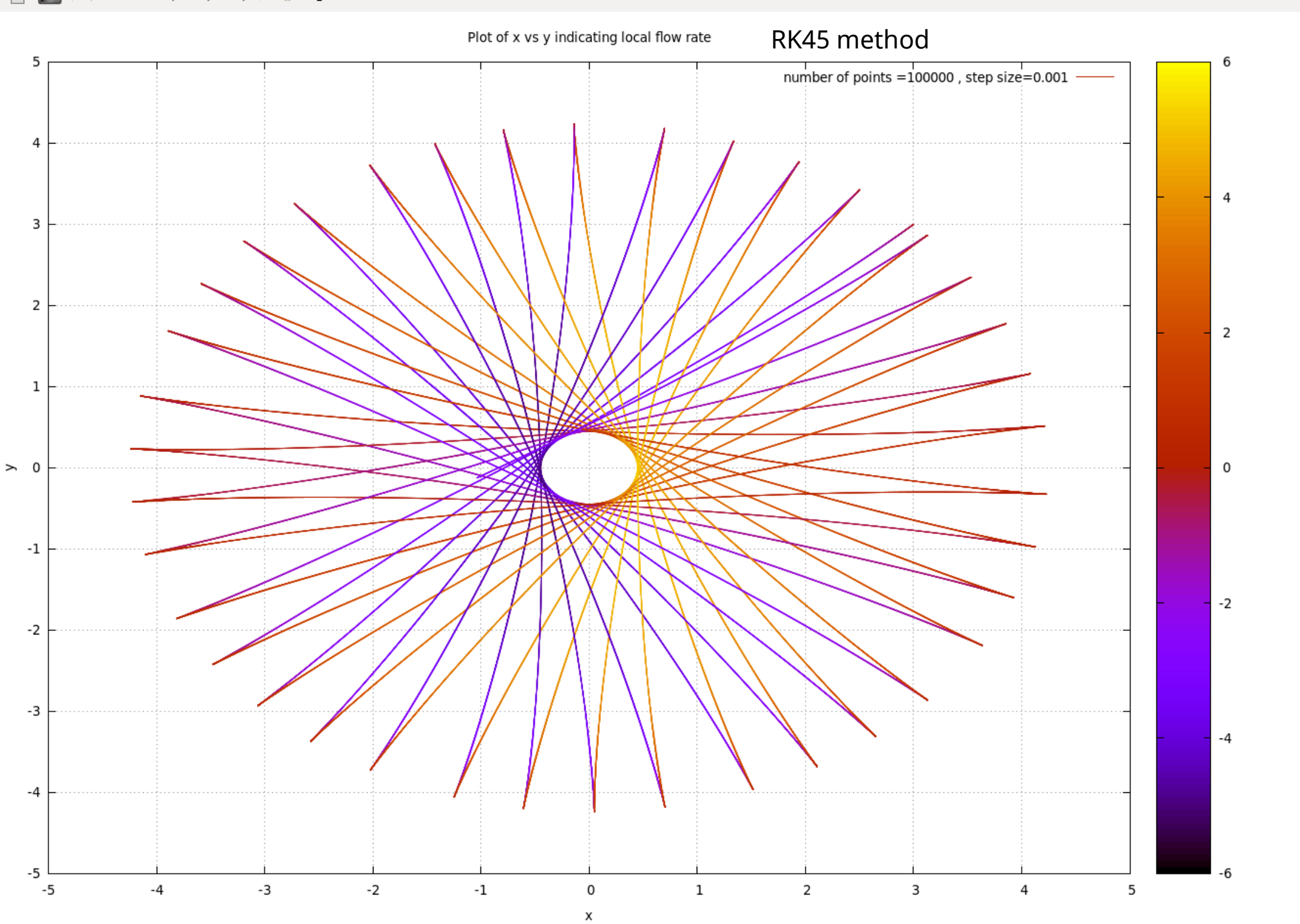
- For similar initial conditions ,similar plots are obtained for lower step size,higher number of points for euler and higher step size and lower number points for rk45 method.

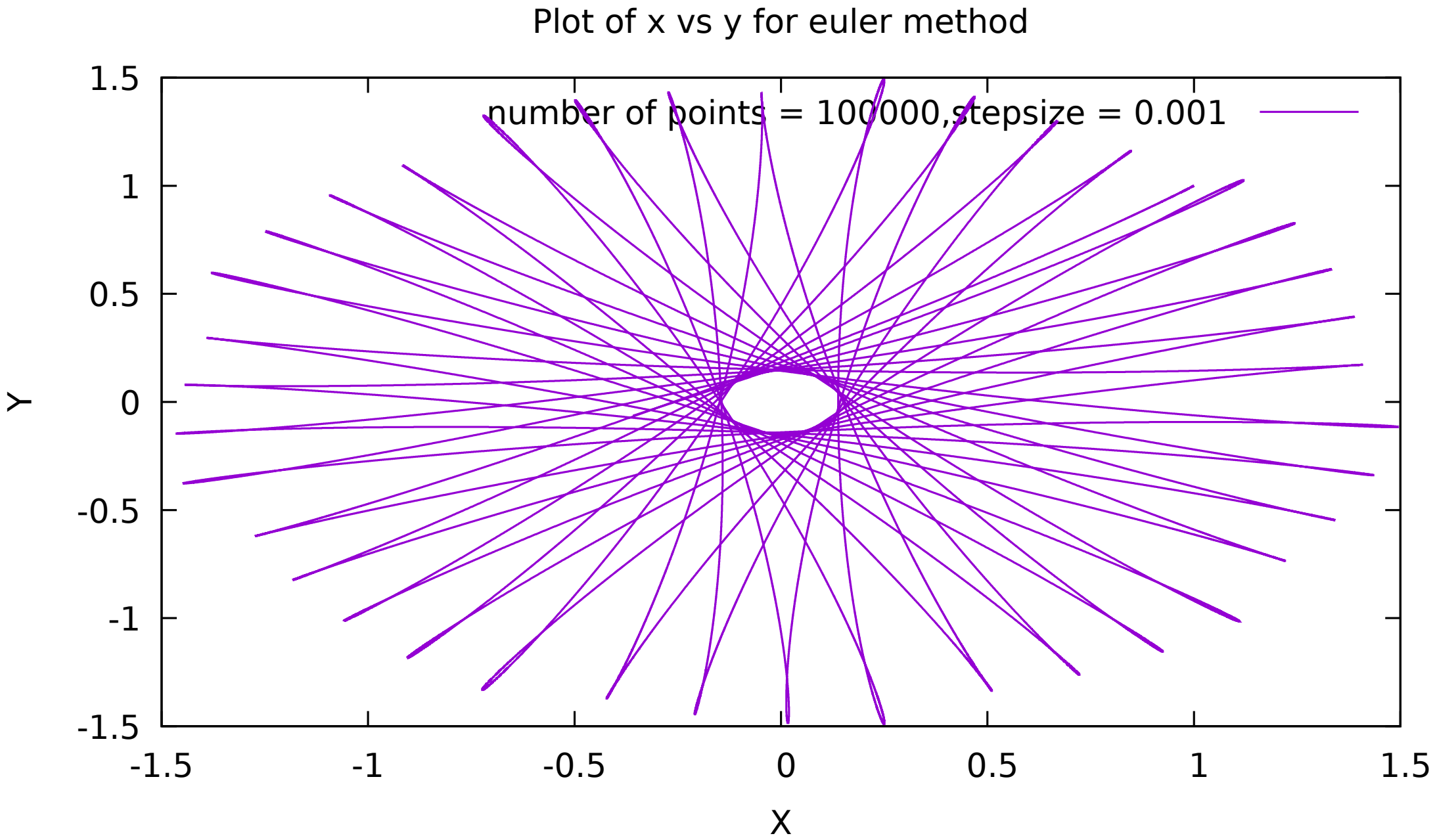


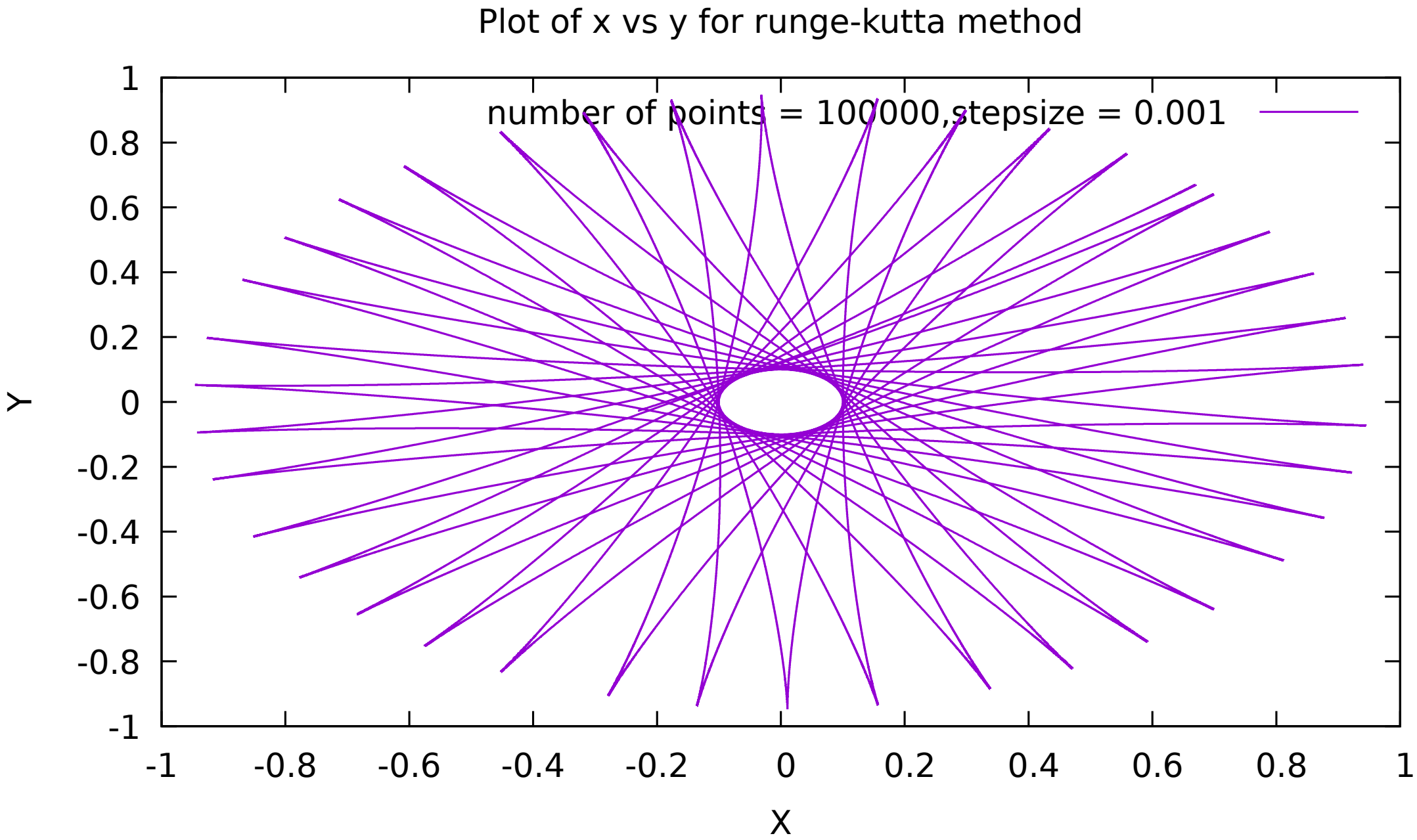


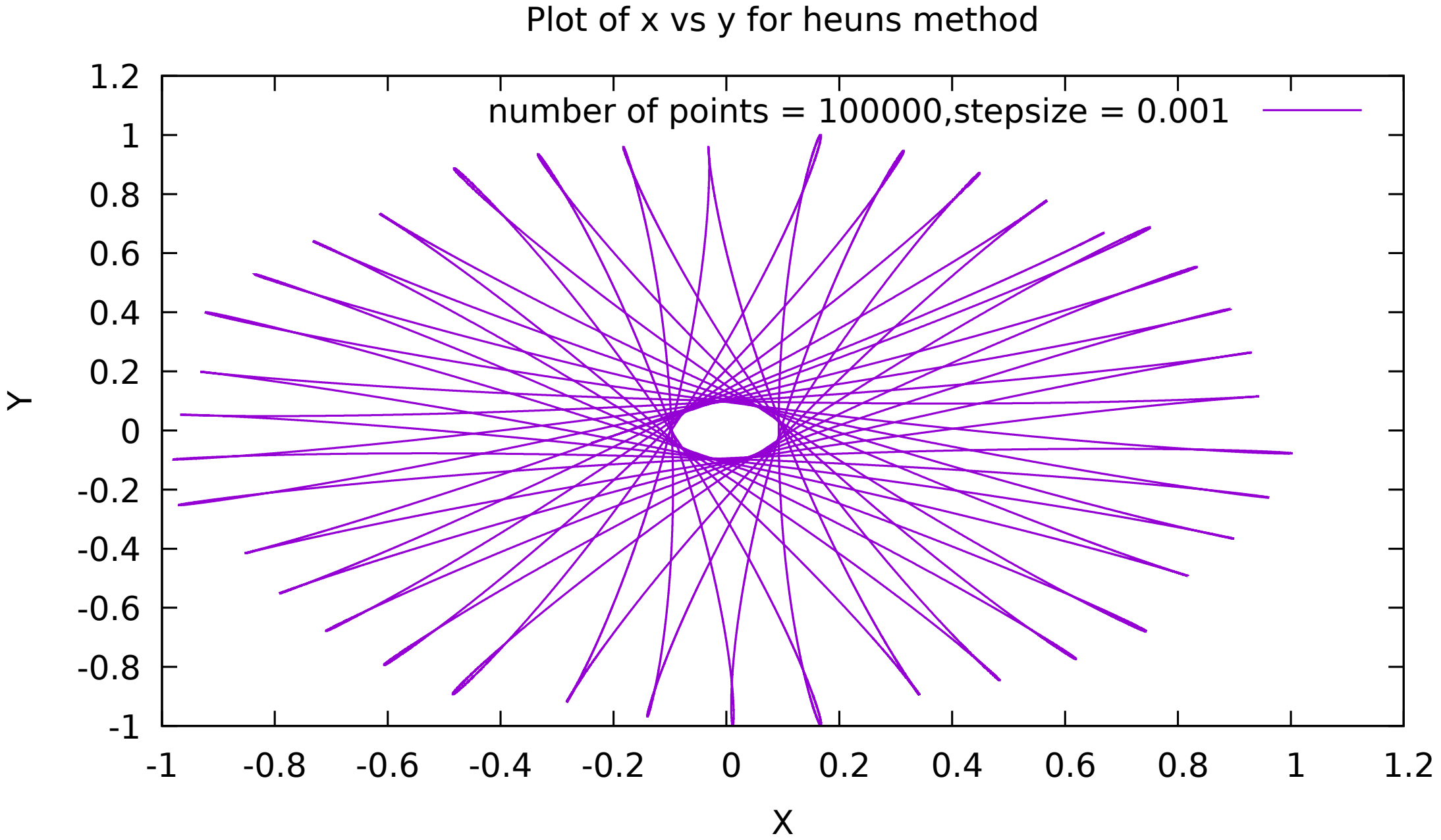
- Various plots for several initial conditions are followed below.

Conclusion: RK 45 is more closer to the actual values when compared to other methods


Plot of x vs y indicating local flow rate
RK45 method
number of points =100000 , step size=0.001
x
y


Plot of x vs y for euler method
number of points = 100000,stepsize = 0.001
1.5
1
0.5
0
-0.5
-1
-1.5
-1.5
-1
-0.5
0
0.5
1
1.5
Y
X


Plot of x vs y for runge-kutta method
number of points = 100000,stepsize = 0.001
Y
X
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1


Plot of x vs y for heuns method
number of points = 100000,stepsize = 0.001
Y
X
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2