//Program-4

//Name:Divyashree H B

//Runge Kutta method of order 4 for f(t,y) = y`= 1/(y^2)-ty

#include<iostream>

#include<vector>

#include <math.h>//exp

#include<iomanip>//precission

#include<fstream>

using namespace std;

ofstream out;

//f(t,y) = y`= 1/(y^2)-ty

long double F(long double t,long double y) {

return ((1 / (y\*y)) - (t\*y));

}

//print runge kutta table

void printValues(int i,long double t, long double w) {

out <<i<<"\t"<< t << "\t\t" << w << endl;

}

vector<long double> getInitialValues() {

vector < long double> inValue(6);

cout << "Enter the intial value of Wo :\t";

cin >> inValue[0];

cout << "Enter the interval :\t";

cin >> inValue[1] >> inValue[2];

cout << "Enter the N values( 3 values):\t";

cin >> inValue[3] >> inValue[4] >> inValue[5];

return inValue;

}

void printHeadings(vector<long double> inValue) {

out << "Divyashree H B" << endl;

out << "Runge-Kutta method of order 4" << endl;

out << "3/31/2017" << endl;

out << endl << "Function : f(t,y) = y`= 1/(y2)-ty " << endl;

out << "The inital value Wo (alpha) is " << inValue[0] << endl;

out << "With the interval ( " << inValue[1] << " , " << inValue[2] << " )" << endl;

}

void RK4(long double h, long double t, long double w,int N) {

long double k1, k2, k3, k4;

for (int i = 1; i <=N; i++) {

k1 = h \* F(t, w);

k2 = h \* F(t + h / 2, w + k1 / 2);

k3 = h \* F(t + h / 2, w + k2 / 2);

k4 = h \* F(t + h, w + k3);

w = w + (k1 + 2 \* k2 + 2 \* k3 + k4) / 6.0;

printValues(i,t+h,w);

t += h;

}

}

void main() {

out.open("output.txt");

int N[3];

int j=3;

vector<long double> inputData;

inputData = getInitialValues();

for (int i = 0; i < 3; i++)

{

N[i] = inputData[j++];

}

printHeadings(inputData);

for (int i = 0; i < 3; i++)

{

long double h = (inputData[2] - inputData[1]) / N[i];

out << "\nThe number of intervals N is " << N[i] << endl;

out << endl << "i\tti\t\twi" << endl;

out << 0 << "\t" << inputData[1] << "\t\t" << inputData[0] << endl;

RK4(h,inputData[1],inputData[0],N[i]); //call 3 times with 3 different values of N

}

}

