Lab 5: Euler's Method, Huen's Method and RK-4 Method for Numerical Differentiation

1. Given equation:
$y' - 3x^2 = 1$ with $y(1) = 2$

Estimate y (2.5) using (i) h = 0.5 and (ii) h = 0.25.

Algorithms (Pseudo-codes)
Euler's Method
1. Declare the variables
2. Read the initial values x and y and the step size h
3. Read the value of x for which y is required, say xp
4. Calculate the total no. of steps as n=(xp-x)/h
5. for i = 1 to n
Calculate the functional value f
y=y+h*f
x=x+h
6. Print the result x and y
7. End for i
Note: f = y' = f(x,y)

Heun's Method:
1. Declare the variables
2. Read the initial values x and y and the step size h
3. Read the value of x for which y is required, say xp
4. Calculate the total no. of steps as n=(xp-x)/h
5. for i = 1 to n
Calculate the functional value f
y=y+h/2*(m1+m2)
x=x+h
6. Print the result x and y
7. End for i

Note:
m1 = y' = f(x,y)
m2=f(x+h, y+h*m1)

Rk-4 Method:
1. Declare the variables
2. Read the initial values x and y and the step size h
3. Read the value of x for which y is required, say xp
4. Calculate the total no. of steps as n=(xp-x)/h
5. for i = 1 to n
Calculate the functional value f
y=y+(m1+2m2+2m3+m4)/6*h
x=x+h
6. Print the result x and y
7. End for i
Note: m1 = y' = f(x,y),
m2=f(x+h/2, y+h/2*m1),
m3=f(x+h/2,y+h/2*m2),
m4=f(x+h, y+h*m1)