Assignment – 13, 14, 15

Course: SC-374

Computational and Numerical Methods

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SET - 13

Numerical stability and implicit methods

Problem - 1

♦ **Statement:**

The initial-value problem $Y'(x) = LY(x), Y(0) = 1, x > 0$, can be numerically sloved by euler's method according to $yn = (1 + Lh)^n$.Test the stability of this method at the fixed value of $x = 0.2$ for $h = 0.1,0.05,0.01,0.001. L = -100$. Carry out similar with the backward euler method.

$$Y(0.2) = 2.0612e - 09$$

h	xf	xb
0.1	81	0.0082645
0.05	256	0.0007716
0.02	1	1.6935e-05
0.01	0	9.5367e-07
0.001	7.0551e-10	5.2658e-09

SET - 14

Trapezoidal method

Problem - 1

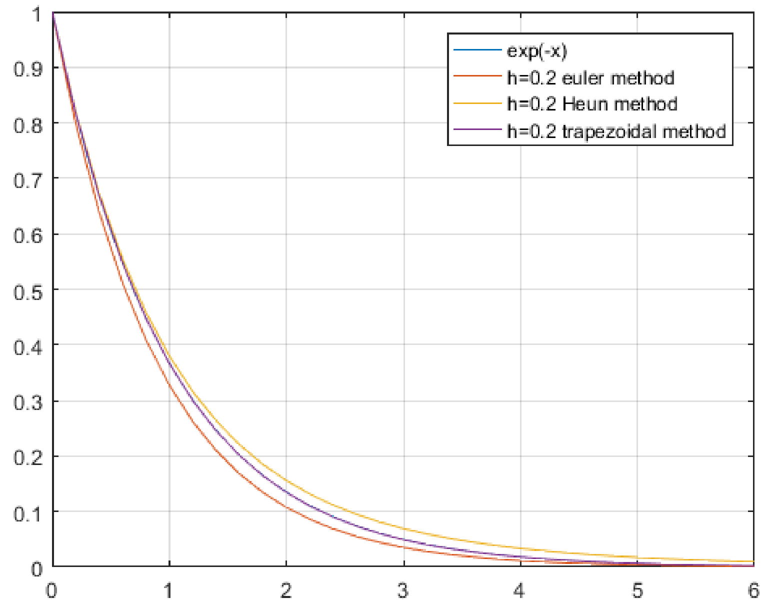
♦ **Statement:**

Consider the following initial value problems, Numerically solve both by Euler's method and trapezoidal method, for range $0 <= x <= 6$, separately using $h = 0.2,0.1,0.05$. For each problem, plot the numerical solutions for every value of h along with the analytical solution. Compare the graphs for errors.

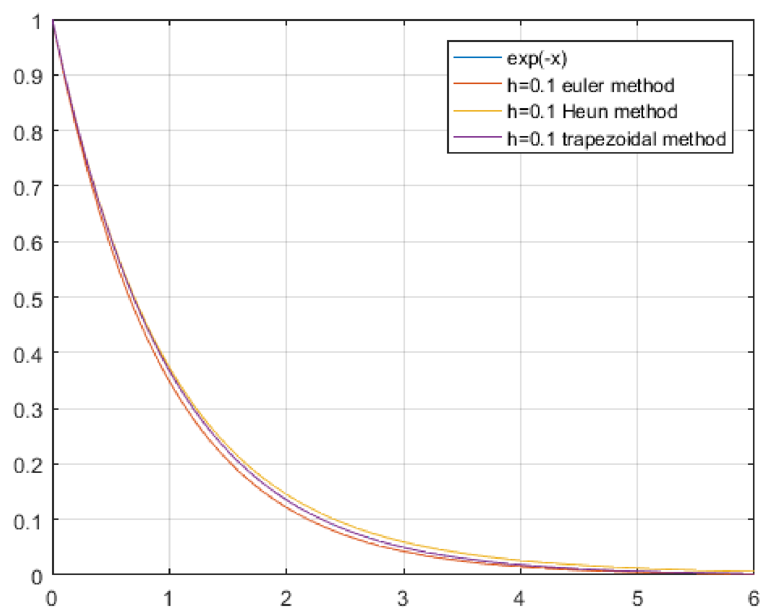
(A) $Y'(x) = -Y(x)$, $Y(0) = 1$.

(a) Graph of function for $h = 0.2$, $h = 0.1$ and $h = 0.05$

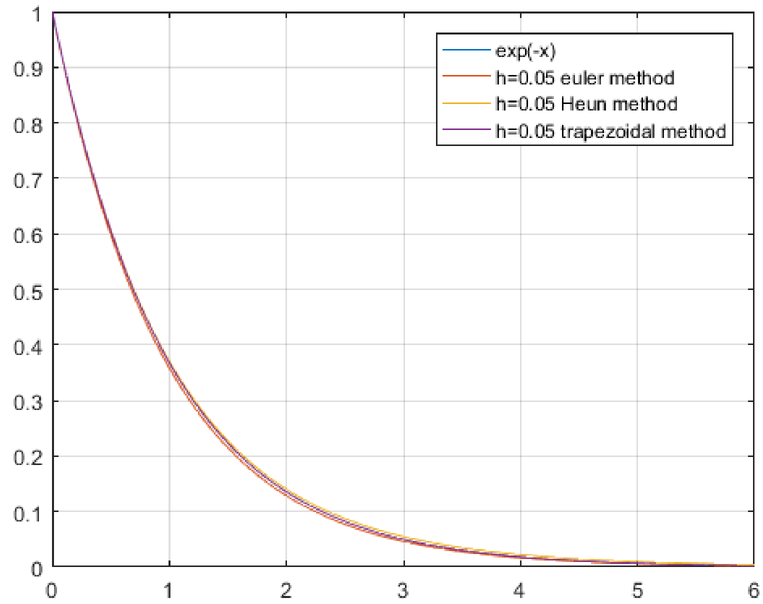
(1) for $h = 0.2$



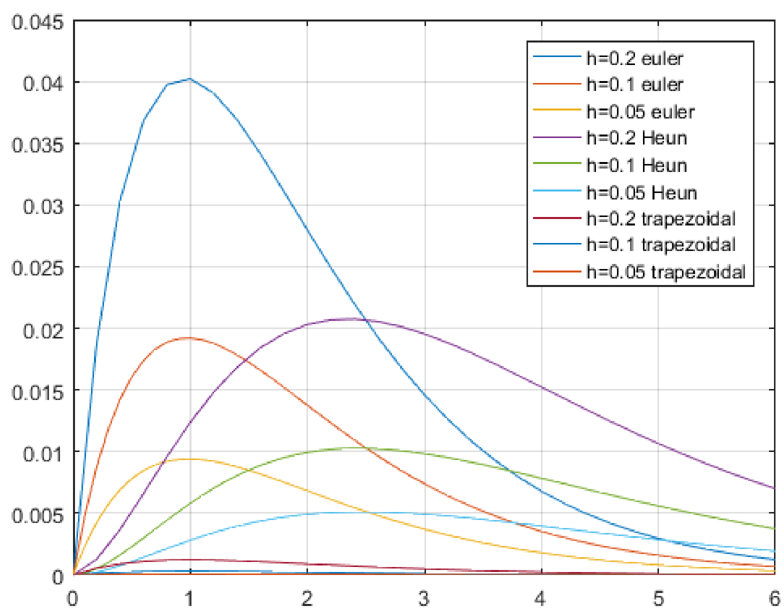
(2) for $h = 0.1$



(3) for $h = 0.05$



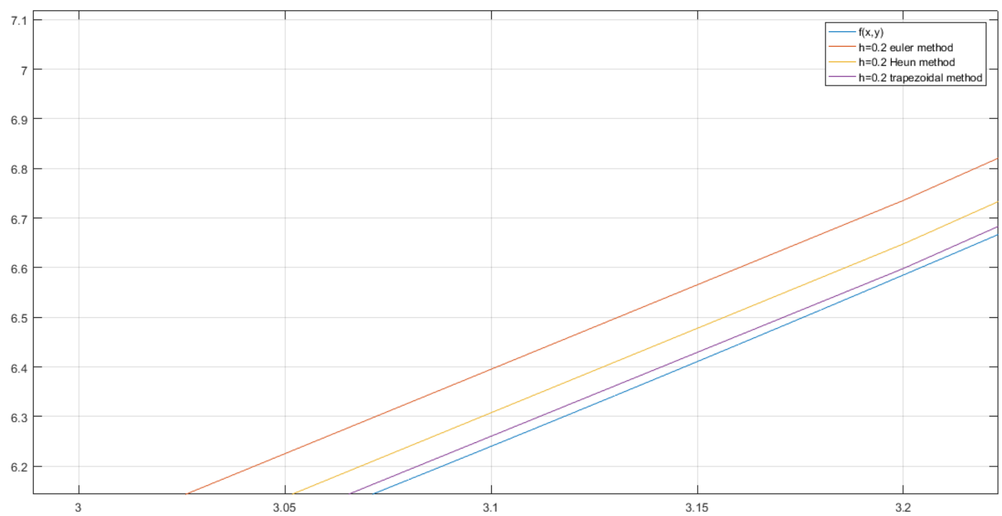
(b) Error function for $h = 0.2, h = 0.1\ and\ h = 0.05$



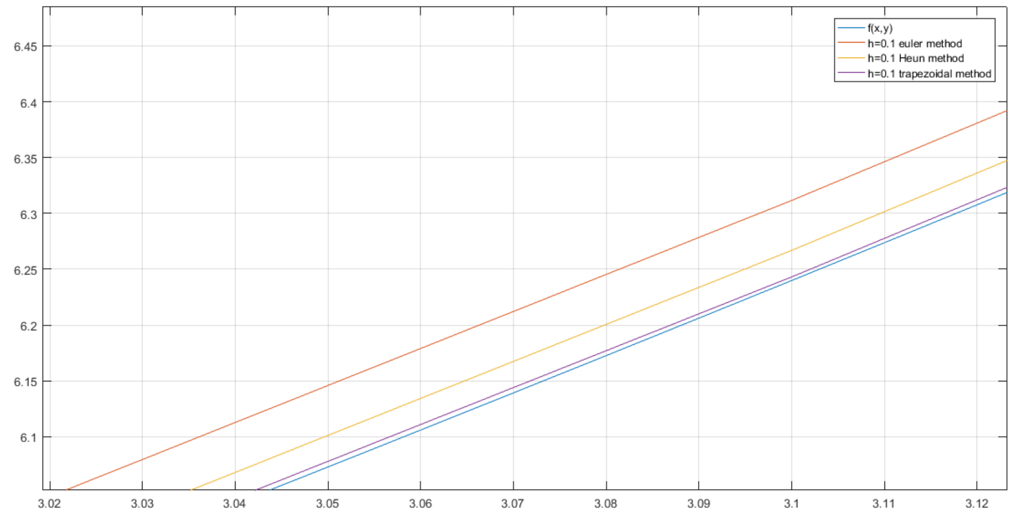
(B) $Y'(x) = \frac{(Y(x) + x^2 - 2)}{(x+1)}, Y(0) = 2.$

(a) Graph of function for $h = 0.2, h = 0.1\ and\ h = 0.05$

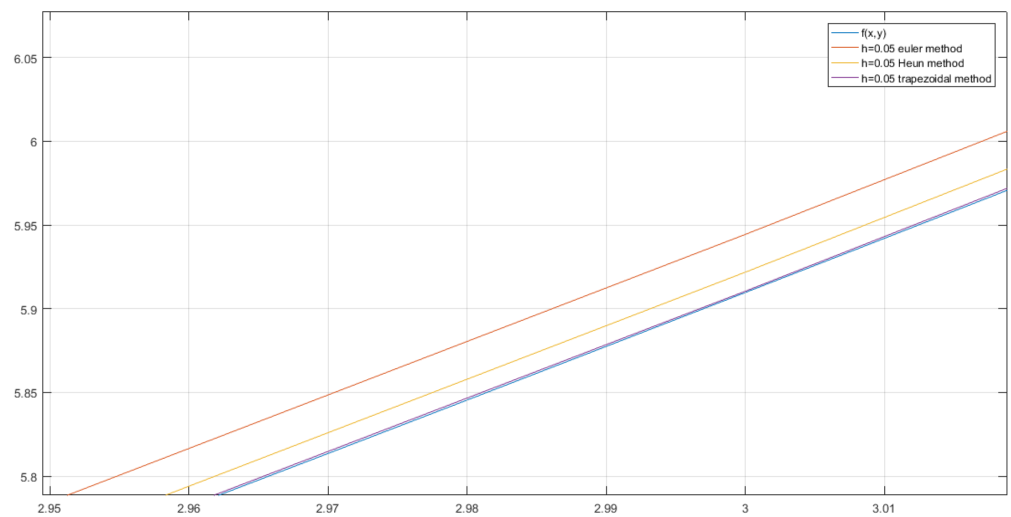
(1) for $h = 0.2$



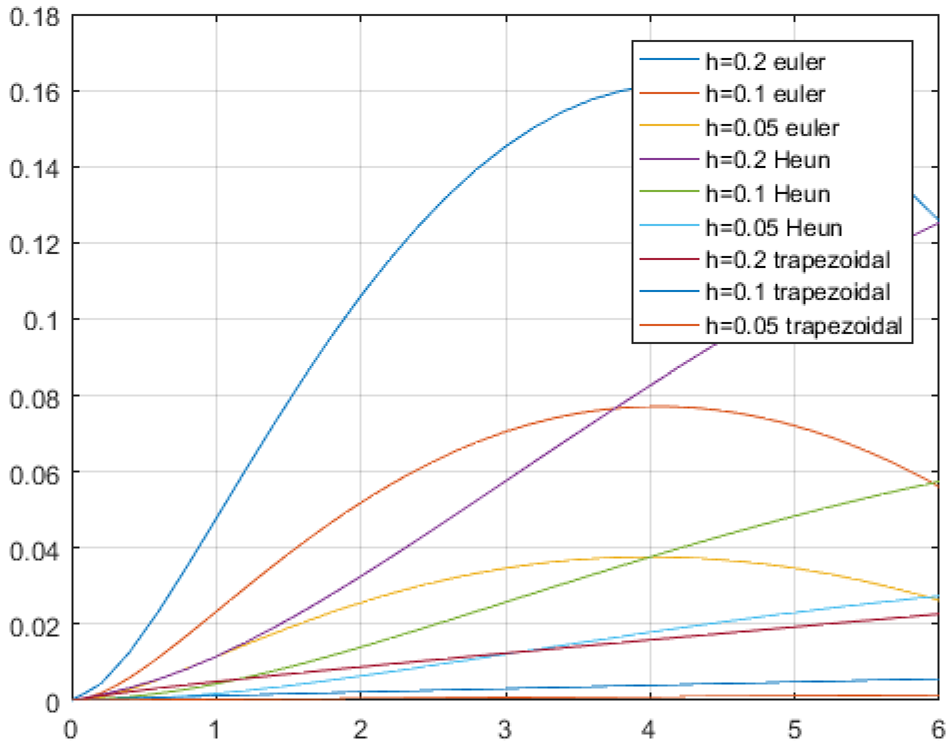
(2) for $h = 0.1$



(3) for $h = 0.05$



(b) Error function for $h = 0.2, h = 0.1\ and\ h = 0.05$



SET - 15

Taylor's method

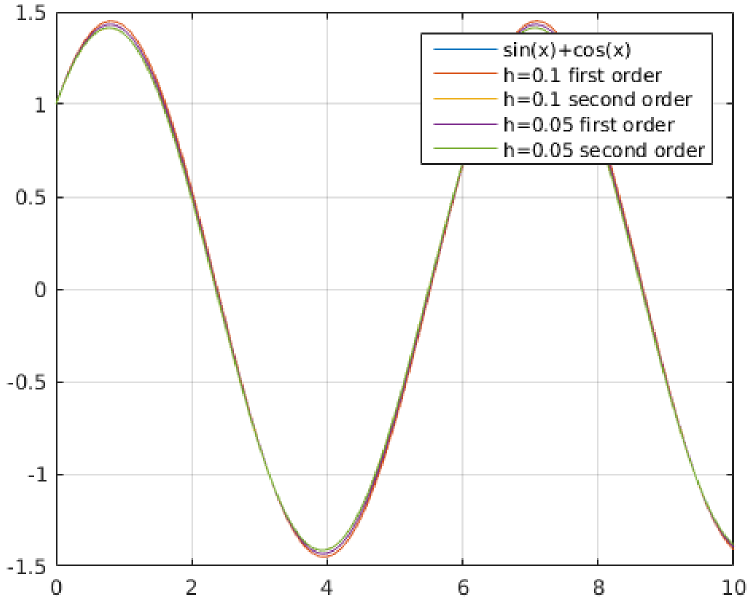
Problem - 1

♦ **Statement:**

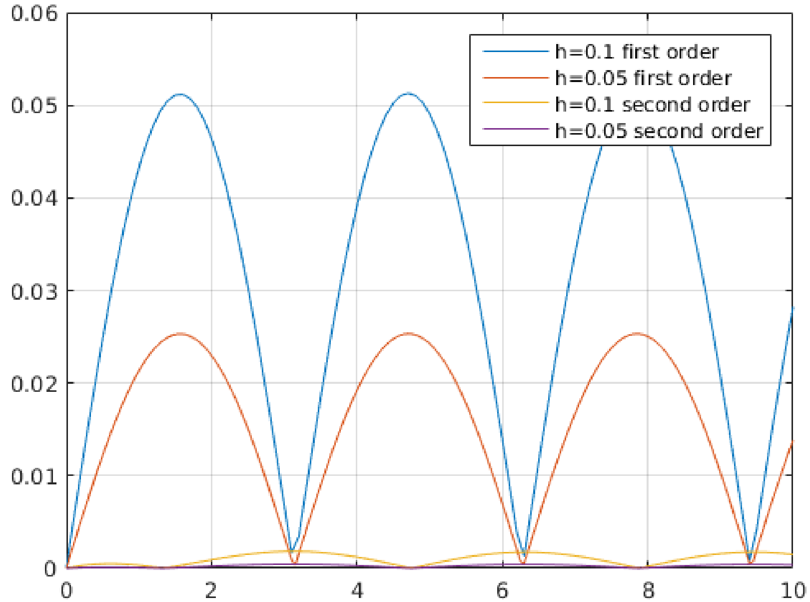
On the initial-value problem, $Y'(x) = -Y(x) + 2cosx$, $Y(0) = 1$, apply both the first order and second order taylor method for $0 <= x <= 10$.

Use $h = 0.1,0.05$. Plot the results of both methods along with the exact integral solutions for comparison.

(a) Graph of function for $h = 0.1\ and\ h = 0.05$ both first-order and second-order



(b) Graph of error function for $h = 0.1\ and\ h = 0.05$ both first-order and second-order


h=0.1 first order
h=0.05 first order
h=0.1 second order
h=0.05 second order
0.06
0.05
0.04
0.03
0.02
0.01
0
0
2
4
6
8
10