MA473: Computational Finance: Lab 2
Aman Bucha, Roll - 200123006

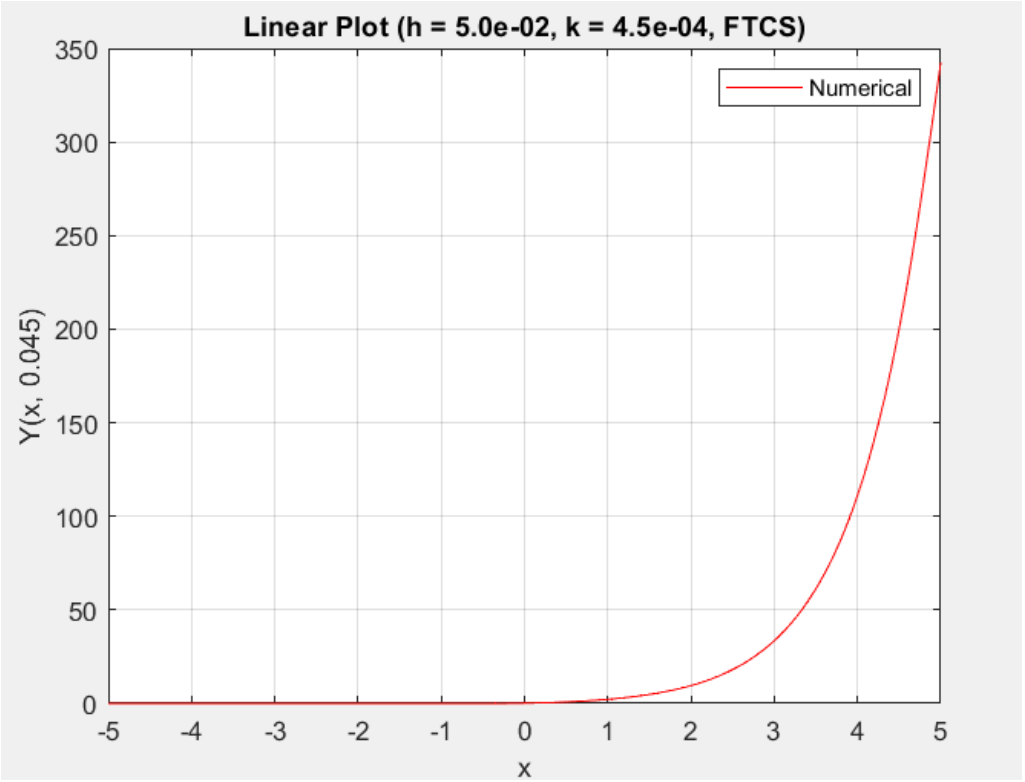
Question 1:

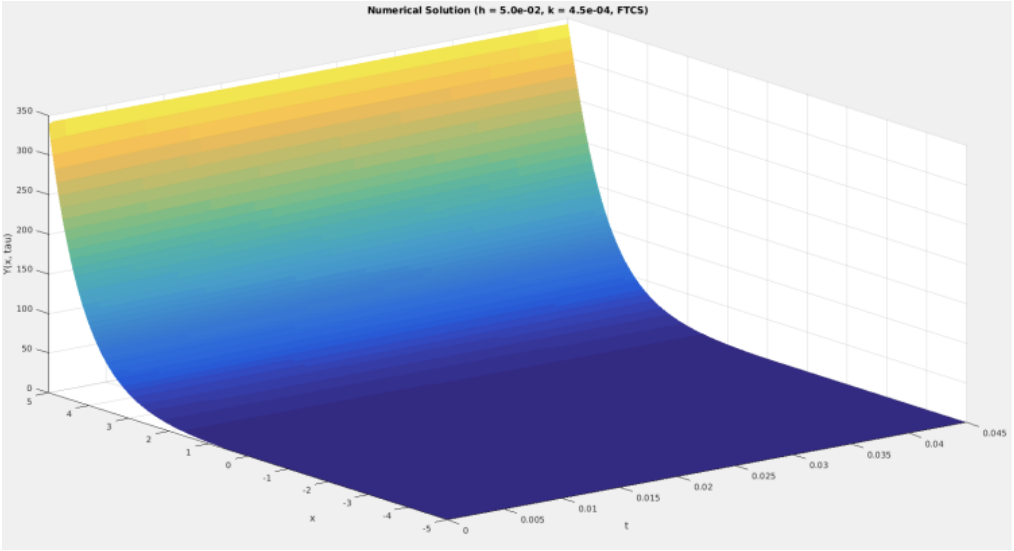
Values used for solving the PDE:
h = dx = 0.05;
k = dt = 0.00045;
r = 0.06;
delta = 0;
sigma = 0.3;
T = 1;
K = 10;
xmin=-5;
xmax =5;

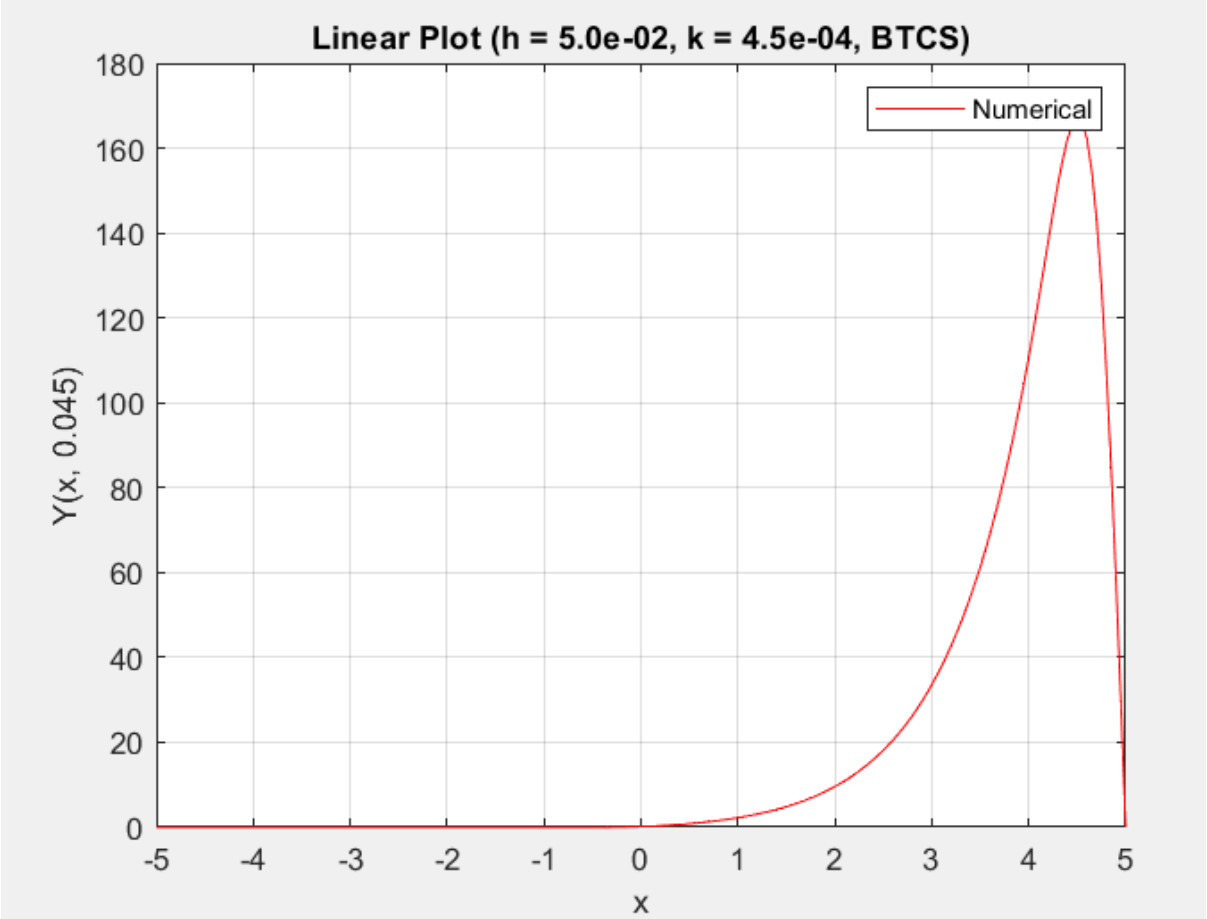
Now, using the condition $t = T - \frac{2\tau}{\sigma^2}$

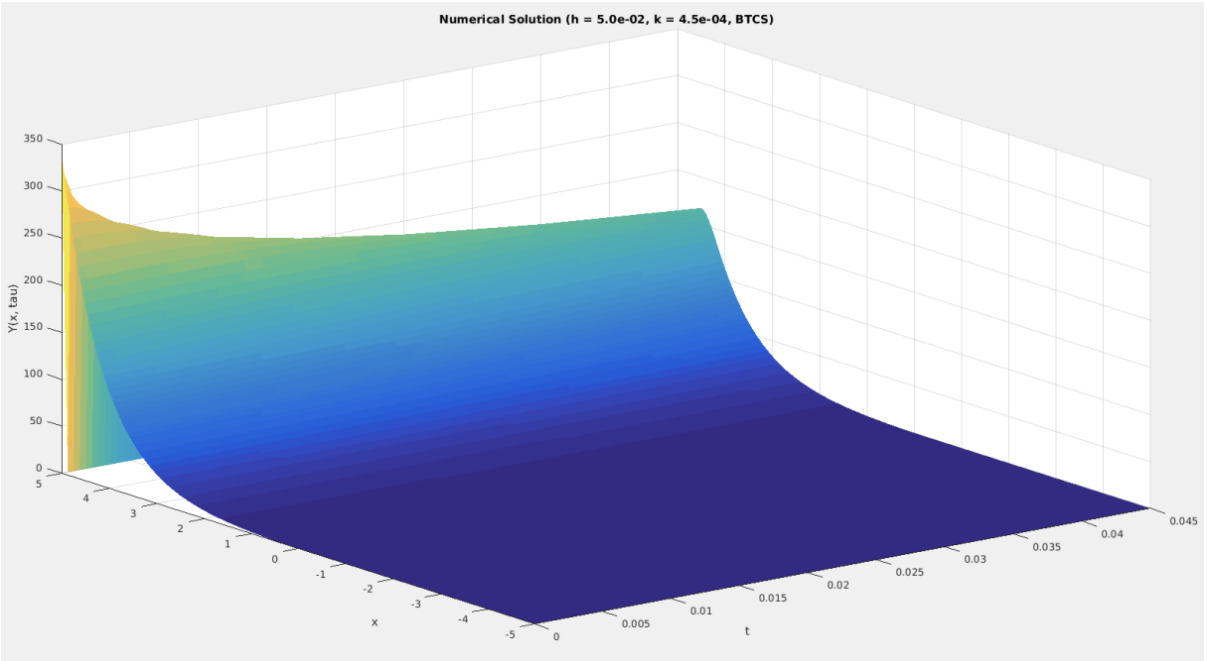
the range of τ ranges from 0 to σ^2 /2 , which turns out to be from 0 to 0.045.
We are plotting plots for $y(x, \tau)$ in this question. Using the relations given we can obtain the solution for $V(s, t)$ also but it will have the same curvature as $y(x, \tau)$.

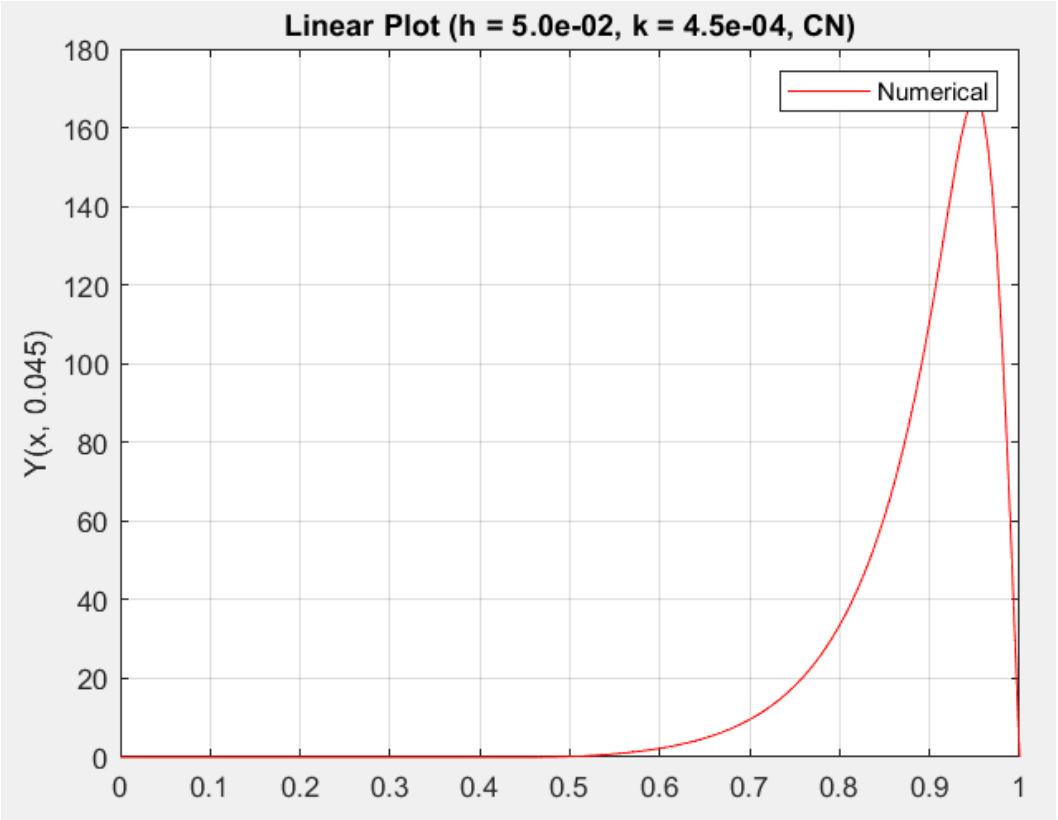
r = dt/dx^2 > 0.18 which means that the method is stable for FTCS and hence this value of h and k works for all methods. Plots for all the methods are as follows:

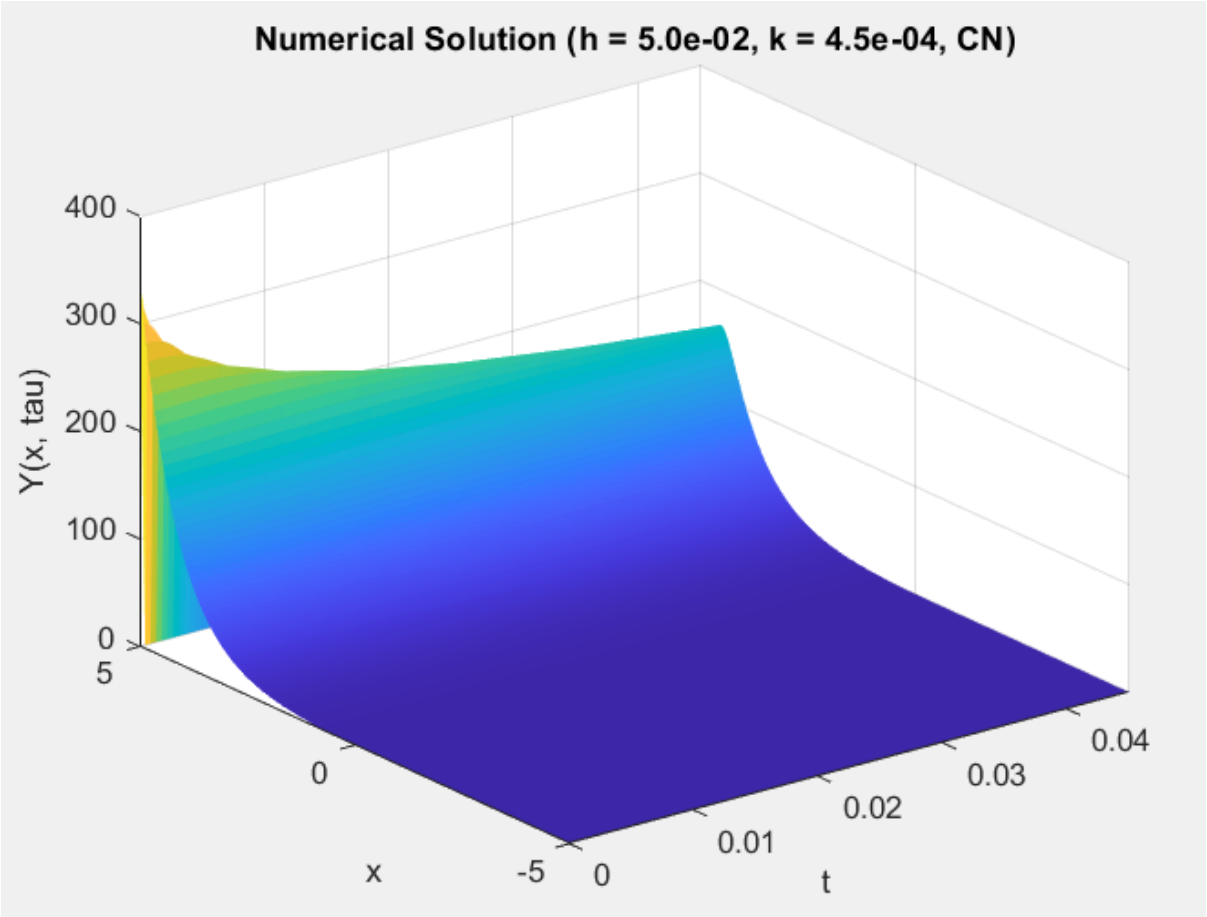

Linear Plot (h = 5.0e-02, k = 4.5e-04, FTCS)
Numerical
Y(x, 0.045)
x
350
300
250
200
150
100
50
0
-5
-4
-3
-2
-1
0
1
2
3
4
5


Numerical Solution (h = 5.0e-02, k = 4.5e-04, FTCS)
Y(x, tau)
x
t


Linear Plot (h = 5.0e-02, k = 4.5e-04, BTCS)
Numerical
Y(x, 0.045)
x
180
160
140
120
100
80
60
40
20
0
-5
-4
-3
-2
-1
0
1
2
3
4
5


Numerical Solution (h = 5.0e-02, k = 4.5e-04, BTCS)
Y(x, tau)
x
t
350
300
250
200
150
100
50
0
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045


Linear Plot (h = 5.0e-02, k = 4.5e-04, CN)
Numerical
Y(x, 0.045)
180
160
140
120
100
80
60
40
20
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Numerical Solution (h = 5.0e-02, k = 4.5e-04, CN)
Y(x, tau)
400
300
200
100
0
5
0
-5
x
0
0.01
0.02
0.03
0.04
t