CLL:113-Tut-8(9.10.19)

The concentration distribution of a reactant undergoing second order reaction in a plug flow reactor is given by the differential equation.

$$\frac{dy}{d\tau} = -y^2$$

Where

$y = \dfrac{C}{C_0}$ and $\tau = \dfrac{kVC_0}{F}$ with the initial condition at $\tau = 0, y = 1$

A. Evaluate and plot the non dimensional concentration profile with non dimensional time τ by
(1)   Explicit Euler Method
(2)   Crank Nicholson Method
(3)   Implicit Euler method
       Each for 5 time steps 0.1, 0.2, 0.5, 1 and 2.
In the three plots that you submit for this question also provide the analytical result.

B. Also provide a comparative graph to show how the relative percentage error varies with τ for all the methods for time step 0.5.

C. Give reasoning for the graphs and submit a doc file with all the results and submit the code(s) separately.