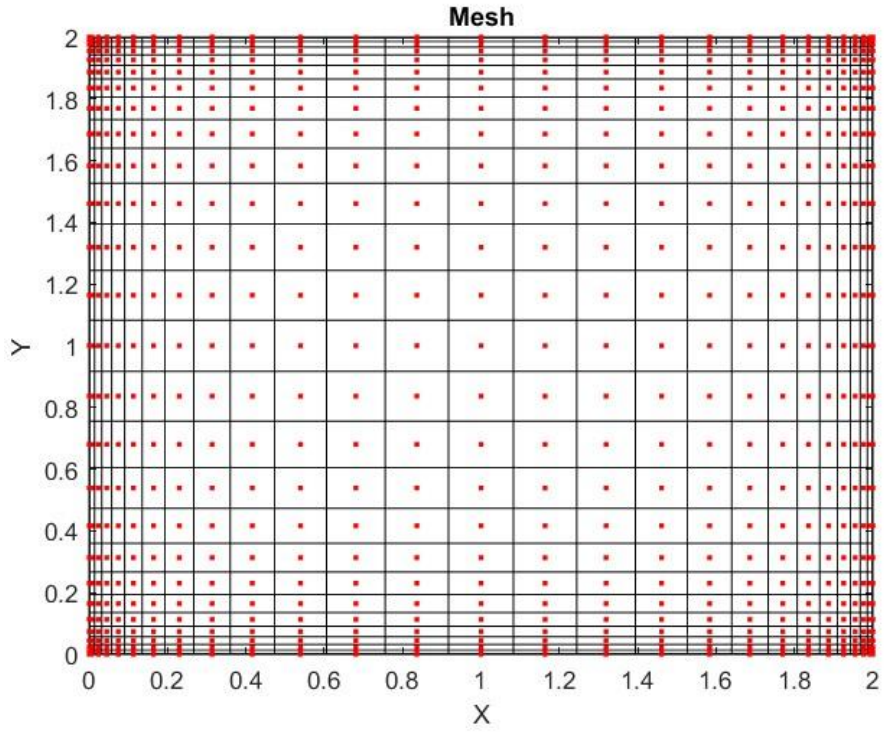
Anish Anand Pophale

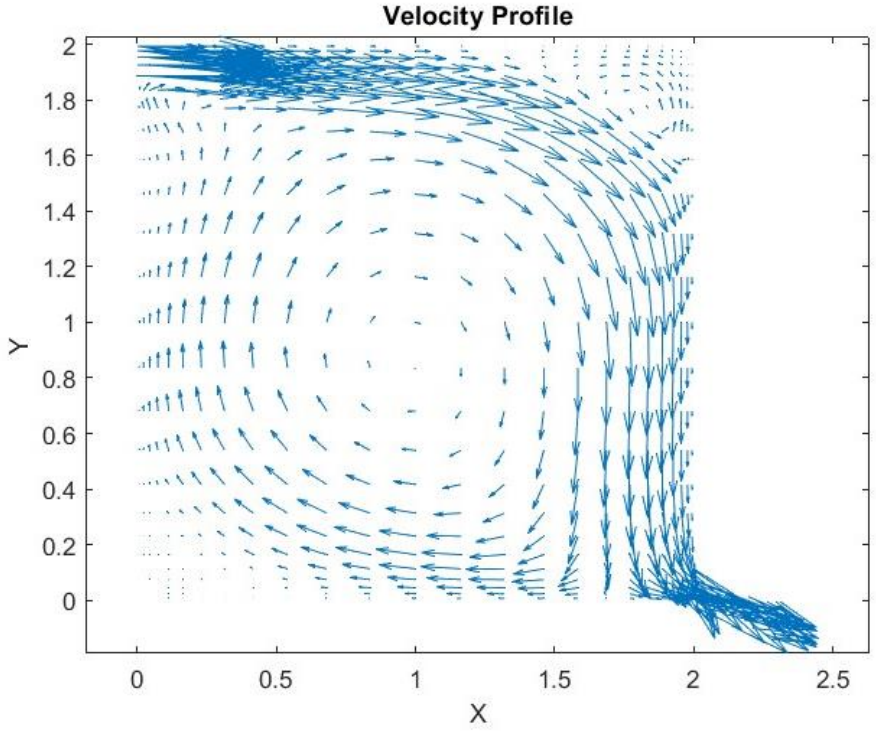
CH20B012

AM5630 Assignment 2

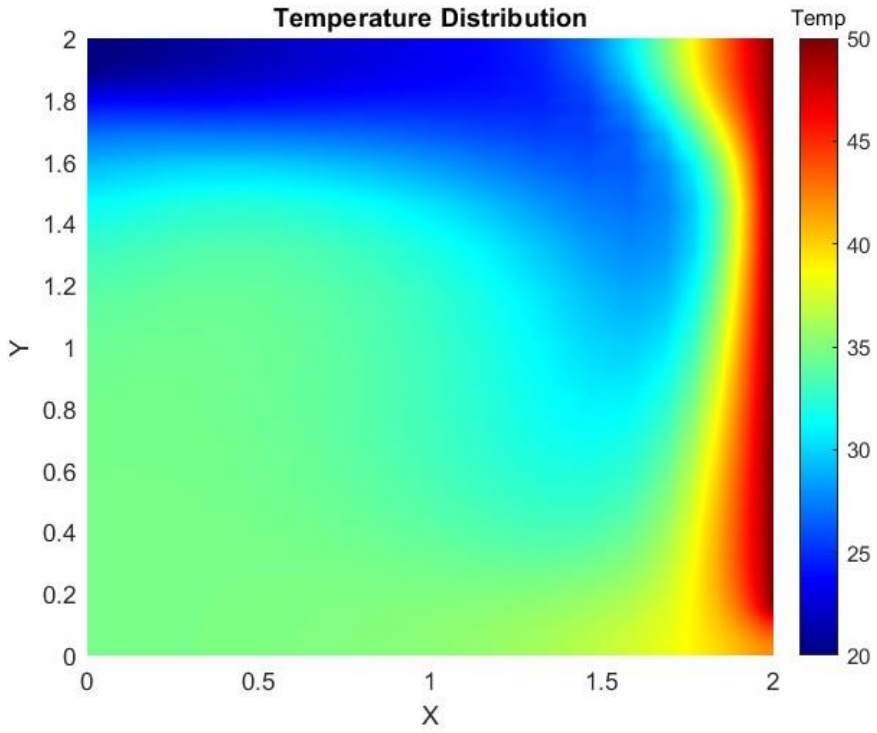
- Given Mesh:



- Given Velocity Field:



- Temperature Profile:

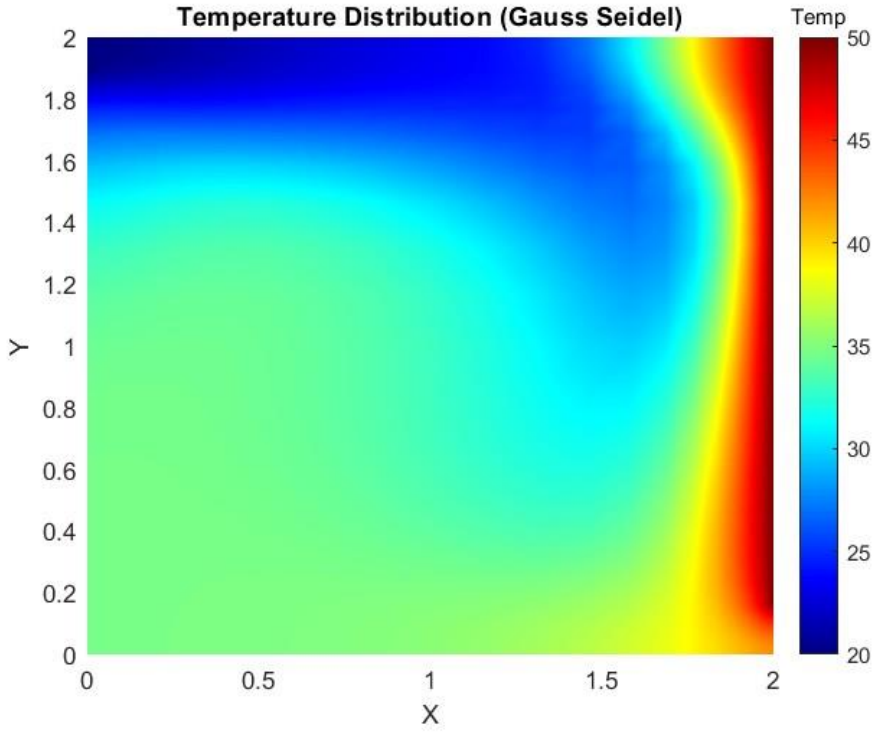


Comparison of different numerical techniques for system of linear equations:

For an error tolerance of 10^{-3}, the solution obtained using Gauss Sidel and TDMA (Sweep in X and Y directions) were same but number of iterations required for convergence changes.

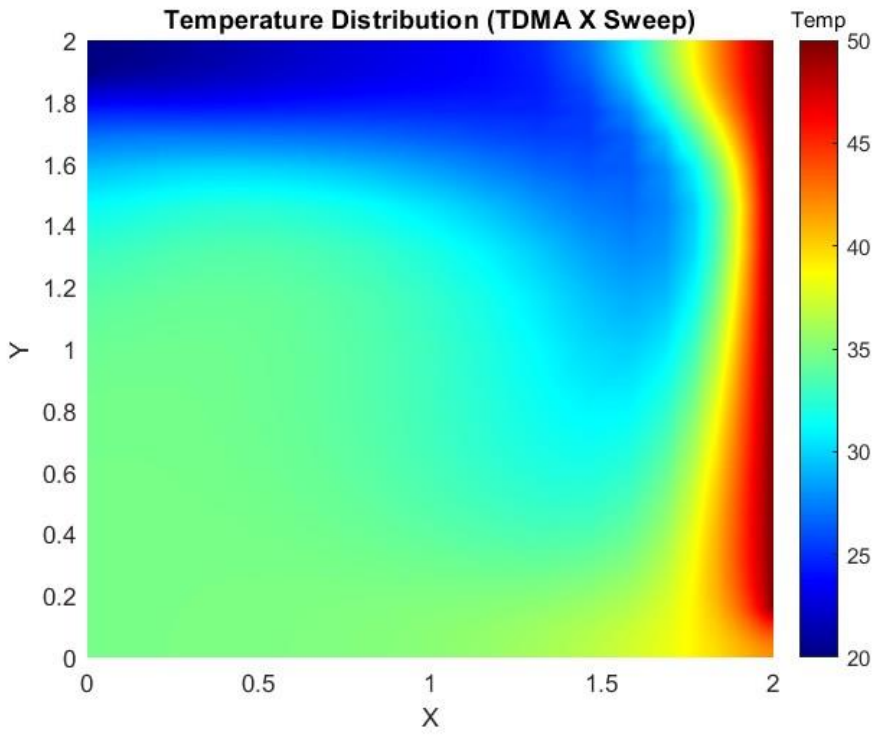
- Gauss Sidel: Number of iterations = 3144

Temperature Distribution:



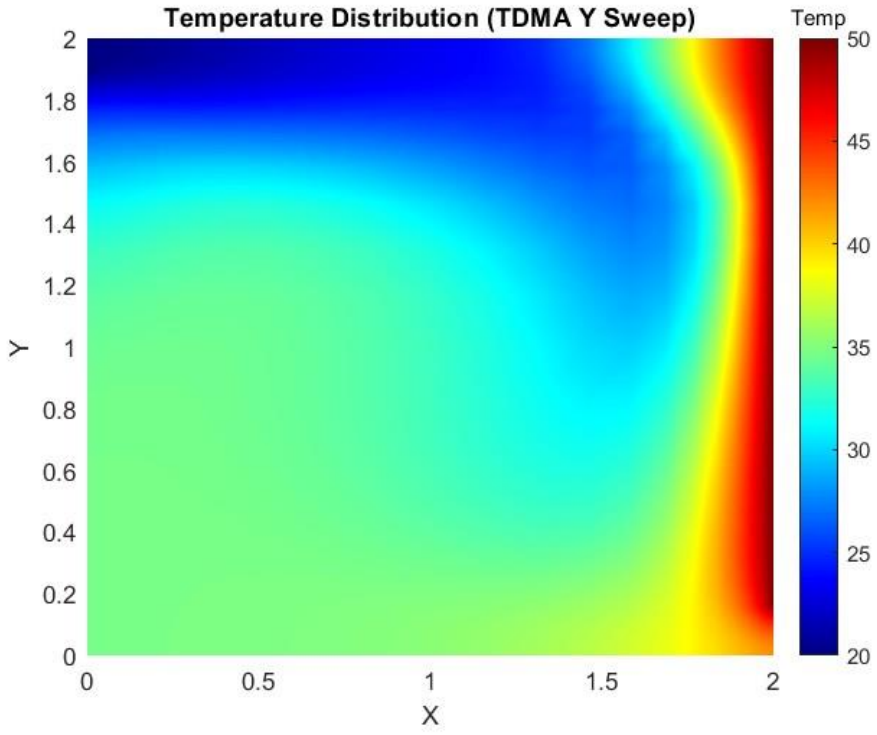
- TDMA (Sweeping in X direction): Number of Iterations = 2125

Temperature Distribution:



- TDMA (Sweeping in Y direction): Number of Iterations = 2092

Temperature Distribution:

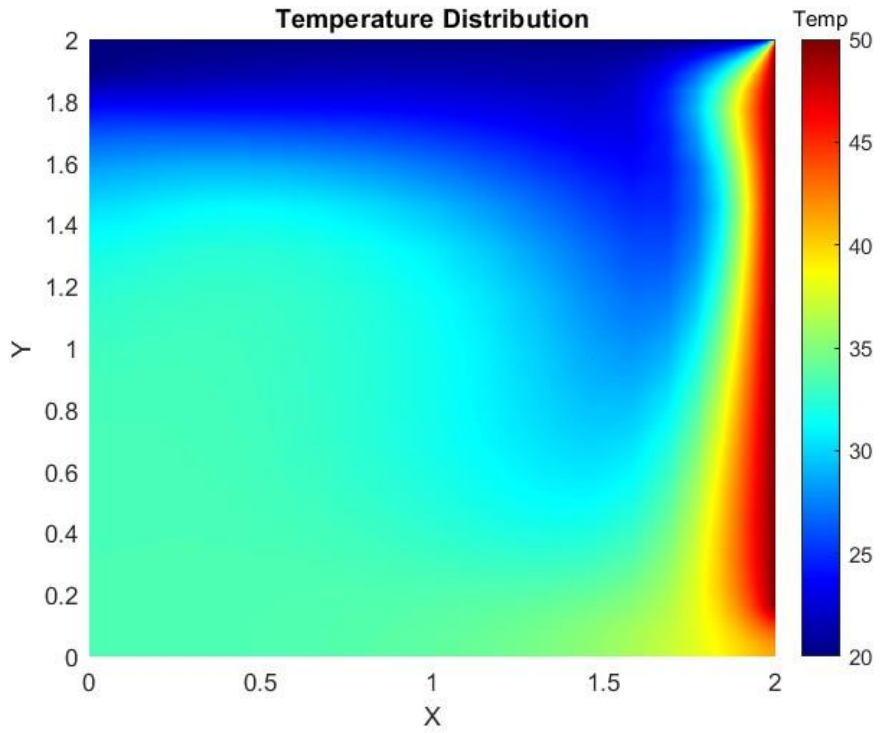


We can hence see that Gauss Sidel method requires more iterations than TDMA for a given error tolerance.

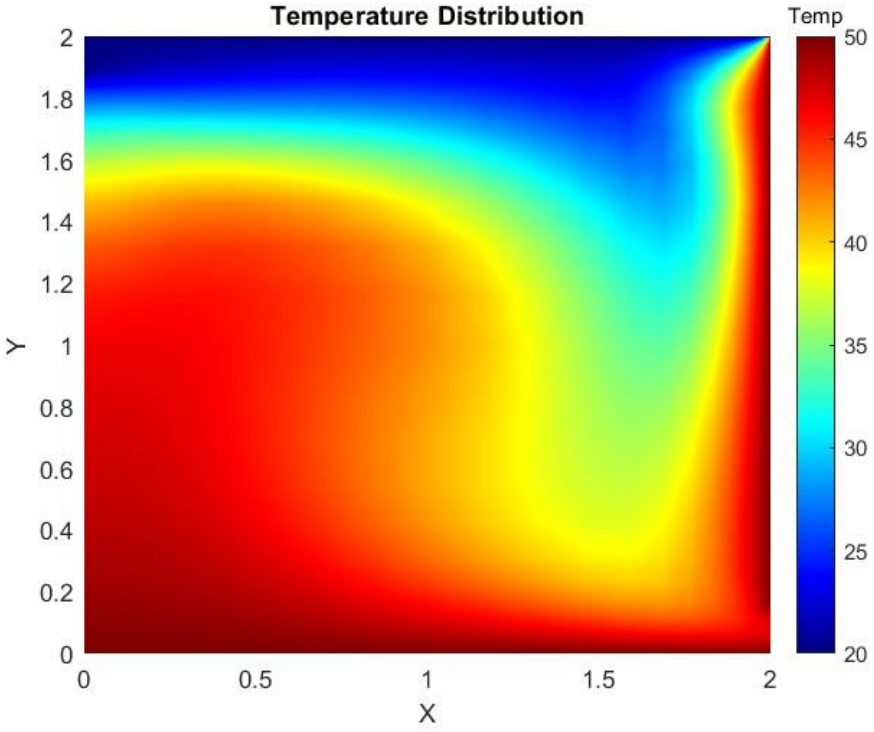
Sweep direction in TDMA does not matter in this case as in both the cases, number of iterations required for convergence are almost the same for the given error tolerance

Q1) Sensitivity to Boundary Conditions:

Changing the top boundary condition from Neumann to Dirichlet with T = 20^0C, we get the following,



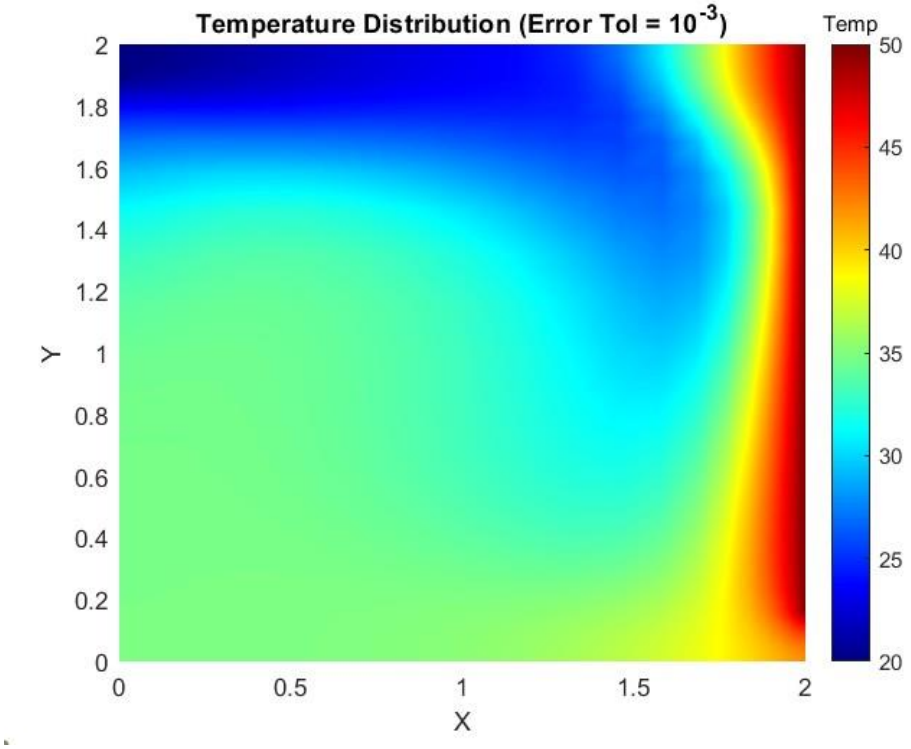
Changing top to 20 ^{0}C and bottom boundary condition to Dirichlet condition with T = 50^0C,



Q2) Sensitivity to convergence criteria:

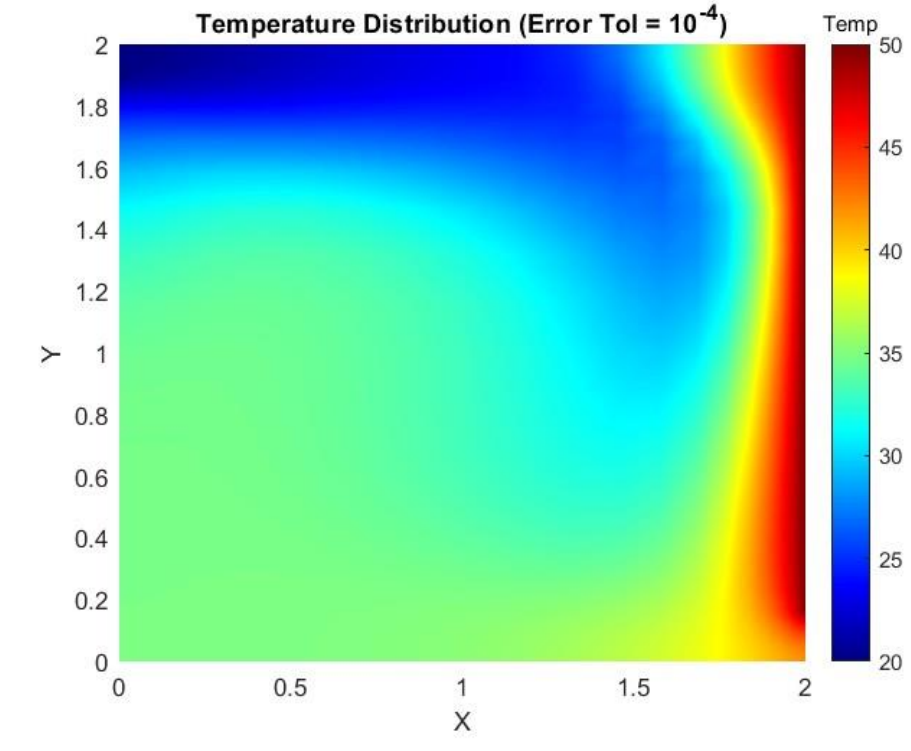
- Error Tolerance = 10^{-3}

Temperature Distribution:

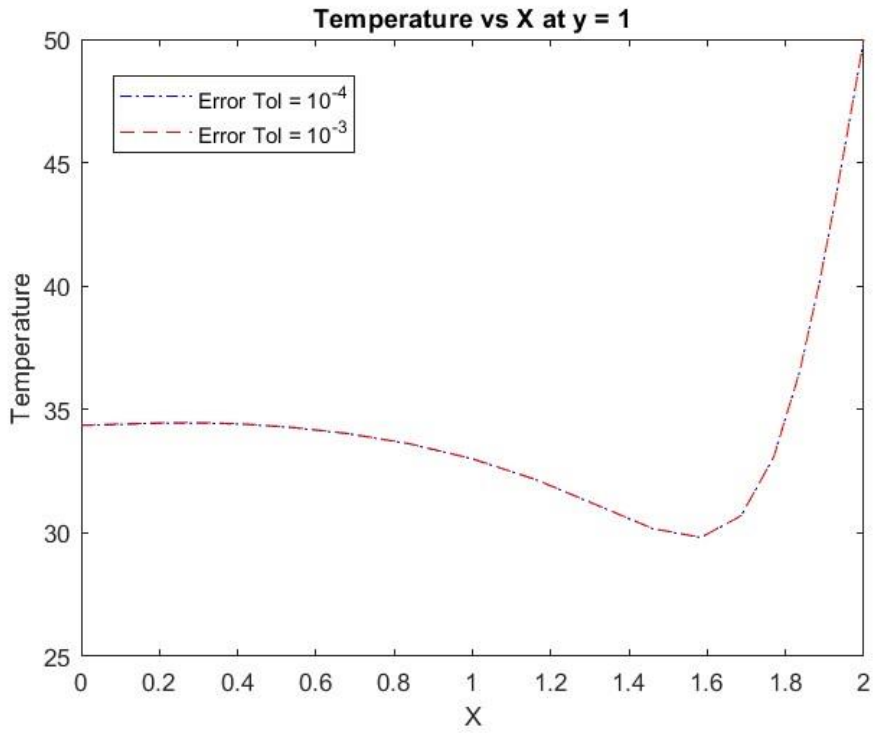


- Error Tolerance = 10^{-4}

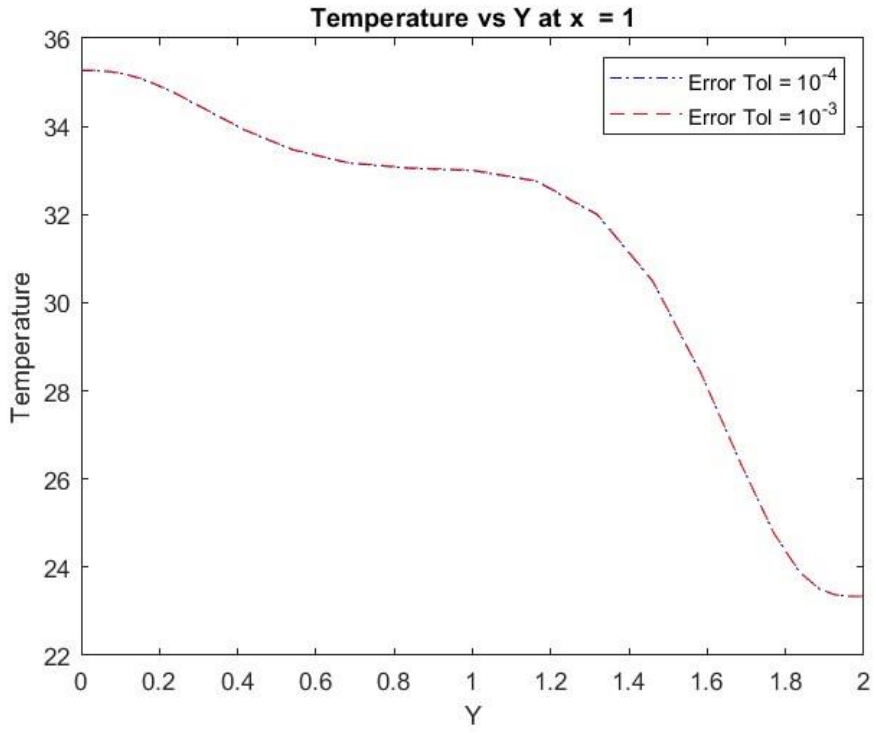
Temperature Distribution:



Temperature vs X at y = 1:



Temperature vs Y at x = 1



- From the plots above, we can see that the solution for the temperature profile does not change as the error tolerance is reduced from 10^{-3} to 10^{-4}