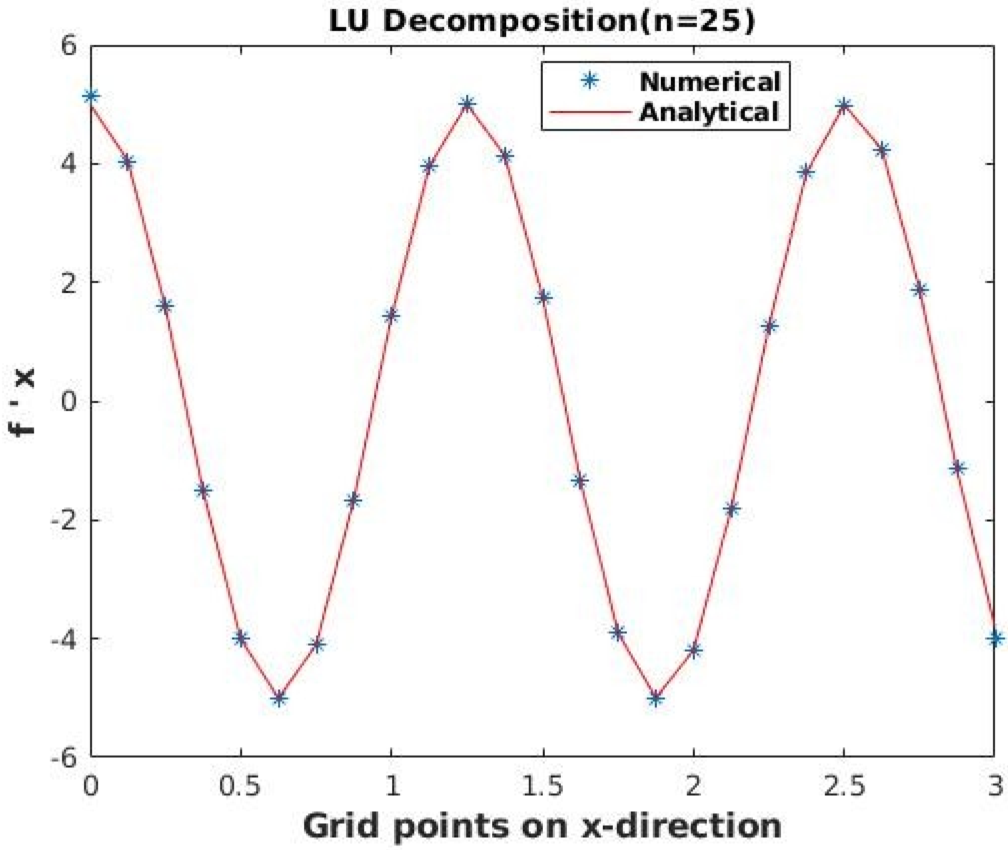
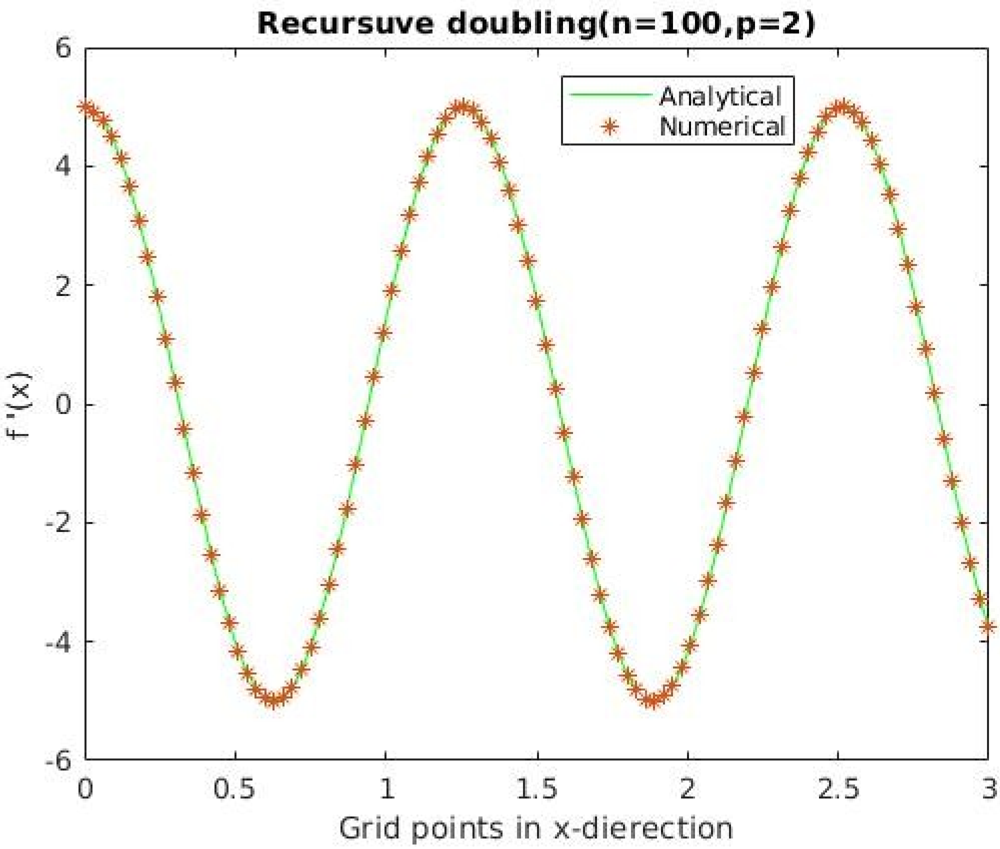
2)

a) Analytical solution and the numerical solution obtained for n = 25.

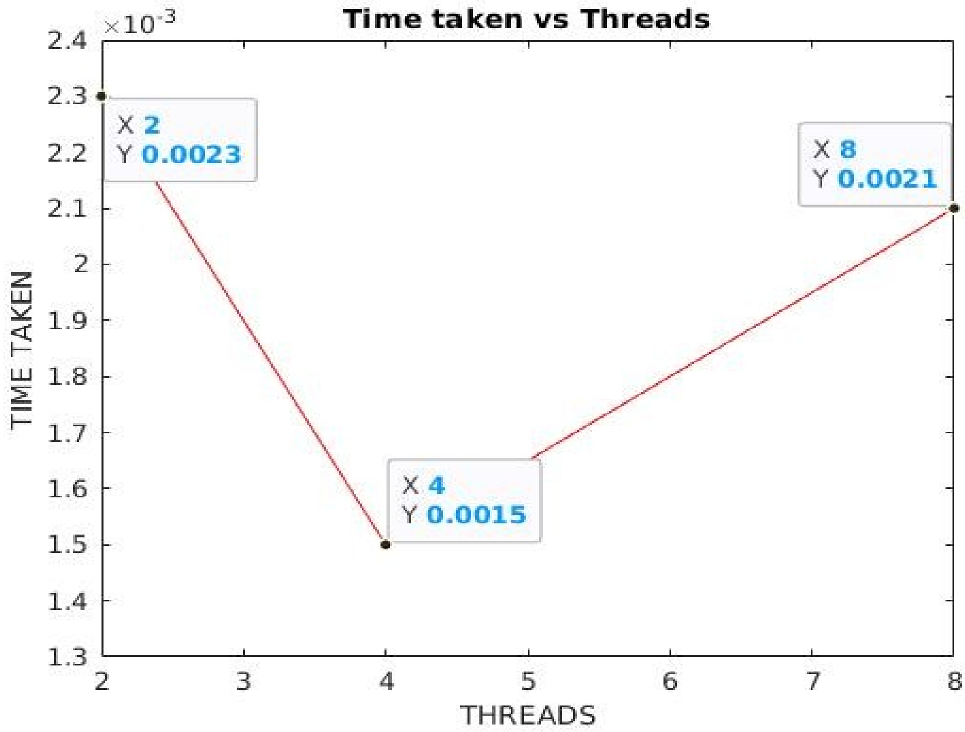


b)

i) Analytical solution and the numerical solution for n = 100 and number of threads p = 2.



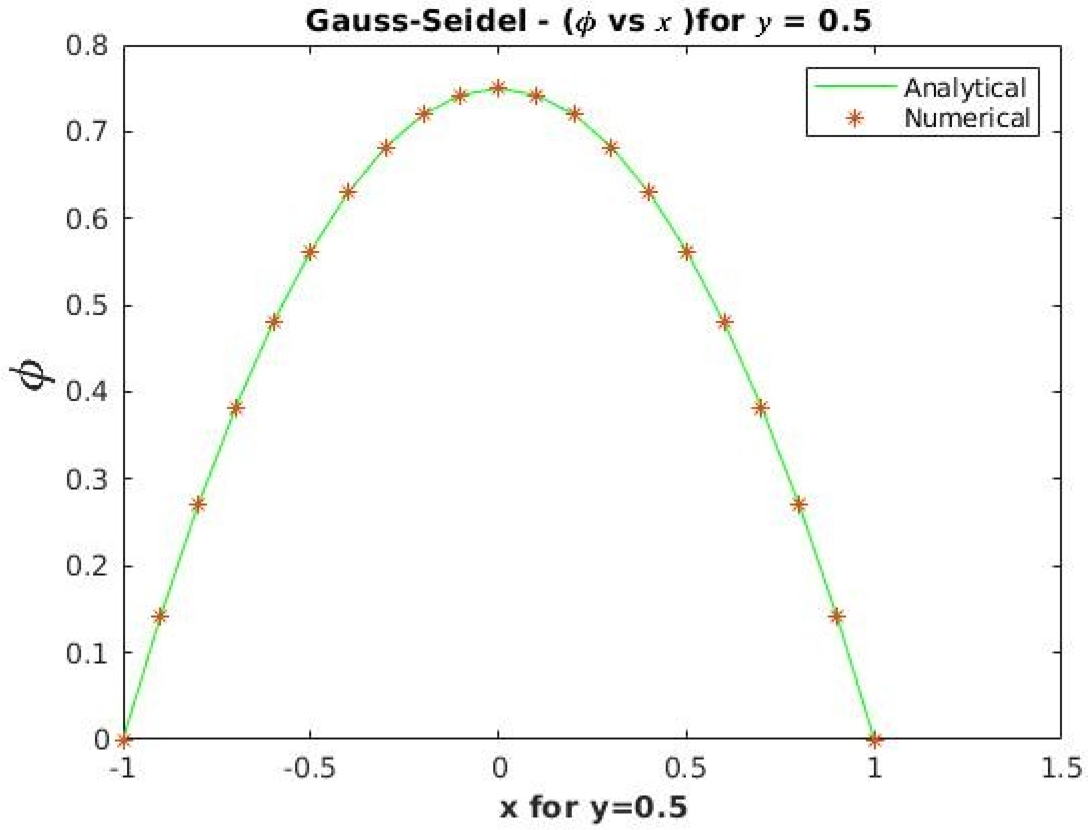
ii) Time-taken by the solver for n = 1000 for number of threads p = 2, 4 and 8.



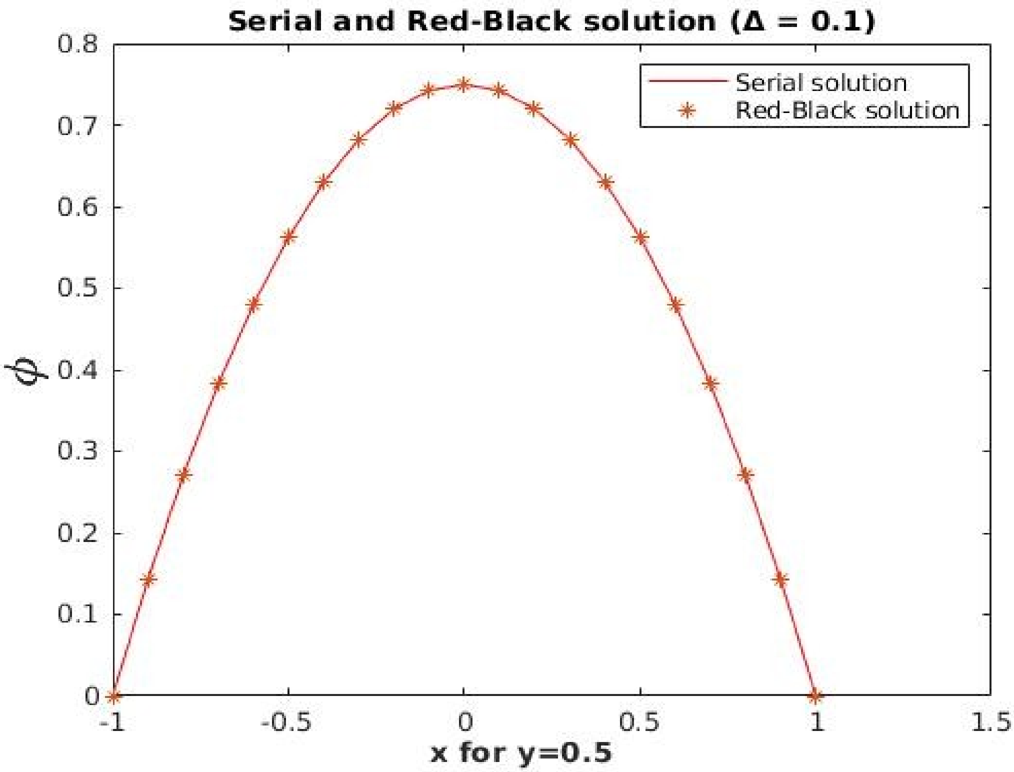
3)

i) <u>421</u> number of iterations are required to bring the numerical solution to within 1% of the exact solution.

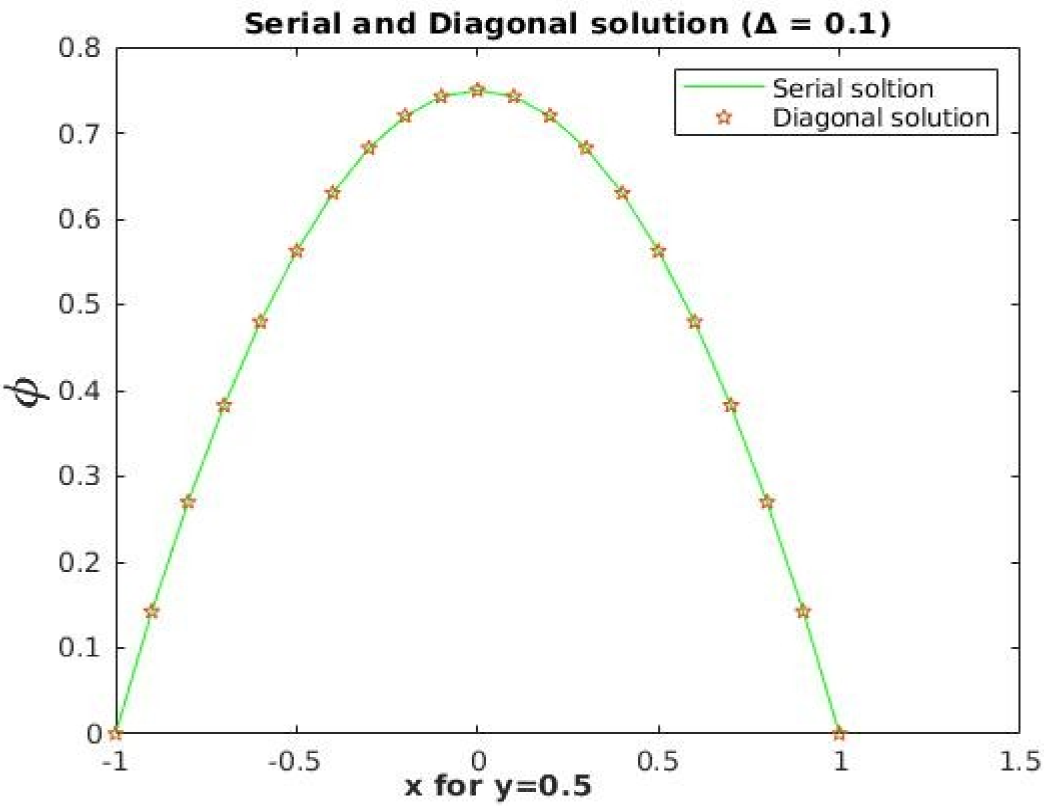
The numerical and the analytical solutions of ϕ vs x for y = 0.5,for delta = 0.1 (21 points)



iii) a) Serial vs Red-Black solution for a grid of Δ = 0.1

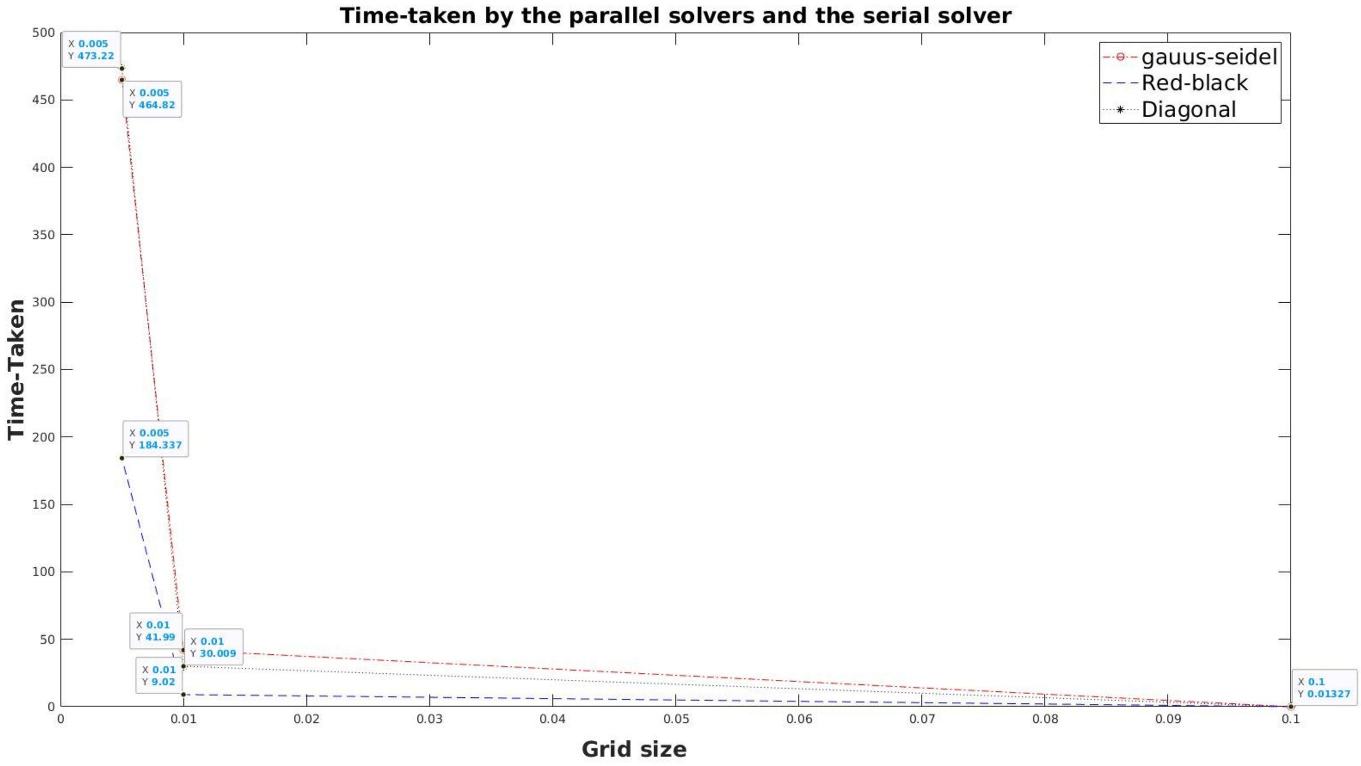


b) Serial vs Diagonal solution for a grid of Δ = 0.1



c)
The time-taken by the parallel solvers and the serial solver as a function of the grid size (Δ)

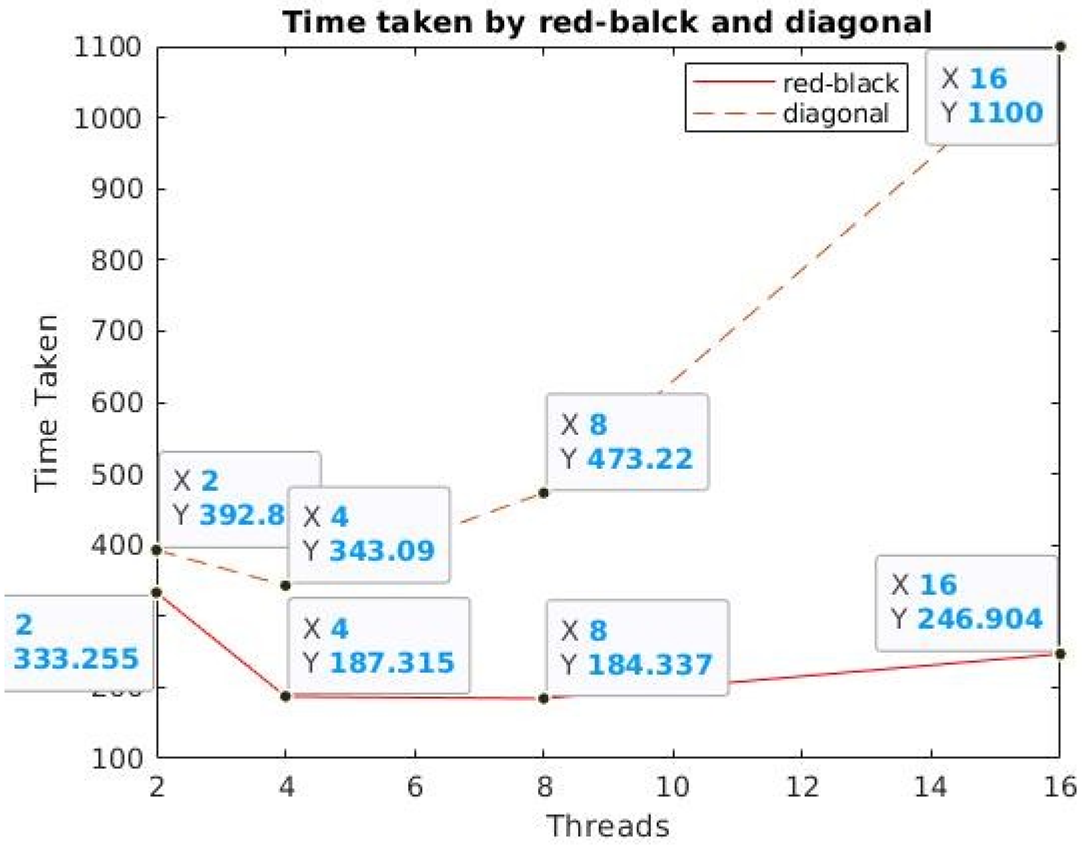
For Δ = 0.1, 0.01, and 0.001 using 8 threads.



<u>OBSERVATIONS:</u>

We can see improvement in performance by using parallel solvers as they are taking less time compared to serial solver
but as we observe the time variation between Red-Black parallel solver and serial solver is large compared to diagonal parallel solver ,it means time taken by Red-Black solver is less compred to diagonal solver.
Hence Red-Black solver results in faster convergence.
Using diagonal solver for 0.005 grid, time taken is more compared to serial solver as its parallelization Is performed along its digonals.Advantage of threads is taken around the main diagonal, however the diagonals away from the main diagonal are not using them properly.

iv) For a grid size of $\Delta = 0.001$, The time-taken by each of the parallel solvers as a function of the number of threads. Considering the number of threads to be p = 2, 4, 8 and 16.



Using the above plot we can say that red-black solver gives faster convergence compared to diagonal solver.