16.901: Homework # 5
Due Date: February 22, 2pm

Starting from the Matlab script, **dif1d.m** from Lecture 5 on ODE stiffness, implement the second-order backwards differentiation algorithm to solve the one-dimensional heat diffusion problem.

When running the simulation, set the number of points to Nx=1001. Run the simulation from $t = 0$ to $t = 0.5$ for three different values of $\Delta t = 0.1$, 0.01, and 0.001.

1. Store the value of the temperature at the middle of the domain (i.e. T at node 501) and plot it versus t. Overlay the results from all three Δt ON THE SAME GRAPH. Also, plot the distribution of $T(x)$ at the final time for all three values of Δt (again, overlay these on the same graph). To clarify: for this part of the problem, you should have only two graphs!

2. Perform the same three Δt simulations using the backward Euler method and make the same two plots as above.

3. Perform the same three Δt simulations using the trapezoidal integration method and make the same two plots as above.

4. Briefly compare the results for the three methods and three Δt. Are any of the methods clearly better for solving this problem.