16.901: Homework # 11
Due Date: April 6, 2pm

In this homework, you will modify the Matlab script **fem_dif1d_gq.m** from the Lecture Notes to use Gaussian quadrature for the evaluation of both the stiffness matrix and source term for the problem,

$$(kT_x)_x + q(x) = 0, \qquad k(x) = e^x, \quad q(x) = 50e^x,$$

with boundary conditions $T(\pm 1) = 100$. The script is available on the webpage under the Homework #11 link and already has Gaussian quadrature implemented for the sourcer term. The exact solution to this problem is,

$$T(x) = 50 + 50\frac{e}{\sinh 1} - 50x - 50\frac{e^{-x}}{\sinh 1}.$$

WARNING: you will need to modify the exact solution in the **fem_dif1d_gq.m** script because it is for the Homework #10 problem (with constant k).

1. Modify the Matlab script using Gaussian quadrature for the stiffness matrix terms. Run the simulation for 5 elements and 10 elements using both one-point and two-point quadrature. For the homework, include the plots of the solutions for both quadrature rules as well as a hard copy of your completed script.

2. For both quadrature rules, what do you think the order of accuracy is for this finite element method? Justify your answer using the plots.