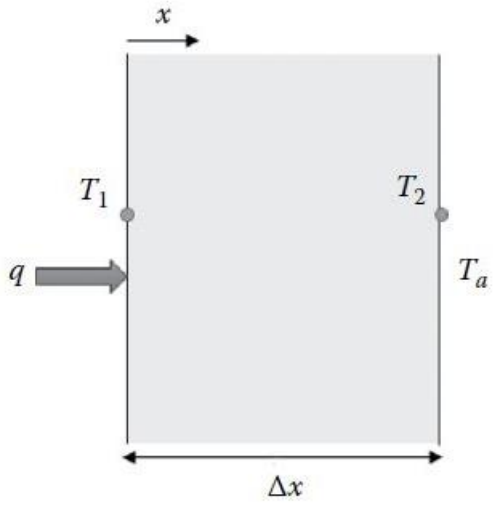
Problem-2

Figure 8.1 shows a one-dimensional slab with heat conduction and radiation. One surface of the slab is maintained at temperature T_1, and the other surface at temperature T_2 has radiative heat transfer with the surroundings that act as a black body at temperature T_a. The radiation from the slab surface can be represented by the Stefan–Boltzmann law:

$$\left.\frac{q_x}{A}\right|_{x=\Delta x} = \sigma\left(T_2^4 - T_a^4\right)\Big|_{x=\Delta x} \quad \left(\sigma = 5.676\times10^{-8}\ \text{W/m}^2\cdot\text{K}^4\right)$$

Calculate and plot the temperature profile within the slab. What is the corresponding value of T_2? The thermal conductivity of the solid slab, k, is dependent upon temperature and is given by $k = 30(1 + 0.002T)$. Assume that the convective heat transfer between the slab and the surroundings is negligible.

Data: $T_1 = 290$ K, $T_a = 1273$ K, $\Delta x = 0.2$ m



First an initial estimate for T_2 is provided and solve the differential equation to find a new T_2. The iterations are continued until the value of T_2 converges.

Write the Matlab code to solve this problem using ode45 and make a report of 1 page containing the plot and the solution of all parts.

- All the files should be sent to **180744.shubhmaheshwari@gmail.com** and chemineers01@gmail.com in a zip folder("Name_Rollno_p2")

- Deadline- Submission due by 23:59 pm, Sunday, 28 Feb .