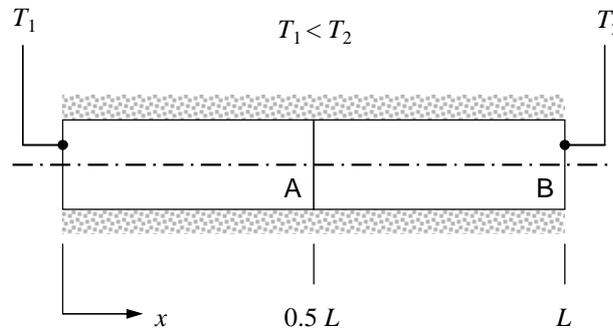


PROBLEM 2.6

KNOWN: Rod consisting of two materials with same lengths. Ratio of thermal conductivities.

FIND: Sketch temperature and heat flux distributions.

SCHEMATIC:

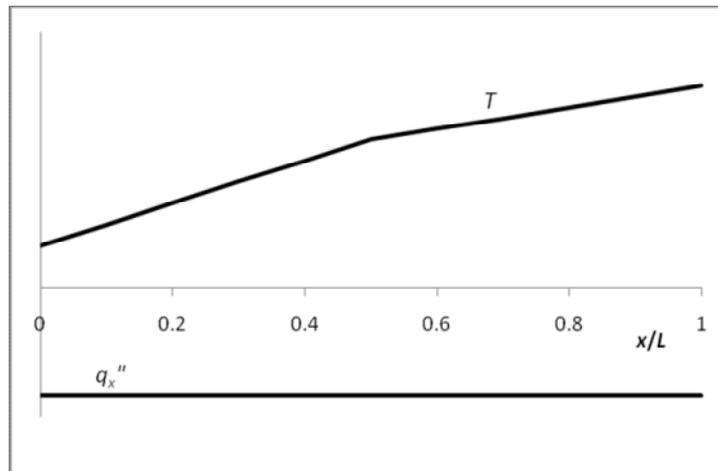


ASSUMPTIONS: (1) Steady-state conditions, (2) One-dimensional conduction, (3) Constant properties, (3) No internal generation.

ANALYSIS: From Equation 2.19 for steady-state, one-dimensional conduction with constant properties and no internal heat generation,

$$\frac{\partial}{\partial x} \left(k \frac{\partial T}{\partial x} \right) = 0 \quad \text{or} \quad \frac{\partial q_x''}{\partial x} = 0$$

From these equations we know that heat flux is constant and the temperature gradient is inversely proportional to k . Thus, with $k_A = 0.5k_B$, we can sketch the temperature and heat flux distributions as shown below:



COMMENTS: (1) Note the discontinuity in the slope of the temperature distribution at $x/L = 0.5$. The constant heat flux is in the negative x -direction. (2) A discontinuity in the temperature distribution may occur at $x/L = 0.5$ due the joining of dissimilar materials. We shall address *thermal contact resistances* in Chapter 3.