ACTIVE LEARNING EXERCISE—Thermal resistance

Consider a chunk of material with thickness L and surface area A as shown in the figure. The left hand face is maintained at a constant temperature T_1 while the right hand side is maintained at a constant temperature of T_2. Is the material has a constant thermal conductivity and is subject to 1-D steady-state conduction with no heat generation,

(a) find the temperature distribution $T = T(x)$.
(b) Use your answer to (a) to find an expression for the rate of heat transfer through the chunk, $\dot{Q}$.
(c) Rearrange your answer in (b) to look like

$$\dot{Q} = \frac{T_1 - T_2}{\text{something}}$$