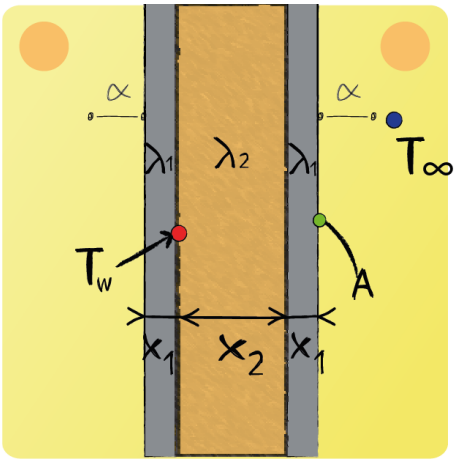
Lecture 7 Question 2

A multi-layer wall is constructed of fiberglass insulation sandwiched between two layers sheet metal. Assume steady-state, one-dimensional heat transfer.
Give an expression for the rate of heat transfer $\dot{Q}$



Rate of heat transfer through a multi-layer wall with convection:

$$\dot{Q} = \frac{T_{\mathrm{A}} - T_{\mathrm{B}}}{\frac{1}{\alpha_A \cdot A} + \sum_{i=1}^{n} \frac{\delta_{\mathrm{i}}}{\lambda_{\mathrm{i}} \cdot A} + \frac{1}{\alpha_B \cdot A}}$$

Between T_{w} and T_{∞} we have 2 solid layers and convection is taking place at the right-side.

And thus:

$$\dot{Q} = \frac{T_{\mathrm{w}} - T_{\infty}}{\frac{x_2}{\lambda_2 \cdot A} + \frac{x_1}{\lambda_1 \cdot A} + \frac{1}{\alpha \cdot A}}$$