Problem 1:

A house has a composite wall of wood, fiberglass insulation, and plaster board, as indicated in the sketch on the board. On a cold winter day the convection heat transfer coefficients are $h_o=60 \text{ W/m}^2\text{K}$ and $h_i=30 \text{ W/m}^2\text{K}$. The total wall surface area is 350 m$^2$.

(a) Determine a symbolic expression for the total thermal resistance of the wall, including inside and outside convection effects for the prescribed conditions. 
(b) Determine the total heat loss through the wall. 
(c) If the wind were blowing violently, raising $h_o$ to 300 W/m$^2$K, determine the percentage increase in the heat loss. 
(d) What is the controlling resistance that determines the amount of heat flow through the wall?
Problem 2:

A thin metallic wire of thermal conductivity $k$, diameter $D$, and length $2L$ is annealed by passing an electrical current through the wire to induce a uniform volumetric heat generation $\dot{E}_g$. The ambient air around the wire is at a temperature $T_\infty$, while the ends of the wire at $x=\pm L$ are also maintained at $T_\infty$. Heat transfer from the wire to the air is characterized by the convection coefficient $h$. Obtain an expression for the steady-state temperature distribution $T(x)$ along the wire.