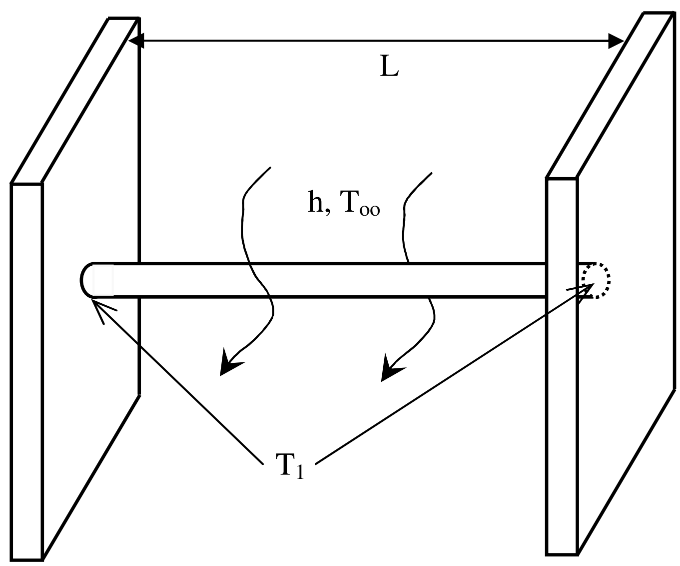
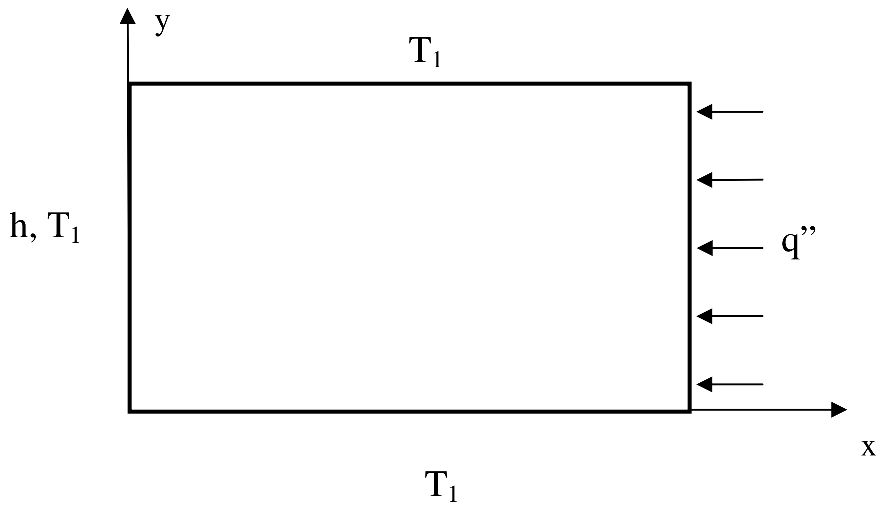
Conduction Qualifier – Spring 2008

1) Consider a solid cylinder of length L and diameter D that is attached between two plane walls. Both ends of the cylinder are maintained at a constant temperature equal to T_1. The curved surface of the cylinder is subjected to convection heat transfer with a uniform convection coefficient h (W/m^2 K) and fluid temperature T_{oo}, noting that $T_1 > T_{oo}$. The thermal conductivity of the cylinder is k. The Bi = (hD/k) is <u>much less</u> than 1.

(**i**) Using a <u>partially-lumped analysis</u>, calculate the steady-state, total heat rate (W) at which energy is transferred from the cylinder into the fluid.
Hint: First find the 1- D temperature distribution.



2) A two-dimensional rectangular solid (L*x*W) is shown below. Initially, the solid is at a uniform temperature of T_1. For t>0, the boundary conditions as shown are applied, namely, convection heat transfer to a fluid at T_1 on the left surface (x=0), a constant, incident heat flux on the right surface (x=L), and a prescribed temperature of T_1 on the top (y=W) and the bottom (y=0).



i) Solve for the temperature distribution of the solid, T(x, y, t). You may leave integrals in your final answer.