AME40453 - Automation and Controls
C2 Pre-Lab Assignment

For the following questions, please express your answers as algebraic equations written on a separate sheet of paper, and show your work. Then, transcribe the equations into your lab notebook.

1. Write down the governing 1st order differential equation for temperature T with simple proportional feedback controller, where $\dot{q} = k_p(T_S - T)$.
2. Using the equation you just wrote, derive an equation for the equilibrium temperature in terms of the system parameters: mc_P, hA, k_p, etc. How does is compare to the set-point T_S? Will the actual temperature converge to the set-point T_S?
3. Using your equation from problem 2, derive an equation for the thermal time constant τ in terms of the system parameters: m, c_P, h, k_p, etc.
4. Sketch the time constant as a function of the proportional gain k_p.