Homework 8

1   Problem

Solve Problem 1a and 1b in the Davies book (p. 312)

2   Problem

Solve Problem 2a and 2b in the Davies book (p. 313)

3   Problem

Solve Problem 3a and 3b in the Davies book (p. 313–314)

4   Problem

Solve Problem 4a and 3b in the Davies book (p. 314)

5   Problem

How long should it take to boil an egg? Model the egg as a sphere with radius of 2.3 cm that has properties similar to water with a density of $\rho = 1000$ kg/m^3 and thermal conductivity of $k = 0.606$ Watts/(m·$^{\circ}C$) and specific heat of $c = 4182$ J/(kg·$^{\circ}$ C). Suppose that an egg is fully cooked when the temperature at the center reaches 70° C. Initially the egg is taken out of the fridge at 4° C and placed in the boiling water at 100° C. Since the egg shell is very thin assume that it quickly reaches a temperature of 100° C. The protein in the egg effectively immobilizes the water so the heat conduction is purely conduction (no convection). Plot the temperature of the egg over time and use the data tooltip in MATLAB to make your conclusion on the time it takes to cook the egg in minutes.
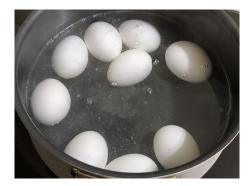

Figure 1: Image source: [Link]