

Homework Set 3 (Section 1.4)

1. Questions from the text: 1.4.1(a-h), 1.4.2, 1.4.7, 1.4.11*

Hints are below:

- 1.4.2(a) Recall that the total heat generated per unit time is given by $\int_0^L Q(x, t) dx$
- 1.4.2(b) To get the flux, we need to determine an expression for u_x (Recall that $\phi = -K_0 u_x$)
- 1.4.2(c) You might recall that

$$\int_0^L Q(x, t) dx = \phi(L, t) - \phi(0, t)$$

2. Consider the following instance of the heat equation, where there is heat loss through the lateral surface:

$$\text{PDE } u_t = u_{xx} - u \quad 0 < x < 1 \quad 0 < t < \infty$$

$$\text{BCs } \begin{cases} u(0, t) = 1 \\ u(1, t) = 1 \end{cases} \quad 0 < t < \infty$$

Find the steady state solution. Where is the heat flowing in this problem (you might plot the solution)?