

Exercise 1.5.11

Consider

$$\frac{\partial u}{\partial t} = \frac{k}{r} \frac{\partial}{\partial r} \left(r \frac{\partial u}{\partial r} \right), \quad a < r < b,$$

subject to

$$u(r, 0) = f(r), \quad \frac{\partial u}{\partial r}(a, t) = \beta, \quad \text{and} \quad \frac{\partial u}{\partial r}(b, t) = 1.$$

Using physical reasoning, for what value(s) of β does an equilibrium temperature distribution exist?