

2.2 Use Eq. (2.17) to find the weighted residuals formulation of Eqs. (2.1) – (2.3) in terms of the heat flux  $q$ .

**Solution:**

$$\int_0^L K \frac{d\phi}{dx} \frac{dT}{dx} dx - \int_0^L \phi Q dx + \phi \left( -K \frac{dT}{dx} \right) \Big|_0^L = 0$$

The heat flux term at  $x = L$  must be zero, and  $-K \frac{dT}{dx} \Big|_{x=0} = q$  Hence

$$\int_0^L K \frac{d\phi}{dx} \frac{dT}{dx} dx = \int_0^L \phi Q dx + \phi(0) q$$