

HW 1.3

#4.19

$$k = 1 \text{ W/m}\cdot\text{C}$$

$$L = 8 \text{ m}$$

$$T_1 = 500 \text{ C}^\circ \quad T_2 = 400 \text{ C}^\circ$$

$$z = 0.15 \text{ m}$$

$$r = 10 \text{ cm}$$

$$D = 0.1 \text{ m}$$

$$R_1 = R_2 = 0.05 \text{ m}$$

$$S = \frac{2\pi L}{\cosh^{-1}\left(\frac{z^2 - R_1^2 - R_2^2}{2R_1 R_2}\right)}$$

$$= \frac{2\pi(8)}{\cosh^{-1}\left(\frac{0.15^2 - 0.05^2 - 0.05^2}{2(0.05)(0.05)}\right)} = 26.1 \text{ m}$$

$$Q = \frac{S k (T_1 - T_2)}{2.21 \text{ kW}} = \frac{(26.1)(1)(100)}{2.21 \text{ kW}} = 2611 \text{ W}$$

#4.81

$$r_1 = 0.01 \text{ m} \quad r_2 = 0.1 \text{ m}$$

$$z = 0.07 \text{ m}$$

$$L = 1 \text{ m}$$

$$T_2 = 25^\circ$$

$$q' = 100 \text{ W/m}$$

$$k = 0.76 \text{ W/m}\cdot\text{C}^\circ$$

$$R = \frac{2\pi L}{\cosh^{-1}\left(\frac{z^2 - r_1^2 - r_2^2}{2r_1 r_2}\right)} = \frac{2\pi(1)}{\cosh^{-1}\left(\frac{0.07^2 - 0.01^2 - 0.1^2}{2(0.1)(0.01)}\right)}$$

$$R = 3.90 \text{ m}$$

$$Q = S k (T_{\text{pipe}} - T_2) \Rightarrow T_{\text{pipe}} = T_2 + \frac{Q}{S k}$$

$$T_{\text{pipe}} = 25 + \frac{100}{(3.90)(0.76)} = 58.7 \text{ C}^\circ$$