Prob 6.12 Boundary Layer Temp. Dist.

$$\frac{T - T_s}{T_\infty - T_s} = 1 - \exp\left(-Pr \frac{u_\infty y}{\nu}\right)$$

$$T = (T_\infty - T_s)\left(1 - \exp\left(-Pr \frac{u_\infty y}{\nu}\right)\right) + T_s$$

$$\frac{dT}{dy} = (T_\infty - T_s) \frac{Pr\, u_\infty}{\nu} \exp\left(Pr \frac{u_\infty y}{\nu}\right)$$

$$q'' = -k_f \left.\frac{dT}{dy}\right|_{y=0}$$

$$q'' = k_f Pr \frac{u_\infty}{\nu} \left[T_s - T_\infty\right]$$

$$h = k_f \frac{Pr}{\nu} u_\infty$$

$T_{avg} = 350\,K$

$k_f = 0.03\ W/mK$

$$q'' = 0.03 \frac{W}{mK} \cdot 0.7 \cdot 5000 \frac{1}{m} \cdot \left[100\,K\right]$$

$$q'' = 10{,}500 \frac{W}{m^2}$$

$$\boxed{h = 105 \frac{W}{m^2 K}}$$