① $\eta = \frac{y}{x}\left(\frac{U_\infty x}{\nu}\right) = \frac{.002}{.1}\left(\frac{1 \times .1}{10^{-5}}\right) = 2$

② P. 136 $\frac{u}{U_\infty} = 5'(\eta) = 5'(2) = .63$, $u = 1(.63) = .63\ m/s$, $T_w = 400K$, $T_\infty = 300K$

③ $Pr = \nu/\alpha = 1$ $\frac{T - T_w}{T_\infty - T_w} = \frac{u}{U_\infty} = .63$, $\Rightarrow T(\eta = 2) = 337K$

② $q_w'' = \dot{m} c_p \frac{dT_M}{dx}$, $T_M - T_i = \frac{1}{\dot{m} c_p}\int q_w'' dx$

a) $(T_M - T_i)\dot{m} c_p = CONST \times$

b) $= \int B e^{-cx} = B(-1/c) e^{-x} + B(1/c)$

$\rho c_p \frac{\partial T_M}{\partial t} + \rho u_M c_p \frac{\partial T}{\partial x} = q_w'' = B t e^{-cx}$

②

$$q_w'' = q''(x, y=0) = -k\frac{\partial t}{\partial y}\Big|_{y=0} = \frac{k}{.893}\left(\frac{\beta}{9\alpha}\right)^{1/3}\left[\int_0^x \frac{1}{(x-\xi)^{1/3}}\frac{dT_w}{d\xi}d\xi + \frac{\Delta T_w(\xi_m)}{(x-\xi_m)^{1/3}}\right]$$

a) $T_w - T_i = const = A$

$$q_w'' = \frac{k}{.893}\left(\frac{\beta}{9\alpha}\right)^{1/3}\left[0 + \frac{A}{(x-0)^{1/3}}\right]$$

b) $T_w - T_i = Ax$

$$q_w'' = \frac{k}{.893}\left(\frac{\beta}{9\alpha}\right)^{1/3}\int_0^x \frac{A\,d\xi}{(x-\xi)^{1/3}}$$

c) $0 < x < 1$ $\quad T_w - T_i = Ax$

$x > 1$ $\quad = A$

$$\frac{q_w''}{\frac{k}{.893}(\quad)^{1/3}} = \int_0^x \frac{A\,d\xi}{(x-\xi)^{1/3}} - \int_1^x \frac{A\,d\xi}{(x-\xi)^{1/3}} = \int_0^1 \frac{A\,d\xi}{(x-\xi)^{1/3}}$$