Cankaya University
Faculty of Engineering
Mechanical Engineering department
ME 313 Heat transfer

Quiz 6
Fall 2017

Experimental measurements of the temperature distribution in flow of atmospheric pressure air over thewing of an airplane indicate that the temperature distribution near the surface can be approximated by a linear equation:

$T - T_s = a\,y(T_\infty - T_s)$

T_s = surface temperature K

$a = 2\,m^{-1}$

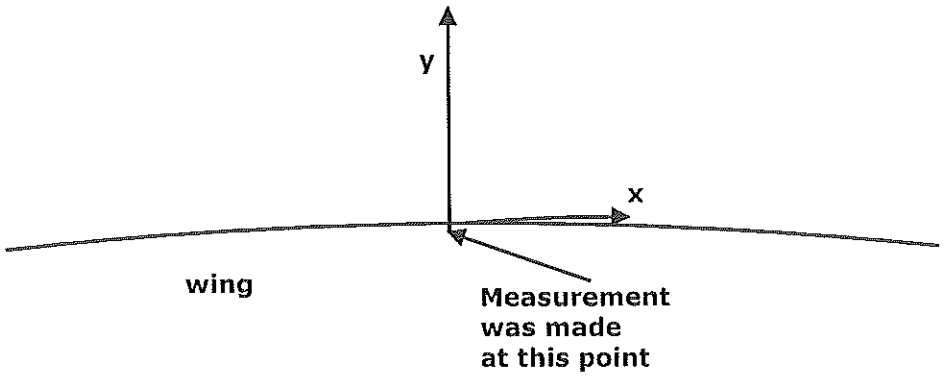
T_∞ = free stream air tyemperature K

y = perpendicular dis tan ce from surface (mm)

$T_s = 50\,^0C$

$T_\infty = -50\,^0C$

a) Estimate convection heat transfer coefficient
b) Calculaye the heat flux in W/m^2



$$h = \frac{-k\left(\frac{\partial T}{\partial y}\right)_{y=0}}{T_w - T_\infty} \Rightarrow$$

$$T_f = \frac{T_w + T_\infty}{2} = \frac{50-50}{2} = 0^\circ C \qquad k = 0.0237\ \frac{W}{m\,K}$$

$$\frac{\partial T}{\partial y} = a(T_\infty - T_s)$$

$$\therefore h = ak = (2)(1)(0.0237) = 0.0474$$

$$h = 0.0474\ W/m^2K$$

$$q = h(T_s - T_\infty) = 0.0474(50+50) = 4.74\ W/m^2K$$