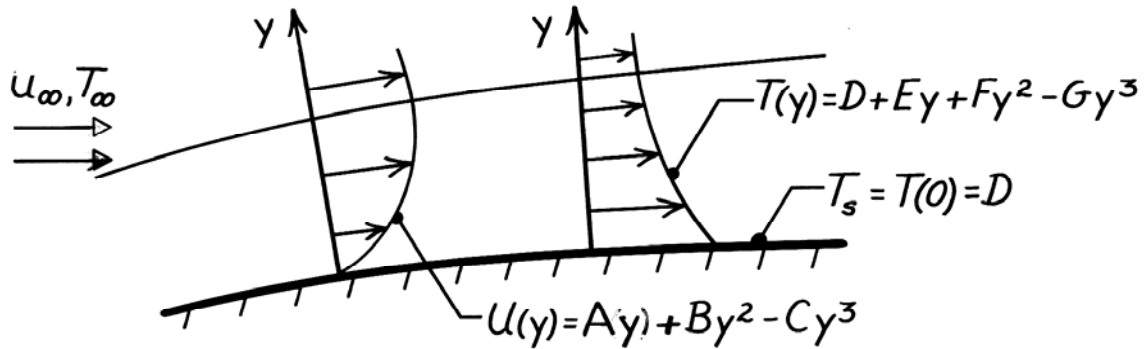


PROBLEM 6.2

KNOWN: Form of the velocity and temperature profiles for flow over a surface.

FIND: Expressions for the friction and convection coefficients.

SCHEMATIC:



ANALYSIS: The shear stress at the wall is

$$\tau_s = \mu \left. \frac{\partial u}{\partial y} \right|_{y=0} = \mu \left[A + 2By - 3Cy^2 \right]_{y=0} = A\mu.$$

Hence, the friction coefficient has the form,

$$C_f = \frac{\tau_s}{\rho u_\infty^2 / 2} = \frac{2A\mu}{\rho u_\infty^2}$$

$$C_f = \frac{2A\nu}{u_\infty^2}.$$

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The convection coefficient is

$$h = \frac{-k_f (\partial T / \partial y)_{y=0}}{T_s - T_\infty} = \frac{-k_f [E + 2Fy - 3Gy^2]_{y=0}}{D - T_\infty}$$

$$h = \frac{-k_f E}{D - T_\infty}.$$

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COMMENTS: It is a simple matter to obtain the important surface parameters from knowledge of the corresponding boundary layer profiles. However, it is rarely a simple matter to determine the form of the profile.