These problems are due on Friday, Mar 26

7-1 Water at 20°C flows over one side of a flat plate 2 m x 2 m with a mean velocity of 4 m/s. A measurement reveals the force needed to hold the plate in place is 0.4 Newtons in the direction opposite the flow.
   a. What is the average shear stress exerted by the water on the surface of the plate?
   b. What is the skin friction coefficient, $C_f$?
   c. Use the Reynolds analogy to determine the heat transfer coefficient.
   d. What is the Nusselt number?

7-2 Air at 20°C flows over a flat plate at a velocity of 5 m/s.
   a. Plot the variation in the local heat transfer coefficient from $Re_x = 0$ to $Re_L = 2E6$. Assume the transition Reynolds number is $5E5$. (Excel is recommended for this plot).
   b. For $Re_T = 5E5$, at what value of $x$ does the flow become turbulent?
   c. For $Re_L = 2E6$, what is the length of the plate?
   d. Show on the same graph as in “a.” the value of the average heat transfer coefficient over this length.

7-3 A tractor trailer rig travels down the highway on a hot summer day at 100 km/hr. The trailer is 15 m in length and can be assumed as a flat plate. The air is at 30°C, and the top of the trailer absorbs $q_{abs} = 200$ W/m² of energy from solar radiation. If this energy is dissipated by convection to the environment only, estimate the surface temperature of the top of the trailer.