NAME:
AERO 360
Examination 2
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Use any and all pertinant charts and tables on this examination where appropriate.

1. Consider flow over a triangular shaped airfoil with all conditions given in in Figure 1. Determine the dimensional lift force F_L, the dimensional drag force F_D, and the lift and drag coefficients C_L and C_D.

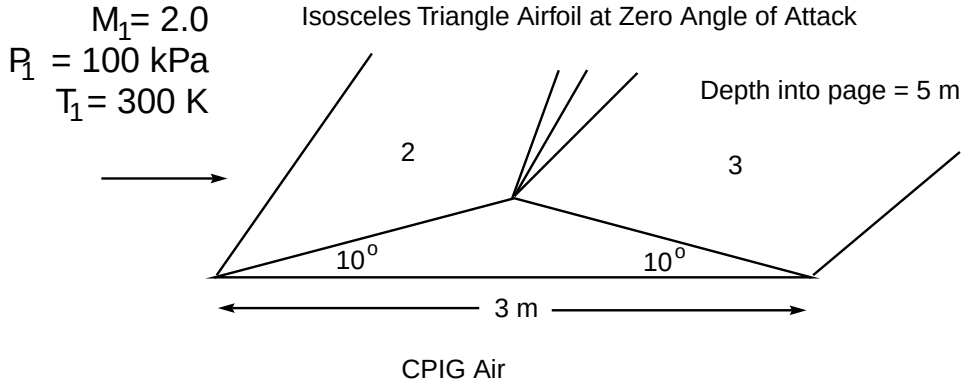

Figure 1: Flow over a triangular airfoil

2. At a certain point in a duct, CPIG air flows with a velocity of 500 $\frac{ft}{s}$ and has a pressure and temperature of 10 $psia$ and $40°F$, respectively. Calculate the following quantities at a point downstream in the duct where the cross sectional area is 15 percent smaller than that at the upstream section: stagnation pressure and temperature, static pressure and temperature, velocity, and Mach number.

3. Methane (CPIG, $\gamma = 1.3$, $R = 0.5184\ \frac{kJ}{kg\ K}$) flows adiabatically in a 0.3 m diameter commercial steel pipe. At the inlet the pressure $P_1 = 0.8\ MPa$, the temperature $T_1 = 320\ K$, and the velocity $u_1 = 30\ \frac{m}{s}$. The Darcy friction factor for such a flow is known to be $f = 0.00333$. Find the maximum possible length of the pipe and the pressure and velocity of the methane and the end of a pipe of such length.

4. CPIG air at 535 K, 101.3 kPa enters a frictionless constant-area duct at 130 $\frac{m}{s}$. Determine the maximum amount of heat that can be transferred per unit mass of air, i.e. find the maximum q (which has units $\frac{kJ}{kg}$).