AE 2020 Homework Set #6
Due on Tuesday March 27, 2001

1. Consider a thin symmetrical airfoil at 1.5 degrees angle of attack. Using thin airfoil theory, calculate the lift coefficient, and the moment coefficient about the leading edge.
   Answer: Cl = 0.164, Cmle = -0.041

2. The NACA 4412 airfoil has a mean camber line given by:

$$\frac{z}{c} = 0.2\frac{x}{c} - 0.25\left(\frac{x}{c}\right)^2 \qquad \text{for } 0 < x/c < 0.4$$

$$\frac{z}{c} = 0.0222 + 0.0888\frac{x}{c} - 0.111\left(\frac{x}{c}\right)^2 \qquad \text{for } 0.4 < x/c < 1$$

   Using the thin airfoil theory, calculate (a) the angle of zero lift, (b) the lift coefficient at 3 degree angle of attack.

   Hint: This problem is very similar to the worked-out problem 6.2 in the text.

   Answer: α_0 = -4.16 deg, C_l = 0.782

3. For the airfoil given in problem 2 above, calculate $C_{mc/4}$ and the center of pressure when α=3 degrees.
   Answer: $C_{mc/4}$= -.1063, X_{cp}/c = 0.386

4. An airfoil has the following mean camber line shape:

$$z(x) = 4hx(1-x)$$

   Here h is a constant. The distances z and x have been non-dimensionalized by the chord, so that c=1.

   a) Show that the lift coefficient for this airfoil is given by $C_l = 2\pi\alpha + 4\pi h$

   b) Show that the lift coefficient at the aerodynamic center is given by: $C_m = -\pi h$