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### Homework 5

I.  Consider a thin airfoil of chord length $c$, a thickness ratio $\theta = 0$ and a camber ratio $m = 0.05$. The airfoil camber line is a parabola. We take the line joining the leading and trailing edges as the x-axis centered at the airfoil midchord. The equation for the camber line is

$$z_c = mc \left( 1 - (\frac{x}{c/2})^2 \right). \qquad (1)$$

The airfoil is placed in a flow with upstream velocity $V_\infty$ at an angle of attack $\alpha$. Calculate the airfoil lift coefficient, $c_\ell$, its moment with respect to the leading edge,$c_{m,\ell e}$, its center of pressure,$x_{cp}$, and its angle of attack of zero lift, $\alpha_{L=0}$. Compare the airfoil profile and its aerodynamic coefficients with those of a Joukowski airfoil of the same thickness and camber ratio. Plot both profiles and the variation of $c_\ell$ versus $\alpha$.