

AER 307S - TEST 3

The following may prove useful:

$$\int \cos^2 mx dx = \frac{1}{2m}(mx + \sin mx \cos mx) + C$$

1. An airfoil has its location of maximum camber at  $0.4c$ . Forward of this point, the equation of the mean camber line is

$$z/c = [0.8(x/c) - (x/c)^2]/8$$

Aft of  $x/c = 0.4$ , the mean camber line is given by

$$z/c = [0.2 + 0.8(x/c) - (x/c)^2]/18$$

Find the section lift coefficient as a function of angle of attack and the angle of attack for zero lift. (20 marks)

2. Consider an untwisted wing with an aspect ratio of 9.00. The chord at the tip is 0.4 times the chord at the root and varies linearly in between. The zero-lift angle of attack is  $-1.2^\circ$  across the span. The geometric angle of attack is  $4^\circ$ . Using four stations located at  $\pi/8, \pi/4, 3\pi/8$ , and  $\pi/2$ , find the linear system of equations for  $A_1, A_3, A_5$ , and  $A_7$ , but *do not solve it*. Write the equations for  $\theta = \pi/4$  and  $\theta = 3\pi/8$  only. (20 marks)