AOE 3104 Vehicle Performance Problem Sheet 4

Due 14 February, 2003

19. Consider an aircraft that has a wing span of 15 m, a wing area of 37.5 m^2, and a gross weight of 88000 N. In level flight, the lift equals the weight. The aircraft is flying at 200 knots. Also the Oswald efficiency factor is 0.9, and the zero-lift drag coefficient is 0.0220. Determine the following:

a) lift coefficient
b) induced drag coefficent
c) total drag coefficient
d) induced drag (N)
e) zero-lift drag (N)
f) total drag (N)
g) lift to drag ratio, (L/D)

20. Repeat problem (19) for the case where altitude is 10,000 m. From your results, discuss (for the case where true airspeed is a constant (200 knots) the effects of altitude on C_L, C_{D0L}, $C_{Di,}$ C_D, and the L/D.

21. The aircraft in problem (19) has a wing with an airfoil that has a 2-D lift-curve slope of 5.9 /rad. Use the DATCOM formula to estimate the 3-D lift-curve slope. The wing has a leading edge sweep angle of 30 degrees, and a taper ratio of 0.5. Make the calculations for 200 knots at

a) sea-level
b) 10,000m

22. Consider a rectangular wing. Assume that it has an airfoil with a lift-curve slope of 2π. Also assume that we are at low speed so that M = 0 (neglect compressibility effects). Calculate the lift-curve slope for the wing if the aspect ratio is 6 using: A rectangular wing has a span efficiency factor of 0.83

a) Prandtl's relation
b) DATCOM formula