1. A piston–engined airplane has the following characteristics: $W = 11000\ N$, $S = 11.9\ m^2$, $C_D = 0.032 + 0.055{C_L}^2$, $C_{Lmax} = 1.4$. Obtain the maximum and minimum speeds in level flight at an altitude of 3 Km assuming that the engine BHP is 103 KW and the propeller efficiency is 0.83.(Hint: $P_a = \eta_p \times BHP$, where η_p is the propeller efficiency)

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2. A glider weighing 4905 N has a wing area of 25 m^2, $C_{DO} = 0.012$, $A = 16$ and $e = 0.87$. Determine (a) the minimum angle of glide, minimum rate of sink and corresponding speeds under sea level standard conditions (b) the greatest duration of flight and the greatest distance that can be covered when glided from a height of 300 m. Neglect the changes in density during glide.

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3. An airplane with a weight of 156960 N and a wing area of 49 m^2 has a drag polar given by $C_D = 0.017 + 0.06{C_L}^2$. It accelerates under standard sea level conditions from a speed of 100 m/s to 220 m/s. Obtain the distance covered and the time taken during the acceleration, assuming the thrust output to remain roughly constant at 53950 N.(Hint: Use Simpson's rule to integrate numerically)

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4. An airplane climbs at constant equivalent air speed in troposphere. Obtain an expression for the correction to be applied to the value of rate of climb calculated with the assumption of the steady climb.

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5. An airplane with a wing area of 20 m^2 and a weight of 19620 N dives with engine switched off, along a straight line inclined at 60^0 to the horizontal. What is the acceleration of the airplane when the flight speed is 250 Km/hr? If the airplane has to pull out of this dive at a radius of 200 m, what will be the lift coefficient required and the load factor? Drag polar is given by: $C_D = 0.035 + 0.076{C_L}^2$ and the maneuver takes place around an altitude of 2 km (Density at this altitude is 1.0065 Kg/m^3).

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