AE236: Compressible Fluid Mechanics
Quiz 1
January 28, 2020

Duration: 45 minutes **Maximum Marks: 10**

Step marks will not be given for incorrect solution procedure.
Answer all questions. All the best!

1. A supersonic aircraft is flying horizontally at an altitude of $3000m$ with a constant flight speed of $2000km/h$. The aircraft passes directly over a ground observation post. Find the time taken to hear the sound waves from the aircraft at the observation post after it has passed directly over it. Assume average temperatue of atmospheric air below $3000m$ altitude is 27^0C. (3)

2. Show that the isentropic relation connecting the static and stagnation pressures can be reduced to the Bernoulli's equation for small Mach numbers. (3)

3. An aircraft is flying at an altitude of $12km$ with a Mach number of 0.82. The cross-sectional area of the inlet diffuser is $0.5m^2$. Determine (i) the mass of air entering the diffuser per second, (ii) the speed of the aircraft, (iii) the stagnation pressure and temperature of air at the diffuser entry. From the table of standard atmosphere, at an altitude of 12 km, $T = 216.65K, p = 0.193bar, \rho = 0.311kg/m^3$ and $a = 295.2m/s$. (4)