AE236: Compressible Fluid Mechanics
Tutorial 1

1. Air expands isentropically from 20 bar and 100^0 C to 12 bar. Determine the temperature and density at the final state. Also, find the ratio of initial to final acoustic velocity.

2. Air at a stagnation state of 3 bar and 300 K is isentropically accelerated to $200 m/s$. Determine the pressure, temperature and Mach number of the flow.

3. A supersonic aircraft is flying horizontally at an altitude of 2500 m with a constant flight speed of 500 m/s. 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 temperature of atmospheric air is 28^0 C. Explain your answer using a diagram.

4. A storage chamber supplies high pressure air to a pneumatic machine. It is found that there is an unavoidable leak at the joints and the total area through which leakage occurs is estimated to be 1 cm^2. Calculate the mass flow rate through the joints if the chamber is maintained at 5 atm and 20^0 C (1 $atm = 1.01325$ bar).