AME 538
Examination 2
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1. (30) Air, with $\gamma = 7/5$, $R = 287\ J/kg/K$, flows isentropically in a variable area duct. At station 1, the static temperature, static pressure, and velocity are 400 K, 100 kPa, and 300 m/s. Find the static temperature, static pressure, and velocity at a point downstream where the duct has twice the area.

2. (30) Air, with $\gamma = 7/5$, $R = 287\ J/kg/K$ is initially at rest in a cylinder at $T = 300\ K$, $P = 100\ kPa$. At $t = 0$, a piston initially at $x = 0$ is suddenly retracted at velocity 150 m/s. Determine the final temperature after the rarefaction, and sketch the process in an $x - t$ plane.

3. (40) Consider a cylinder of radius c in a two-dimensional, inviscid, incompressible flow field, with far field velocity U in the x direction, far-field pressure P_o, and density ρ. Find the amount of circulation Γ which is necessary to merge the two stagnation points to a single point. Find the pressure at the stagnation point. Sketch the streamlines and lines of constant potential.