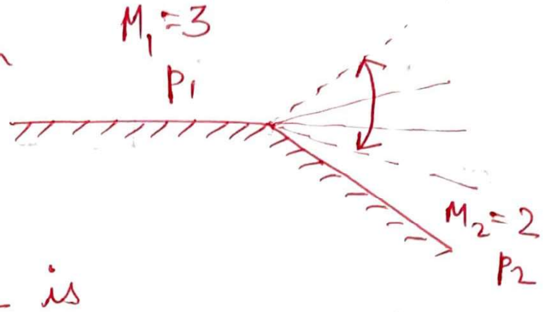
AERODYNAMICS

HAL Exam

P1.) Consider a flow over a convex corner at Mach 3. The flow leaves and slides along the corner at Mach 2, where pressure across the expansion is p_1 & p_2 as shown in the figure. Then pressure ratio across the corner $\frac{P_2}{P_1}$ is (use $\gamma = 1.4$)



A.) $(1.8)^{\gamma/\gamma-1}$

B.) $(1.5)^{\gamma/\gamma-1}$

C.) $(1.2)^{\gamma/\gamma-1}$

D.) $(1.08)^{\gamma/\gamma-1}$

P2.) Consider an unsteady temperature field $T = (xy + z + 3t)$ K, where x, y, z are position points & t is time. If velocity field $\vec{V}$ is given by $\vec{V} = xy\hat{i} + z\hat{j} + 5t\hat{k}$, then rate of change of temperature of a particle at a point (1, 1, 1) at time 3 sec is

A.) 25 K/sec.

B.) 10 K/sec.

C.) 18 K/sec.

D.) 20 K/sec.

P3.) For a flow with velocity field given by

$u = \frac{y}{x^2+y^2}$ & $v = \frac{-x}{x^2+y^2}$, then magnitude of vorticity at (1, 2) equals

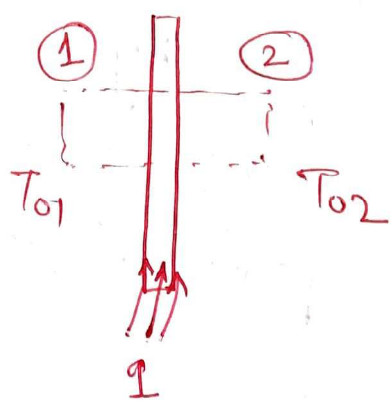
A.) 5 B.) 10 C.) 0 D.) 6

P4.) The velocity components of viscous fluid are $u = 2xy$ & $v = x^2+y$. For an infinitesimal fluid element, if shear stress on an x-plane in the y-direction at (2, 7) is equal to $M \times 10^{-5}$ N/m³, then value of M is

[use $\mu = 1.7 \times 10^{-5}$]

A.) 13.6 B.) 10.5 C.) 8.6 D.) 4.5

P5.) Heat q is added to a flow (1-dimensional), as shown in the figure. If T_{01} & T_{02} are total temperature in region ① & ② respectively, then



A.) $T_{02} = T_{01}$ B.) $T_{02} < T_{01}$

C.) $\frac{q}{2c_p} = T_{02} - T_{01}$ D.) $T_{02} > T_{01}$