Solution to Problem 350A:

The upstream Mach number, M_1, is

$$M_1 \;=\; \frac{1200}{(1.4 \times 280 \times 230)^{1/2}} \;=\; 4 \tag{1}$$

and using the table for the Prandtl-Meyer function, $\nu(M_1) = 65.8°$, and therefore $\nu(M_2) = (65.8 + 35)° = 100.8°$ and $M_2 = 9.5$.

The expansion through the Prandtl-Meyer fan is isentropic so from the isentropic tables

$$\frac{T_2}{T_1} \;=\; \frac{T_2}{T_0}\frac{T_0}{T_1} \;=\; \frac{0.052}{0.238} \;=\; 0.218 \tag{2}$$

and therefore $T_2 = 50.2°K$. Also

$$\frac{u_2}{u_1} \;=\; \frac{u_2}{u^*}\frac{u^*}{u_1} \;=\; \frac{2.384}{2.138} \;=\; 1.115 \tag{3}$$

and therefore $u_2 = 1338 m/s$.

In the limit as $\nu(M_2) \rightarrow 130.5°$, then $\nu(M_1) \rightarrow 130.5° - 35° = 95.5°$ and therefore

$$M_1 \;\rightarrow\; 8 \quad \text{and} \quad T_1 \;=\; \frac{u_1^2}{M_1^2 \gamma \mathcal{R}} \;=\; 57.4°K \tag{4}$$