$$M_1^* M_2^* = 1$$

Trivial soln $\quad M_1^* = 1 \Rightarrow M_2^* = 1$

$\qquad\qquad\qquad M_1^* > 1 \Rightarrow M_2^* < 1$

$$(M_1^*)^2 = \left(\frac{u_1}{a^*}\right)^2 = \frac{u_1^2}{\gamma R T^*} = \frac{u_1^2}{\underbrace{\gamma R T}_{a^2}} \cdot \frac{T_1}{T^*}$$

$$(M_1^*)^2 = M_1^2 \cdot T_1/T^* = M_1^2 \cdot \frac{T_{01}/T^*}{T_{01}/T_1}$$

$$(M_1^*)^2 = \frac{M_1^2 \cdot \left(\frac{\gamma+1}{2}\right)}{1 + \frac{\gamma-1}{2} \cdot M_1^2}$$

$$f(M_1, M_2) = 1 \rightarrow \text{Prandtl's Relation}$$

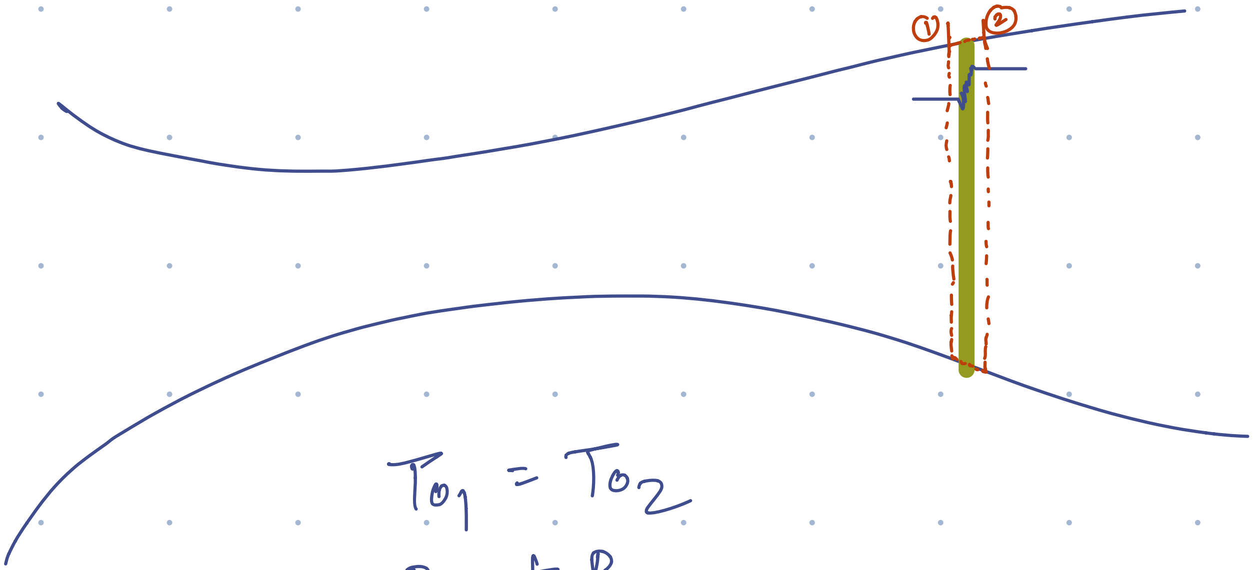
After solving this,

$$M_2^2 = \frac{1 + \frac{\gamma-1}{2} M_1^2}{\gamma M_1^2 - \frac{\gamma-1}{2}}$$

As $M_1 \rightarrow \infty$, (large M_1)

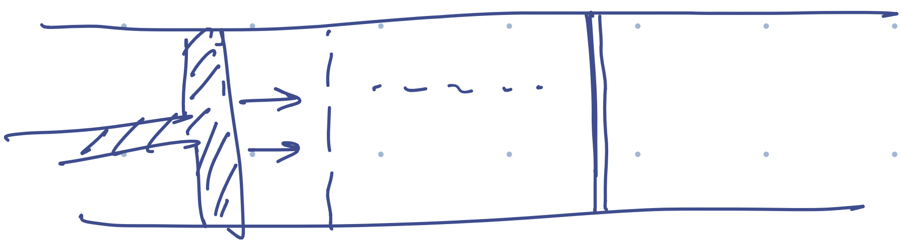
$$M_2 \rightarrow \frac{\gamma-1}{2\gamma}$$

Normal shock (Stationary)



$T_{0_1} = T_{0_2}$

$P_{0_1} \neq P_{0_2}$



M_1 $\quad$ M_2 $\quad$ P_2/P_1 $\quad$ T_2/T_1 $\quad$ ρ_2/ρ_1 . . . . .

Strength of a normal shock.

$P_2/P_1 \uparrow \qquad \dfrac{M_2}{M_1} \downarrow$

$a = \sqrt{\gamma R T}$

$\gamma \downarrow \rightarrow$ More compressible fluid.

$$\frac{P_2}{P_1} = \frac{1+\gamma M_1^2}{1+\gamma M_2^2} = 1 + \frac{2\gamma}{\gamma+1}\left(M_1^2 - 1\right)$$

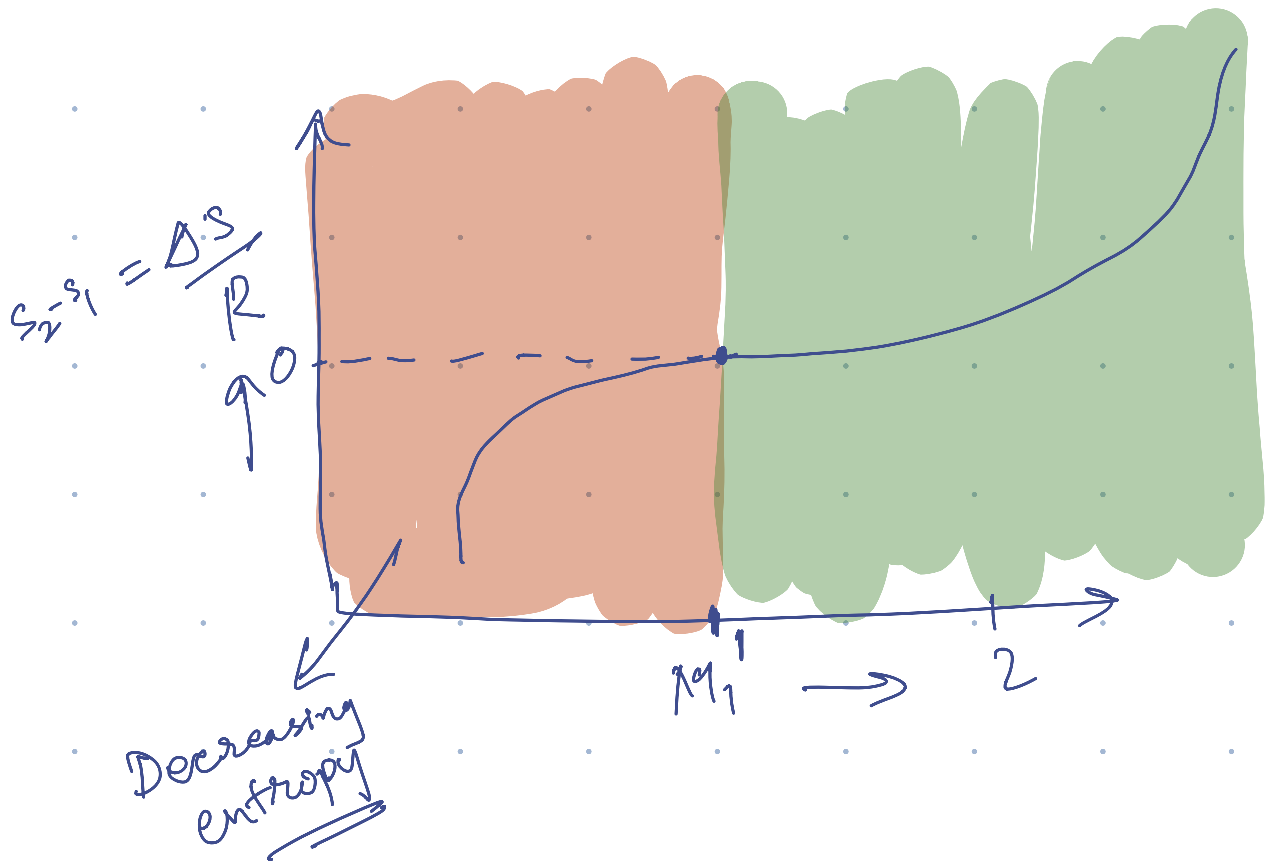
$$\frac{T_2}{T_1} = 1 + \frac{2(\gamma-1)}{(\gamma+1)^2}\,\frac{\gamma M_1^2+1}{M_1^2}\,\underline{\left(M_1^2-1\right)}$$

$\downarrow$

γ as $M_1 \to \infty$

$\frac{T_2}{T_1}\uparrow$ & $M_1\uparrow$

$$s_2 - s_1 = C_p \ln T_2/T_1 - R \ln P_2/P_1$$



Moving Shock