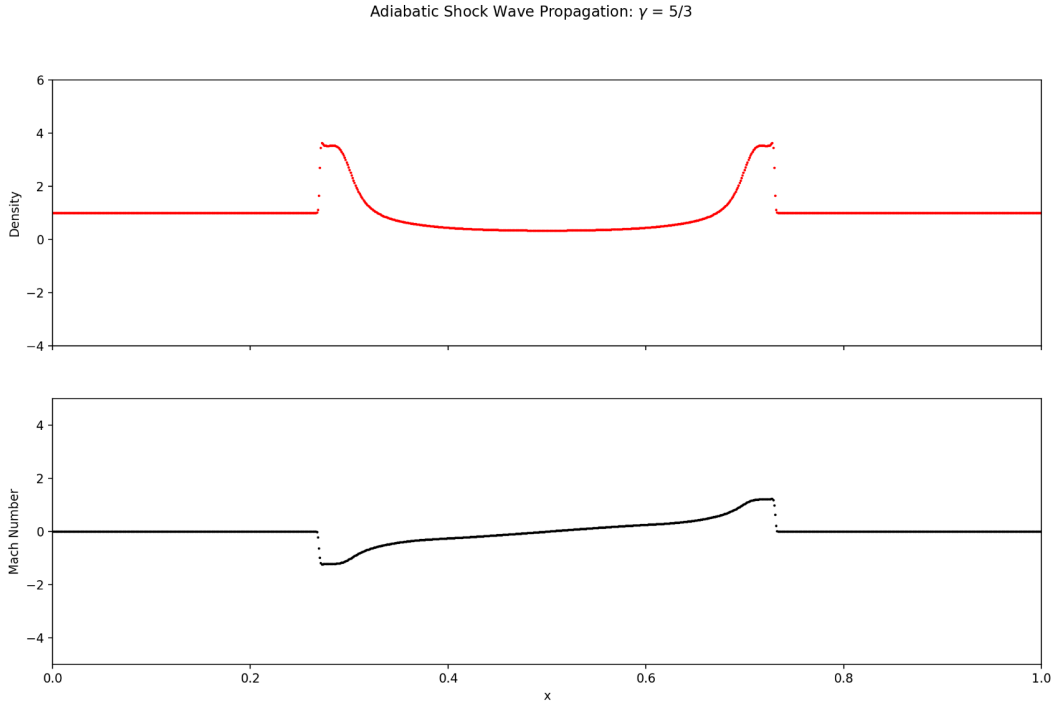
Q3. Adiabatic Shock

1. The pre-post shock density ratio is ~1/3.5 as shown in the screenshot below. We expect for high mach number that:

$$\frac{\rho_1}{\rho_2} = \frac{\gamma-1}{\gamma+1} = \frac{\frac{5}{3}-1}{\frac{5}{3}+1} = \frac{1}{4}$$

This is close to our observed ratio. The reason they are not exactly the same is because the mach number is not sufficiently high for the expression to reduce completely to ¼.



2. The width of the shock is ~0.025. This with is set by the viscosity and speed of the fluid and can be approximated as:

$$\Delta x = \frac{\lambda_{mfp}}{Ma}$$

Since Mach number depends on sound speed, which in turn depends on adiabatic index (γ), we can change the width by changing (γ). We show this by showing the shock for a diatomic gas (γ=7/3) below. Clearly the shock width increases.