$$h_L = f\frac{L}{D}\frac{V^2}{2g}$$

$$h_L = K_L\frac{V^2}{2g}$$

$$1\,(ft)^3 = 7.48\ gal$$

$$0\ Celsius = 273\ Kelvin$$

Air Gas Constant = 287 J/kg*K

$$\frac{d}{dx}sin^3(x) = 3sin^2(x)\cos(x)$$

$$\int sin^3(x)\,dx = \frac{1}{3}cos^3(x)\ -\cos(x)$$

$$c = \sqrt{kRT} \qquad V = \mathrm{M}\sqrt{kRT}$$

Sonic velocity

$$T_0 = T\left(1 + \frac{k-1}{2}\mathrm{M}^2\right)$$

$$p_0 = p\left(1 + \frac{k-1}{2}\mathrm{M}^2\right)^{k/(k-1)}$$

$$\rho_0 = \rho\left(1 + \frac{k-1}{2}\mathrm{M}^2\right)^{1/(k-1)}$$

Stagnation properties

$$\frac{p_2}{p_1} = \left(\frac{\rho_2}{\rho_1}\right)^k \qquad \frac{p_2}{p_1} = \left(\frac{T_2}{T_1}\right)^{k/(k-1)}$$

Isentropic process

$$\frac{T_2}{T_1} = \frac{1 + \frac{k-1}{2}\mathrm{M}_1^2}{1 + \frac{k-1}{2}\mathrm{M}_2^2}$$

$$\frac{p_2}{p_1} = \frac{1 + k\mathrm{M}_1^2}{1 + k\mathrm{M}_2^2}$$

$$\frac{\rho_2}{\rho_1} = \frac{\mathrm{M}_1}{\mathrm{M}_2}\left[\frac{1 + \frac{k-1}{2}\mathrm{M}_2^2}{1 + \frac{k-1}{2}\mathrm{M}_1^2}\right]^{1/2}$$

$$\frac{V_2}{V_1} = \frac{\mathrm{M}_2}{\mathrm{M}_1}\left[\frac{1 + \frac{k-1}{2}\mathrm{M}_1^2}{1 + \frac{k-1}{2}\mathrm{M}_2^2}\right]^{1/2}$$

$$\mathrm{M}_2^2 = \frac{\mathrm{M}_1^2 + \frac{2}{k-1}}{\frac{2k}{k-1}\mathrm{M}_1^2 - 1} \qquad \mathrm{M}_1 > \mathrm{M}_2$$

Normal shock wave