Fluid Mechanics: Assignment #1

Due on 2nd September, 2018

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Problem 1

The *Knudsen Number* is given by,

$$\text{Kn} = \frac{\lambda}{L} = \frac{k_B T}{\sqrt{2}\pi d^2 p L}$$

where L is the characteristic length scale, and T and p are the temperature and pressure respectively. We can take some approximations for the the variations of T and p, but we note that data for the variation of T and p is also available publicly here. We import that data and use it to do our calculations. We also assume some standard values for all the other parameters.
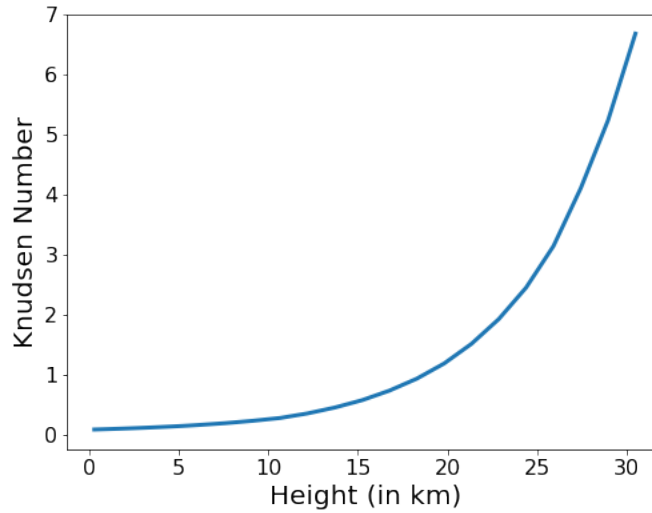
Problem 2

$$\frac{dC}{d\eta} = \kappa \exp\left(\frac{-\eta^2}{4D}\right)$$

where $\eta = x/\sqrt{t}$. Integrating the above with respect to η within limits 0 and $x/\sqrt{t}$, one gets,

$$C(x,t) = \sqrt{D\pi}\kappa \ \text{erf}\left(\frac{x}{2\sqrt{D}\sqrt{t}}\right)$$

The function is plotted below,

Problem 3