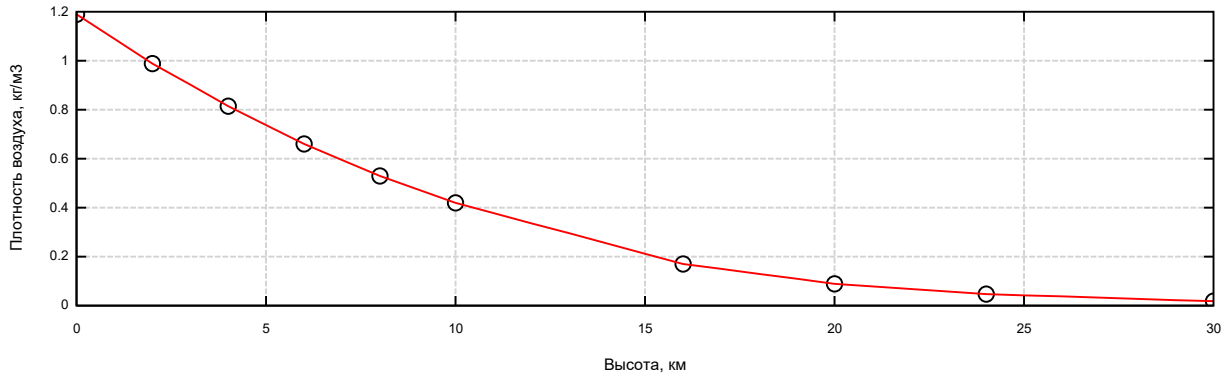
Плотность воздуха по высоте

Вариант 1. Линейно-кусочная интерполяция табличных данных из интернета

$$Air := \begin{bmatrix} 0 & 2 & 4 & 6 & 8 & 10 & 16 & 20 & 24 & 30 \\ 1.190 & 0.989 & 0.815 & 0.661 & 0.530 & 0.420 & 0.171 & 0.0897 & 0.0477 & 0.0186 \end{bmatrix}$$

$$\rho 1_{air}(h) := \left| \begin{array}{l} h := \frac{h}{км} \\ \text{linterp}\left(\text{row}(Air, 1)^{T}, \text{row}(Air, 2)^{T}, h\right) \frac{кг}{м^3} \end{array} \right.$$

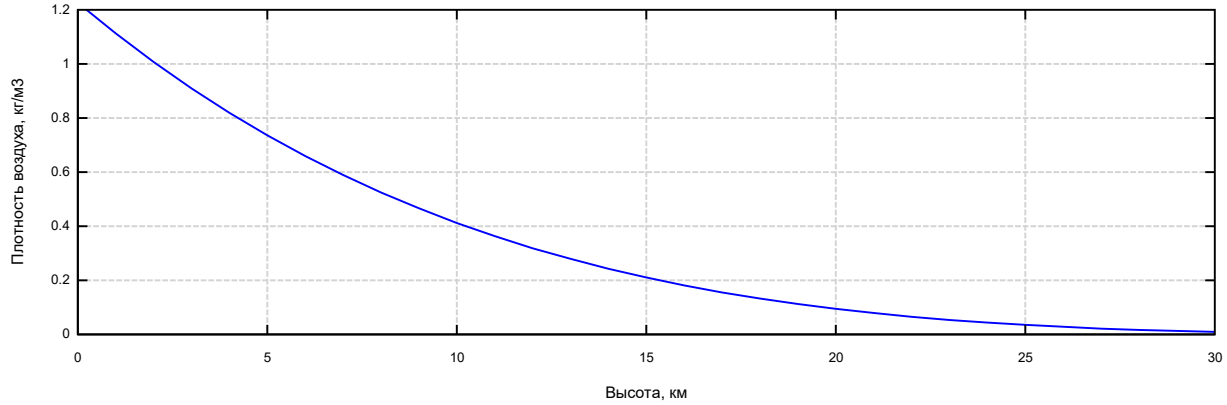
$$h := [(0\ м), 1\ км .. (30\ км)]$$



$$\begin{cases} Air^{T} \\ \text{augment}\left(\frac{h}{км}, \overrightarrow{\rho 1_{air}(h)}\right) \end{cases}$$

Вариант 2. Барометрическая формула и закон идеального газа

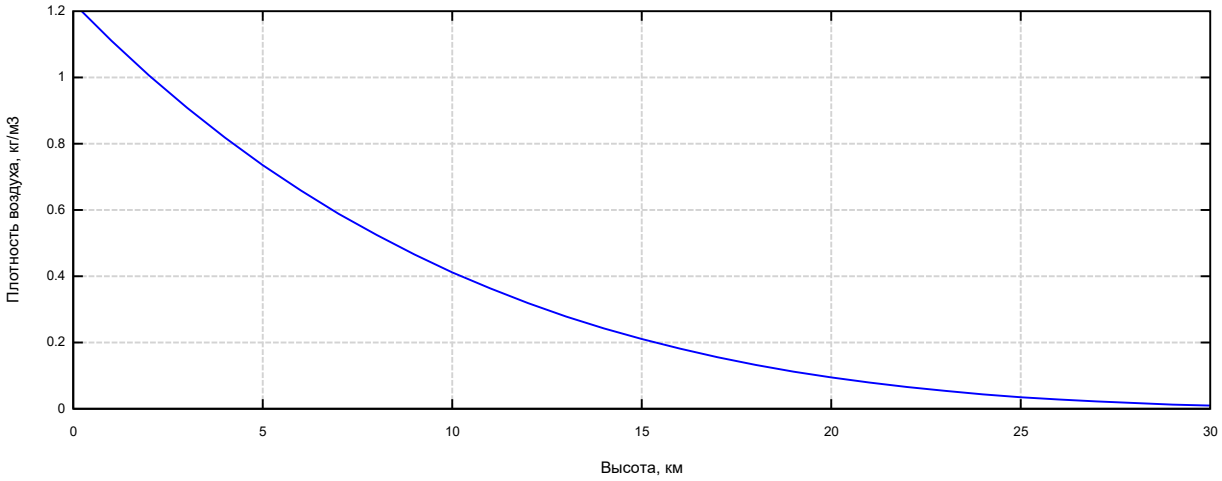
$$\rho 2_{air}(h) := \left| \begin{array}{l} k := 0.0065\ \frac{К}{м} \\ T_0 := 15\ °C \\ T := T_0 - k \cdot h \\ M_{air} := 29\ \frac{г}{моль} \\ p := 1\ атм \cdot \left(1 - \frac{k \cdot h}{T_0}\right)^{\frac{g_з \cdot M_{air}}{R_m \cdot k}} \\ \frac{p \cdot M_{air}}{R_m \cdot T} \end{array} \right.$$



$$\text{augment}\left(\frac{h}{км}, \overrightarrow{\rho 2_{air}(h)}\right)$$

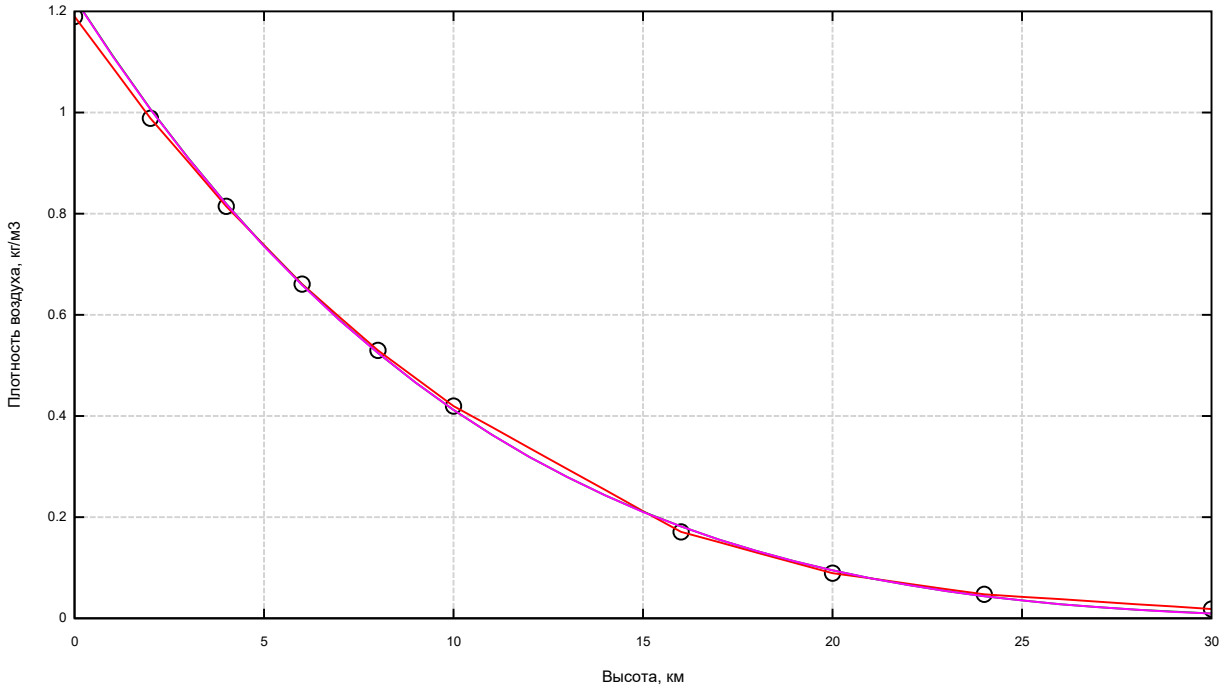
Вариант 3. Барометрическая формула и пакет CoolProp Wrapper
(4 оператора в матрице с одной строкой и с 4 столбцами - экономия места в расчёте)

$$\rho 3_{air}(h) := \left\| \begin{array}{c} \left[\begin{array}{cccc} k := 6.5\ \frac{К}{км} & T_0 := 15\ °C & T := T_0 - k \cdot h & M_{air} := 29\ \frac{г}{моль} \end{array} \right. \quad p := 1\ атм \cdot \left(1 - \frac{k \cdot h}{T_0}\right)^{\frac{g_з \cdot M_{air}}{R_m \cdot k}} \\ \text{CoolProp\_Props}("D", "T", T, "P", p, "Air") \end{array} \right.$$

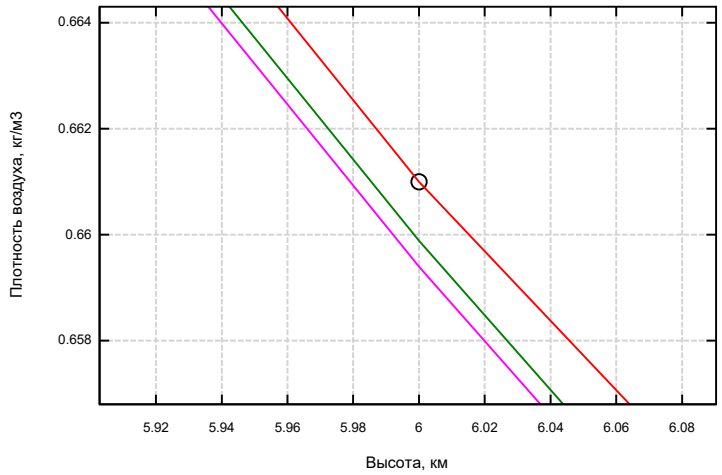


$$\text{augment}\left(\frac{h}{км}, \overrightarrow{\rho 3_{air}(h)}\right)$$

Сравнение трех методов



$$\begin{pmatrix} \text{Air}^T \\ \text{augment}\left(\frac{h}{км}, \overrightarrow{\rho 1_{air}(h)}\right) \\ \text{augment}\left(\frac{h}{км}, \overrightarrow{\rho 2_{air}(h)}\right) \\ \text{augment}\left(\frac{h}{км}, \overrightarrow{\rho 3_{air}(h)}\right) \end{pmatrix}$$



$$\begin{pmatrix} \text{Air}^{T} \\ \text{augment}\left(\frac{h}{\text{км}}, \overrightarrow{\rho 1_{air}(h)}\right) \\ \text{augment}\left(\frac{h}{\text{км}}, \overrightarrow{\rho 2_{air}(h)}\right) \\ \text{augment}\left(\frac{h}{\text{км}}, \overrightarrow{\rho 3_{air}(h)}\right) \end{pmatrix}$$