[tex57] **Energy distribution for N ideal gas atoms**

The equilibrium velocity distribution for N atoms of a classical ideal gas is

$$f(\mathbf{v}_1, \ldots \mathbf{v}_N) = \left(\frac{m}{2\pi k_B T}\right)^{3N/2} e^{-m(v_1^2+\cdots+v_N^2)/2k_BT},$$

where $\mathbf{v}_i = (v_{ix}, v_{iy}, v_{iz})$.

(a) Determine the associated energy distribution $f_E(E)$, where $E = \frac{1}{2}m(v_1^2 + \cdots + v_N^2)$.

(b) Define the function $F_n(x)$ via $F_n(x)dx = f_E(E)dE$ with $x = E/nk_BT, n = 3N/2 - 1$ and plot $n^{-1}F_n(x),\ 0 < x < 4$ for $N = 1, 2, 10, 20$.

(c) How is the trend of this function for increasing N to be interpreted?