Exercise 13 Problem 4

Maxwell-Boltzmann distribution

$$f(v) = av^2 e^{-v^2/2b}$$

Data samples $\{v, f(v)\}$

The fitting problem can be simplified by mapping both the model and the data into a linear form before running the fit:

1. Mapping $\{v, f(v)\} \to \{x, g(x)\}$:

$$\begin{cases} x = v^2 & \text{a: map } v \to v^2 \\ g(x) = \ln\left(\frac{f(v)}{v^2}\right) & \text{b: map } f(v) \to \ln\left(\frac{f(v)}{v^2}\right) \end{cases}$$

$$g(v^2) = \ln\left(ae^{-v^2/2b}\right)$$

$$= \ln a - v^2/2b$$

$$= \ln a - x/2b$$

this is a linear function

$$g(x) = c + mx \text{, where}$$

$$\begin{cases} c = \ln a \\ m = -1/2b \end{cases}$$

2. Fit the mapped data to find c, m.

3. Solve for a and b: $\begin{cases} a = e^c \\ b = -1/2m \end{cases}$