[tex36] **Thermodynamics of a real paramagnet**

The magnetization M of a paramagnetic system was measured over a certain temperature range, and it was found to depend only on the ratio H/T: $M = f(H/T)$.

(a) Show that the internal energy is then independent of H: $U = U(T)$.

(b) Show that the entropy then has the following functional form:

$$S(T,H) = S_1(T) - \frac{H}{T} f\left(\frac{H}{T}\right) + \int_0^{H/T} dx\, f(x),$$

where

$$S_1(T) = S_0 + \int_{T_0}^{T} dT' \frac{U(T')}{T'}.$$