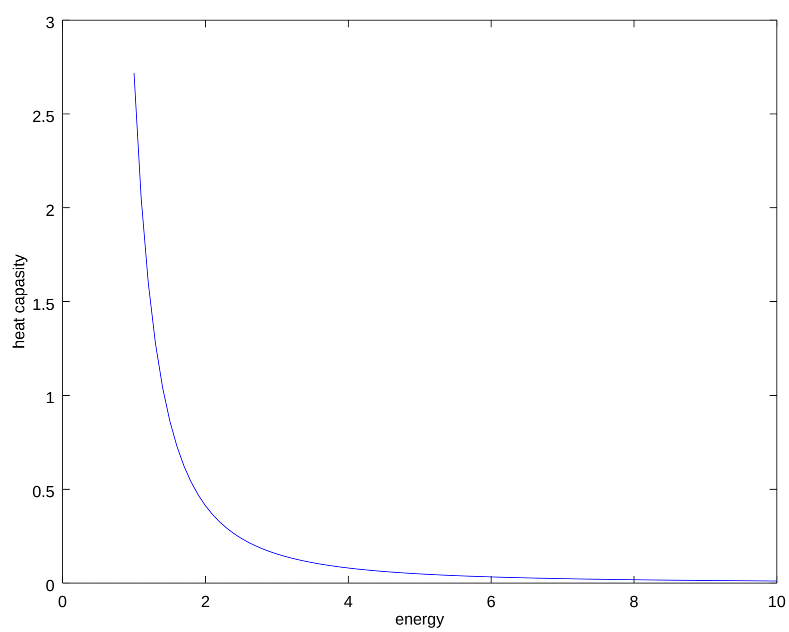
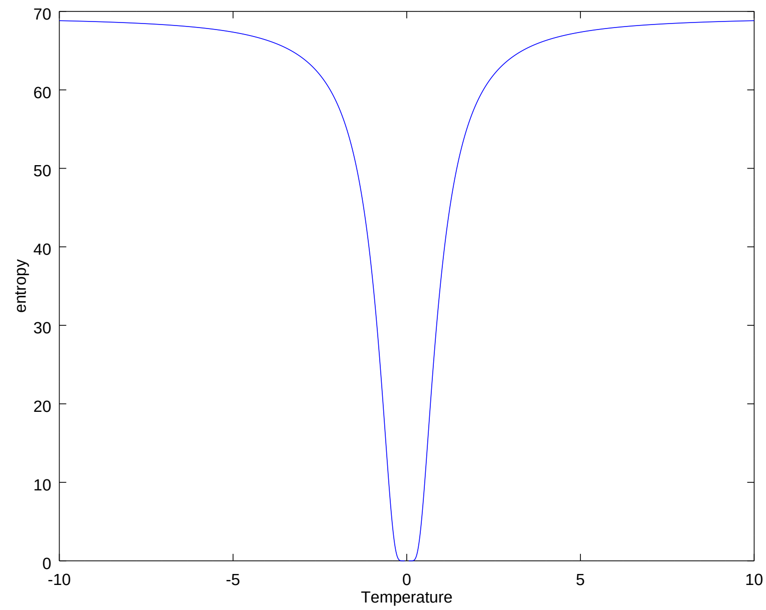
Exercise 3.3: In the left plot the slope of the line is steep, in other words a slight increase in energy drastically increases entropy and a slight decrease in energy drastically decreases entropy. In the right plot the slope of the line is shallow, in other words a slight increase in energy results in a small increase in entropy and a slight decrease in energy results in a small decrease in entropy. The total system will go twards a state with more entropy, if it can do so while conserving total energy, thus the best option for the system is for U_b to decrease and U_a to increase, energy will flow A to B.

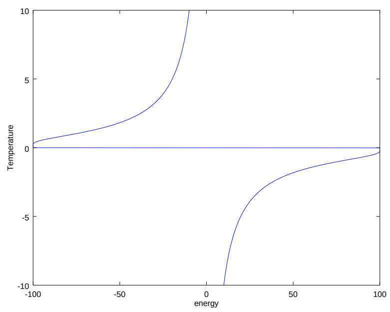
Exercise 3.8: From 3.5 we have $U = N\epsilon e^{-\epsilon/kT}$. Note that $C = \frac{\partial U}{\partial T} = N\epsilon e^{-\epsilon/kT}(\epsilon/kT^2)$. I will polt it in a unit system where $N = \epsilon = k = 1$.



Exercise 3.22: Note that $\frac{S}{k_B} \approx N\ln(N) - N_\uparrow \ln(N_\uparrow) - (N - N_\uparrow)\ln(N - N_\uparrow)$ and that $N_\uparrow = \frac{N}{2}(1 - \frac{U}{N\mu B})$ and $U = -N\mu B \tanh(\frac{\mu B}{k_B T})$. Let's plot the situation where $N = 100$, in a unit system where $k_B = \mu = 1$ and leting $B = 1$.



If the strength of the feald is increased the magnitude of the energy of a state will incrase and we can see by the following plot,that the magnitude of the temperature of that state will decrease.



Noting that the entropy of a state is unefected by changes in the strength of the feald we see that if the temperature is increased it will simply compress the temperatur vs entropy graph along the x-axis.