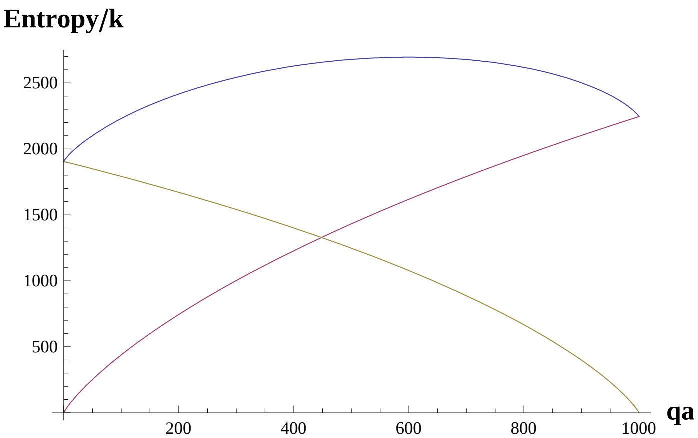
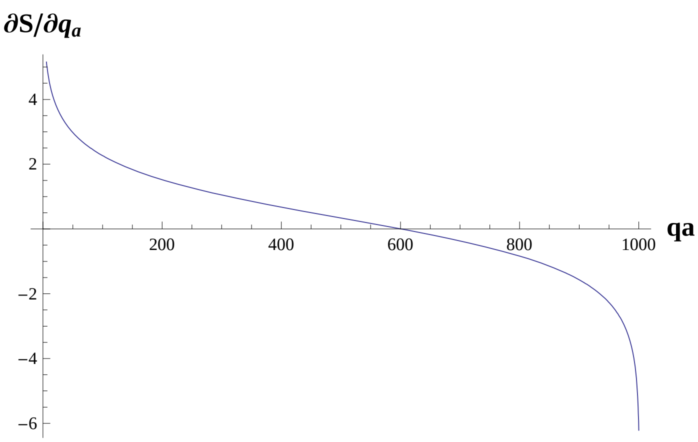
```
Clear[na, nb, q, states, totalstates, statesa,
 statesb, prob, entropy, entropya, entropyb, k]
na = 3000; nb = 2000; q = 1000;  k = 1.38 × 10^-23;
statesa[qa_] := (na + qa - 1) ! / (qa ! (na - 1) !)
statesb[qa_] := (q - qa + nb - 1) ! / ((q - qa) ! (nb - 1) !)
states[qa_] := statesa[qa] statesb[qa]
totalstates = Sum[states[qa], {qa, 0, q}];
entropya[qa_] := Log[statesa[qa]]
entropyb[qa_] := Log[statesb[qa]]
entropy[qa_] := entropya[qa] + entropyb[qa]
Plot[{entropy[qa], entropya[qa], entropyb[qa]}, {qa, 0, q},
 AxesLabel → {Style[qa, 14, Bold], Style["Entropy/k", 14, Bold]}]
derivative[qa_] := entropy[qa] - entropy[qa - 1]
Plot[derivative[qa], {qa, 0, q},
 AxesLabel → {Style[qa, 14, Bold], Style["∂S/∂qa", 14, Bold]}]
```





The red curve represents the entropy of solid A as a function of qa; the yellow curve represents the entropy of solid B as a function of qa, and the blue (upper) curve is the total entropy of the entire sytem A + B. Notice that the total entropy achieves a maximum at qa = 60, the most probable state of the system. The vertical axis is in "natural units" of S/k (which yields a dimensionless number).