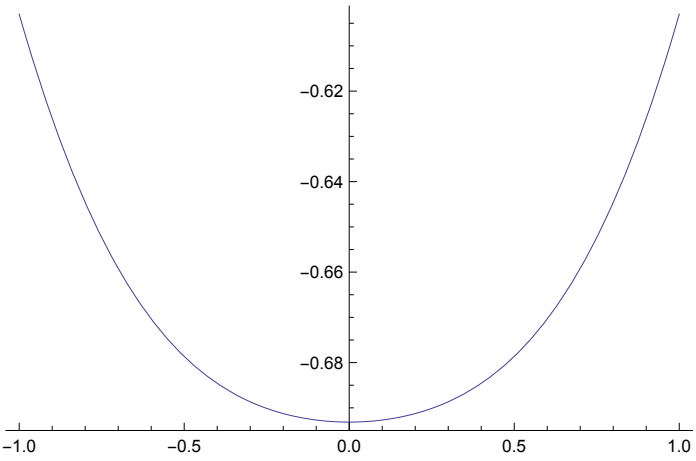
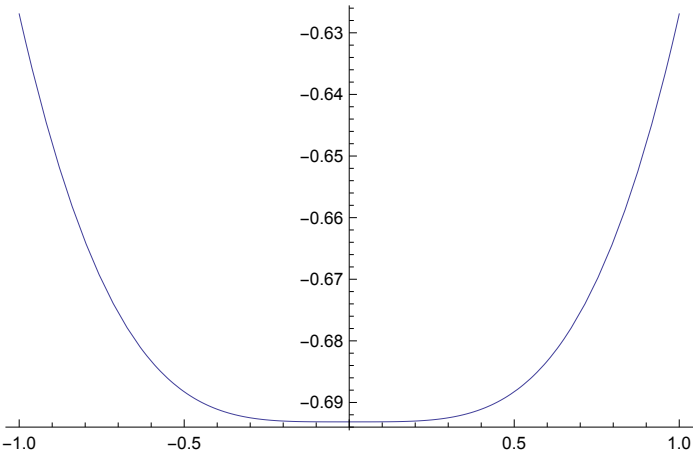
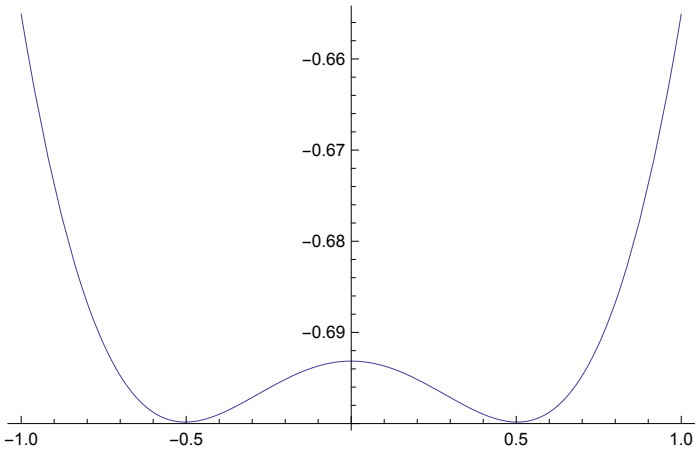
```
(*this Mathematica notebook evaluates the free energy function
  of the Weiss ferromagnet (mean field ferromagnet) with J=1 *)

(* Z = exp{-N beta f(beta,h)} = \int dm exp{-N beta f(beta,h,m)}}     *)
(* we consider beta f(beta,h,m), denoted by betaf*)

betaf[beta_, h_, m_] := beta m^2/2 - Log[2 Cosh[beta m + beta h]]


(* first we plot betaf as a function of m in the high temperature phase,
beta=0.9<beta_c=1 *)

Plot[betaf[.9, 0, m], {m, -1, 1}]
```




```
(*at the critical temperature beta=beta_c=1*)
Plot[betaf[1, 0, m], {m, -1, 1}]
```



```
(*in the low temperature phase, beta=1.1>beta_c=1*)
Plot[betaf[1.1, 0, m], {m, -1, 1}]
```




```
(*explore the free energy function yourself by tuning beta and h.
   Initially beta is set to the critical value beta=1 and h=0*)
(*for instance, what happens if you turn on a magnetic field,
either below T_c or above T_c ? *)
```

```
Animate[Plot[betaf[beta, h, m], {m, -1, 1}], {{beta, 1}, 0.1, 2}, {{h, 0}, -.5, .5
 }, AnimationRunning → False]
```