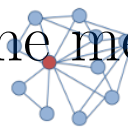


# The free energy landscape for the mean field 1D ising model



**MathsNET**  
A joined up approach to  
teaching and learning  
mathematics

- 
- What is significant about the points where the black curve intercepts with the  $x$  axis?
  - When the applied field  $H$  is equal to 0 at how many points does the black line intercept with the  $x$  axis? What happens as the the inverse temperature is increased?
  - Describe the shape of the green curve when  $H = 0$  and when (a)  $T < 2\frac{k_B T}{J}$  and when (b)  $T > 2\frac{k_B T}{J}$ . How does the shape of this curve differ in these two regimes? What happens to the derivative of the free energy with respect to  $\langle M \rangle$  at  $H = 0$  when  $T = 2\frac{k_B T}{J}$ ?
  - What happens to the shape of the green curve when  $H \neq 0$ . Comment on the behavior of the turning points and the way this number changes with field strength and temperature.

# The free energy landscape for the mean field 1D ising model



**MathsNET**  
A joined up approach to  
teaching and learning  
mathematics

- Given what you have discussed explain how the magnetization behaves as you move from the  $T > 2\frac{k_B T}{J}$  regime to the  $T < 2\frac{k_B T}{J}$  regime in the absence of an applied field
- How does the magnetisation behave as the temperature is increased in the presence of an applied magnetic field?