Problem 5
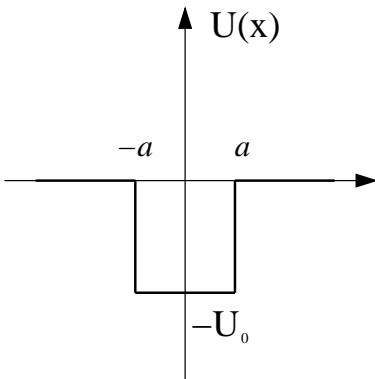
Using the definition of the Brillouin Functions calculate $B_J(x)$ for $J = 1$ and $J = 3/2$. Try to express these functions as a linear combination of Fermi/Bose distribution functions.

Problem 6

i) Consider one-dimensional symmetric potential well

$$U(x) = \begin{cases} -U_0, & |x| < a \\ 0, & |x| > a \end{cases} \tag{1}$$

Find an energy of shallow level $U_0 \ll \hbar^2/(ma^2)$.

ii) Consider two-dimensional symmetric potential well

$$U(\rho) = \begin{cases} -U_0, & \rho < a \\ 0, & \rho > a \end{cases} \tag{2}$$

where $\rho = \sqrt{x^2 + y^2}$. Find the energy of the shallow level $U_0 \ll \hbar^2/(ma^2)$ corresponding to $M^z = 0$ where M^z is a projection of the orbital moment on the axis z. Compare the result with i).