

## Exercises in Statistical Mechanics

Based on course by Doron Cohen, has to be proofed  
*Department of Physics, Ben-Gurion University, Beer-Sheva 84105, Israel*

This exercises pool is intended for a graduate course in “statistical mechanics”. Some of the problems are original, while other were assembled from various undocumented sources. In particular some problems originate from exams that were written by B. Horovitz (BGU), S. Fishman (Technion), and D. Cohen (BGU).

### ===== [Exercise 2052]

#### Pressure in a box with $V(x)$ potential

A particle is confined by hard walls to move inside a box  $[0, L]$ . There is an added external potential  $U(x)$ . Find the force (“Pressure”) on the wall at  $x = L$ .

- (1) The short way - evaluate the density of the particles in the vicinity of the wall, and assume that the pressure there is the same as that of an ideal gas.
- (2) The long way - using the Virial theorem relate the force at  $x = L$  to the expectation function of  $xU'(x)$ .
- (3) Explain why the Virial based derivation gives the force on the  $x = L$  and not on the  $x = 0$  wall.