Physics 630, Spring 2024
Problem Set 6, due Wednesday, April 3.

Problem from Kardar:

Chapter 4:
5a,b

$$\textit{Hint}: \int_0^\infty dx\, x^{d-1} \exp(-x^s) = \frac{1}{s}\Gamma(d/s).$$

Additional Problem: Molecular adsorption

Consider a canonical ensemble of N diatomic models with temperature T stuck on a metal surface of square symmetry. Each molecule can either be aligned in the x or y direction with zero energy, or along the z direction with energy ε.

(a) Evaluate the partition function for this system.
(b) Evaluate the Helmholtz free energy F.
(c) Evaluate the internal energy E.
(d) Evaluate the entropy S.
(e) Evaluate the heat capacity C.
(f) What is the probability that a specific molecule is standing up?