

Quiz I (Supplementary) – Fall 2024

Time: 12:05 pm to 1:05 pm

1. The following integral appears in the context of studying the Maxwell-Boltzmann distribution of molecular speed. Calculate the integral using the definition of Γ functions discussed in the class.

$$I = \int_0^{\infty} a x^3 e^{-bx^2} dx,$$

where a and b are two constants.

2. A particle of mass m is dropped from a height y with an initial speed of zero. Assuming that there is no air resistance and the acceleration due to gravity is g , plot the phase-space trajectory of the particle.
3. Calculate the ratio of the volume of a (hyper) sphere to (hyper) cube in d dimensions. Assume that the radius of the sphere is unity and the length of the cube is 2. Plot the ratio for $d=2$ to 6 against d . (Note: You do not have to show the derivation of volume calculations.)
4. Calculate the Gaussian integral below as discussed in the class

$$I = \int_0^{\infty} a e^{-bx^2} dx$$