

Physics 325 Homework 7

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Due: 10/30/02 by 4 PM

Problem 1 - Boas 4.13.28 revised

In discussing the velocity distribution of molecules of an ideal gas, a function $F(x, y, z) = f(x)f(y)f(z)$ is needed such that $d(\ln F) = 0$ when $\phi = x^2 + y^2 + z^2 = \text{const.}$ Then by the Lagrange multiplier method $d(\ln F + \lambda\phi) = 0$. Use this to show that

$$F(x, y, z) = Ae^{-\lambda(x^2+y^2+z^2)}$$

Hint: the Lagrange multiplier equation separates into three independent equations, one for each variable.

Problem 2 - Boas 5.2.34 revised

A dielectric lamina with (surface) charge density σ proportional to y (in other words $\sigma = ky$) covers the area between the parabola $y = 16 - x^2$ and the x-axis. Find the total charge.

Problem 3 - Moment of Inertia

Find the moment of inertia about its axis of a cylindrical shell of total mass M with inner and outer radii r_1 and r_2 .