1 Spherical Shell Step Functions

One way to write volume charge densities without using piecewise functions is to use step (Θ) or δ functions.

Consider a spherical shell with charge density

$$\rho(\vec{r}) = \alpha 3 e^{(kr)^3}$$

between the inner radius a and the outer radius b. The charge density is zero everywhere else.

(a) (2 pts) What are the dimensions of the constants α and k?

(b) (2 pts) By hand, sketch a graph the charge density as a function of r for $\alpha > 0$ and $k > 0$.

(c) (2 pts) Use step functions to write this charge density as a single function valid everywhere in space.