

PHY 712 – Problem Set #3

1. Consider a one-dimensional charge distribution of the form:

$$\rho(x) = \begin{cases} 0 & \text{for } x \leq -a/2 \\ \rho_0 x/a & \text{for } -a/2 \leq x \leq a/2 \\ 0 & \text{for } x \geq a/2, \end{cases}$$

where ρ_0 and a are constants.

- (a) Solve the Poisson equation for the electrostatic potential $\Phi(x)$ with the boundary conditions $\Phi(-a/2) = 0$ and $d\Phi(-a/2)/dx = 0$.
- (b) Find the corresponding electrostatic field $E(x)$.
- (c) Plot $\Phi(x)$ and $E(x)$.
- (d) Discuss your results in terms of elementary Gauss's Law arguments.