PHGN361 Exam 1: NAME

1. (a) Using the integral form of Gauss's Law, **DERIVE** the electric field due to an infinite **CYLINDER** of charge, with radius R and charge density $\rho = Ar$ **AND** a constant surface charge density σ_0 at $r = R$, where A is a constant. Find the field both inside and outside the cylinder. (b) Prove that your result is consistent with the differential form of Gauss's Law.

   Note $\nabla \cdot \vec{v} = \frac{1}{s}\frac{\partial}{\partial s}(sv_s) + \frac{1}{s}\frac{\partial}{\partial \phi}(v_\phi) + \frac{\partial}{\partial z}v_z$

2. A sphere of radius R has volume charge density $\rho = \rho_0 \sin(\theta)\cos(\phi)r/R$. Write an **INTEGRAL** expression for the electric field on the x-axis a distance $x_0 > R$ due to this charge distribution.