Special Problem 5-3.6

A dielectric cylinder of infinite length is centered along the *z*-axis. This cylinder has a radius of two and a permittivity of $\varepsilon_1 = 3\varepsilon_0$.

Outside the dielectric cylinder is free space.

It is known that the electric field **in** the dielectric cylinder is:

$$\mathbf{E}_1(\bar{r}) = \frac{4}{\rho}\hat{a}_\rho + \frac{3}{\rho}\hat{a}_\phi$$

While the electric field outside the cylinder has the form:

$$\mathbf{E}_0(\bar{r}) = \frac{A}{\rho}\hat{a}_\rho + \frac{B}{\rho}\hat{a}_\phi$$

where *A* and *B* are **unknown constants**.

Find:

1) the electric field $\mathbf{E}_0(\bar{r})$ outside the dielectric (i.e. the values of *A* and *B*)

2) the **surface** charge density of the polarization (i.e., **bound**) charge on the cylinder **surface**.