1) Three static distributions of currents (including volumetric and surface) generate corresponding magnetic fields that depend only on the cylindrical coordinate \( r \) as shown in Figures (a), (b), and (c) below and point in the \( z \)-direction. Find the (volume AND possible surface) current distributions in these three cases.

2) Consider a spherical volume of radius \( R_0 \). The static electric field distribution is given by

\[
E = \begin{cases} 
(A / R_0)(-\hat{R}\cos(\theta) + \hat{\theta}\sin(\theta)); & R < R_0 \\
(AR_0^3 / R^3)(\hat{R}2\cos(\theta) + \hat{\theta}\sin(\theta)); & R > R_0 
\end{cases}
\]

where \( A \) is a constant. Find the volumetric and surface charge distributions everywhere in space. Find the total charge on the surface of the sphere.

3) 

\[4.24\] In a certain region of space, the charge density is given in cylindrical coordinates by the function:

\[\rho_v = 5re^{-r} \text{ (C/m}^3\text{)}\]

Apply Gauss’s law to find \( \mathbf{D} \).

4) 

\[4.26\] If the charge density increases linearly with distance from the origin such that \( \rho_v = 0 \) at the origin and \( \rho_v = 4 \text{ C/m}^3 \) at \( R = 2 \text{ m} \), find the corresponding variation of \( \mathbf{D} \).
6) If there is no surface current at the interface and the magnetic field in medium 1 is \( \mathbf{H}_1 = \hat{x} H_1^x + \hat{y} H_1^y + \hat{z} H_1^z \), find:

(a) \( \mathbf{H}_2 \)

(b) \( \theta_1 \) and \( \theta_2 \)

(c) Evaluate \( \mathbf{H}_2 \), \( \theta_1 \), and \( \theta_2 \) for \( H_1^x = 2 \, \text{A/m} \), \( H_1^y = 0 \), \( H_1^z = 4 \, \text{A/m} \), \( \mu_1 = \mu_0 \), and \( \mu_2 = 4 \mu_0 \).

5.31* Given that a current sheet with surface current density \( \mathbf{J}_s = \hat{x} 8 \, \text{A/m} \) exists at \( y = 0 \), the interface between two magnetic media, and \( \mathbf{H}_1 = \hat{z} 11 \, \text{A/m} \) in medium 1 \( (y > 0) \), determine \( \mathbf{H}_2 \) in medium 2 \( (y < 0) \).

5.34 Show that if no surface current densities exist at the parallel interfaces shown in Fig. 5-47, the relationship between \( \theta_4 \) and \( \theta_1 \) is independent of \( \mu_2 \).

7) You are given an electric field (given in a phasor form)

\[
\mathbf{E} = \begin{cases} 
\hat{x} E_0 \sin(\beta z); & z > 0 \\
0; & z < 0 
\end{cases}
\]

i. Find the magnetic (phasor) field

ii. Find the volumetric charge density and current density in the entire space

iii. Find the surface charge density and current density in the entire space