KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Department of Electrical Engineering

EE 340 Electromagnetic

Homework 2 (Due Wednsday March 14)

1- Three identical point charges of 10 nC each are located at the vertices of an equilateral triangle of side 10 cm. Calculate the magnitude of:

(a) the force on each charge,

(b) the electric field intensity at the center of the triangle.

2- Figure (1) shows a line charge in free space forms a semicircle of radius *b*. Determine the magnitude and direction of the electric field intensity at the center of the semicircle. The line density is given by $\rho_l = \cos\phi$ c/m.

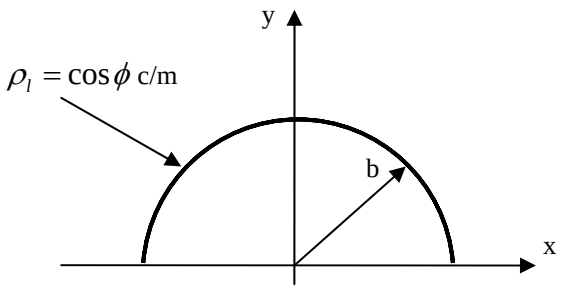

Fig. 1

3- Figure (2) illustrat a uniform surface charge sensity of ρ_s c/m^2 located in free space on $z = 0, a \le r \le b, \ 0 \le \phi \le \pi/2$, ($r, \phi, z$ - cylindrical coordinates). Find the electric field intensity at (0, 0, 0).

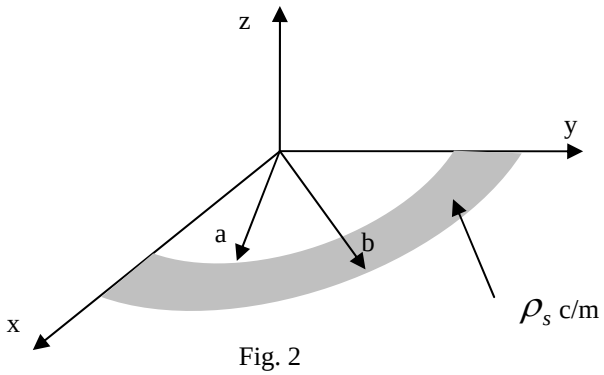

Fig. 2

4- A long cylinder of radius 0.2 *m* lies along the *z* axis and carries a uniform surface charge density of 10 mC/m^2. Calculate the flux passing through a window at $\rho = 2$ m, $\pi/4 \le \phi \le 3\pi/4$, and $2 \le z \le 4$.

5- A charge distribution of the following form is set up in air:
$\rho_v = 10^{-6} e^{-r}\ C/m^3$, where *r* is the radial distance of he spherical coordinates.
Find the electric field intensity $\overline{E}$ everywhere.

6- Given the volume charge distribution in cylindrical coordinates as

$$\rho_v = \begin{cases} 12\rho \quad nC/m^3, & 1 < \rho < 2 \\ 0, & otherwise \end{cases}$$

Calculate the electric field intensity $\overline{E}$ everywhere.

7- Three concentric spherical shells $r = 1$, $r = 2$, $r = 3$ m, respectively, have charge distriutions 2, -4 and 5 $\mu C/m^2$.

a. Calculate the flux through $r = 1.5\,m$ and $r = 2.5\,m$.

b. Find $\overline{D}$ at $r = 0.5\,m$, $r = 2.5\,m$, and $r = 3.5\,m$.