THE CITADEL
THE MILITARY COLLEGE OF SOUTH CAROLINA

Department of Electrical and Computer Engineering

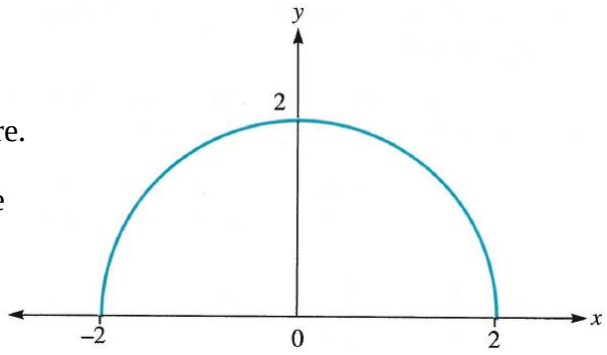
ELEC 318 Electromagnetic Fields **HW #3, due February 5, 2015**

Reading Assignment: Chapter 4 (through Section 4.7)

Written Assignment:

1. A point charge Q is located at point $P(0, -4, 0)$, while a 10 nC charge is uniformly distributed along a semicircular ring as shown in the figure.

   Determine the value of Q such that the electric field at the origin is zero.



2. Determine the electric field vector at point $P(0, 0, 10\text{ m})$ due to a rectangular plate described by $-2\text{ m} \le x \le 2\text{ m}$, $-5\text{ m} \le y \le 5\text{ m}$, $z = 0$ carrying a uniform charge density of 10^{-5} C/m^2. **Express your answer in V/m, in the appropriate direction.**

3. The plane $x + 2y = 5$ carries a uniform charge density of 6 nC/m^2. Determine the electric field vector at $P(-1\text{ m}, 0, 1\text{ m})$, **in free space.**

4. A volume charge density as a function of location is $\dfrac{50e^{-R}}{R}\ \dfrac{\text{nC}}{\text{m}^3}$.
   Solve for the electric field everywhere, **in free space.**

5. The electric scalar potential as a function of location is $x^2 y(z+3)$ V
   where x, y, and z are in meters. Determine, **in free space** ...
   (a) the electric field vector at $P(3\text{ m}, 4\text{ m}, -6\text{ m})$, and
   (b) the charge within the cube $0 \le x \le 1\text{ m}$, $0 \le y \le 1\text{ m}$, $0 \le z \le 1\text{ m}$.

6. The electric field as a function of location is $20R\sin\theta\,\hat{\mathbf{R}} + 10R\cos\theta\,\hat{\boldsymbol{\theta}}$ V/m.
   Calculate the work required to move a charge of 10 nC…
   (a) from $A(5, 30°, 0°)$ to $B(5, 90°, 0°)$, and
   (b) from $C(10, 30°, 0°)$ to $A(5, 30°, 0°)$.