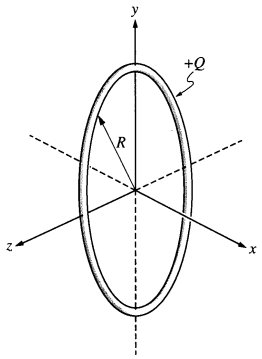
Electrostatics 6



1999E3. The nonconducting ring of radius R shown above lies in the yz-plane and carries a uniformly distributed positive charge Q.

a. Determine the electric potential at points along the x-axis as a function of x.

b. i. Show that the x-component of the electric field along the x-axis is given by

$$E_x = \frac{Qx}{4\pi\varepsilon_0\left(R^2 + x^2\right)^{\frac{3}{2}}}$$

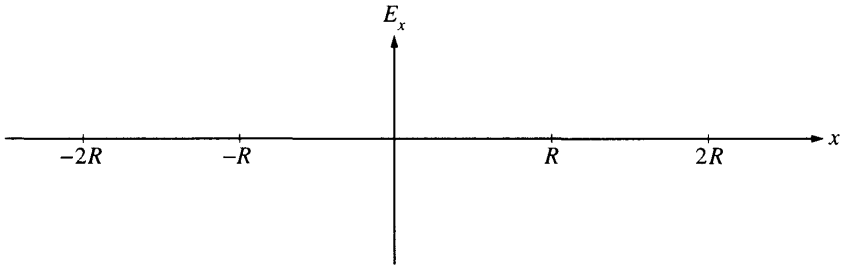
ii. What are the y- and z- components of the electric field along the x-axis?

c. Determine the following.

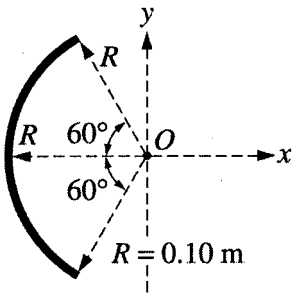
i. The value of x for which E_x is a maximum

ii. The maximum electric field $E_{x\,max}$

d. On the axes below, sketch E_x versus x for points on the x-axis from x = -2R to x = +2R.



e. An electron is placed at x = R/2 and released from rest. Qualitatively describe its subsequent motion.



2002E1. A rod of uniform linear charge density $\lambda = +1.5 \times 10^{-5}$ C/m is bent into an arc of radius R = 0.10 m. The arc is placed with its center at the origin of the axes shown above.

a. Determine the total charge on the rod.

b. Determine the magnitude and direction of the electric field at the center O of the arc.

c. Determine the electric potential at point O.

A proton is now placed at point O and held in place. Ignore the effects of gravity in the rest of this problem.

d. Determine the magnitude and direction of the force that must be applied in order to keep the proton at rest.

e. The proton is now released. Describe in words its motion for a long time after its release.