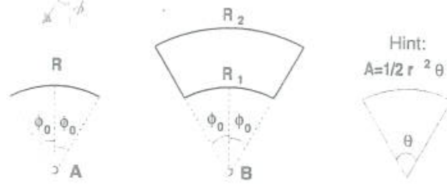

- a) (10 pts) A thin nonconducting rod is bent to form a circular arc of radius R that subtends an angle $2\phi_0$ as shown in the diagram on the left. If that rod carries a charge q (uniformly distributed), show that the magnitude of the electric field at point A will be $E = \frac{q \sin\phi_0}{4\pi\epsilon_0 R^2 \phi_0}$. **Show your work!**
- b) (10 pts) Now consider the wedge in the center diagram. If a charge q is uniformly distributed over the region that extends from R_1 to R_2 (subtending an angle $2\phi_0$), what is the magnitude of the electric field at point B **[See the hint in the right diagram]**
- c) (5 pts) Suppose a small non-uniform but spherically-symmetric charge distribution of total charge Q is placed at point B. What is the magnitude of the force that the charge Q will exert on the wedge?

a) $d\vec{E} = \frac{k\,dq}{r^2}\hat{r}$ $r = R$

$k = \frac{1}{4\pi\epsilon_0}$

$$|\vec{E}| = \frac{q \sin\phi_0}{4\pi\epsilon_0 R^2 \phi_0}$$

$dA = r(2\phi_0)\,dr$

EXTRA PAGE

b) Build the wedge out of infinitesimal arcs

$$|\vec{E}| = \frac{q \sin\phi_0}{\pi\epsilon_0 \phi_0 (R_2^2 - R_1^2)} \ln\left(\frac{R_2}{R_1}\right)$$

c)