Lecture 16 - revision for weeks 1-6

(Continued)

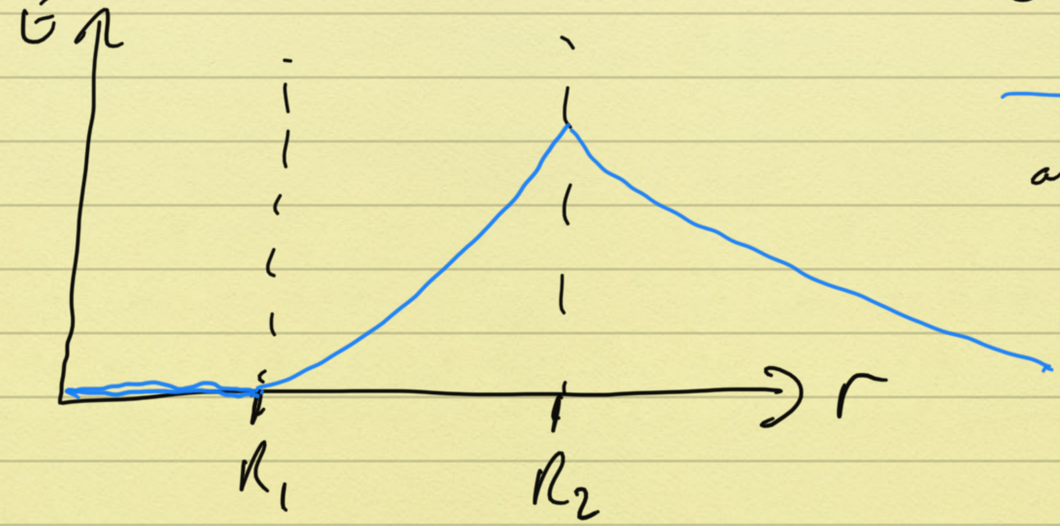
$\boxed{\text{Ex } 16.3}$

$R_1 < r < R_2$

$E = E_0 \left(r^2 - \frac{R_1^3}{r} \right)$

at $r = R_1$
$E = 0.$

(b)

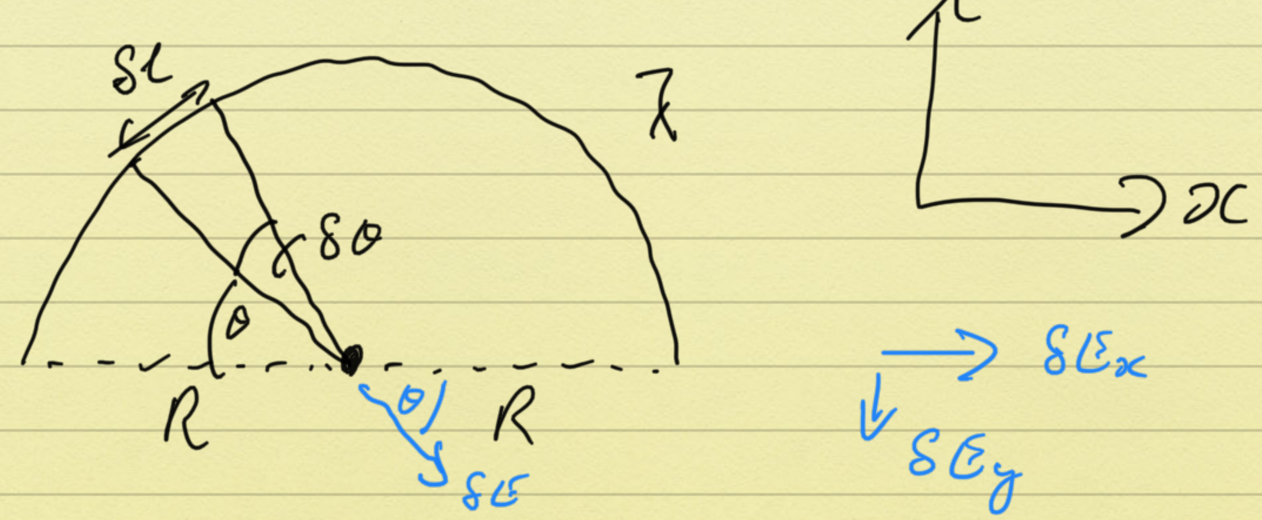


(c) $V \quad (r > R_2)$ $\qquad E = \frac{\rho_0}{3\varepsilon_0} \left(R_2^3 - R_1^3 \right) \frac{1}{r}$

$$V = - \frac{\rho_0}{3\varepsilon_0} \left(R_2^3 - R_1^3 \right) \int \frac{dr}{r}$$

$$= - \frac{\rho_0}{3\varepsilon_0} \left(R_2^3 - R_1^3 \right) \ln r + C$$

$\boxed{Ex\ 16.4}$



Coulomb's law.

$$\delta E = \frac{\lambda\, \delta l}{4\pi\varepsilon_0 R^2}$$

By symmetry x-component cancels out leaving just a y component in the negative y-dir^n.

Just consider magnitude:

$$\delta E_y = \frac{\lambda\, \delta l}{4\pi\varepsilon_0 R^2} \sin\theta$$

$$\delta\theta = \frac{\delta l}{R} \Rightarrow \delta l = R\,\delta\theta$$

$$\delta E_y = \frac{\lambda \, \delta\theta}{4\pi\varepsilon_0 R} \sin\theta$$

$$|\underline{E}| = \frac{\lambda}{4\pi\varepsilon_0 R} \int_0^{\pi} \sin\theta \, d\theta$$

$$= \frac{\lambda}{4\pi\varepsilon_0 R} \Big[-\cos\theta \Big]_0^{\pi}$$

$$= \frac{\lambda}{4\pi\varepsilon_0 R} \times 2 = \frac{\lambda}{2\pi\varepsilon_0 R}$$

$$\underline{E} = -\frac{\lambda}{2\pi\varepsilon_0 R} \, \underline{\hat{y}}$$