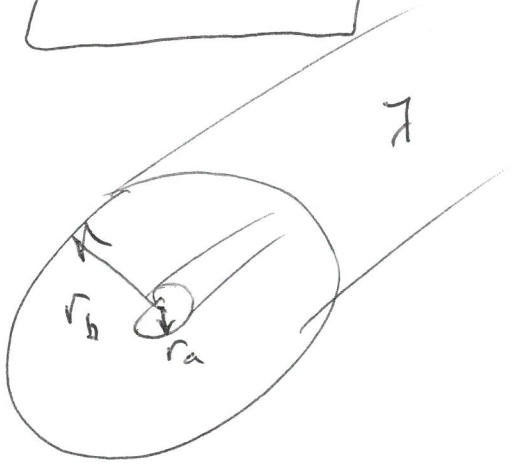
EM1 Lec 9

Ex 9.1



$$\underline{E} = \frac{\lambda}{2\pi\varepsilon_0 r}\,\hat{\underline{r}}$$

$$V = -\int_{r_b}^{r_a} \underline{E}\cdot dr = \frac{-\lambda}{2\pi\varepsilon_0}\left[\ln r\right]_{r_b}^{r_a}$$

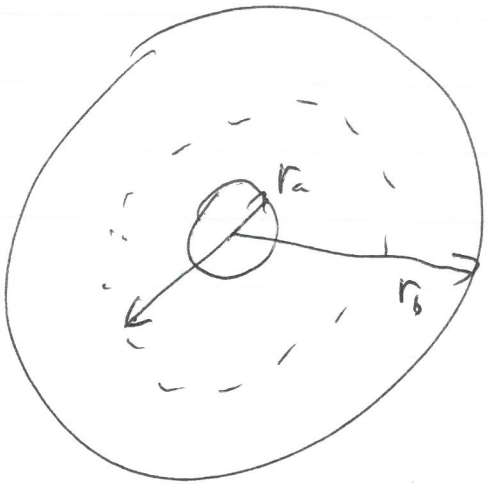
$$V = \frac{\lambda}{2\pi\varepsilon_0}\ln\left(\frac{r_b}{r_a}\right)$$

$$C = \frac{Q}{V} \qquad C \text{ per unit length} = \frac{\lambda}{V}$$

$$C\,(\text{unit length}) = \frac{2\pi\varepsilon_0}{\ln\left(\frac{r_b}{r_a}\right)}$$

Ex 9-2

Spherical capacitor.



$$\underline{E} = \frac{Q}{4\pi\varepsilon_0 r^2}\,\hat{\underline{r}}$$

$$V = -\int_{r_b}^{r_a} \underline{E}\cdot d\underline{r}$$

$$V = \frac{-Q}{4\pi\varepsilon_0}\int_{r_b}^{r_a}\frac{dr}{r^2} = \frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{r_a}-\frac{1}{r_b}\right)$$

$$V = \frac{Q}{4\pi\varepsilon_0}\,\frac{(r_b - r_a)}{r_a r_b}$$

$$C = \frac{Q}{V} = 4\pi\varepsilon_0\,\frac{r_a r_b}{r_b - r_a}$$
