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Source: Griffith: Introduction to electro dynamics
Problem! An inverted hemisphisical bowl of radius R
carries a uniform surface charge density or. Find the
carries a uniform surface charge density σ . Find the potential difference between the 'north pol' and the center. [Asswer! $(R\sigma/2E)/[\sqrt{2}-1)$]
center. [Assever! (Ro/2E) / 52-1)]
P
To find: Vp-Vo=?
RO
V_o :
$V_0 = \frac{1}{47280} \int \sigma da$ $R = \frac{1}{47280} \int \sigma da$
$= \frac{\sigma}{4\pi\epsilon_0 R} \int \frac{da = \sigma(2\pi R^2)}{4\pi\epsilon_0 R}$
= OR
2 &
() Commidering an
V_{p} = From cosine rule $Cos0=R^{2}+R^{2}-1$ $\Rightarrow \pi^{2}=2R^{2}(1-los0)$ [Considering and $2R^{2}-1$ = $\sqrt{2}R(1-los0)^{2}/2$
$2R = \lambda = \sqrt{2R(1-\cos\theta)}$
$V = \int \left(\sigma d\alpha - \sigma \right) \left((Rd0) \left(2\pi R \sin 0 \right) \right) = \sigma R \left(\sin 0 d\theta \right)$
$V_{p} = \frac{1}{\sqrt{116}} \int \frac{\sigma d\alpha}{r} = \frac{\sigma}{\sqrt{116}} \int \frac{(Rd0)(2\pi R \sin 0)}{\sqrt{2}R \sqrt{1-\cos 0}} \frac{\pi V_{2}}{2\sqrt{2} \varepsilon_{0}} \int \frac{\sin 0 d\theta}{\sqrt{1-\cos 0}}$
$= \frac{\partial R}{2\sqrt{2} \mathcal{E}_0} \int \frac{dt}{\sqrt{t}} \qquad \begin{cases} 1 - \cos\theta = t \\ \sin\theta d\theta = dt \end{cases}$
2/2 Eo o J V E Sin Odo = dt y
$= \sigma R \left(\sqrt{1 - \sigma} \right) = \sigma R$
$\frac{\sigma R}{\sqrt{2} \xi_0} \left(\sqrt{1-0} \right) = \frac{\sigma R}{\sqrt{2} \xi_0}$
$\frac{1}{V_{p}-V_{o}} = \frac{\sigma R}{2 \varepsilon_{o}} \left(\sqrt{2}-1 \right)$