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PH108 : Electricity & Magnetism

Weekly Quiz 3 - Using the Dirac Delta Function

7 February, 2018

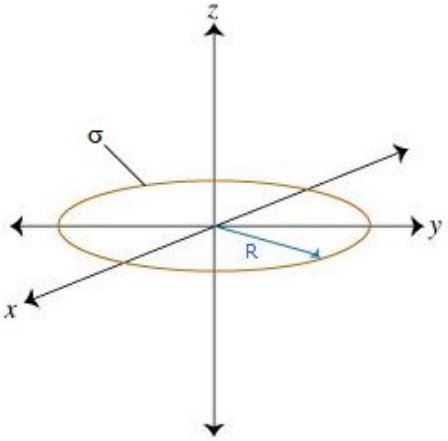
Instructions: Read these before beginning!

1) Fill out the details carefully & correctly, else the quiz will NOT fetch you marks or attendance.
2) You have **5 min** to fill all the answer(s) at the specified location(s), for a total of **1 mark**.
3) There will be NO partial marking. Only answer(s) at specified location(s) will be considered.
4) Any sort of malpractice will be strongly penalised!

All the Best! Use the backside for rough work.

Question

Let's try to find out the VOLUME charge density of a uniformly charged thin disk of radius R and surface charge density σ, placed in the X-Y plane, in spherical polar co-ordinates.



We can directly eliminate any ϕ dependence (due to symmetry of the scenario).
So, $\rho(\mathbf{r}) = \sigma f(r) g(\theta)$ for r $\in [0, r]$. Find $g(\theta)$. [Hint: X-Y plane!]

$g(\theta) =$ [$\frac{1}{2}$ **mark**]

Now, using the form of $\rho(\mathbf{r})$ supplied and $g(\theta)$, find $f(r)$.

Hint 1: You can use dimensional analysis... (dimension of Dirac Delta of the form $\delta(x)$ is x^{-1})

Hint 2: $\int\limits_{disk} \rho(\mathbf{r}) dV$ = total charge on the disk.

$f(r) =$ [$\frac{1}{2}$ **mark**]

————————Question Ends Here————————

P.S.: For more information, read about 'Charge densities and the Dirac Delta function'.