No.

Date

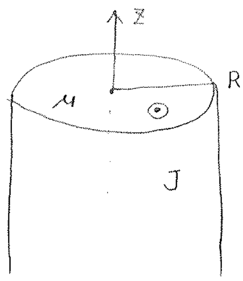
(2) $V_{ab} = -\int_b^t \frac{Q}{4\pi\varepsilon_2 r^2}dr - \int_t^a \frac{Q}{4\pi\varepsilon_1 r^2}dr = \frac{Q}{4\pi\varepsilon_2}\left(\frac{1}{t}-\frac{1}{b}\right) + \frac{Q}{4\pi\varepsilon_1}\left(\frac{1}{a}-\frac{1}{t}\right)$

$C = \frac{Q}{V_{ab}} = \frac{4\pi\varepsilon_2}{\frac{1}{t}-\frac{1}{b}} + \frac{4\pi\varepsilon_1}{\frac{1}{a}-\frac{1}{t}} = 4\pi\left(\frac{\varepsilon_2}{\frac{1}{t}-\frac{1}{b}} + \frac{\varepsilon_1}{\frac{1}{a}-\frac{1}{t}}\right)$

(3) $Q>0$ のとき $\frac{Q}{4\pi\varepsilon_1 a^2} = \frac{Q}{4\pi\varepsilon_2 t^2}$ より $\varepsilon_1 a^2 = \varepsilon_2 t^2$

$Q<0$ のとき $\frac{Q}{4\pi\varepsilon_1 t^2} = \frac{Q}{4\pi\varepsilon_2 b^2}$ より $\varepsilon_1 t^2 = \varepsilon_2 b^2$

問2.

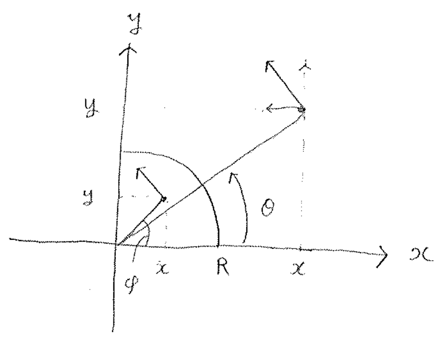


$r \geqq R$ のとき $H \cdot 2\pi r = J$

$H = \frac{J}{2\pi r}$ より $B = \frac{\mu_0 J}{2\pi r}$

$0 \leqq r < R$ のとき $H \cdot 2\pi r = \frac{r^2}{R^2}J$

$H = \frac{rJ}{2\pi R^2}$ より $B = \frac{\mu r J}{2\pi R^2}$



$r \geqq R$ のとき

$\hat{B}_x = \hat{x}\frac{\mu_0 J}{2\pi r} \cdot -\sin\theta = \hat{x}\frac{\mu_0 J}{2\pi\sqrt{x^2+y^2}} \cdot -\frac{y}{\sqrt{x^2+y^2}}$

$= -\hat{x} \cdot \frac{y\mu_0 J}{2\pi(x^2+y^2)}$

$\hat{B}_y = \hat{y}\frac{\mu_0 J}{2\pi r} \cdot \cos\theta = \hat{y}\frac{\mu_0 J}{2\pi\sqrt{x^2+y^2}} \cdot \frac{x}{\sqrt{x^2+y^2}}$

$= \hat{y}\frac{x\mu_0 J}{2\pi(x^2+y^2)}$

$0 \leqq r < R$ のとき

$\hat{B}_x = \hat{x} \cdot \frac{\mu r J}{2\pi R^2} \cdot -\sin\varphi = \hat{x} \cdot \frac{\mu\sqrt{x^2+y^2}J}{2\pi R^2} \cdot -\frac{y}{\sqrt{x^2+y^2}}$

$= -\hat{x} \cdot \frac{\mu y J}{2\pi R^2}$

$\hat{B}_y = \hat{y} \cdot \frac{\mu r J}{2\pi R^2} \cdot \cos\varphi = \hat{y} \cdot \frac{\mu\sqrt{x^2+y^2}J}{2\pi R^2} \cdot \frac{x}{\sqrt{x^2+y^2}}$

$= \hat{y} \cdot \frac{\mu x J}{2\pi R^2}$

$$\begin{cases} \hat{B} = \hat{B}_x + \hat{B}_y = \frac{\mu_0 J}{2\pi(x^2+y^2)}\left\{-\hat{x}y + \hat{y}x\right\} & (r \geqq R \text{ のとき}) \\ \hat{B} = \hat{B}_x + \hat{B}_y = \frac{\mu J}{2\pi R^2}\left\{-\hat{x}y + \hat{y}x\right\} & (0 \leqq r < R \text{ のとき}) \end{cases}$$