KGÜ 4

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16:02

a) $\Phi_0 = \Phi(t_0) = \int_F \vec{B}\, d\vec{F}$

$= B_0 \vec{e}_z \left(\frac{b}{2} \cdot b + \frac{3}{4} b \cdot b + b \cdot \frac{b}{2} \right)$

$= B_0 \vec{e}_z \left(b^2 \left(\frac{1}{2} + \frac{3}{4} + \frac{1}{2} \right) \right) = B_0 \cdot b^2 \cdot \frac{7}{4}$ ✓

b) $\tilde{\Phi}_0 = B_0 b^2 \cdot 1{,}5$ ✓

c) $\Phi(t) = \Phi_0 \cos(\omega t)$ ✓

$\tilde{\Phi}(t) = \tilde{\Phi}_0 \cos(\omega t)$ ✓

$[\vec{J}] = \frac{I}{A}$

d) $\int \vec{E}\, d\vec{r} = 0$ ✓

$I = J \cdot A$

e) $\oint \vec{E}\, d\vec{s} = \int_A^H \vec{E}\, d\vec{s} = -\frac{\partial}{\partial t} \int_F \vec{B}\, d\vec{F} = \dot{\Phi}$

$y = [0, \frac{b}{4}]$

$\Leftrightarrow \int_A^H \frac{\vec{J}}{\sigma} = -\frac{\partial}{\partial t} \left(B_0 \cdot (1{,}5 b^2 + b \cdot y) \cdot \cos(\omega t) \right)$

$= B_0 (1{,}5 b^2 + b y) \sin(\omega t)\, \omega = \int_0^b \frac{\vec{J}}{\sigma}\, dx = \frac{dI}{\sigma} \cdot \int_0^b d \cdot dy\, dx$

$d \frac{I}{\sigma} d b\, dy$

$dI = B_0 (1{,}5 b^{\cancel{2}} + \cancel{b} y) \sin(\omega t)\, \omega \frac{\cdot \sigma}{d \cancel{b}} \frac{1}{dy}$?

$\int_0^{b/4} dI = B_0 \sin(\omega t) \frac{\omega \sigma}{d} \cdot \left[1{,}5 b y + \frac{1}{2} y^2 \right]_0^{b/4}$

$= B_0 \sin(\omega t) \frac{\omega \sigma}{d} \cdot \left[\frac{3}{2} \cancel{b^2} \frac{1}{4} + \frac{1}{2} \cancel{b^2} \cdot \frac{1}{16} \right] b^2$

$= B_0 \sin(\omega t) \frac{\omega \sigma}{d} \left[\underbrace{\frac{1}{32} + \frac{3}{8}}_{\frac{13}{32}} \right] b^2$

$= B_0 \sin(\omega t) \frac{\omega \sigma}{d} \frac{13}{32} b^2$ (v)

e) 1.) $j_x(y) = \sigma E_x(y) = \dots$

$$\oint \vec{E}\, d\vec{l} = \int_b^0 E_x(y)\, dx = -\dot{\phi}(y)$$

2.) $\Rightarrow E_x(y) = \frac{1}{b} \cdot \dot{\phi}(y)$

$\Rightarrow$ 1.) $\underline{j_x(y) = \frac{\sigma}{b} \dot{\phi}(y)}$ 3.)

$$\phi_0(y) = \frac{6}{4} b^2 B_0 + \left(\frac{y}{b/4}\right) \cdot \frac{B_0}{4} \cdot b^2 \qquad t = 0$$

$$\phi(y,t) = \phi_0(y) \cos(\omega t)$$

aus 3.) $j_x(y) = \frac{\sigma}{b} \dot{\phi}(y,t) = -\frac{\sigma}{b} \omega B_0 \sin(\omega t) \left[\frac{3}{2} b^2 + y b\right]$ $\left[0 \leq y < \frac{b}{4}\right]$

$$I(t) = -d \left(-\frac{\sigma}{b} \omega B_0 \sin(\omega t)\right) \int_0^{b/4} \left[\frac{3}{2} b^2 + y b\right] dy$$

$\left[I(t) = -d \int_0^{b/4} j_x(y)\, dy \qquad \vec{J} = -j_x \vec{e}_x \right]$

$$\Rightarrow I(t) = \sigma d \omega B_0 \sin(\omega t) \cdot \frac{13}{32} b^2$$