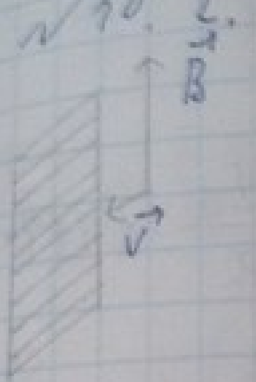
№10.2.



Дано: v, B

З-ти: σ - ?

1) $q_e \cdot v \cdot B = q_e \cdot E \quad (F_л = F$

$E = v \cdot B$

$\vec{E} = v \cdot B \cdot \vec{e}_x$

$\vec{D} = \varepsilon_0 \cdot \vec{E}$

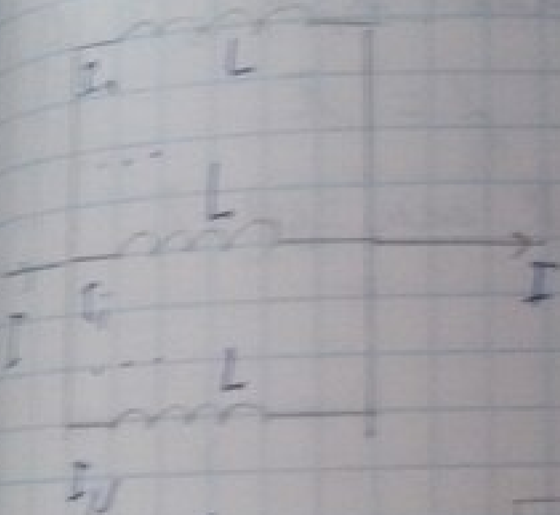
2) $\oint\limits_S \vec{D}\, d\vec{S} = \sum\limits_S q$

$\varepsilon_0 \cdot v \cdot B \cdot S = \sigma \cdot S$

$\boxed{\sigma = \varepsilon_0 \cdot v \cdot B.}$

$= \frac{\rho l}{S}$

Дз №10.3.



Дано: N, L

Х-ти: L' - ?

$$\frac{1}{L'} = \underbrace{\frac{1}{L} + \ldots + \frac{1}{L}}_{N}$$ (т.к. паралл. соед.)

$$\frac{1}{L'} = \frac{N}{L} \Rightarrow \boxed{L' = \frac{L}{N}}$$

№10.2.

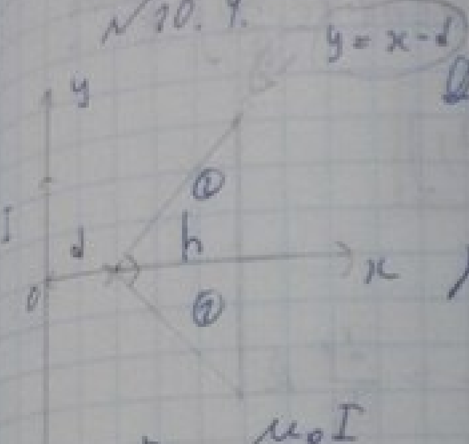
Дано: v, B

Х-ти: σ - ?

$\cdot \sin[\omega_0 \cdot \frac{1}{2} \cdot \frac{\ }{\delta}]$

$$\boxed{\mathcal{E}\left(\frac{\ln 2}{\delta}\right) = B \cdot ab\,\omega_0 \left(\frac{1+\ln 2}{2}\right) \cdot \sin\left(\frac{\omega_0 \cdot \ln 2}{2\delta}\right)}$$

№10.4.



Дано: $d, h, R, I_1 = I_0 e^{-(t/\tau)^2}$, I_0, τ

Н-ти: I_2^{max} - ?

1) $B = \frac{\mu_0 I}{2\pi x}$

$$\Phi = \int B\,dS = 2\int_d^{d+h} dx \int_0^{x-d} \frac{\mu_0 I}{2\pi x}\,dy =$$

$$= 2\int_d^{d+h} \frac{\mu_0 I(x-d)}{2\pi x}\,dx = \frac{\mu_0 I}{\pi}\left[[(d+h)-d] - d\cdot \ln\left(\frac{d+h}{d}\right)\right]$$

2) $\mathcal{E}_{инд} = -\frac{\partial \Phi}{\partial t} = \left(d \ln \frac{d+h}{d} - h\right) \cdot \frac{\mu_0}{\pi} \cdot \frac{\partial I}{\partial t} =$

$= I_0 \cdot e^{-(t/\tau)^2} \cdot \frac{2t}{\tau^2} \cdot \frac{\mu_0}{\pi}\left(h - d \ln \frac{d+h}{d}\right)$

3) $I = \frac{\mathcal{E}_{инд}}{R} = \frac{2\mu_0 I_0 t}{\tau^2 \pi R} \cdot \left[h - d\ln\left(\frac{d+h}{d}\right)\right] \cdot e^{-(t/\tau)^2}$

$$I' = \frac{I_0 \mu_0 2}{\tau^2 \pi R}\left[h - d\ln\left(1+\frac{d}{h}\right)\right]\cdot$$

$$\cdot\left(e^{-(t/\tau)^2} + t\cdot\left(-\frac{2t}{\tau^2}\right)\cdot e^{-(t/\tau)^2}\right) = 0$$

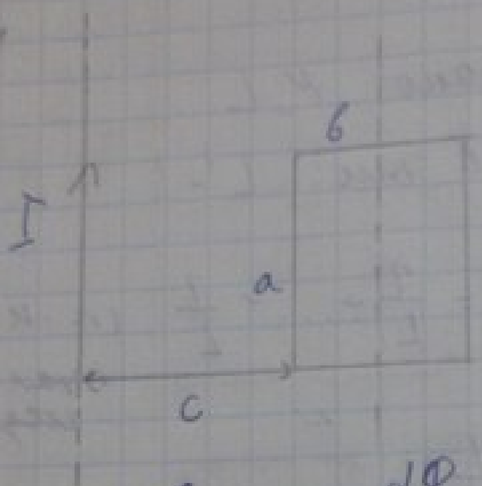
$$1 - \frac{2t^2}{\tau^2} = 0 \Rightarrow 2t^2 = \tau^2 \Rightarrow t = \frac{\tau}{\sqrt{2}}$$

$$I^{max} = \frac{\mu_0 I_0 \cdot \tau \cdot \sqrt{2}}{\tau^2 \pi R}\left[h - d\ln\left(1+\frac{h}{d}\right)\right]\cdot e^{-1/2} =$$

$$\boxed{= \sqrt{\frac{2}{e}}\frac{\mu_0 I_0}{\pi R \tau}\cdot\left[h - d\ln\left(1+\frac{h}{d}\right)\right]}$$

№ 10.12.

№ 10.5.



Дано: a, b, c, I, R,
$\alpha = \pi$
Н-ти: Δq – ?

1) $$|\mathcal{E}_{инд}| = \frac{d\Phi}{dt} = I_{инд} \cdot R = \frac{dq}{dt} \cdot R$$

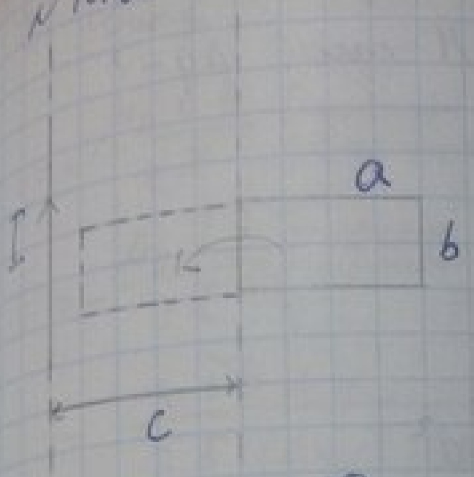
$$dq = \frac{d\Phi}{R} \Rightarrow \Delta q = \frac{\Delta \Phi}{R}$$

$$\Phi_{было} = \int B\,dS = \int_{c}^{c+b} \frac{\mu_0 I}{2\pi r} a\,dr = \frac{\mu_0 I a}{2\pi} \cdot \ln\left(1+\frac{b}{c}\right)$$

$$\Phi_{стало} = -\frac{\mu_0 I a}{2\pi} \cdot \ln\left(1+\frac{b}{c}\right)$$ (с минусом, т.к. нормаль сменила направление на противоположное)

2) $$\Delta q = \left(\frac{\mu_0 I a}{2\pi} \cdot \ln\left(1+\frac{b}{c}\right) + \frac{\mu_0 I a}{2\pi} \ln\left(1+\frac{b}{c}\right)\right) \cdot \frac{1}{R} = \boxed{\frac{\mu_0 I a}{\pi R} \ln\left(1+\frac{b}{c}\right)}$$

№10.6.



Дано: I, a, b, c, S, λ

Найти: Δq - ?

1) $R = \dfrac{\lambda \cdot (2a+2b)}{S}$

– сопротивление рамки

2) $|\mathcal{E}_{инд}| = \dfrac{d\Phi}{dt} = I_{инд} \cdot R = \dfrac{dq}{dt} \cdot R$

$dq = \dfrac{d\Phi}{R} \Rightarrow \Delta q = \dfrac{\Delta\Phi}{R}$

3) $\Phi_{было} = \int B dS = \int\limits_{c}^{c+a} \dfrac{\mu_0 I}{2\pi r} a\,dr = \dfrac{\mu_0 I a}{2\pi} \cdot \ln\left(\dfrac{c+a}{c}\right)$

$\Phi_{стало} = \int B dS = \int\limits_{c-a}^{c} \dfrac{\mu_0 I}{2\pi r} a\,dr = \dfrac{\mu_0 I a}{2\pi} \cdot \ln\left(\dfrac{c}{c-a}\right)$

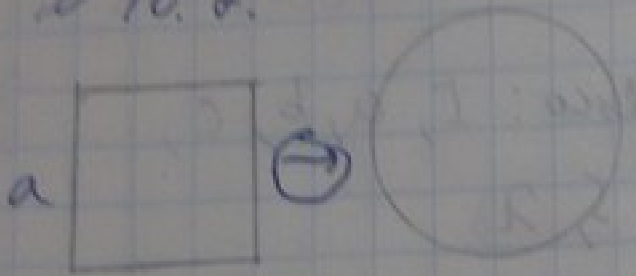
4) $\Delta q = \dfrac{\mu_0 I a}{2\pi R} \ln\left[\dfrac{c}{c-a} \cdot \dfrac{c+a}{c}\right] =$

$= \boxed{\dfrac{\mu_0 I a \cdot S}{4\lambda(a+b)} \ln\left[\dfrac{c+a}{c-a}\right]}$

№10.2.

Дано: a, $\vec{B}$, R

Н-ти: Δq - ?



1) $\Delta\Phi = -B\Delta S$

$\Delta q = \dfrac{\Delta\Phi}{R} = \dfrac{-B\Delta S}{R}$

2) $4a = 2\pi r$ $\quad S_1 = a^2$

$r = \dfrac{2a}{\pi} \Rightarrow \quad S_2 = \pi \cdot \dfrac{4a^2}{\pi^2} \Rightarrow \Delta S = a^2\left(\dfrac{4}{\pi} - 1\right)$

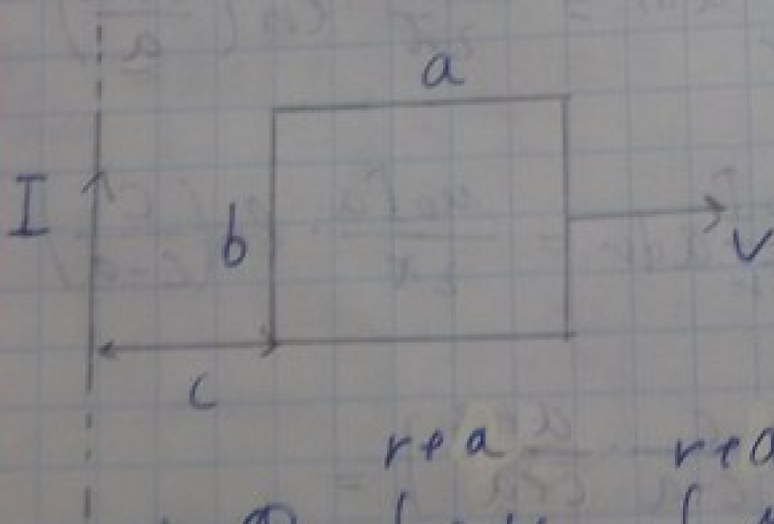
3) $\boxed{\Delta q = \dfrac{Ba^2}{R} \cdot \left(1 - \dfrac{4}{\pi}\right)}$

№10.8.

$r = \frac{\;}{\pi} \Rightarrow S_2 -$

3) $\boxed{\Delta q = \frac{Ba^2}{R} \cdot \left(1 - \frac{4}{\pi}\right)}$

№ 10.8.



Дано: I, a, b, c, v

Н-ти: $\mathcal{E}_i - ?$

1) $\Phi = \int\limits_{r}^{r+a} B\,dS = \int\limits_{r}^{r+a} \frac{\mu_0 I}{2\pi r} b\,dr = \frac{\mu_0 I b}{2\pi} \ln\frac{r+a}{r}$

$r(t) = c + vt$

2) $\mathcal{E}_{инд} = -\frac{d\Phi}{dt} = -\frac{d}{dt}\left[\frac{\mu_0 I b}{2\pi}\ln\left(\frac{c+vt+a}{c+vt}\right)\right]$

$$= -\frac{\mu_0 I b}{2\pi}\left(\frac{v}{c+vt+a} - \frac{v}{c+vt}\right) =$$

$$= -\frac{\mu_0 I b}{2\pi}\left(\frac{cv+v^2t-vc-v^2t-av}{(c+vt)(a+c+vt)}\right) =$$

$$= \frac{\mu_0 I b a v}{2\pi\cdot((c+vt)(c+vt+a)}$$

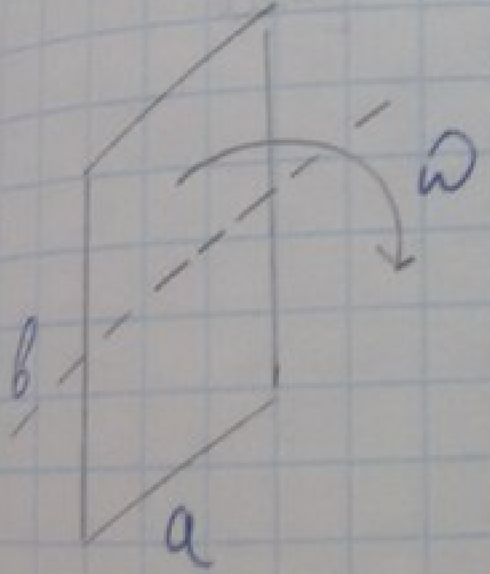
Ответ: $\boxed{\frac{\mu_0 I a b v}{2\pi(c+vt)(c+vt+a)}}$

№10. 9.

$L \quad R \quad \omega$

Ответ: $\boxed{\dfrac{\mu_0 I a b v}{2\pi(c+vt)(c+vt+a)}}$

№ 10. 9.



Дано: $a,\ b,\ B,\ \omega$

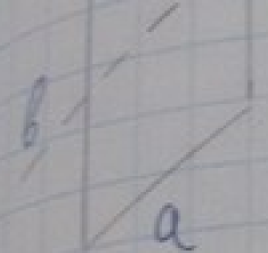
Н-ти: $\mathcal{E}_i$ - ?

1) $\mathcal{E}_i = -\dfrac{\partial \Phi}{\partial t} = -\dfrac{\partial}{\partial t}\left[B \cdot ab \cdot \cos\omega t\right)$

$= \boxed{B \cdot ab \cdot \omega \cdot \sin\omega t}$

№ 10. 10.

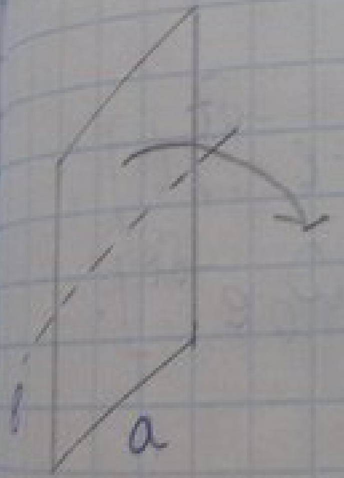
$B = B_0 \cdot \cos\Omega t,\ B_0$



7) $\mathcal{E}_i = -\frac{\partial \Phi}{\partial t} = -\frac{\partial}{\partial t}\left[B\cdot ab\cdot \cos\omega t\right)$

$= \boxed{B\cdot ab\cdot \omega\cdot \sin\omega t}$

№ 10.10.



Дано: $a, b, \omega, \Omega, B = B_0\cdot\cos\Omega t, B_0$

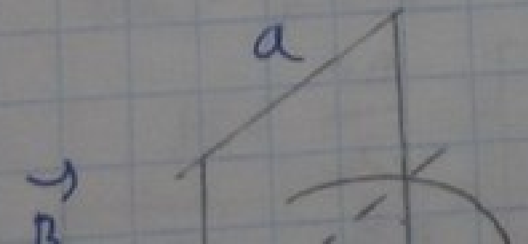
Н-ти: $\mathcal{E}_i$ – ?

$$\Phi = B \cdot S = B_0 \cdot \cos \Omega t \cdot ab \cdot \cos \omega t$$

$$\mathcal{E} = -\frac{\partial \Phi}{\partial t} = -B_0 \cdot ab\left(-\omega \cdot \sin \omega t \cdot \cos \Omega t - \Omega \cdot \sin \Omega t \cdot \cos \omega t\right)$$

Ответ: $\mathcal{E} = B_0 \cdot ab\left(\omega \cdot \sin \omega t \cdot \cos \Omega t + \Omega \sin \Omega t \cdot \cos \omega t\right)$

№ 10.11.

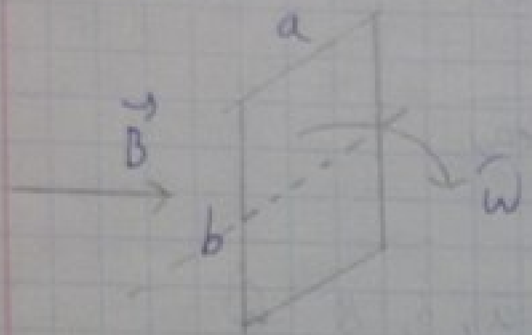


Дано: $a, b, B,$

$\omega = \omega_0 \left(1 - e^{-\delta t}\right)$

Ответ: $\mathcal{E}_i = B_0 ab(\omega \cdot \sin\omega t \cdot \cos\Omega t + \Omega \sin\Omega t \cdot \cos\omega t)$

№ 10.11.



Дано: a, b, B,

$\omega = \omega_0(1 - e^{-\delta t})$

К-ти: $\mathcal{E}_{i_{\frac{1}{2}max}}$ - ?

1) $\max \omega = \omega_0$

$\omega_0(1 - e^{-\delta t}) = \frac{1}{2}\omega_0$

$e^{-\delta t} = \frac{1}{2}$

$-\delta t = -\ln 2$

$t = \frac{\ln 2}{\delta}$

2) $\Phi = B \cdot S = B \cdot a \cdot b \cdot \cos[\omega_0(1 - e^{-\delta t})t]$

$\mathcal{E}_i = \frac{-\partial \Phi}{\partial t} = B \cdot ab \cdot [\omega_0(1 - e^{-\delta t}) + t \cdot \delta \omega_0 e^{-\delta t}] \cdot$

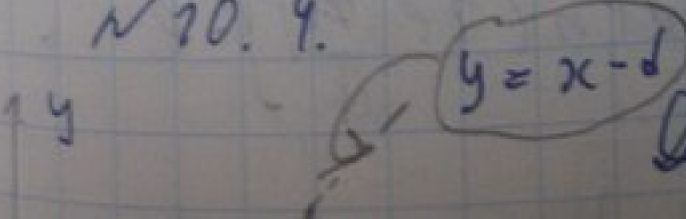
$\cdot \sin[\omega_0(1 - e^{-\delta t})t]$

$$\mathcal{E}_e\left(\frac{\ln 2}{\delta}\right) = B\cdot ab\cdot\left[\frac{1}{2}\omega_0 + \frac{\ln 2}{\delta}\cdot\delta\cdot\omega_0\cdot\frac{1}{2}\right]\cdot$$

$$\cdot \sin\left[\omega_0\cdot\frac{1}{2}\cdot\frac{\ln 2}{\delta}\right]$$

$$\boxed{\mathcal{E}_e\left(\frac{\ln 2}{\delta}\right) = B\cdot ab\,\omega_0\left(\frac{1+\ln 2}{2}\right)\cdot\sin\left(\frac{\omega_0\cdot\ln 2}{2\delta}\right)}$$

№ 10. 4.



Дано: $d,\ h,\ R,\ I_1 = I_0\cdot e^{-(t/\tau)^2},$

№ 10.12.

1) $\mathcal{E}_{инд} = -\frac{\partial \Phi}{\partial t} = I_{инд} \cdot R = \frac{dq}{dt} R$

$-\frac{\Delta \Phi}{\Delta t} = \frac{\Delta q}{\Delta t} R \Rightarrow \Delta q = -\frac{\Delta \Phi}{R}$

2) $\Phi_{было} = B \cdot S = \mu_0 I n S$, т.к. в соленоиде

$B = \frac{\mu_0 I n}{2} \underbrace{(\cos\beta_2 - \cos\beta_1)}_{= 1+1}$, т.к. соленоид длинный; $l >> R$

$\Phi_{стало} = 0$

3) $\Delta q = \boxed{\frac{\mu_0 I n S}{R}}$