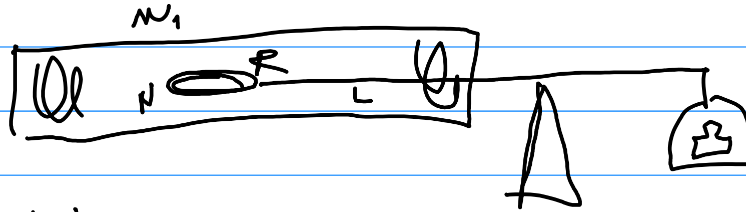
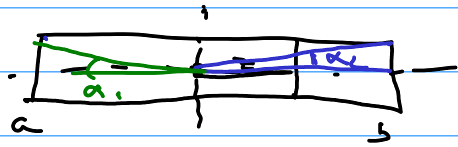
$\boxed{3.1.7}$



B v SOLENOIDU

B_z 1 zav. : $\frac{\mu_0 I R^2}{2(R^2+z^2)^{3/2}}$ $\qquad dI = I n_1 dz$

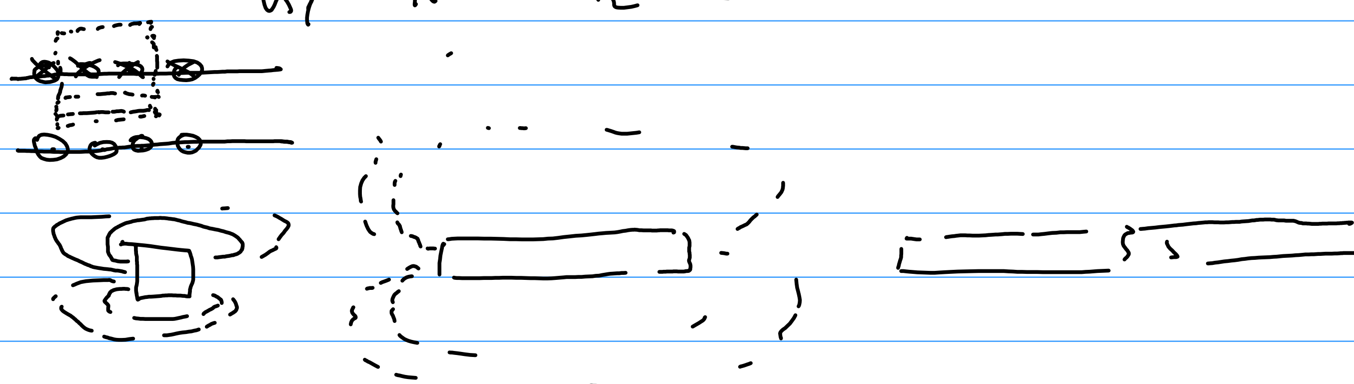


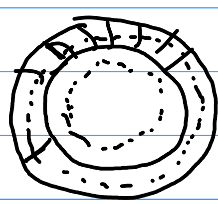
$$B = \int_a^b \frac{\mu_0 I n_1 R^2}{2}\cdot\frac{dz}{(R^2+z^2)^{3/2}} =$$

$$= \frac{\mu_0 I n_1 R^2}{2}\left(\frac{b}{\sqrt{R^2+b^2}} - \frac{a}{\sqrt{R^2+a^2}}\right) \qquad \frac{1}{R^2}\frac{z}{\sqrt{R^2+z^2}}$$

$$= \frac{\mu_0 I n_1}{2}\cdot\left(\cos\alpha_2 - \cos\alpha_1\right) = \underline{\underline{\mu_0 I n_1}}$$

$\alpha_1 \to \pi \qquad \alpha_2 \to 0$

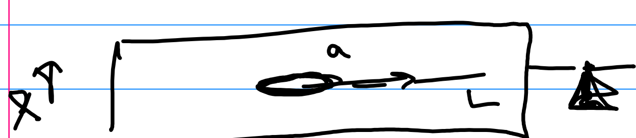




$\oint \vec{B}\cdot d\vec{l} \neq 0$

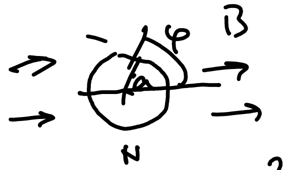
$\oint \vec{B}\cdot d\vec{l} = \mu_0 n \cdot 2\pi R \cdot I$

$B = \mu_0 n I \qquad R\to\infty$: SOLENOID



$\vec{F} = q\vec{v}\times\vec{B}$

$d\vec{F} = I\, d\vec{l}\times\vec{B}$



$d\vec F = I\, d\vec l \times \vec B = I B\, dl \cdot \cos\varphi\, \hat x$

$dl = a\, d\varphi$

$$\vec F = N\int_0^{2\pi} d\vec F = 0.$$

$$M = \int d\vec F\cdot(L - a\cos\varphi) = N\int_0^{2\pi} I B a\, d\varphi\, \underbrace{\cos\varphi\cdot(L - a\cos\varphi)}$$

$$\int_0^{2\pi}\cos^2\varphi = \pi \qquad M = N I B a^2\pi$$
$$= \mu N I^2 n_1 a^2 \pi$$

VEKT. POT.

$$\vec A : \vec B = \nabla\times\vec A$$

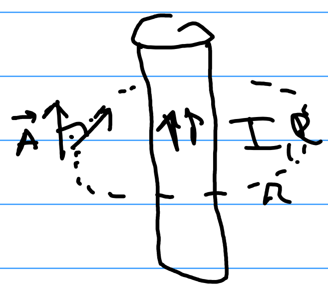
$\nabla\cdot\vec B = 0$

$\nabla\times\vec B = \mu_0\vec j \qquad \nabla\times\nabla\times\vec A = \nabla(\nabla\cdot\vec A) - \Delta\vec A$

voľba: $\nabla\cdot\vec A = 0$

$$\Delta\vec A = -\mu_0\vec j$$
$$\Delta A_x = -\mu_0 j_x$$
$$\vdots$$
$$\Delta\varphi = -\frac{\rho}{\varepsilon_0}$$
$$A_x = \frac{\mu_0}{4\pi}\int_V \frac{j_x(r)}{r}\,dV \quad \dots$$

$\boxed{3.1.11}$



$\vec A = ?$ $\qquad A_z = \frac{\mu_0}{4\pi}\int_V \frac{j_z}{r}\,dV$

$\vec B = \frac{\mu_0 I}{2\pi r}$ $\qquad$ analógia: nabitý válec

$$2\pi r\cdot L\cdot E = L\cdot\pi R^2\cdot\rho/\varepsilon_0$$

$$E = \frac{R^2\rho}{2\varepsilon_0 r} \to \varphi = \frac{R^2\rho}{2\varepsilon_0}\cdot\ln r$$

$$A_z = \frac{R^2 j\mu_0}{2}\ln r$$

$\vec{B} = \nabla\times\vec{A} =$

$A = (0, 0, c\cdot\ln r)$

$$\nabla\times\vec{A} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ 0 & 0 & c\cdot\ln r \end{vmatrix} = \left(c\frac{\partial \ln r}{\partial y}, -c\frac{\partial \ln r}{\partial x}, 0\right)$$

$$\frac{\partial \ln\sqrt{x^2+y^2}}{\partial y} = \frac{\frac{1}{2}r^{-1}\cdot 2y}{r} = \frac{y}{r^2}$$

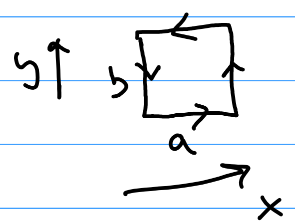
$$= \frac{R^2\cdot j\mu_0}{2}\left(\frac{y}{r^2}, \frac{-x}{r^2}, 0\right)$$

$$\frac{\sin\varphi}{r}, \frac{-\cos\varphi}{r}, 0$$

cylind.: $B_\varphi = \frac{I\mu_0}{2\pi R}$

DÚ

- mag. dipól z potenciálu pomocí elstat. řešení dipólu

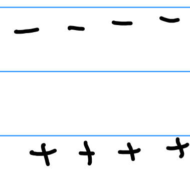


$\vec{A} = ?$

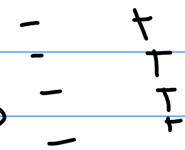
$\downarrow$

$\vec{B} = ?$

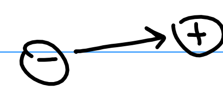
I_x



I_y



elstat.:



$\varphi_{dip.} = \ldots$

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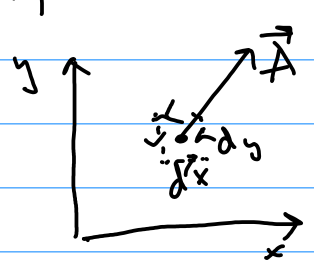
význam $\nabla\times\vec{A}$



$$\oint \vec{A}\cdot d\vec{l} = \left(\cancel{A_x} - \frac{\partial A_x}{\partial y}\frac{dy}{2}\right)\cdot dx$$

$$+ \left(\cancel{A_y} + \frac{\partial A_y}{\partial x}\frac{dx}{2}\right)\cdot dy -$$

$$- \left(\cancel{A_x} + \frac{\partial A_x}{\partial y}\frac{dy}{2}\right)\cdot dx - \left(\cancel{A_y} - \frac{\partial A_y}{\partial x}\frac{dx}{2}\right)\cdot dy$$

$$= -\frac{\partial A_x}{\partial y}dx\,dy + \frac{\partial A_y}{\partial x}dx\,dy = (\nabla\times\vec{A})_z\cdot dS$$