1. m, q

$t=0 \rightarrow \vec{B} \perp \vec{v}$ - kružno gibanje

do $t = T$

$\phi = ?$

$$\vec{F_B} = q\vec{v} \times \vec{B} = qvB \cancel{\sin\alpha}\ \overset{1}{} \ (90°)$$

$$\rightarrow F_{cp} = qvB$$

$$\frac{m v^{\cancel{2}}}{\cancel{r}} = qvB \qquad w = \frac{v}{r}$$

$$m\omega = qB$$

$$\omega = \frac{d\phi}{dt} = \frac{qB}{m} \quad / \cdot dt$$

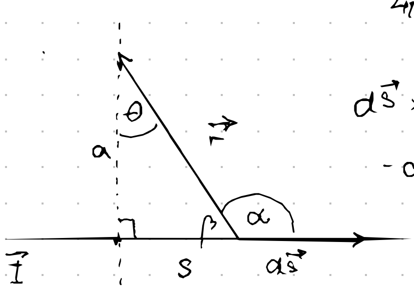
$$d\phi = \frac{qB}{m} dt \quad / \int$$

$$\int_0^{\phi} d\phi = \frac{qB}{m} \int_0^{T} dt$$

$$\boxed{\phi = \frac{qBT}{m}}$$

2. Izvod izraza za jakost mag. polja na udaljenosti „a" od beskonačno dugačkog vodiča kojim teče struja jakosti I.

B.S. pravilo: $\vec{B} = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{s} \times \hat{r}}{r^2}$



$d\vec{s} \times \hat{r}$ je vektorski umnožak $ds \cdot \sin\alpha$ $\quad |\hat{r}| = 1$

- ds je komadić od s po kojem integriramo

$$d\vec{s} \times \hat{r} = ds \cdot \sin\alpha = ds \cos\theta$$

$$\alpha = 180° - \beta$$

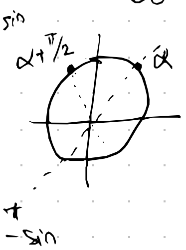
$$\beta = 90 - \phi$$

$$\alpha = 180° - 90 + \phi$$

$$\alpha = 90 + \phi$$

↳ isti sinus

↳ $\sin\alpha = \cos\theta$



ds preko $d\theta$ = ?

$$\operatorname{tg}\theta = \frac{s}{a}$$

$$s = \operatorname{tg}\theta \cdot a \rightarrow ds = a \frac{1}{\cos^2\theta} d\theta$$

$$\cos\phi = \frac{a}{r} \Rightarrow r = \frac{a}{\cos\phi}$$

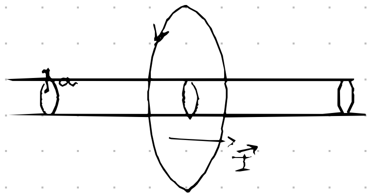
$$\frac{1}{r^2} = \frac{\cos^2\phi}{a^2}$$

$$d\vec{s} \times \hat{r} = \frac{a}{\cos\theta} d\theta$$

$$\Rightarrow \vec{B} = \frac{\mu_0 I}{4\pi} \int \frac{a\, d\theta}{\cos\theta} \cdot \frac{1}{r^2}$$

$$B = \frac{\mu_0 I}{4\pi} \int \frac{\cancel{a}}{\cancel{\cos\theta}} \cdot \frac{\cos^{\cancel{2}}\theta}{a^{\cancel{2}}} d\theta = \boxed{\frac{\mu I}{4\pi} \int \cos\theta\, d\theta}$$

3.



$$\oint \vec{B}\,d\vec{l} = \mu_0 \iint \vec{J}\, d\vec{A} = \mu_0 I_{ZAT.}$$

a) $r > a$

$$\oint B dl = B \int dl = B 2 r \pi$$

b) $r < a$

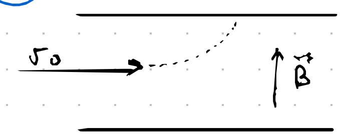
$$J = \frac{I}{\pi a^2}$$

$$\oint B \cdot dl = 2 r \pi$$

$$\mu_0 I_{zat} = \mu_0 \iint J \cdot dA = \frac{\mu_0 I}{\pi a^2} r^2 \pi$$

$$B 2 r \pi = \frac{\mu_0 I r^2 \pi}{\pi a^2} \Rightarrow B = \frac{\mu_0 I r}{2 \pi a^2}$$

4.



$V_0 \hat{x}$

$\vec{B} = B_0(\hat{y} - \hat{z})$

$F_L = ?$

$F_L = q \vec{v} \times \vec{B} \quad q = e$

→ ovdje smijemo tako rješavati jer mi samo gledamo moment kada uđe u polje i ima samo x komponentu

$$F_L = q \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ v_0 & 0 & 0 \\ 0 & B_0 & -B_0 \end{vmatrix} = q\left(0\hat{x} + v_0 B_0 \hat{y} + v_0 B_0 \hat{z}\right)$$

$$F_L = q v_0 B_0 (\hat{y} + \hat{z}) \rightarrow |F_L| = \sqrt{2 (q v B_0)^2} = \sqrt{2}\, q v B_0$$

5. $\vec{\nabla} \vec{E}$.

$$E = E_x \sin(\omega t - kz)\hat{x} + E_y(\omega t - kz)\hat{y}$$

$$\vec{\nabla} = \frac{\partial}{\partial x}\hat{x} + \frac{\partial}{\partial y}\hat{y} + \frac{\partial}{\partial z}\hat{z}$$

$$\vec{\nabla} \vec{E} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ E_x \sin(\omega t - kz) & E_y(\omega t - kz) & 0 \end{vmatrix} = \hat{x}(0 + E_y k) - \hat{y}(0 + E_x k \cos(\omega t - kz)) + \cancel{\hat{z}\,0}$$