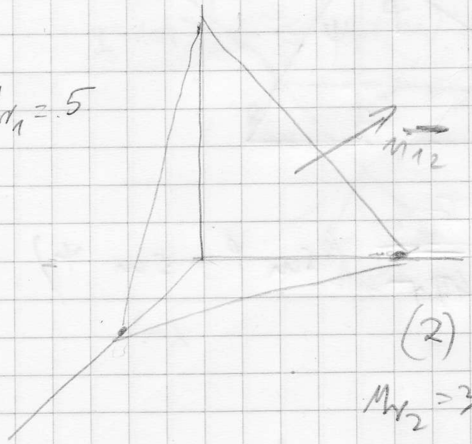
(12.)

$$H_1 = \frac{3a_x - 0.5a_y}{\mu_0} \qquad B_1 = 15\vec{a_x} - 2.5\vec{a_y}$$



$\mu_{r1} = 5$

$$\vec{n_{12}} = \frac{6\vec{a_x} + 4\vec{a_y} + 3a_z}{\sqrt{61}}$$

(2)

$\mu_{r2} = 3$

$$\vec{H_2} = \underbrace{H_x}_{\frac{B_x}{\mu_0\mu_{r2}}}\vec{a_x} + \underbrace{H_y}_{\frac{B_y}{3\mu_0}}\vec{a_y} + \underbrace{H_z}_{\frac{B_z}{3\mu_0}}\vec{a_z}$$

$\underline{I}$ $\vec{n_{12}} \times (H_2 - H_1) = 0 = \begin{vmatrix} \vec{a_x} & \vec{a_y} & \vec{a_z} \\ \frac{6}{\sqrt{61}} & \frac{4}{\sqrt{61}} & \frac{3}{\sqrt{61}} \\ \frac{B_x}{3\mu_0} - \frac{3 \cdot 3}{3\mu_0} & \frac{B_y}{3\mu_0} + \frac{3 \cdot 0.5}{3\mu_0} & \frac{B_z}{3\mu_0} \end{vmatrix} = 0$

$$\begin{vmatrix} \vec{a_x} & \vec{a_y} & \vec{a_z} \\ 6 & 4 & 3 \\ B_x - 9 & B_y + 1.5 & B_z \end{vmatrix} = 0 \Rightarrow \begin{array}{ll} 4B_z - 3B_y - 4.5 = 0 & (1) \\ -6B_z + 3B_x - 27 = 0 & (2) \\ 6B_y + 9 - 4B_x + 36 = 0 & (3) \end{array}$$

$\underline{II}$ $\vec{n_{12}} \cdot (\vec{B_2} - B_1) = 0$

$$\frac{1}{2}B_x - \frac{27}{6} = B_z$$
$$\frac{2}{3}B_x - \frac{45}{6} = B_y$$

$$\frac{6a_x + 4\vec{a_y} + 3\vec{a_z}}{\sqrt{61}}\left((B_x - 15)a_x + (B_y + 2.5)\vec{a_y} + B_z a_z\right) = 0 \quad / \cdot \sqrt{61}$$

$+10$

-90

$$6 \cdot (B_x - 15) + 4 \cdot (B_y + 2.5) + 3B_z = 0 \qquad (4)$$

$$6B_x + 4B_y + 3B_z = 80$$

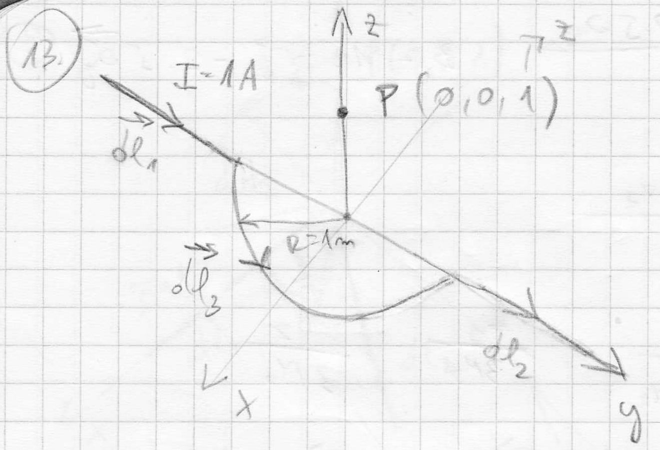
13.5

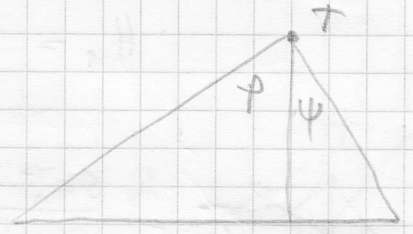
30

$$6B_x + \frac{8}{3}B_x - \frac{180}{6} + \frac{3}{2}B_x - \frac{81}{6} = 80$$

$$10.16\,B_x = 123.5 \longrightarrow B_x = 12.15$$

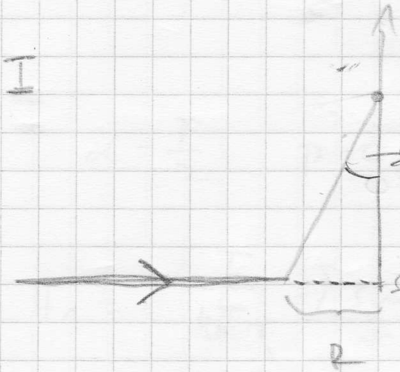
13.





$$\vec{H} = \vec{a_\alpha}\frac{I}{4\pi r}(\sin\varphi + \sin\psi)$$

I



$$\sin\varphi = \frac{R}{\sqrt{z^2+R^2}}$$

$$\sin\varphi = \frac{1}{\sqrt{2}}$$

→ kao da imamo beskonačan pravac umanjen za ostatak dio

↓

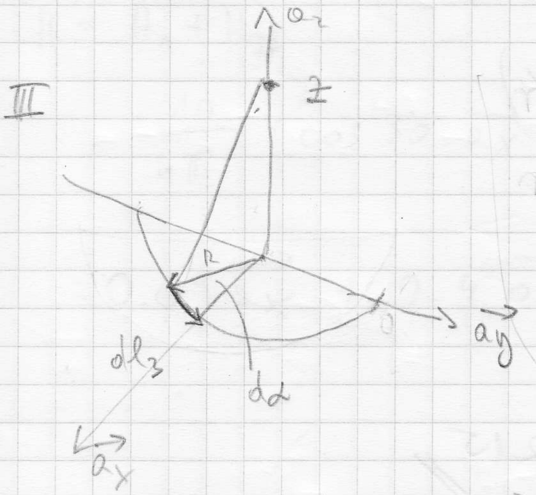
$$\vec{H} = \vec{a_\alpha}\frac{I}{4\pi r}(\sin\varphi + \sin 0)$$

$$\vec{H_1} = \frac{I}{4\pi R}(\sin 90 + \sin 0) - \frac{I}{4\pi R}\left(\sin\frac{1}{\sqrt{2}} + \sin 0\right)\left(\vec{a_x}\right)$$

II isti slučaj

$$\vec{H_{12}} = \frac{I}{2\pi R} - \frac{I}{2\pi R}\cdot\sin\varphi = \frac{I}{2\pi R}\left(1 - \frac{1}{\sqrt{2}}\right)$$

III

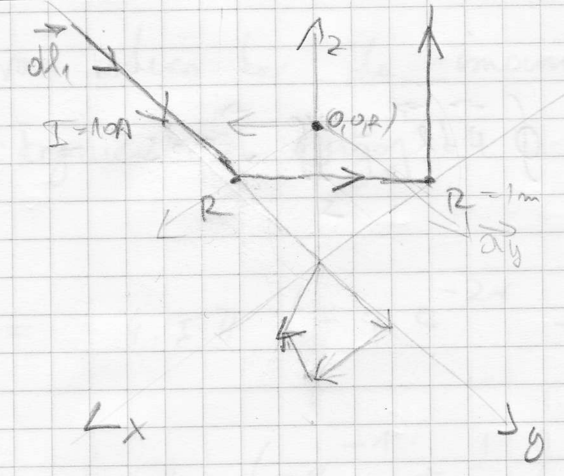


$$\left.\begin{aligned}\vec{r} &= z\vec{a_z}\\ \vec{r}' &= R\,\vec{a_r}\end{aligned}\right\} R = z\vec{a_z} - R\vec{a_r}$$

$$dl = R\,d\alpha$$

$$H_3 = \frac{I}{4\pi}\int\frac{z\cos\alpha\,\vec{a_x} + z\sin\alpha\,\vec{a_y} + R a_z}{\sqrt{(R^2+z^2)}^3}R\,d\alpha$$

16.



I

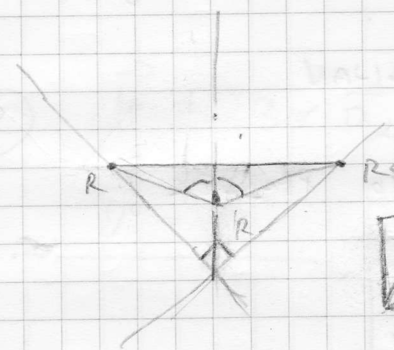
$$H_1 = \frac{I}{4\pi R}(\sin 90 + \sin 0) - \frac{I}{4\pi R}(\sin\alpha + \sin 0)$$

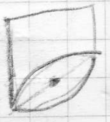
$$\sin\alpha = \frac{1}{\sqrt{2}}$$

$$\vec{H_1} = \frac{I}{4\pi R}\left(1 - \frac{1}{\sqrt{2}}\right)(\vec{a_x})$$

r_1

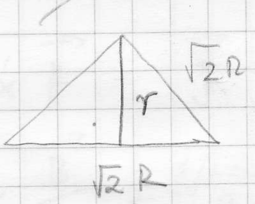
II



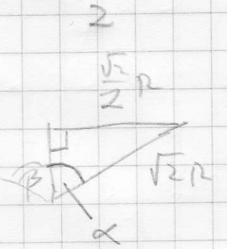


$$\vec{H_2} = \frac{I}{4\pi r_2}(\sin\alpha + \sin\beta)$$

$$\vec{H_2} = \frac{I}{4\pi r_2}(\sin 30^\circ + \sin 30^\circ)$$ (smjer okomit na obje premne dolje)

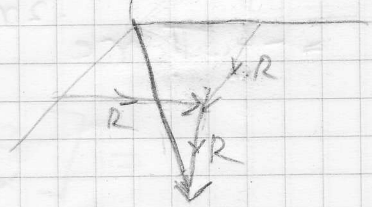


$$r = \frac{\sqrt{2}\,R\sqrt{3}}{2} = v_{vis} = \frac{a\sqrt{3}}{2}$$

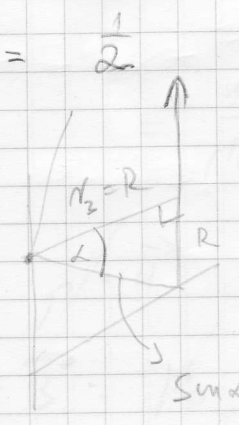


$$\sin\alpha = \frac{1}{2}$$

$$\frac{\vec{a_x} + \vec{a_y} - \vec{a_z}}{\sqrt{3}}$$



III



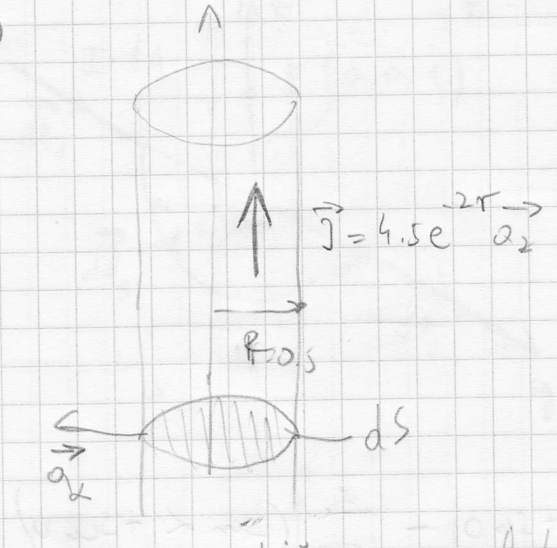
$$\vec{H_3} = \frac{I}{4\pi r_3}(\sin 45 + \sin 90)(\vec{a_y})$$

$$\vec{H_3} = \frac{I}{4\pi R}(\sin 45 + \sin 90)\vec{a_y}$$

$$\sin\alpha = \frac{R}{\sqrt{2}R}$$

$$\vec{H} = \vec{H_1} + \vec{H_2} + \vec{H_3}$$

19



$$\oint \vec{H}\, d\vec{l} = \iint_S \vec{J}\, n\, dS = I$$

I unutar vodiča ne obuhvatim cijelu struju već samo dio

$$I = \iint 4.5 e^{-2r} \vec{a_z}\, dS = \cancel{\int_0^z dz} \underbrace{\int_0^r r}_{\text{JAKOBIJAN}}\, 4.5 e^{-2r} \vec{a_z}\, dr \int_0^{2\pi} d\alpha$$

POVRŠINA TI JE SAMO PRESJEK !

$$I = 4.5 \cdot 2\pi \int_0^r r \cdot e^{-2r}\, dr = \left| \begin{matrix} u = r & du = dr \\ dv = e^{-2r} & v = -\frac{1}{2} e^{-2r} \end{matrix} \right|$$

$$= 4.5 \cdot 2\pi \cdot \left(-\frac{1}{2} e^{-2r} \cdot r \right) + 4.5 \cdot \cancel{2}\pi \frac{1}{\cancel{2}} \int_0^r e^{-2r}$$

$$= -4.5\pi\, r e^{-2r} - \frac{4.5\pi}{2} \left(e^{-2r} - 1 \right)$$

$$I = \oint H\, d\vec{l} = 2r\pi \cdot \vec{H}_1$$

$$\vec{H}_1 = \frac{\overset{2.25}{\cancel{4.5}}\cancel{\pi} \left(-re^{-2r} + \frac{1}{2}(1 - e^{-2r}) \right)}{\cancel{2} r \cancel{\pi}}$$

$$H_1 = \frac{1.125}{r} \left(-2re^{-2r} + 1 - e^{-2r} \right) \vec{a_\alpha}$$

II van vodiča kao da imamo skoncentrisanu struju u jednoj strujnici u drugoj

$$I = 4.5\pi \left(-r e^{-2r} + \frac{1}{2} - \frac{1}{2} e^{-2r} \right) \Bigg|_{r=0.5}$$

$$I = 4.5\pi \cdot \left(-e^{-1} + \frac{1}{2} \right)$$

$$\vec{H}_2 = \frac{\cancel{4.5\pi}}{\cancel{2r\pi}} \cdot \left(-e^{-1} + \frac{1}{2} \right) = \frac{0.297}{r} \vec{a_\alpha}$$

za $r > 0.5$

(20) $\vec{H} = 3r \, \vec{a_\alpha}$ CILINDRIČNI VODIČ

$\vec{J} = ?$

$$B = \mu_0 \cdot H$$

$$\nabla \times \vec{H} = \vec{J}$$

u cilindričnom

$$\nabla \times \frac{\vec{B}}{\mu_0} = \frac{1}{\mu_0} \Bigg(\vec{a_r} \cancel{\left(\frac{1}{r} \frac{\partial B_z}{\partial \alpha} - \frac{\partial B_\alpha}{\partial z} \right)}^{\to 0} +$$

$$+ \vec{a_\alpha} \cancel{\left(\frac{\partial B_r}{\partial z} - \frac{\partial B_z}{\partial r} \right)}^{\to 0} +$$

$$+ a_z \frac{1}{r} \left[\frac{\partial}{\partial r} (r B_\alpha) - \frac{\partial B_r}{\partial \alpha} \right] =$$

$$= \frac{1}{\mu_0} \cdot \left[\frac{1}{r} (6r) - 0 \right] = \frac{1}{\mu_0} \cdot 6 \, \vec{a_z}$$

$$\nabla \times \vec{B} = \mu_0 \cdot \vec{J} \qquad \vec{B} = \mu_0 \cdot \vec{H}$$

$$\vec{J} = 6 \, \vec{a_z}$$