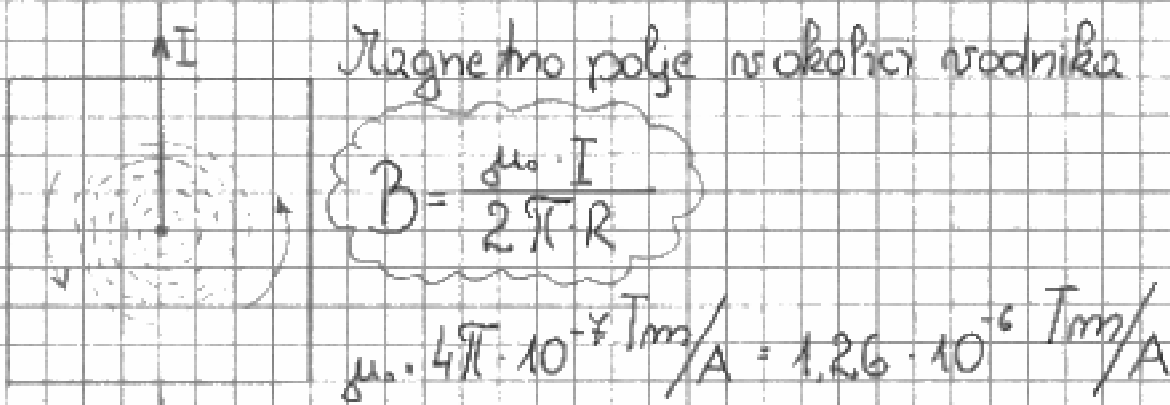
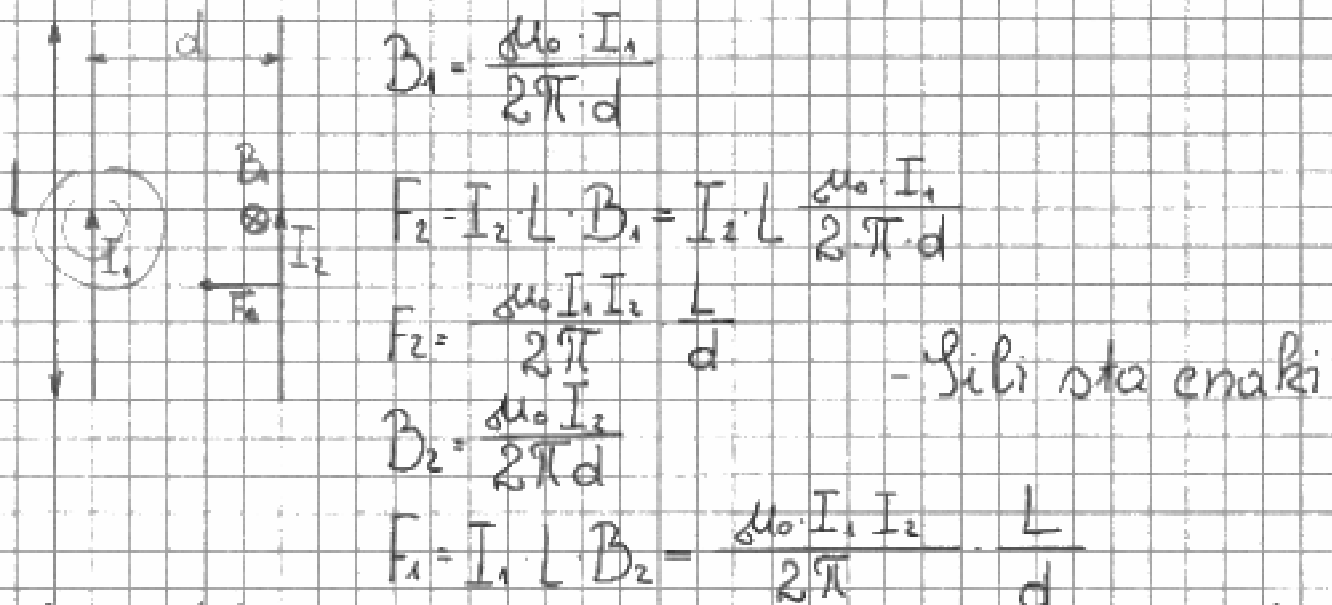


Magnetno polje zaradi električnega toka



Pravilo desne roke

Sila med vodniki

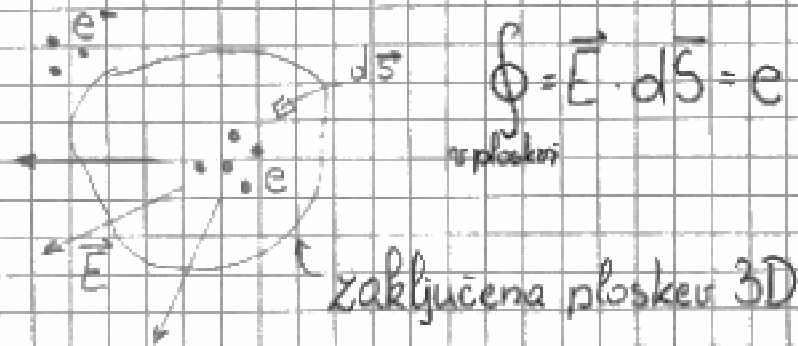


- Paralelna tokovna se privlačita, antiparalelna pa odbojata

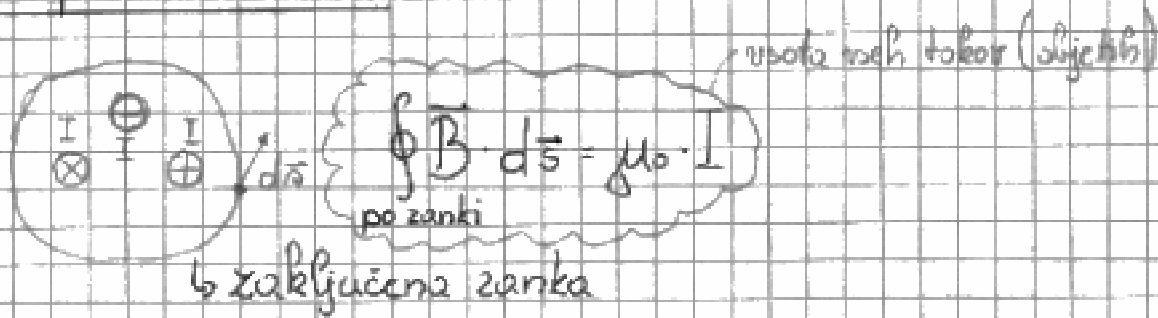
AMPEROV ZAKON

- Analogija Gaussovemu zakonu

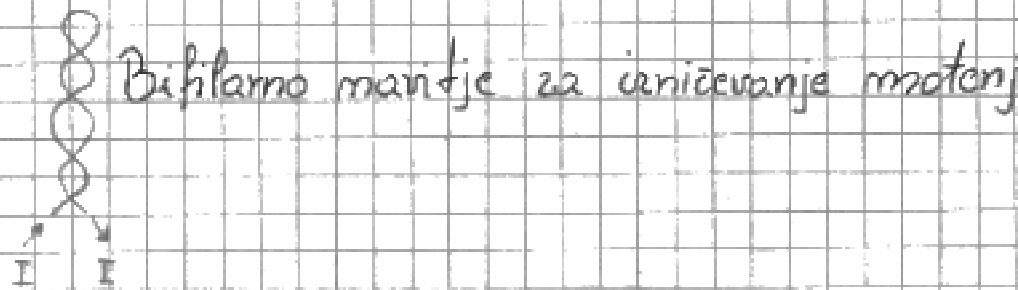
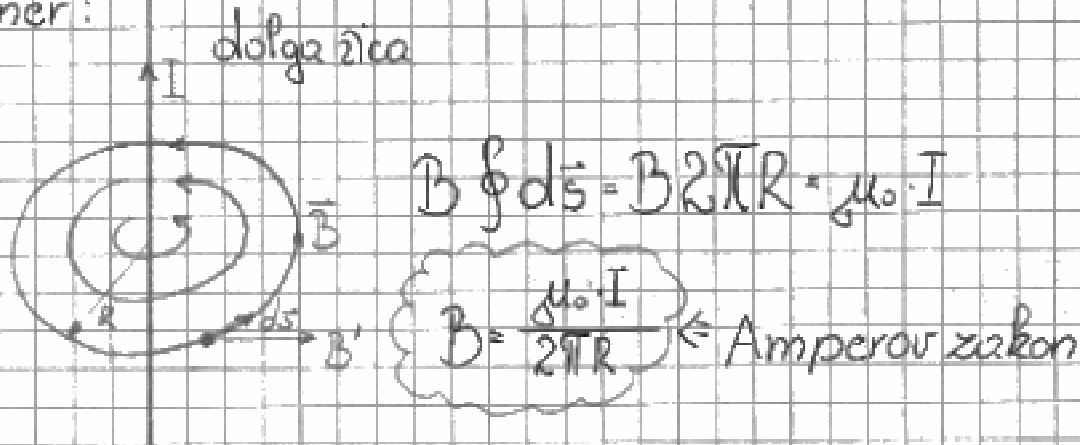
- Gaussov zakon:



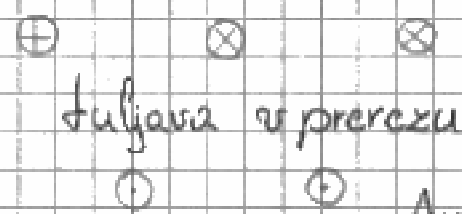
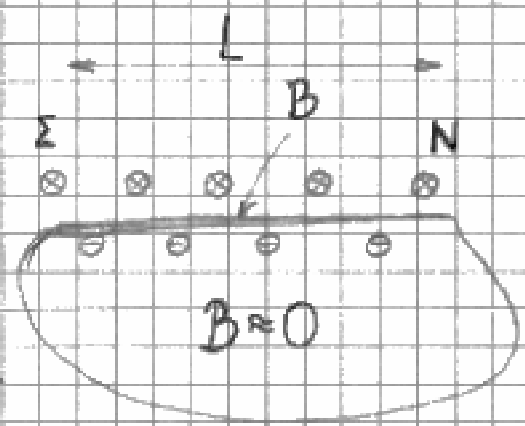
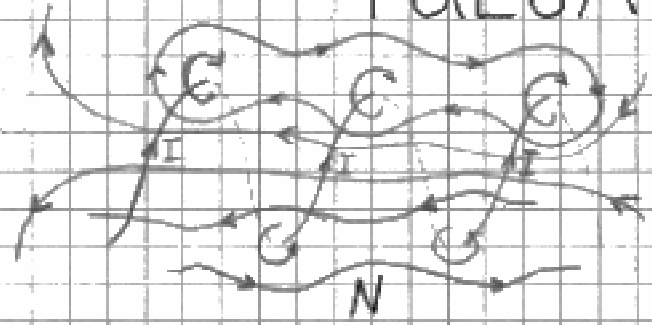
- Amperov zakon:



Primer:



TULJAVA



Priljubeno računano polje znotraj tuljave

Amperov zakon $\oint \vec{B} \cdot d\vec{s} = \mu \cdot N \cdot I$

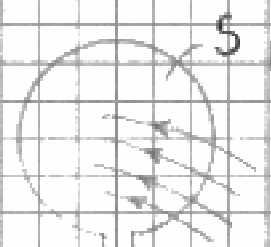
$$\oint \vec{B} \cdot d\vec{s} = \underbrace{\int_{\text{zunaj}} \vec{B} \cdot d\vec{s}}_{\approx 0} + \underbrace{\int_{\text{znotraj}} \vec{B} \cdot d\vec{s}}_{B \cdot L}$$

$$B \cdot L = \mu \cdot N \cdot I$$

$$B = \frac{\mu \cdot N \cdot I}{L}$$

magnetno polje znotraj tuljave

Indukcija



S površina

magnetni pretok $\Phi_{\text{m}} = B \cdot S$

$$\Phi_{\text{m}} = \vec{B} \cdot \vec{S} = B \cdot S \cdot \cos \varphi$$

φ - kot med pravokotnico na ravnici in \vec{B}

Faradayev zakon indukcije

$$U_{\text{i}} = \frac{d\Phi_{\text{m}}}{dt}$$

↑
inducirana

spr. magnetnega pretoka

za inducirano napetost lahko

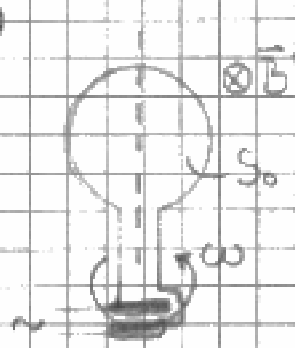
spreminjamo: - velikost B

- smer \vec{B} (raztegujemo zanko)

- S

- smer \vec{S} (vrtimo zanko)

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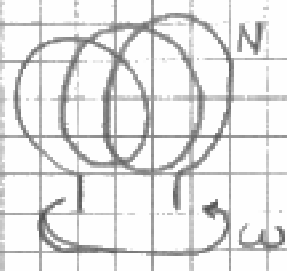


\vec{B} konstant

$$\Phi_m = \vec{B} \cdot \vec{S} = B \cdot S_0 \cdot \sin \omega t$$

$$U_i = \underbrace{B \cdot S_0 \cdot \omega}_{U_0} \cos \omega t = U_0 \cdot \cos \omega t$$

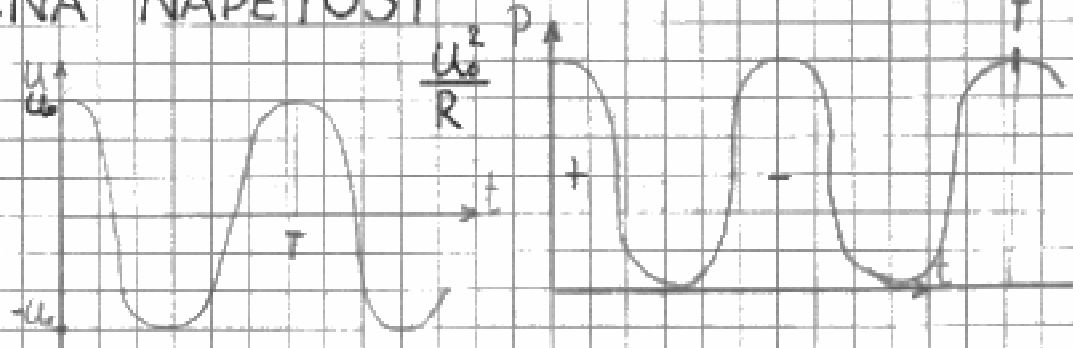
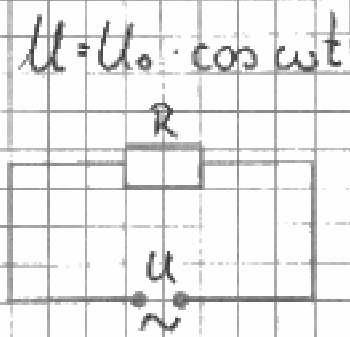
S številom navojev ali večjo hitrosti vrtenja se inducirana napetost poveča



$$\Phi_m = N \cdot \vec{B} \cdot \vec{S}$$

$$U_i = \underbrace{N \cdot B \cdot S_0 \cdot \omega}_{U_0} \cos \omega t$$

IZMENIČNA NAPETOST



$$P = U \cdot I = \frac{U^2}{R} = \frac{U_0^2}{R} \cos^2 \omega t$$

Kač miha med 0 in P_0 $P_0 = \frac{U_0^2}{R}$

Povprečna moč je polovica moči P_0 (vs eni periodi)

$$\frac{1}{T} \int_0^T P \omega dt = \bar{P}$$

$$\bar{P} = \frac{1}{2} P_0 = \frac{U_0^2}{R}$$

$$\frac{1}{T} \left(\frac{1}{2} P_0 \cdot T \right) = \frac{1}{2} P_0$$

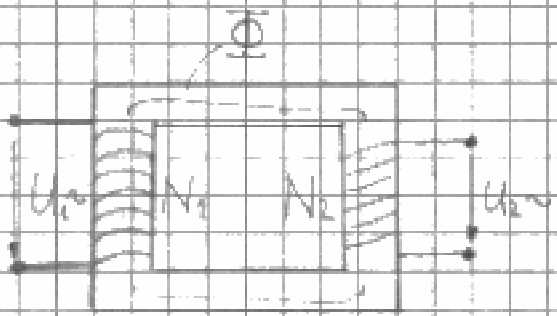
$$U_{\text{ef}} = \frac{U_0}{\sqrt{2}}$$

Kaksina kilita efektiivna enosmerna mapetost, ki bi
dajale isto moč

$$\overline{P} \left(\frac{U_0}{\sqrt{2}} \right)^2 \frac{1}{R} = \frac{U_{ef}}{R} \Rightarrow U_{ef} = \frac{U_0}{\sqrt{2}} \approx \frac{U_0}{1,4}$$
$$230V \Rightarrow \underline{\underline{U_0 = 325V}}$$

Transformator

6.3.2007



indukcija: $U_i = \frac{d\Phi}{dt}$

(Soremembra magnetnega pretoka)

Obe tuljeni umata isti magnetni pretok:

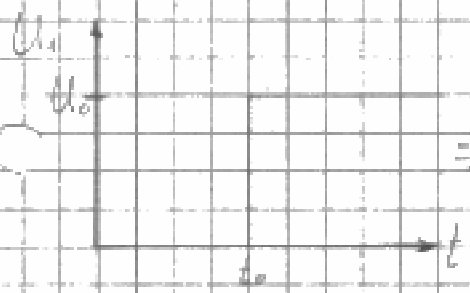
$$\frac{U_1}{N_1} = \frac{U_2}{N_2}$$

Zanka z N meraji:

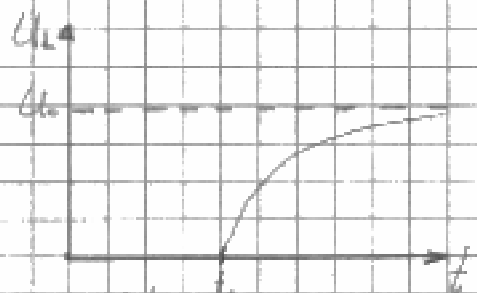
$$U_i = N \cdot \frac{d\Phi}{dt}$$

$$U_2 = \frac{N_2}{N_1} \cdot U_1$$

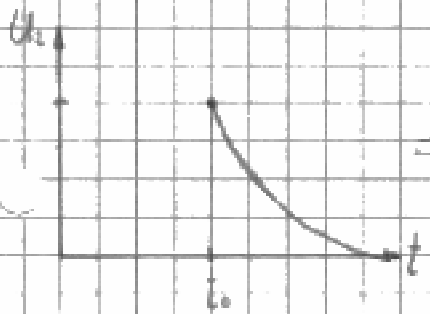
Če priklopimo mapetost enosmerno na transformator:



⇒ transformator ⇒ $\Phi(t) \propto I(t)$



$$U_2(t) = \frac{N_2}{N_1} \cdot \frac{d\Phi}{dt} \propto \frac{N_2}{N_1} \cdot \frac{dI}{dt}$$



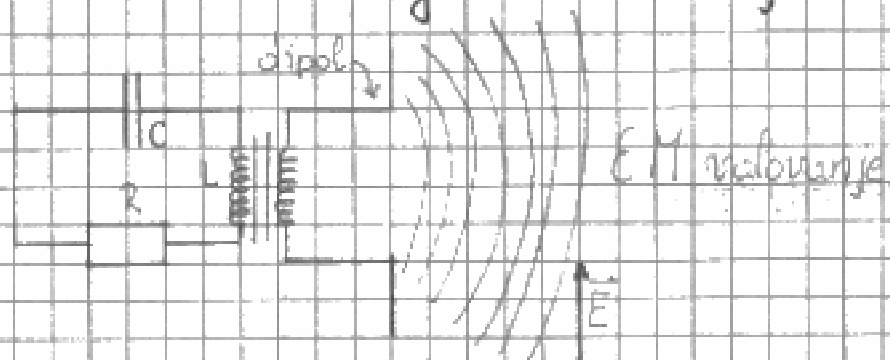
Transformator ne deluje na ~ mapetost, ker je $\frac{d\Phi}{dt}$ različen od Φ samo malo časa

$$P_1 = P_2 \Rightarrow U_1 \cdot I_1 = U_2 \cdot I_2 \Rightarrow \frac{U_1}{U_2} = \frac{I_2}{I_1}$$

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Transformator transformira tokove v obratnem razmerju kot napetosti.

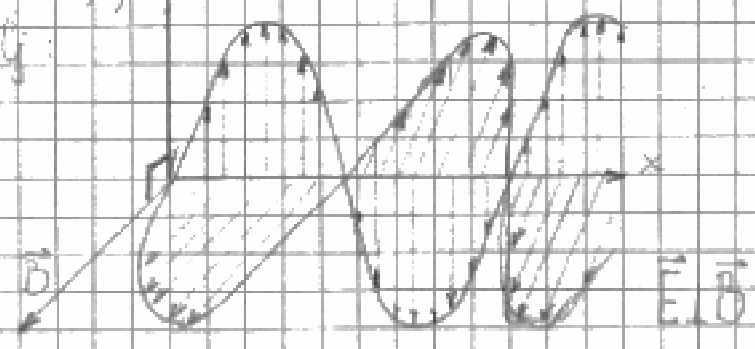
Elektromagne tno valovanje



V limiti velikih razdalj:

$$\vec{E} = E_0 \sin(kx - \omega t)$$

$$\vec{B} = B_0 \sin(kx - \omega t)$$



$$\frac{E}{B} = c$$

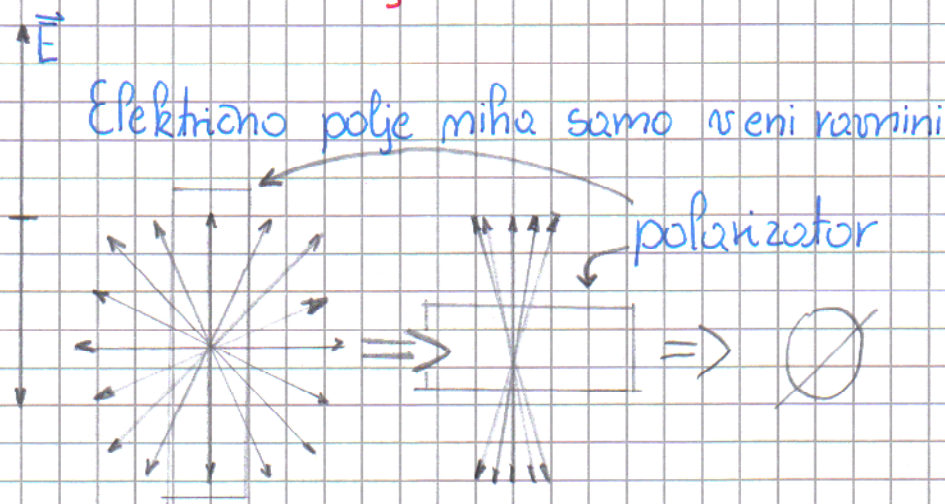
$$c = \frac{1}{\sqrt{\mu_0 \cdot \epsilon_0}} \approx 3 \cdot 10^8 \text{ m/s} = 3 \cdot 10^5 \text{ km/s}$$

Svetlobno leto: pot, ki ga svetloba prepotuje v enem letu

$$x = v \cdot t = c \cdot t = 3 \cdot 10^5 \text{ km/s} \cdot 365 \cdot 24 \cdot 60 \cdot 60 = 157 \cdot 10^{11} \text{ km}$$

$\vec{E} \times \vec{B}$ → kaže v smeri razširjanja valovanja

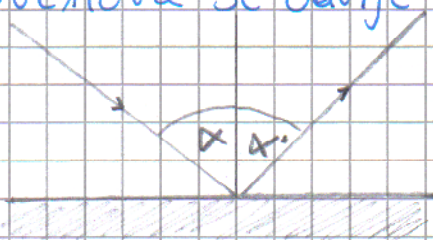
Polarizacija



Lom Svetlobe

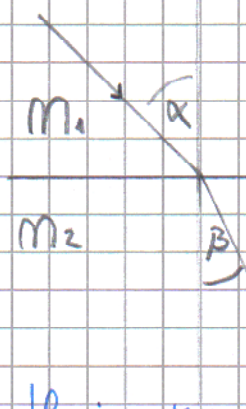
$$n = \frac{c_0}{c} \quad n \geq 1 \text{ (lomnikohnik)}$$

Svetlobe se odbojijo pod istim kotom, pod katerim je prišle



1) Pri odbojni zaton $\alpha = \alpha'$

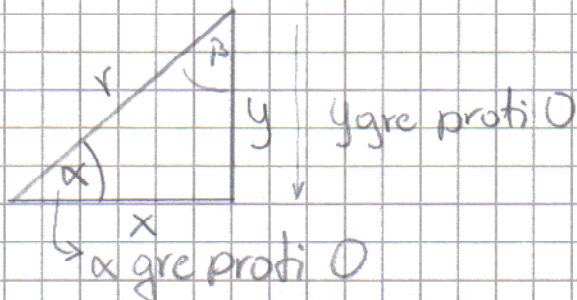
2) Lomni zakon:



$$n_1 \cdot \sin \alpha = n_2 \cdot \sin \beta$$

$$\frac{\sin \alpha}{\sin \beta} = \frac{n_2}{n_1}$$

Totalni odboj: za določene kote lomni zakon ne velja (kadar je kot β večji od 90° se začne svetloba odbojati. Ta kot se imenuje kritični kot φ_c)



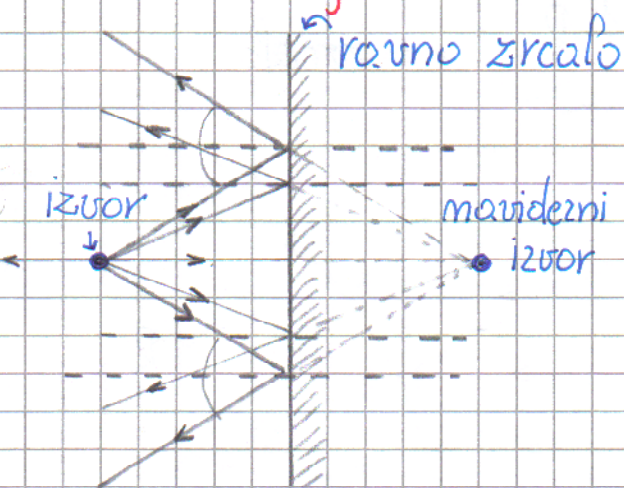
$$\frac{y}{r} = \sin \alpha$$

$$\frac{x}{r} = \cos \alpha$$

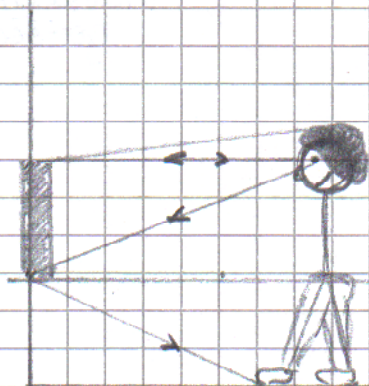
$$\frac{y}{x} = \operatorname{tg} \alpha$$

$$\frac{x}{r} = \sin \beta ; \frac{y}{r} = \cos \beta ; \frac{x}{y} = \operatorname{tg} \beta$$

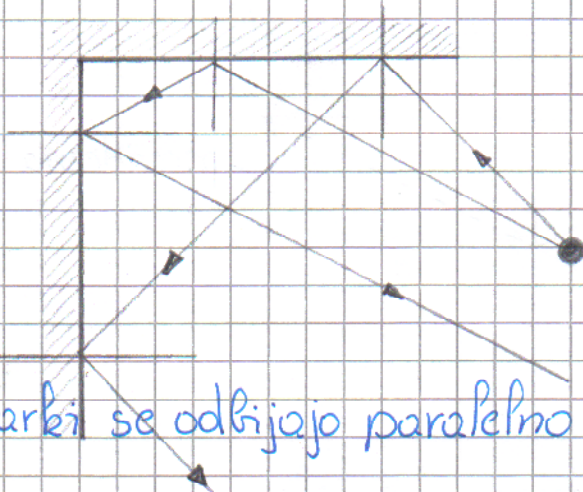
Odboj svetlobe zrcala



Primer: Kako veliko ogledalo potrebujem, da se vidim v ogledalu?

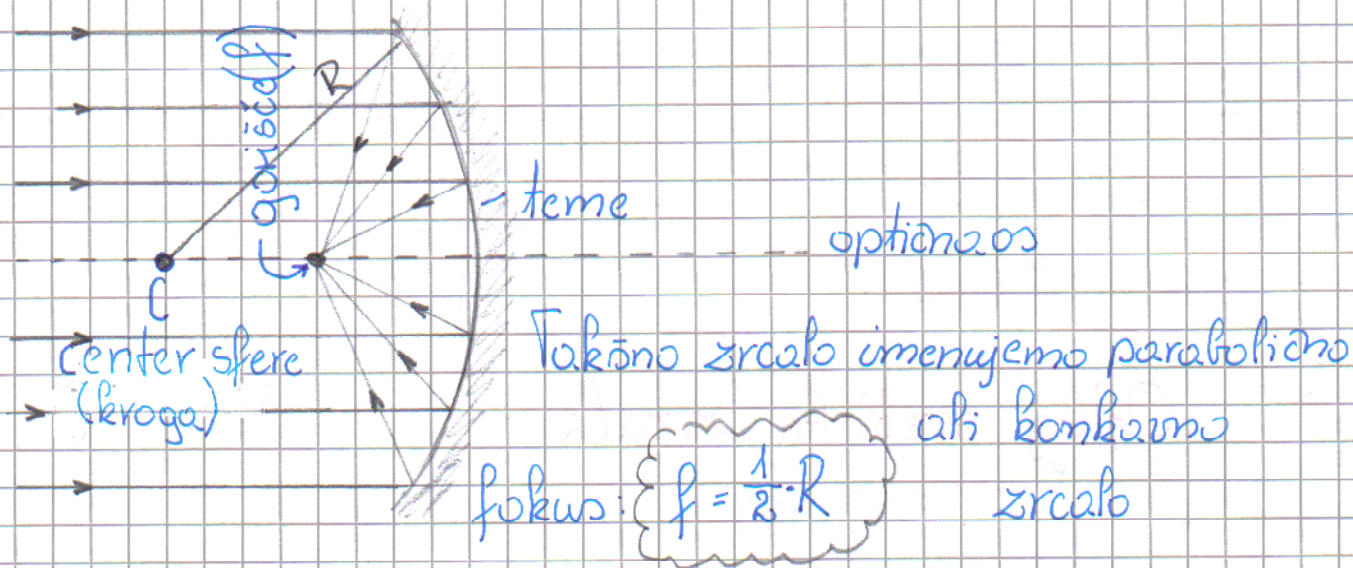


Ogledalo je lahko za polovice manjše, kot je velika oseba, ki se gleda vanj.



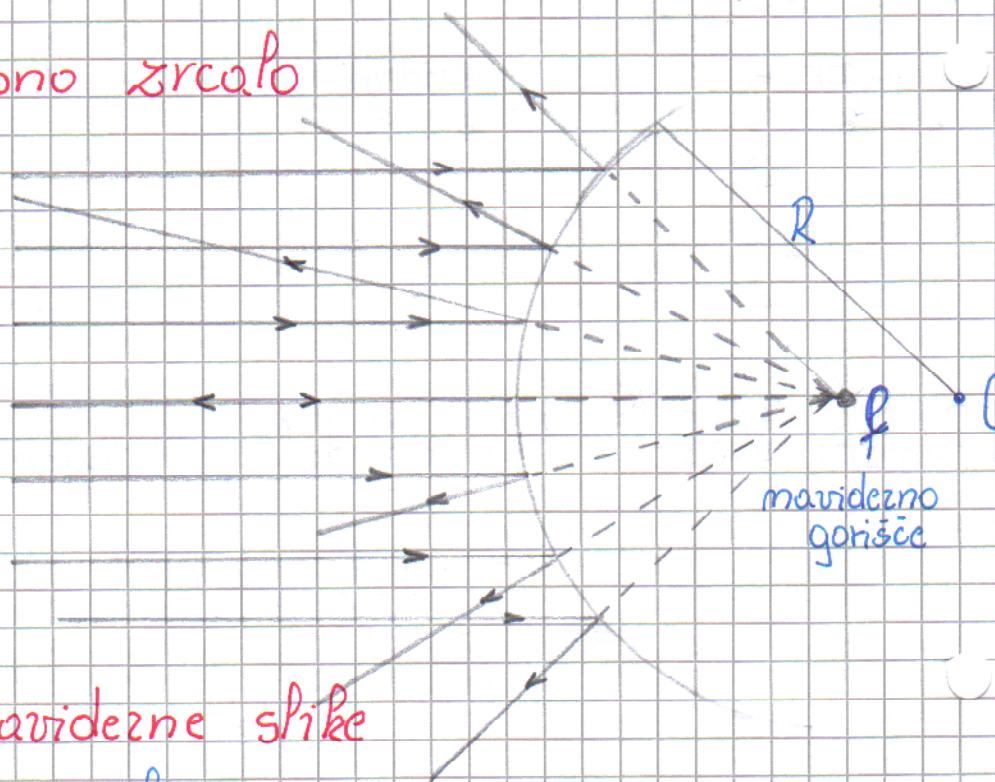
Pravo kotno zrcalo: žarki se odbijajo paralelno

Sferično zrcalo

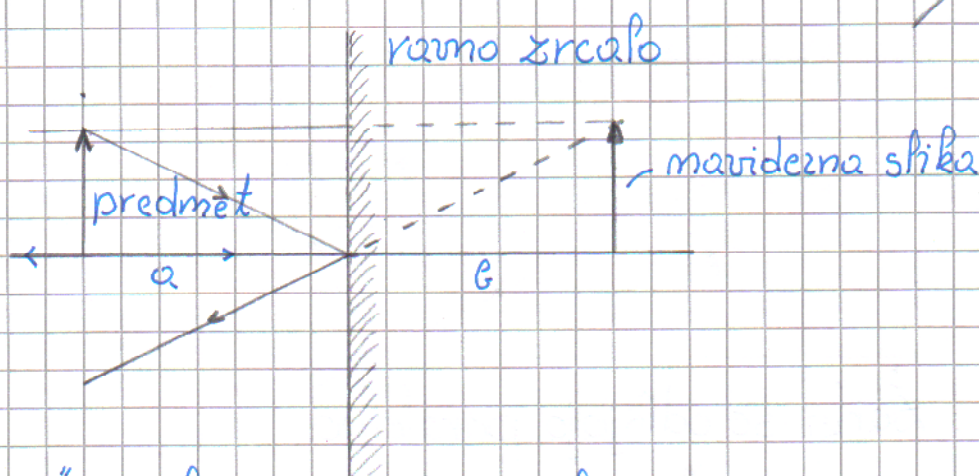


Konvexno zrcalo

$$f = \frac{1}{2} \cdot R$$

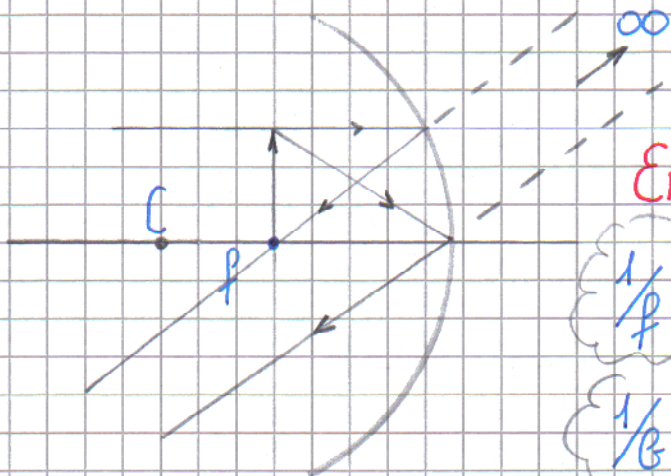
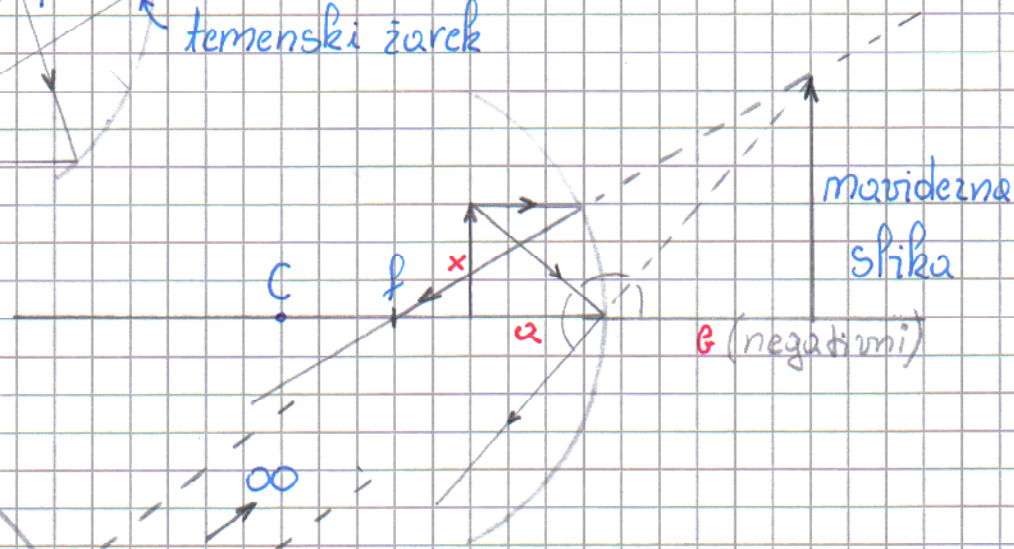
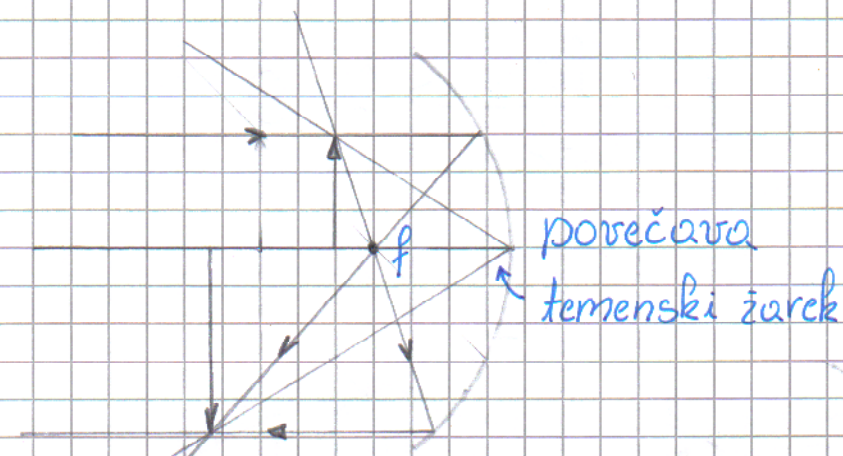
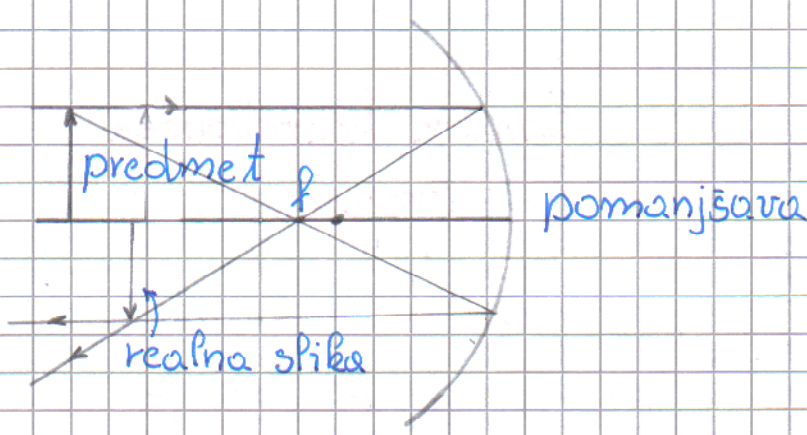


Realne in navidezne slike



enačba ravnega zrcala

$$a = g$$



Enačba sfernega zrcala

$$\frac{1}{f} = \frac{1}{a} + \frac{1}{G}$$

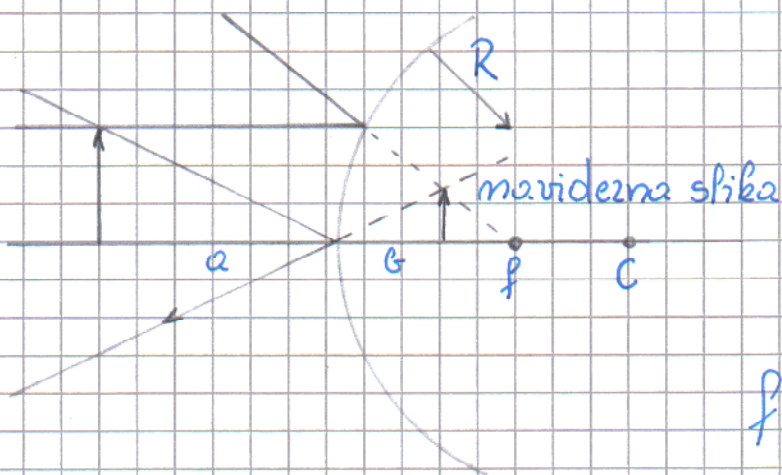
$$\frac{1}{G} = \frac{1}{f} - \frac{1}{a}$$

$$G = \frac{1}{\frac{1}{f} - \frac{1}{a}} = \frac{f \cdot a}{a - f}$$

$$y = x \cdot \frac{f}{a - f}$$

povečava

Konvekčno zrcalo



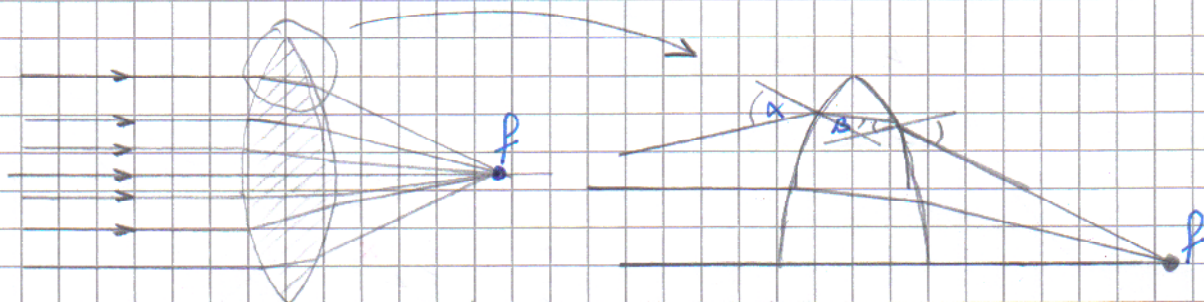
Enačba konveksnega zrcala

$$\frac{1}{f} = \frac{1}{a} + \frac{1}{g}$$

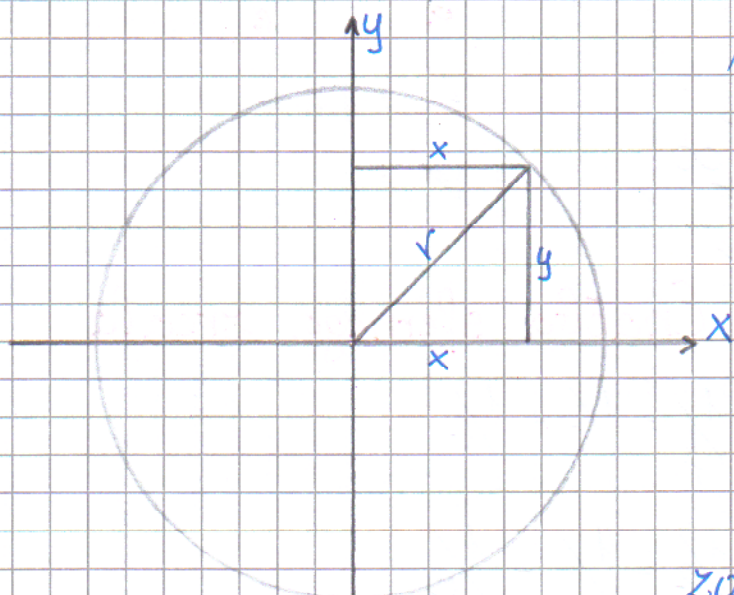
$$f = \frac{1}{2}R \quad R < 0 \Rightarrow f < 0$$

$$g = \frac{fa}{a-f} \Rightarrow g < 0$$

LEČE



$$\sin \alpha = n \cdot \sin \beta$$



$$x^2 + y^2 = r^2$$

$$y^2 = r^2 - x^2$$

$$y = \pm \sqrt{r^2 - x^2}$$

za majhen $x \ll r$

$$y = \sqrt{r^2 \left(1 - \left(\frac{x}{r}\right)^2\right)} = r \sqrt{1 - \left(\frac{x}{r}\right)^2}$$

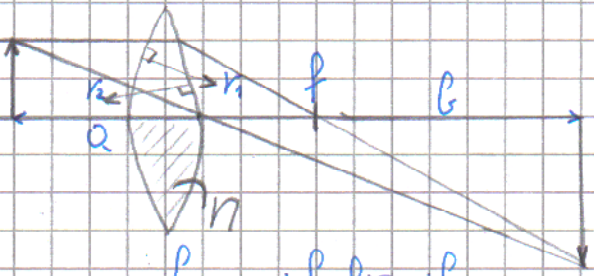
$$= r \cdot \left(1 - \left(\frac{x}{r}\right)^2\right)$$

$$x \ll r \Rightarrow \frac{x}{r} \ll 1$$

$$y \approx r \left[1 - \frac{1}{2} \left(\frac{x}{r}\right)^2\right]$$

$$y \approx r - \frac{1}{2}r \left(\frac{x}{r}\right)^2$$

Enačba leče (Bikonveksna)



$$\frac{1}{f} = \frac{1}{a} + \frac{1}{g}$$

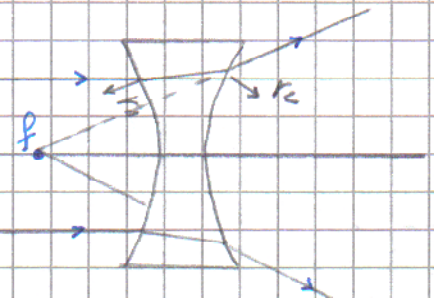
$$\frac{1}{f} = (n-1) \left(\frac{1}{r_1} - \frac{1}{r_2} \right)$$

krivinski radij
(moraš paziti predznake)

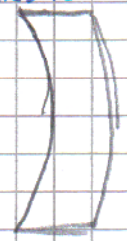
lomni količnik

$$\frac{1}{f} = D \text{ (dioptrija)}$$

(Bikonkavna)



konvexno-konkavna



plan-konkavna

