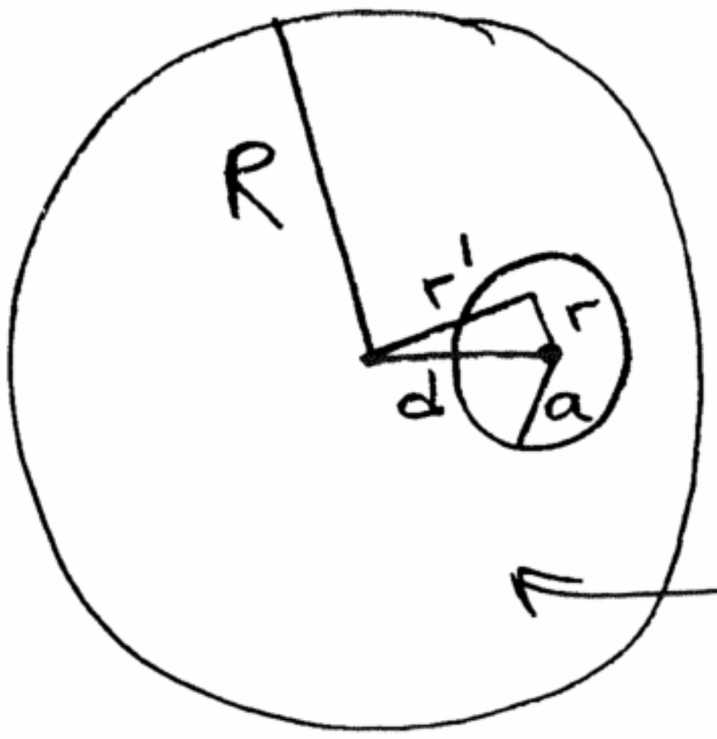
P24.14 Benson

$R > d > a$



$$Q = \frac{4\pi}{3} R^3 \rho$$

einleitt ρ

a) sýna að $\bar{E}$ sé einsleitt í holrúminu

Einsleit kúla með R, ρ

$$\rightarrow \bar{E}_1 = \frac{kQ\bar{r}'}{R^3} = \frac{k\bar{r}'}{R^3} \frac{4\pi}{3} R^3 \rho$$

$$= \frac{4\pi k \bar{r}'}{3} \rho$$

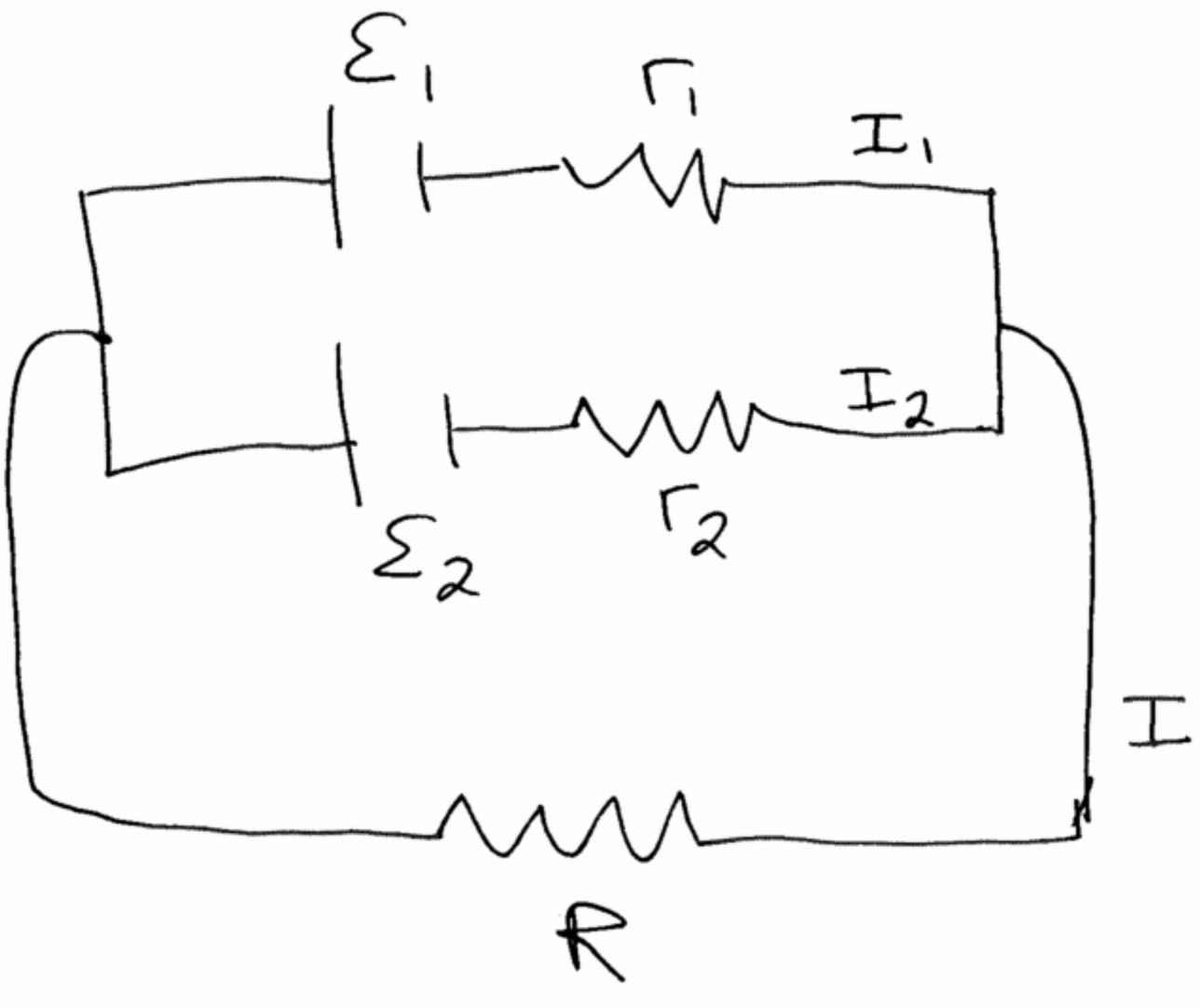
Einsleit kúla með $a, -\rho$

$$\rightarrow \bar{E}_2 = -\frac{4\pi k}{3} \bar{r} \rho$$

$$\bar{E}_{Total} = \bar{E}_1 + \bar{E}_2 = \rho(\bar{r}' - \bar{r})/(3\epsilon_0)$$

$$= \rho \bar{d}/(3\epsilon_0)$$

(2) P2815 Bousch



Varðveisla straums $\boxed{I = I_1 + I_2}$ (1)

1. lykkja $\mathcal{E}_1 - I_1 r_1 - IR = 0$ (2)

2. lykkja $\mathcal{E}_2 - I_2 r_2 - IR = 0$ (3)

Þurfum greinilega að losna við I_1 og I_2

$$\Sigma_1 - I_1 r_1 - IR = 0 \quad (2)$$

$$\Sigma_1 - (I - I_2) r_1 - IR = 0$$

$$(3) \rightarrow I_2 = \frac{\Sigma_2 - IR}{r_2}$$

$$(2) \rightarrow \Sigma_1 - I r_1 + \frac{\Sigma_2 - IR}{r_2} r_1 - IR = 0$$

$$\Sigma_1 + \frac{\Sigma_2 r_1}{r_2} - I r_1 - \frac{IR r_1}{r_2} - IR = 0$$

$$\Sigma_1 + \Sigma_2 \frac{r_1}{r_2} - I r_1 - IR\left(\frac{r_1}{r_2} + 1\right) = 0$$

$$\rightarrow \frac{1}{\left(\frac{r_1}{r_2} + 1\right)} \left\{ \Sigma_1 + \Sigma_2 \frac{r_1}{r_2} \right\} - \frac{I r_1}{\frac{r_1}{r_2} + 1} = IR$$

$$\rightarrow \frac{r_2}{r_1 + r_2} \left\{ \Sigma_1 + \Sigma_2 \frac{r_1}{r_2} \right\} - \frac{I r_1 r_2}{r_1 + r_2} = IR$$

$$\frac{r_1 r_2}{r_1 + r_2} \left\{ \frac{\Sigma_1}{r_1} + \frac{\Sigma_2}{r_2} \right\} - \frac{I r_1 r_2}{r_1 + r_2} = IR$$

leist sem

$$\Sigma_{eq} - I r_{eq} = IR$$

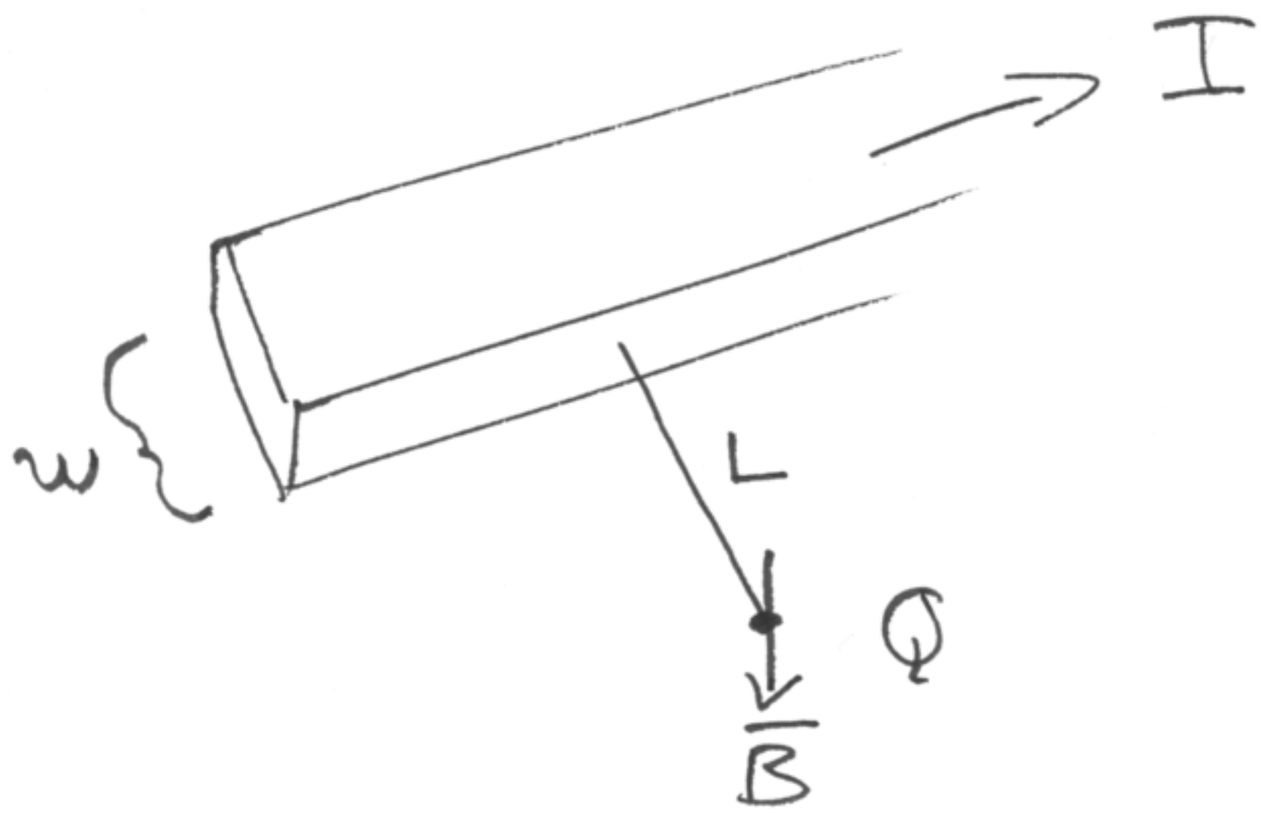
$$\rightarrow \boxed{\Sigma_{eq} = \frac{r_1 r_2}{r_1 + r_2} \left\{ \frac{\Sigma_1}{r_1} + \frac{\Sigma_2}{r_2} \right\}}$$

$$\boxed{r_{eq} = \frac{r_1 r_2}{r_1 + r_2} = \left\{ \frac{1}{r_1} + \frac{1}{r_2} \right\}^{-1}}$$

sýnt og búast
við

3

P30.6



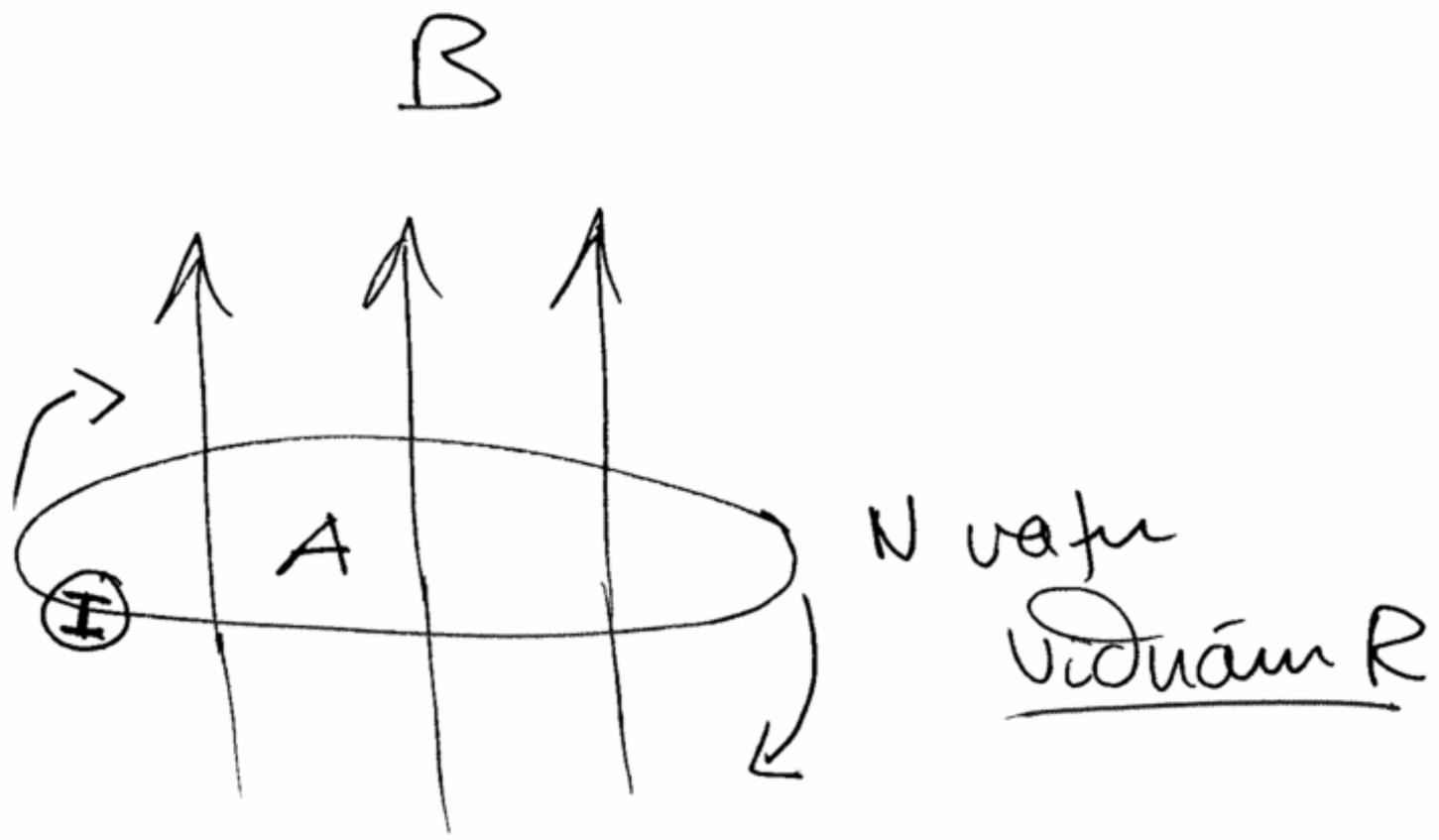
$$dB = \frac{\mu_0 dI}{2\pi x} \quad , \quad dI = I\frac{dx}{w}$$

$$|B| = \left| \frac{\mu_0 I}{2\pi w} \int_L^{L+w} \frac{dx}{x} \right|$$

$$= \frac{\mu_0 I}{2\pi w} \left(\ln(L+w) - \ln(L) \right)$$

$$= \frac{\mu_0 I}{2\pi w} \ln\left(\frac{L+w}{L}\right)$$

(4) (E31.16)



Reikna ΔQ um strauminn eftir snúning um 180°.

$$\Phi = BA$$

breyting vegna snúnings

$$\boxed{\Delta\Phi = -2BA}$$

ispenna $$\Sigma = -N\frac{\Delta\Phi}{\Delta t} = \frac{2NBA}{\Delta t}$$

en einnig gildir

$$\Sigma = IR = \frac{\Delta Q}{\Delta t}R$$

$$\rightarrow \Delta Q = 2NBA/R$$

5 E33.22

RLC-série

$C = 10\mu F$

$f = 50 Hz$

$i_0 = 2A$

$v_0 = 48V$

$\phi = -\pi/4$ ↘

a) fonte R

$$Z = \frac{V}{I} = \frac{v_0}{i_0} \qquad Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$\tan\phi = \frac{X_L - X_C}{R}$$

$$Z = R\sqrt{1 + \frac{(X_L - X_C)^2}{R^2}}$$

$$= R\sqrt{1 + \tan^2\phi}$$

$$\rightarrow R = \frac{Z}{\sqrt{1+\tan^2\phi}} = \frac{Z}{2}$$

↑ ↑

$\sqrt{2}$

$$Z^2 = R^2 + (X_L - X_c)^2$$

$$= R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2$$ allt pottí rema L

betra ~~co~~ nota

$$\tan\phi = -1 = \frac{\omega L - \frac{1}{\omega C}}{R}$$

$$\rightarrow \quad \omega L - \frac{1}{\omega C} = -R$$

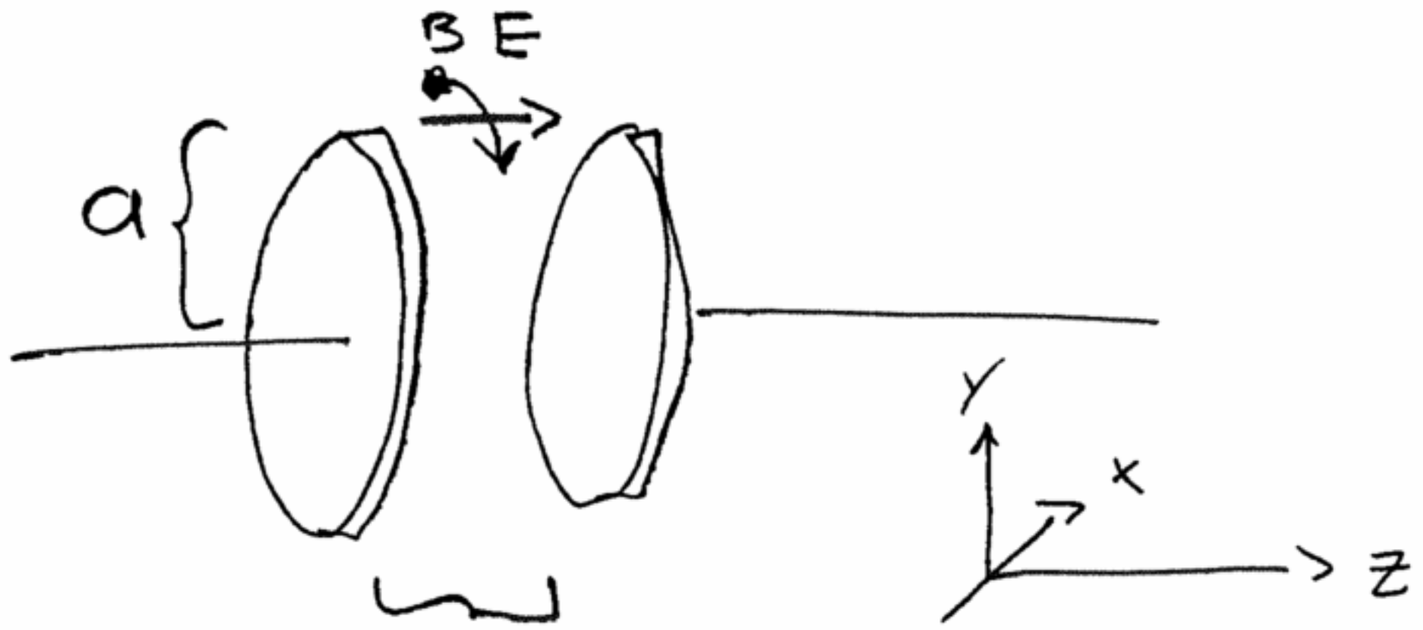
$$\rightarrow \omega L = \frac{1}{\omega C} - R$$

$$\rightarrow \quad L = \frac{1}{\omega^2 C} - \frac{R}{\omega} = \frac{1}{\omega}\left(\frac{1}{\omega C} - R\right)$$

↑

allt pollt

P34.1 Bunsen



Example 34.1 →

a) finna B við jaðarinn $r = a$

$$B(r) = \frac{1}{2}\mu_0\epsilon_0\left(\frac{dE}{dt}\right)r$$

$$B(a) = \frac{1}{2}\mu_0\epsilon_0\left(\frac{dE}{dt}\right)a$$

b) $\bar{S}$ við jaðarinn — hvar rétt

$$\bar{S} = \frac{\bar{E}\times\bar{B}}{\mu_0}$$ → $\bar{S}$ hvar í stefni

$$S = \frac{EB}{\mu_0} = \frac{1}{2}\epsilon_0 E\left(\frac{dE}{dt}\right)a$$

c) Þ inni í C í hleðslu

$$P = SA = S(2\pi a \cdot d)$$

$$= \frac{1}{2}\epsilon_0 E\left(\frac{dE}{dt}\right) a \cdot 2\pi a d$$

$$= \epsilon_0 \pi d a^2 E\left(\frac{dE}{dt}\right)$$

E34.15

$S_{sól} = 1\ kW/m^2$

við yfirborð jarðar

a) meðal orkuþéttleiki

$$U_{ave} = S_{ave}/c \sim 3.33 \cdot 10^{-6}\ J/m^3$$

b) sólar orkan á jörðina á 1 stundu

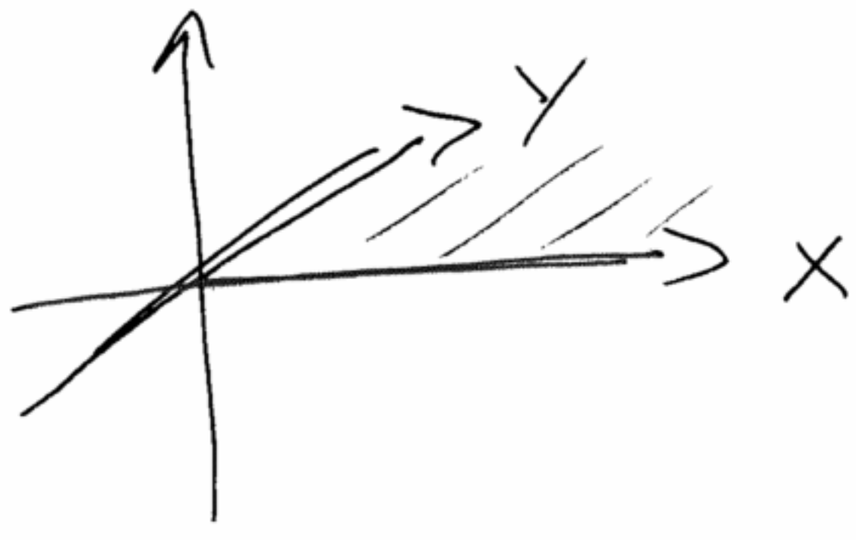
$$U = SAt = S(\pi R^2)(3600\ s)$$

$$\sim 4.6 \cdot 10^{20}\ J$$

(7)

Veljum speglanir í sléttunni

x-y , x-z , z-y



Geislinn úr hefur vigurinn

(x_0, y_0, z_0) ←

sem speglun sýgr við sína

næsti t.d. $(x_0, -y_0, z_0)$

þrjár speglanir

-> $(-x_0, -y_0, -z_0)$

og stefna við