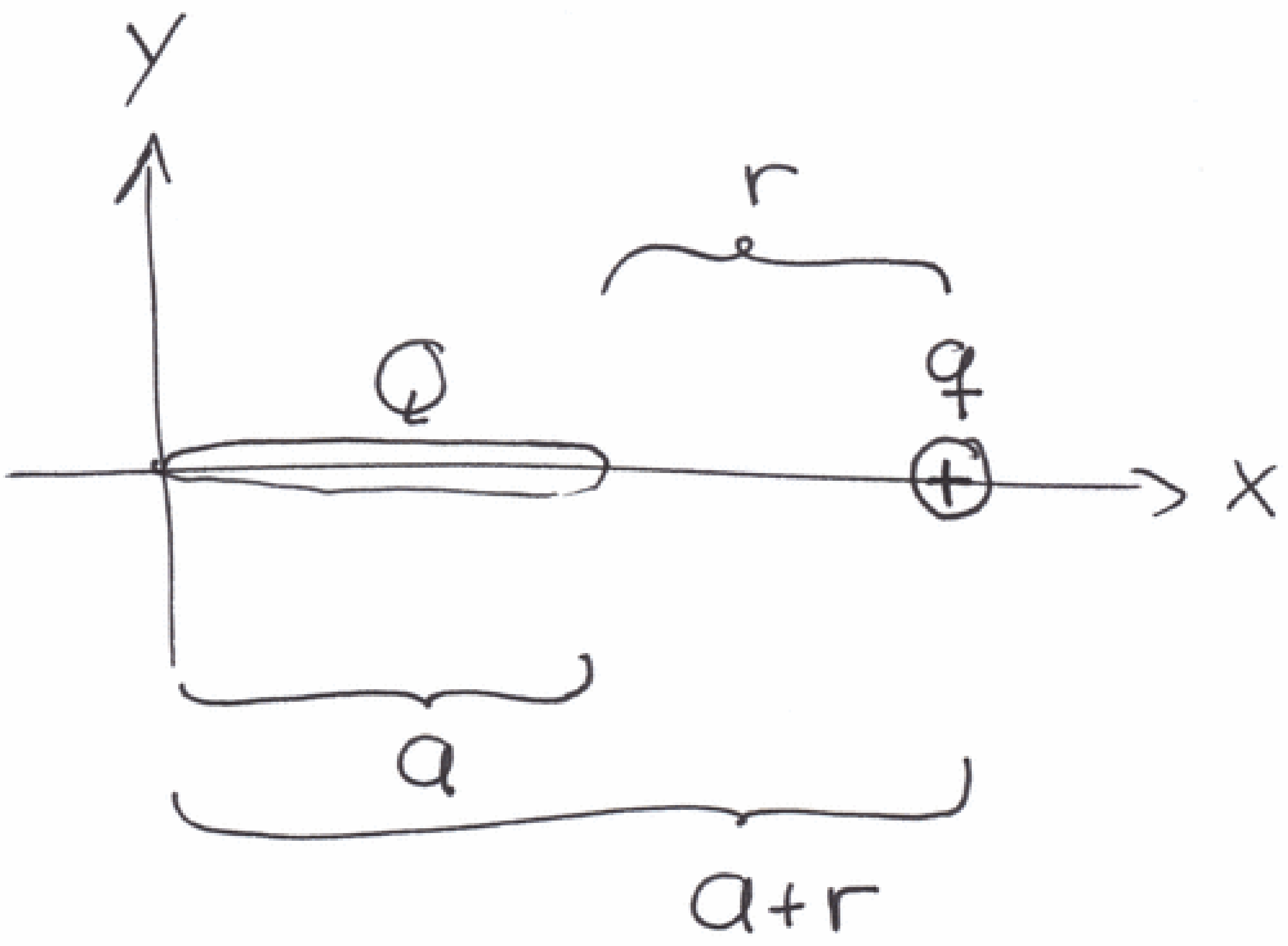
(1)



a) finna x og y-þátt rafsviðsins fyrir punkt a+r þ.s. q er statt.

Búta Q niður í örsmáa búta $dQ = \frac{Q}{a}dx$ og heilda

$$dE_x = \frac{1}{4\pi\epsilon_0}\frac{\frac{Q}{a}dx}{(a+r-x)^2}$$

$$\rightarrow \quad E_x = \frac{1}{4\pi\epsilon_0}\int_0^a \frac{Q\,dx}{(a+r-x)^2 a}$$

$$= \frac{1}{4\pi\epsilon_0}\frac{Q}{a}\left(\frac{1}{r} - \frac{1}{a+r}\right)$$

$$E_y = 0$$

b) Krafter Q å q

$$\overline{F} = q\,\overline{E}$$

$$\rightarrow \quad F_x = \frac{1}{4\pi\epsilon_0}\frac{qQ}{a}\left(\frac{1}{r} - \frac{1}{a+r}\right)$$

c) ~~Ad~~ fell a ferm p. $r >> a$

$$\frac{1}{r+a} = \frac{1}{r(1+\frac{a}{r})} \simeq \frac{1}{r}\left(1 - \frac{a}{r} + \cdots\right)$$

$$\left(\frac{1}{r} - \frac{1}{r+a}\right) \simeq \left(\frac{1}{r} - \frac{1}{r} + \frac{a}{r^2} + \cdots\right)$$

$$\simeq \frac{a}{r^2}$$

$$\rightarrow \quad F_x \xrightarrow[r>>a]{} \frac{1}{4\pi\epsilon_0}\frac{qQ}{r^2}$$

liter ut eins og kraftverinn milli punkt~~ladd~~ladna q og Q fori p. $r>>a$ stiplir ~~stord~~ Q minna og minna måli

②

+λ hleðsla á lengdar-einingu

þverskurður

+λ hleðsla á lengdareiningu á miðás

a) Reikna rafsviðið sem fall af λ og r

r<a

Notum lögmál Gauss

$$\oint \bar{E} \cdot d\bar{A} = \frac{Q_{encl}}{\epsilon_0}$$

notum sívalningssamhverfu → sviðið er aðeins háð λ og r

$$E(2\pi r L) = \frac{\lambda L}{\epsilon_0}$$

lengd sívalnings (L → ∞ ....)

$$\rightarrow \bar{E} = \hat{r}\frac{\lambda}{2\pi r \epsilon_0}$$

$a < r < b$

sívalningurinn er leiðari ->
innan hans er $\bar{E} = 0$

-> Innri veggurinn hefur hleðslu
$-\lambda$ á lengdareiningu

þá er $Q_{encl} = 0$ fyrir Gaussyfirborð
innan veggja sívalnings

$r > b$

innst   innri veggur   ytri veggur

$$\text{Gauss} \quad E(2\pi r L) = \frac{+\lambda - \lambda + 2\lambda}{\epsilon_0}$$

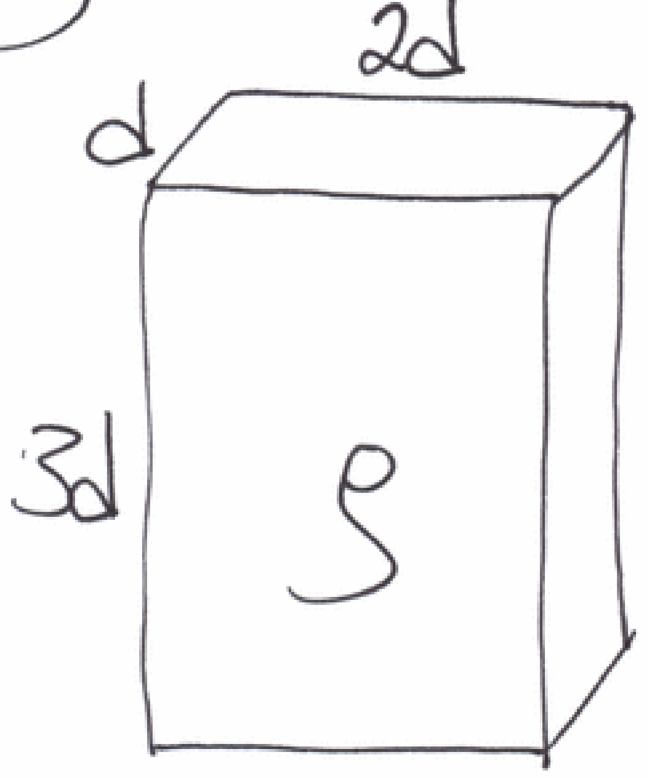
sívalningurinn var upphaflega hlaðinn $+\lambda$
-> er hleðslan á ytri vegg jöfn þeirri
á innri vegg en með gagnstæðu
formerki að viðbættu $+\lambda$

$$\bar{E} = \hat{r}\frac{2\lambda}{2\pi r \epsilon_0} = \hat{r}\frac{\lambda}{\pi \epsilon_0 r}$$

b) 'A inni vegg $-\lambda$

'A ytri vegg $+2\lambda$

(3)



Spennumunur V milli gagnstæðra flata

a) Hæstur straumþéttleiki

$$I = \frac{V}{R}$$

$$J = \frac{I}{A} = \frac{V}{RA}$$

flötur

$$R = \frac{\rho L}{A}$$

$$\rightarrow J = \frac{VA}{\rho L A}$$

$$\rightarrow J = \frac{V}{\rho L}$$

því fæst hæstur straumþéttleiki þegar fjarlægð flatanna L er sem minnst

$$\rightarrow L = d$$

$$J_{max} = \frac{V}{\rho d}$$

b) Mestur straumur

$$I = \frac{V}{R} = \frac{VA}{\rho L} = JA$$

verður að taka max gildi

Största flatområdet fås pegar

$L = d$ (för på är $A = 2d \cdot 3d$)

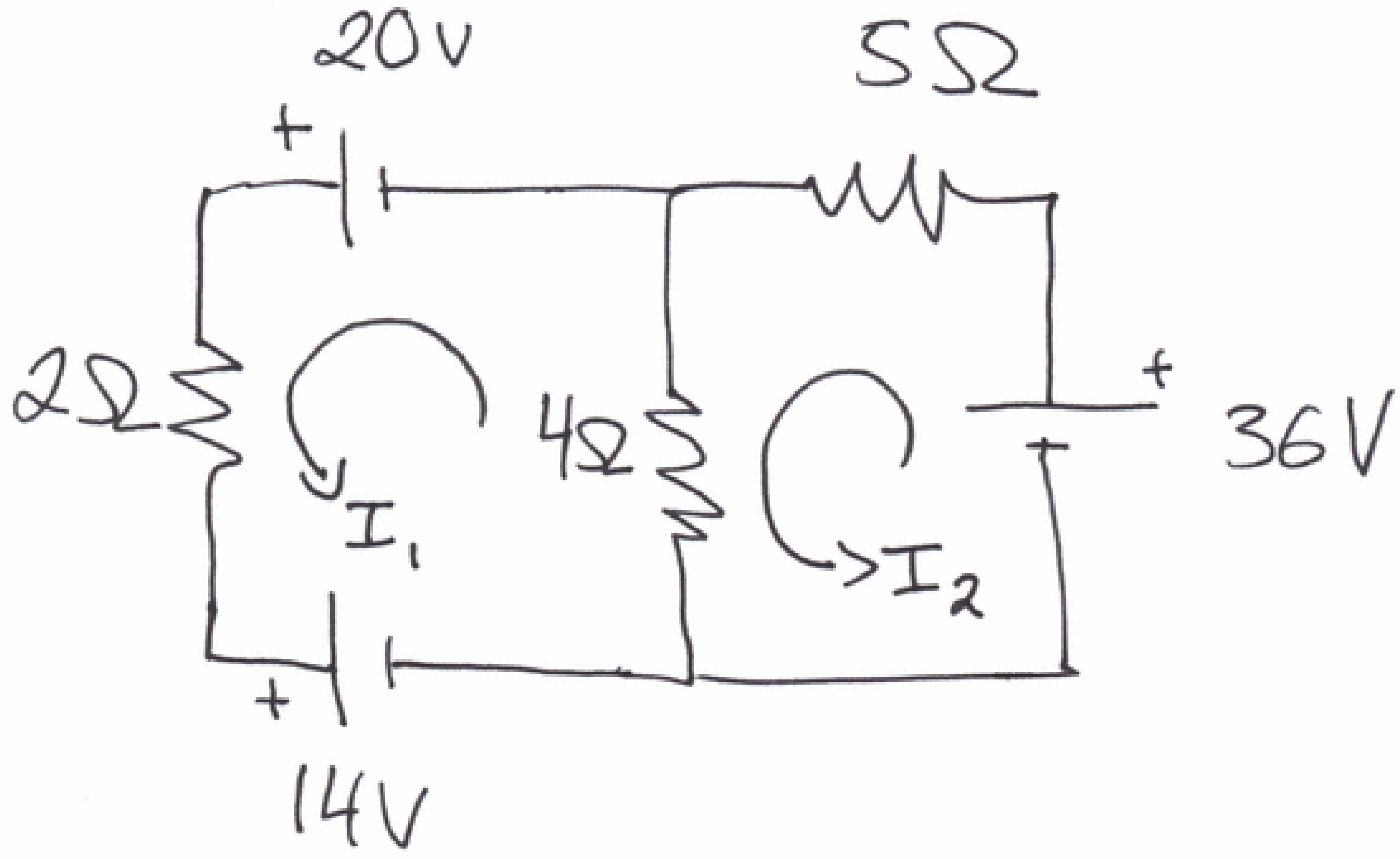
på är lilla J kost

c)

$$\rightarrow I_{max} = J_{max} A_{max}$$

$$= \frac{V}{\rho d} \cdot (6d^2) = 6\frac{Vd}{\rho}$$

4



finna straumana í øllum viðnámunum

<u>Vinstri lykkja</u> (spennufall og íspennur)

$$20 - 2I_1 - 14 - 4(I_1 - I_2) = 0 \qquad 1$$

<u>høgri</u>

$$36 - 5I_2 - 4(I_2 - I_1) = 0 \qquad 2$$

$$-6I_1 + 4I_2 = -6 \qquad 1$$

$$4I_1 - 9I_2 = -36 \qquad 2$$

$$\begin{pmatrix} -6 & 4 \\ 4 & -9 \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} -6 \\ -36 \end{pmatrix}$$

Lausn

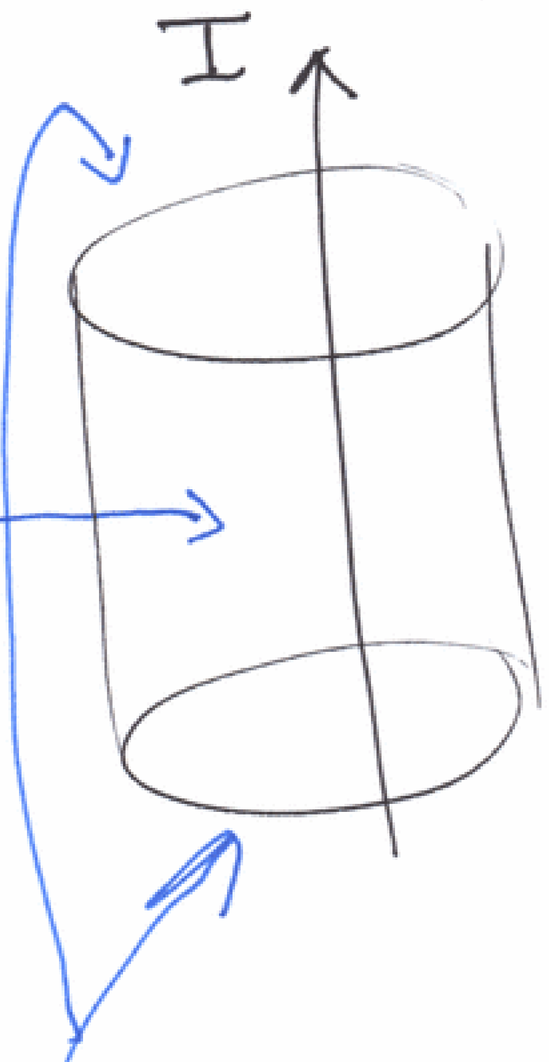
$I_1 = 5.21 \text{ A}$ $\quad (= I_{2\Omega})$

$I_2 = 6.32 \text{ A}$ $\quad (= I_{5\Omega})$

$I_{4\Omega} = I_2 - I_1 = 1,11 \text{ A}$

⑤

Lögmál Ampères



$$\oint \bar{B}\cdot d\bar{l} = \mu_0 I_{encl}$$

einnig gildir

$$\oint \bar{B}\cdot d\bar{A} = 0$$

Ef eitthvert $\bar{B}$ væri samsíða vír á styttist flæði þess utan enda

En samsíða gæti ekki verið þvert á vír

flæðið um þennan flöt er 0

radial sviðið þyrfti að vera einsátta vegna samhverfu

$\rightarrow E_r = 0$

(6)

$$X_{L_1} = X_{C_1} \text{ þegar } \omega = \omega_1$$

$$\downarrow$$

$$\omega_1 L = \frac{1}{\omega_1 C} \quad , \quad \omega_2 = 2\omega_1$$

a) Hver er hlutfallið þ. $\omega = \omega_2$

$$X_{L_2} = \omega_2 L = 2\omega_1 L = 2X_{L_1}$$

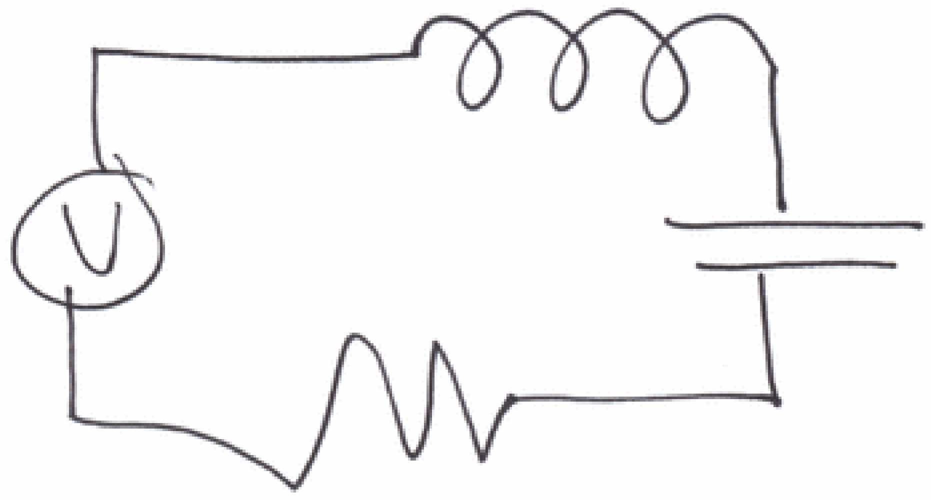
$$X_{C_2} = \frac{1}{\omega_2 C} = \frac{1}{2\omega_1 C} = \frac{X_{C_1}}{2}$$

$$\rightarrow \frac{X_{L_2}}{X_{C_2}} = \frac{2 \cdot 2X_{L_1}}{X_{C_1}} = 4$$

$$\rightarrow X_{L_2} = 4X_{C_2}$$

stærra

b)



Eğer $\omega = \omega_1$ ise $X_{L_1} = X_{C_1}$

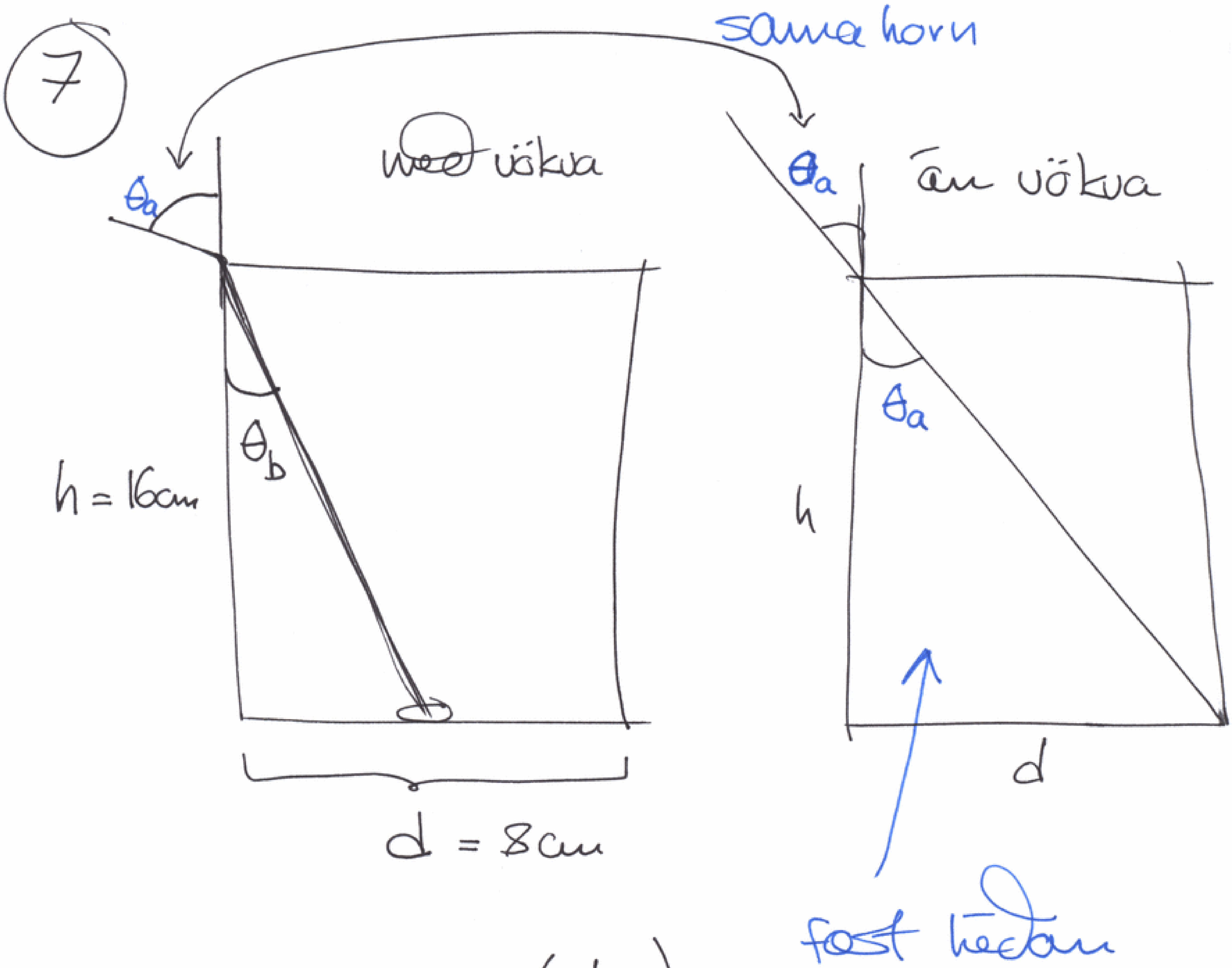
$\rightarrow \omega_1$ ise [illegible]

$$I = \frac{V}{Z}$$

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

[illegible] max [illegible] p. $X_L = X_C$

7



$$\theta_a = \arctan\left(\frac{d}{h}\right)$$

$$\theta_b = \arctan\left(\frac{\frac{1}{2}d}{h}\right)$$

$$n_a \sin\theta_a = n_b \sin\theta_b \quad , \; n_a = 1$$

$$n_b = \frac{\sin\theta_a}{\sin\theta_b} = \frac{\sin(\arctan(\frac{d}{h}))}{\sin(\arctan(\frac{d}{2h}))} = 1{,}8$$