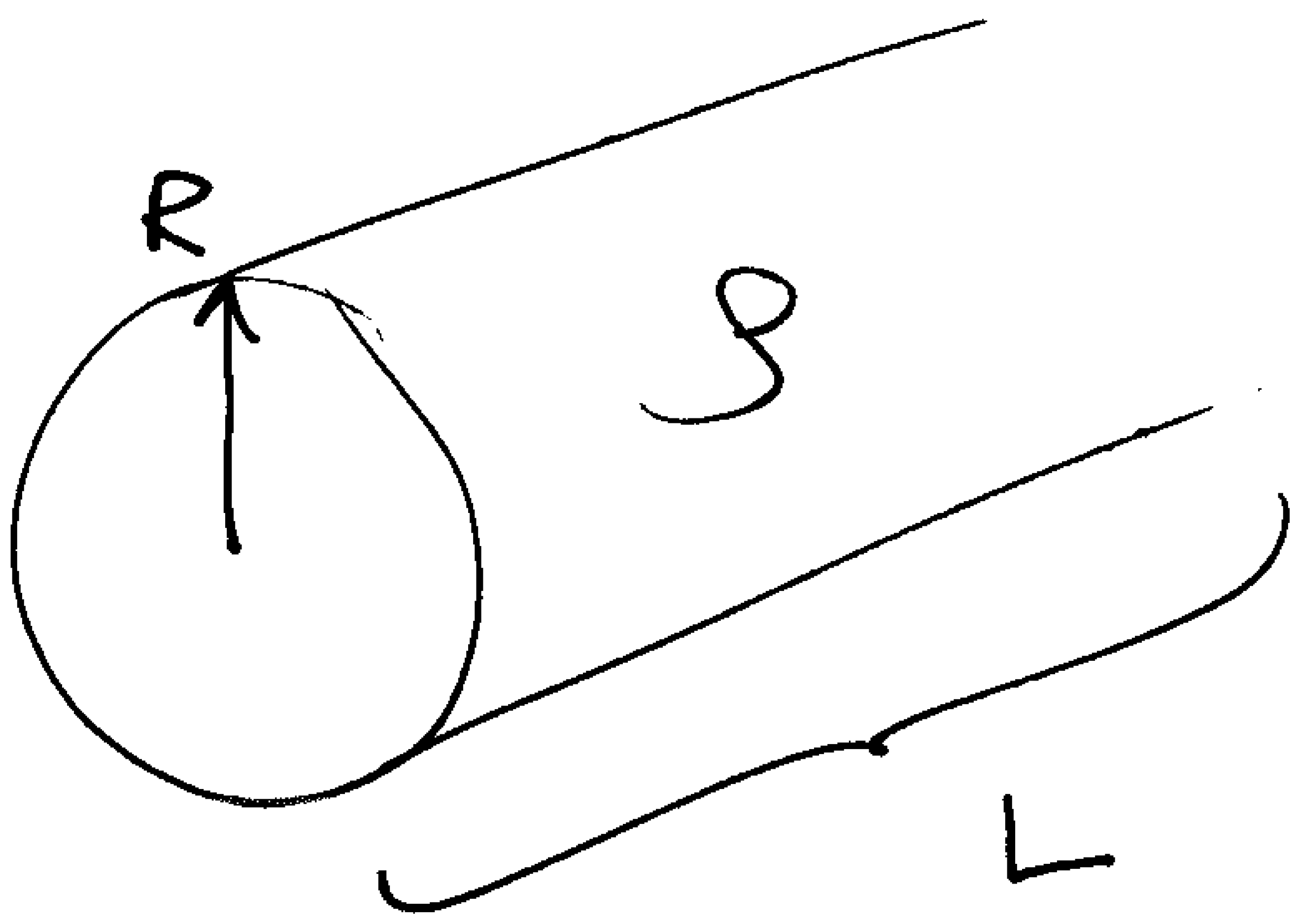
4



Notum lögmál Gauß

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

Hleðsla innan geisla $r < R$

$$Q = \rho V = \rho \pi R^2 L \rightarrow \lambda = \frac{Q}{L} = \rho \pi R^2$$

$$Q' = \rho \pi r^2 L$$

a) $$E(2\pi r L) = \rho \pi r^2 \frac{L}{\epsilon_0}$$

$$\rightarrow E = \rho r / (2\epsilon_0)$$ út frá miðju ef $\rho > 0$

$$\boxed{\bar{E} = \frac{\rho r}{2\epsilon_0} \hat{\rho}}$$

Athugið að ρ er notað hér fyrir hleðsluþéttleika og radial hnitið

b) $R < r$ Aftur lögmál Gauß

$$E(2\pi r L) = \frac{\rho \pi R^2 L}{\epsilon_0} = \lambda L / \epsilon_0$$

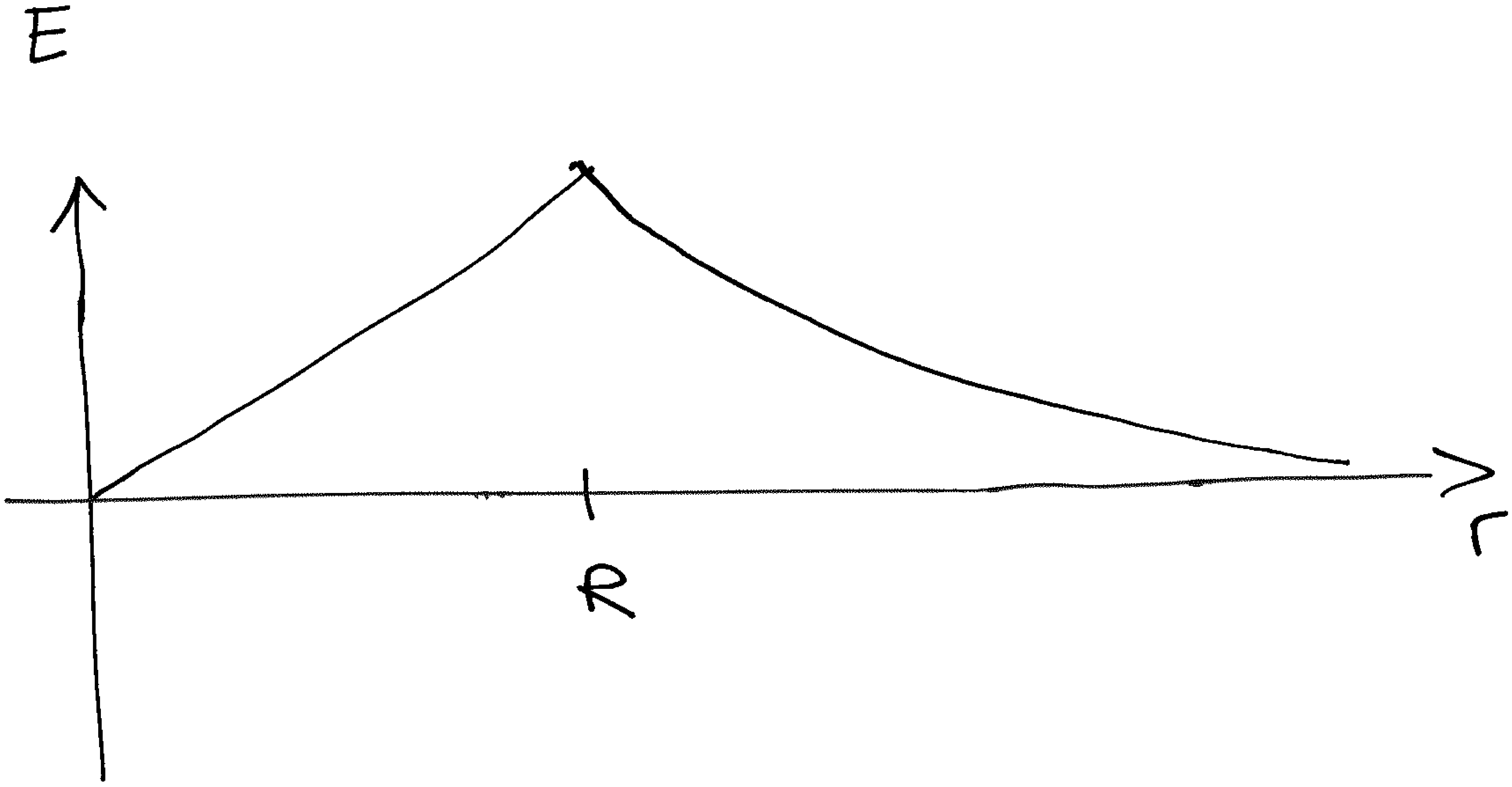
$$\rightarrow \boxed{\bar{E} = \frac{\lambda L}{2\pi r L \epsilon_0}\hat{\rho} = \frac{\lambda}{2\pi r \epsilon_0}\hat{\rho}}$$

c) $$\frac{\lambda}{2\pi R \epsilon_0} = \frac{\rho R}{2\epsilon_0} \rightarrow \lambda = \frac{\rho R}{1} \cdot \pi R$$

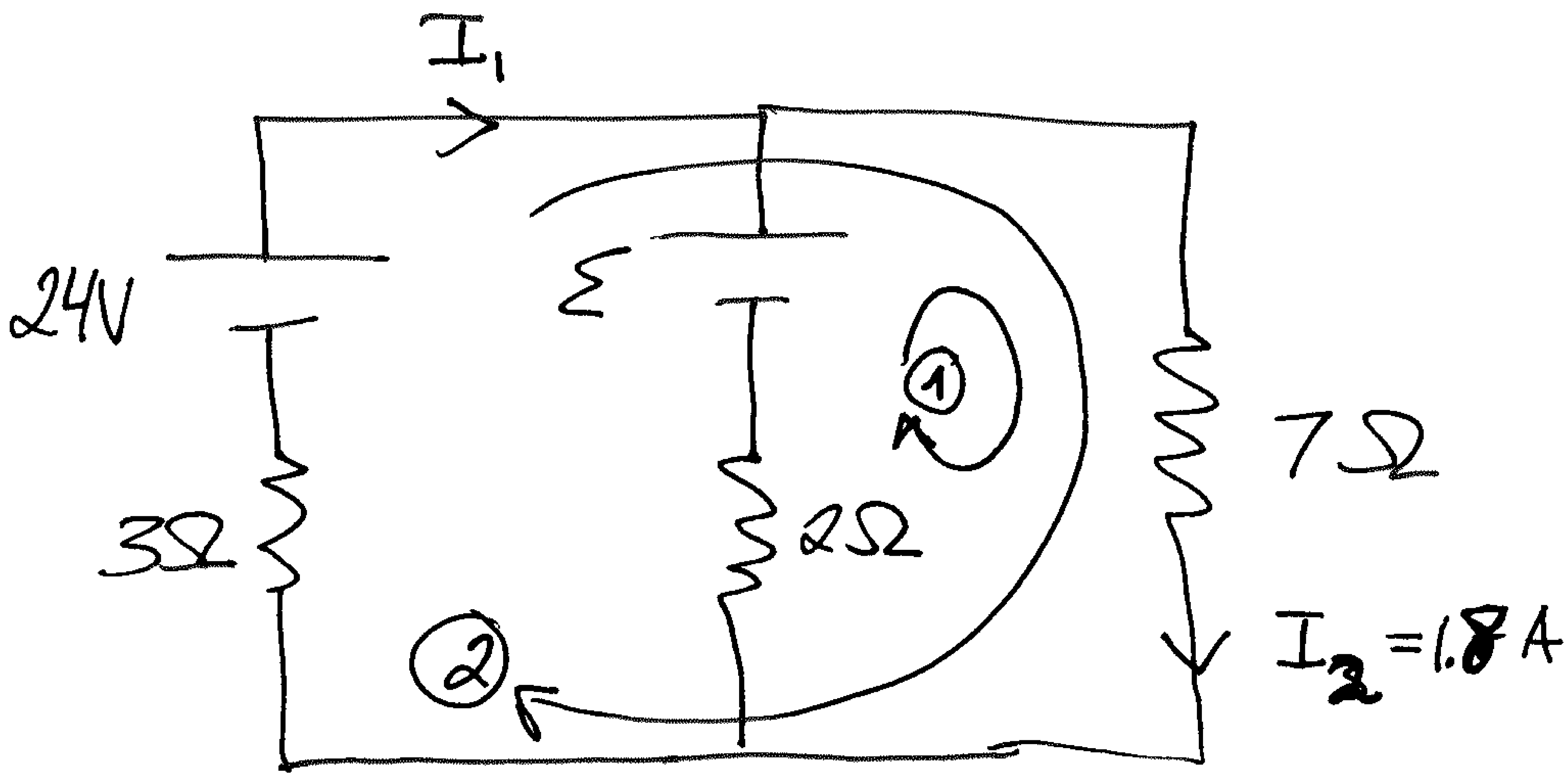
$$= \rho \pi R^2$$

eins og séð áðan

d)



2



Notum Lögmál Kirchhoffs fyrir tvær lykkjur

1 $\qquad \varepsilon - I_2 \cdot 7 - (I_2 - I_1)\cdot 2 = 0$

2 $\qquad 24 - I_1 3 - I_2 \cdot 7 = 0$

$\to I_1 \cdot 3 = 24 - 7 \cdot 1,8 = 11,4$

$\to I_1 = 3.8$ A

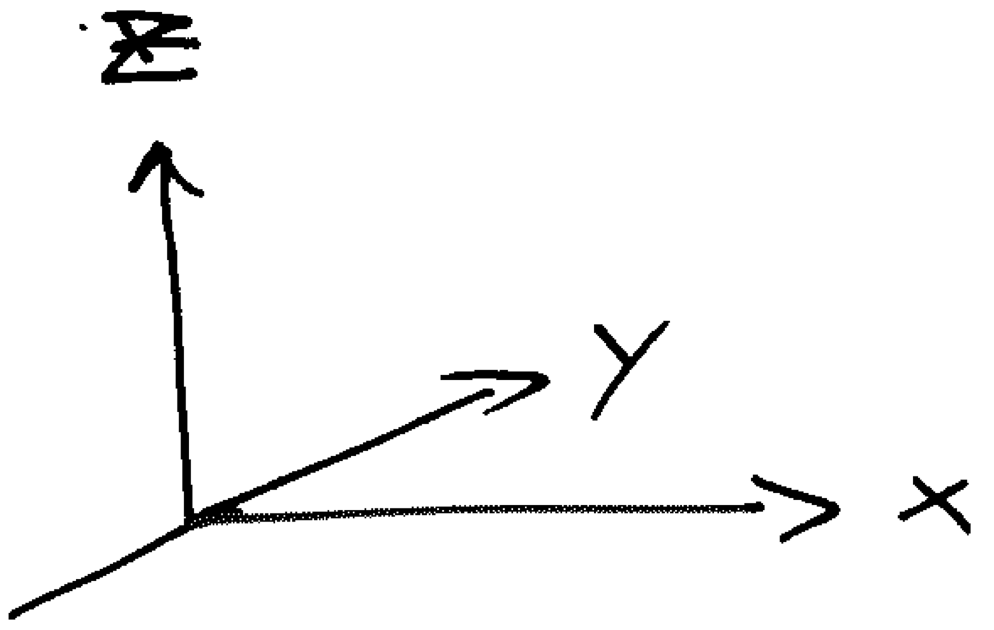
$\to \varepsilon - 7 \cdot 1,8 - (1.8 - 3.8)2 = 0$

$\to \varepsilon = 7 \cdot 1,8 - (2) \cdot 2 = 8,6$ V

3

$q > 0$ $\qquad$ $\bar{B}$?

$\bar{v} = v\hat{z}$



$$\bar{F} = F_0(3\hat{x} + 4\hat{y}), \quad F_0 > 0$$

a) Ákvarða þætti $\bar{B}$

$$\bar{F} = q\,\bar{v} \times \bar{B}$$

$$= q\,(0,0,v) \times (B_x, B_y, B_z)$$

$$= (-B_y q v,\ B_x q v,\ 0)$$

$$\stackrel{\text{ef}}{=} F_0(3\hat{x} + 4\hat{y})$$

þá er

$$-B_y q v = 3F_0$$

$$B_x q v = 4F_0$$

$$\rightarrow \boxed{B_y = -\frac{3F_0}{qv}, \quad B_x = \frac{4F_0}{qv}}$$

b)

Ef nú $|\vec{B}| = \frac{6F_0}{qv} = B$

þá er $B^2 = B_x^2 + B_y^2 + B_z^2$

$$\frac{36F_0^2}{q^2v^2} = \frac{9F_0^2}{q^2v^2} + \frac{16F_0^2}{q^2v^2} + B_z^2$$

$$= \frac{25F_0^2}{q^2v^2} + B_z^2$$

$$\rightarrow B_z^2 = \frac{11F_0^2}{q^2v^2}$$

$$\rightarrow \boxed{|B_z| = \sqrt{11}\,\frac{F_0}{qv}}$$

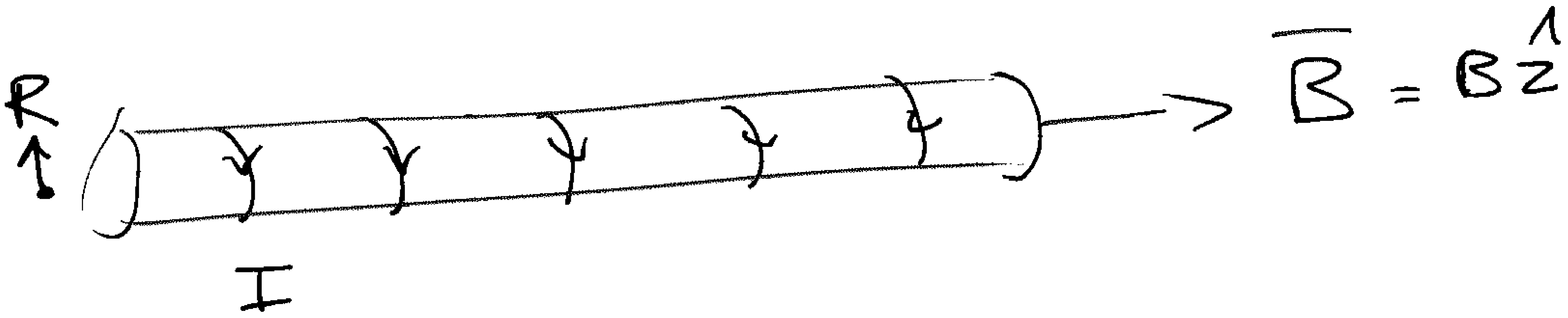
Svo ekki er hægt að ákvarða formerki B_z

(4)

<u>fyrri hluti</u>

sjá <u>Example 28.10</u> í bók

til ~~að~~ leiða út:



$$\bar{B} = \mu_0 n I \hat{z}$$

<u>Seinni hluti</u>

Faraday $\qquad \mathcal{E} = -\frac{d\Phi_B}{dt} N$

íspenna $\qquad \mathcal{E} = -L\frac{dI}{dt}$

$$\rightarrow \quad L\frac{dI}{dt} = N\frac{d\Phi_B}{dt}$$

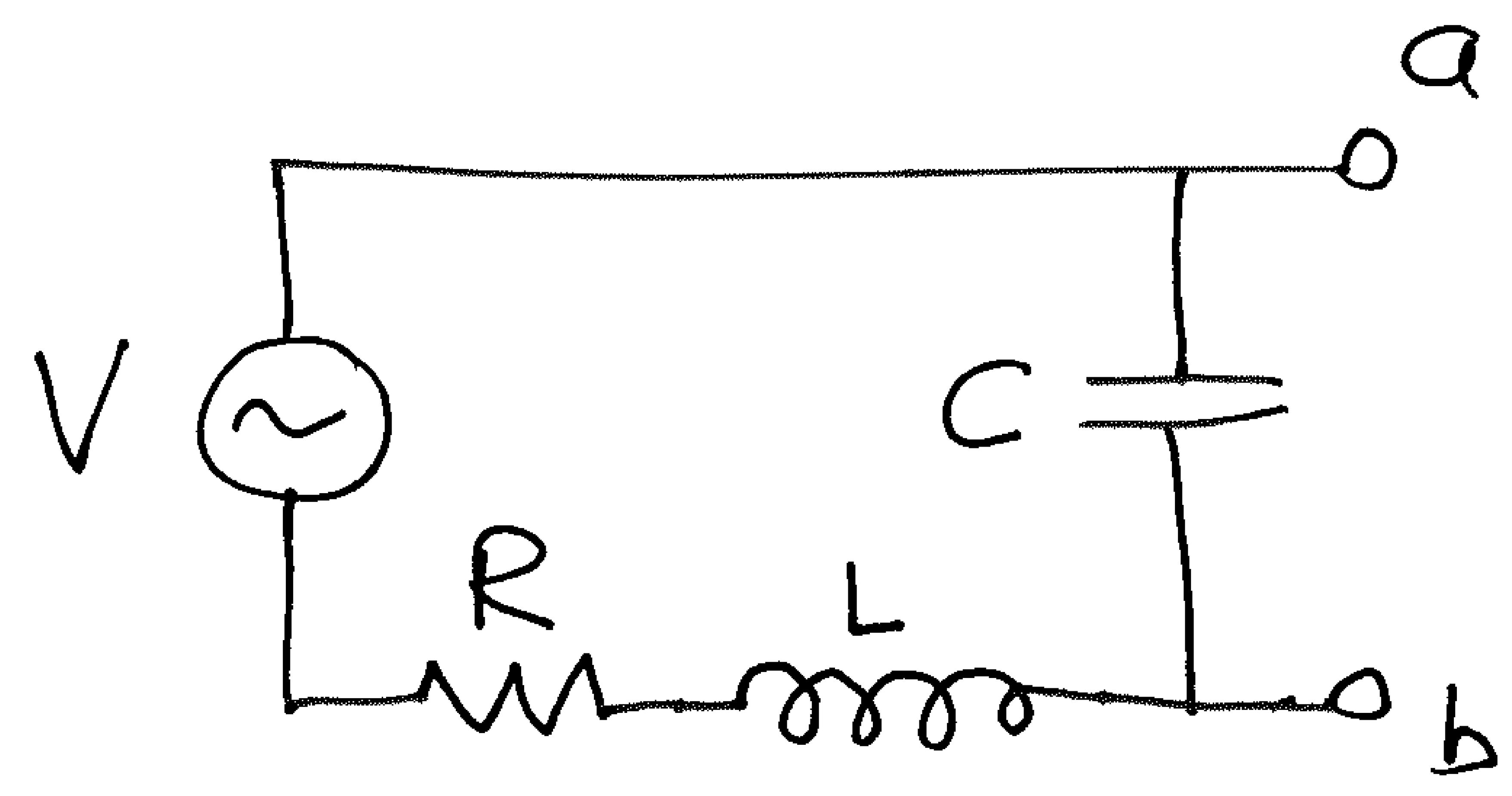
$$\rightarrow \quad LI = N\Phi_B \quad \left(\begin{array}{l}\text{heildum heildisfasta} \\ \text{þ.s. } \Phi_B = 0 \text{ þ. } I = 0\end{array}\right)$$

$$\Phi_B = \bar{B}\cdot\bar{A} = B\pi R^2$$

Sjálfspan $\rightarrow$ $L = \mu_0 n^2 \pi R^2 \ell$

ℓ ← lengd

(5)



$$V = IZ$$

$$V_{ab} = IX_c$$

a)

$$\frac{V_{ab}}{V} = \frac{IX_c}{IZ} = \frac{\frac{1}{\omega C}}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

$$= \frac{1}{\sqrt{(\omega RC)^2 + \omega^2 C^2 \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

$$= \frac{1}{\sqrt{(\omega RC)^2 + (\omega^2 LC - 1)^2}}$$

b, c)

$$\left.\frac{V_{ab}}{V}\right|_{\omega \to 0} = 1 \qquad \left.\frac{V_{ab}}{V}\right|_{\omega \to \infty} = 0$$

d) þetta er lághleypisía

(6)

Nota $\bar{S} = \dfrac{\bar{E} \times \bar{B}}{\mu_0}$

orkuflæðið $\bar{S}$ er í stefnu rafsegulbylgjunnar

a) $-\hat{z}$

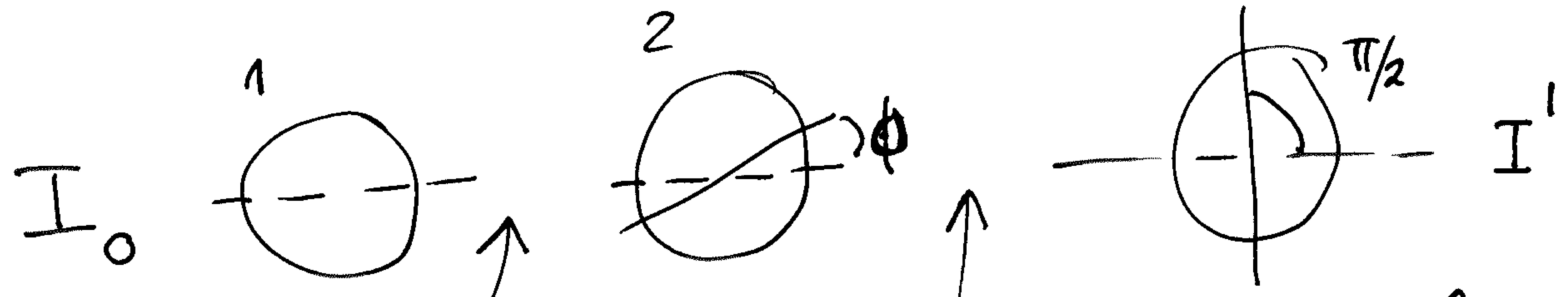
b) $-\hat{z}$

c) $\hat{y}$

d) $\hat{y}$

7

þrjár skautunarsíur



a)

$$I_1 = \frac{1}{2} I_0$$

$$I = I_1 \cos^2 \phi$$

$$I' = I \cos^2(\pi/2 - \phi) = \frac{1}{2} I_0 \cos^2\phi \sin^2\phi = \frac{1}{2} I_0 \frac{1}{4} \sin^2(2\phi) = \frac{1}{8} I_0 \sin^2(2\phi)$$

Sía 1 og 3 loka á allt ljós, en sía #2 hleypir aftur í gegn þegar henni er bætt við!

b)

max við $\phi = \pi/4$ eða $\frac{3\pi}{4}$ . . .