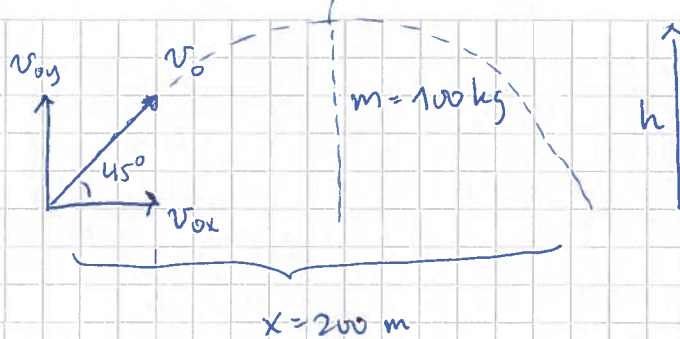


LF-A1



BRUK

$$v = v_0 + a \cdot t$$

$$x = v \cdot t$$

Tid for A på høyde h = tid for A komme x = 100 m

$$v_{0x} \cdot t = 100 \Rightarrow v_{0x} = \frac{100}{t}$$

$$v_y = v_{0y} - g t \Rightarrow 0 = v_{0y} - g t$$

↑ @ x = 100

$$\left. \begin{array}{l} v_{0x} = v_{0y} \Rightarrow 0 = \frac{100}{t} - g t \\ \Rightarrow \frac{100}{t} = g t \Rightarrow t = \sqrt{\frac{100}{g}} \end{array} \right\}$$

$$\Rightarrow \frac{100}{t} = g t \Rightarrow t = \sqrt{\frac{100}{g}}$$

$$\Rightarrow v_{0x} = \frac{100}{t} = \frac{100}{\sqrt{\frac{100}{g}}} = \frac{\sqrt{100} \cdot \sqrt{100}}{\sqrt{100}} \sqrt{g} = \sqrt{100 \cdot g}$$

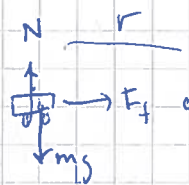
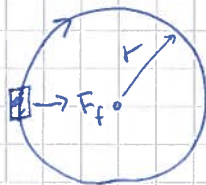
$$v_0 = \sqrt{v_{0x}^2 + v_{0y}^2} \Rightarrow v_0 = \sqrt{2} \cdot \sqrt{100} \cdot \sqrt{g} = \sqrt{200 \cdot g} \approx 44.3 \frac{m}{s}$$

$$\approx 159.5 \text{ km/h} \sim \underline{160 \text{ km/h}} \quad \textcircled{B}$$

LF-A2

FRA OPTIMA

FRA SIDA



NEWTON 2:A; REVEALTE I

$$\text{SILKKE} \quad F_f = m \cdot a = m \cdot \frac{v^2}{r}$$

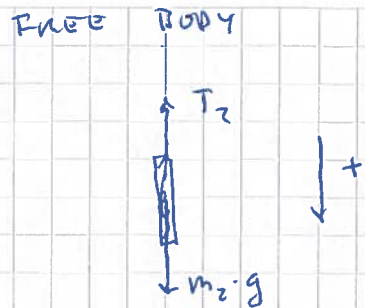
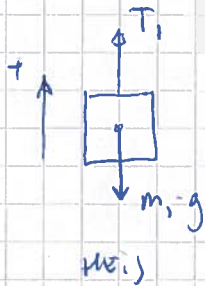
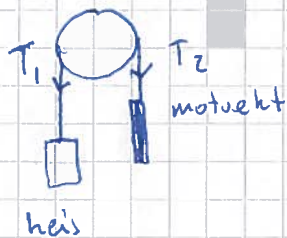
SENTRIPETAL AKSI

$$F_f = \mu_s \cdot N = \mu_s \cdot mg \Rightarrow \mu_s \cdot mg = m \cdot \frac{v^2}{r} \Rightarrow v^2 = \mu_s \cdot g \cdot r$$

$$\therefore v = \sqrt{\mu_s \cdot g \cdot r}$$

ⓐ

LF-A3



NEWTON 2:A  $T_1 - m_1 \cdot g = m_1 \cdot a \Rightarrow T_1 = m_1 (g + a)$

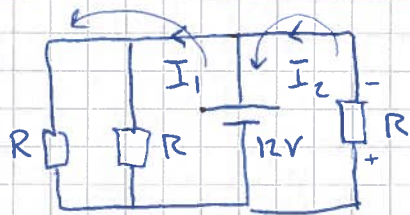
$-T_2 + m_2 \cdot g = m_2 \cdot a \Rightarrow T_2 = m_2 (g - a)$

UVI]  $m_1 = m_2 = m \Rightarrow \left. \begin{aligned} T_1 &= m(g+a) \\ T_2 &= m(g-a) \end{aligned} \right\} \Rightarrow T_1 > T_2$

(N.b.  $T_1 + T_2 = 2mg$   
 $T_1 - T_2 = 2ma$ )

(A)

LF-A4



SLØYFFE  $I_1 = \frac{1}{R'} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$

$\Rightarrow R' = \frac{R}{2}$

KIRCHHOFF:  $12V - I_1 \cdot \frac{R}{2} = 0$

$\Rightarrow I_1 = \frac{2 \cdot 12}{R} = \frac{24}{R}$

SLØYFFE  $I_2$  - KIRCHHOFF

$-I_2 \cdot R - 12V = 0 \Rightarrow I_2 = -\frac{12}{R}$

N.b.  $I_2$  DEFINERT 'NEGATIVE' RETNING : OPPGAVE!

$\frac{24}{I_1} = -\frac{12}{I_2} \Rightarrow I_1 = -\frac{24}{12} \cdot I_2 = -2I_2$  ELLEN  $I_2 = -\frac{1}{2}I_1$

(D)

LF-A5

$$\vec{E}(z,t) = E_0 \cdot \cos\left(\frac{\pi}{3} \cdot 10^7 \cdot z + 10\pi \cdot 10^{14} t\right) \hat{x} \frac{V}{m}$$

$\uparrow$   $\Rightarrow$   $\omega$   $\Rightarrow$   $\nu$   $\Rightarrow$   $f$   
 $\uparrow$   $\Rightarrow$   $k$   $\Rightarrow$   $\lambda$

Z-ROTNINGA      POLARIZASJON

-z

$$\cos(kz \mp \omega t)$$

vi HUSKON  $v_{ph} = \frac{\omega}{k} = \frac{2\pi f}{\frac{2\pi}{\lambda}} = \lambda \cdot f = \left[ \frac{m}{s} \right]$

$3.0 \cdot 10^8 \frac{m}{s}$   $\Rightarrow v_{ph} = \frac{10\pi \cdot 10^{14}}{\frac{\pi}{3} \cdot 10^7} = 3 \cdot 10^8$  (LYSFAHGTEN I VAKUUM)

$600 \cdot 10^{-9} m$   $k = \frac{2\pi}{\lambda} \Rightarrow \frac{\pi}{3} \cdot 10^7 = \frac{2\pi}{\lambda} \Rightarrow \lambda = 6 \cdot 10^{-7} = 600 nm$   
 ELLER  $600 \cdot 10^{-9} m$

B

LF-A6

A:  $\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} = \frac{1}{C_{tot}} \quad \frac{1}{1} + \frac{1}{2} + \frac{1}{5} = \frac{1}{C_{tot}} \Rightarrow C_{tot} = \frac{10}{17}$

B:  $\frac{1}{C_1} + \frac{1}{C_2 + C_3} = \frac{1}{C_B} \quad \frac{1}{1} + \frac{1}{7} \Rightarrow C_B = \frac{7}{8}$

C:  $C_1 + C_2 + C_3 = C_C \Rightarrow C_C = 8$

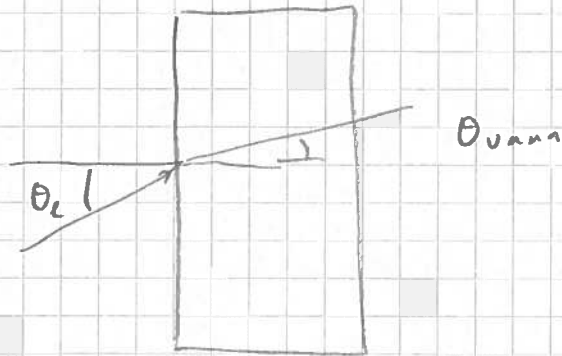
D:  $\frac{1}{C_2} + \frac{1}{C_1 + C_3} = \frac{1}{C_D} \Rightarrow \frac{1}{3 \cdot 2} + \frac{1}{6} = \frac{1}{C_D} \Rightarrow \frac{1}{6} = \frac{1}{C_D}$   
 $C_D = \frac{6}{1} = \frac{7}{2} = 3.5$

E:  $\frac{1}{C_3} + \frac{1}{C_1 + C_2} = \frac{1}{C_E} \Rightarrow \frac{1}{5} + \frac{1}{3} = \frac{1}{C_E} \Rightarrow \frac{8}{15} = \frac{1}{C_E} \Rightarrow C_E = \frac{15}{8}$

D

LF-A 7,1

LYS BREYTER ALTID MOT NORMALEN NÅR  
DET PÅNEMER FRA LAVT TIL HØYT  
TRYKKNING I INDEX



∴ ER (D) RETT

I DETALJE

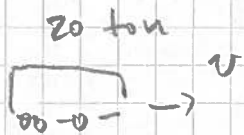
GLAS → GLAS  $1 \cdot \sin 20^\circ = 1.5 \cdot \sin \theta_2 \Rightarrow \theta_2 = 13.2^\circ$

GLAS → VANN  $1.5 \cdot \sin 13.2^\circ = 1.33 \cdot \sin \theta_3$

$\Rightarrow \theta_3 = 14.92^\circ$

∴  $\theta_3 < \theta$  UFT

CF-A8)



$$72 \text{ km/h}$$

$$= 20 \frac{\text{m}}{\text{s}}$$

inelastisch zusammenstoß

$$m_1 \cdot v_1 + m_2 \cdot v_2 = (m_1 + m_2) \cdot v_3$$

$$20.000 \cdot 20 + 1500 \cdot 0 = 21.500 \cdot v_3$$

$$\Rightarrow v_3 = \frac{20.000 \cdot 20}{21.500} = 18.6 \frac{\text{m}}{\text{s}} = 67 \text{ km/h}$$

BEWECHUNGSENERGIEN (kinetisch)

$$E_{\text{FR}} = 20.000 \cdot \frac{1}{2} \cdot 20^2 = 4.000.000 \text{ J}$$

$$E_{\text{ZUS}} = 21.500 \cdot \frac{1}{2} \cdot (18.6)^2 = 3.719.070 \text{ J}$$

$$\text{TAPT: } \frac{4.000.000 - 3.719.070}{4.000.000} = 0.07 \quad 7\%$$

II

CF-A9

BANK

$$B = \frac{\mu_0 \cdot I}{2r}$$

$$\mu_0 = \frac{4\pi}{10^7} \text{ H/m}$$

$$I = 20 \text{ A}$$

$$r = 1.5 \text{ cm} = 0.015 \text{ m}$$

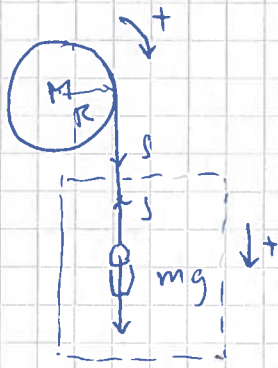
$$\Rightarrow B = 4.19 \cdot 10^{-4} \text{ T}$$

$$= \underline{\underline{0.42 \text{ mT}}}$$

RECHNUNG MIT UN PLANET

D

LF-A10



$$I = \frac{MR^2}{2}$$

HJUL: NEWTON FOR ROTATION

THE GREAT MOMENT

$$S \cdot R = I \cdot \alpha$$

DRÖTE-MOMENT

VINKEL-ÅRS

↙

$$SR = I \cdot \frac{a}{R} \Rightarrow SR^2 = \frac{MR^2}{2} \cdot a$$

NOTE:

$$-s + mg = m \cdot a$$

$$\Rightarrow s = m(g - a)$$

$$\Rightarrow s = \frac{Ma}{2}$$

$$m(g - a) = \frac{M \cdot a}{2}$$

$$mg - ma = \frac{Ma}{2} \Rightarrow mg = \frac{Ma}{2} + ma$$

$$\Rightarrow mg = \left(m + \frac{M}{2}\right) a$$

$$\Rightarrow a = \frac{mg}{\left(m + \frac{M}{2}\right)}$$



N.b.

$$V: \text{SER} \text{ OM } M \gg m \Rightarrow a = \frac{2m}{M} \cdot g$$

RIMKULU

STOR M → TRYG

$$m \gg M \Rightarrow a \approx g$$

m VELOK TUKA

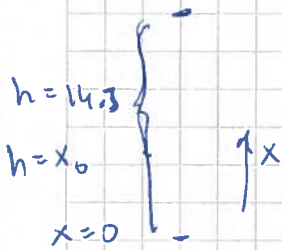
→ HJUL ASÖR

LITEN INDRÖKJ

LF-318

BRUK  $x = x_0 + v_0 t + a \frac{t^2}{2}$  OR  $v = v_0 + a \cdot t$   $a = -g = -9.81 \frac{m}{s^2}$

a) ETTEN EN VEKUND



$$x = x_0 - g \cdot \frac{t^2}{2} = 14.3 - 9.81 \cdot \frac{1}{2} = 9.995 \text{ m}$$

Ans. 9.4 m

b) 1: NÅR ER DEN FØRSTE I BAKKEN

$$0 = 14.3 - \frac{1}{2} g t^2 \Rightarrow t = \sqrt{\frac{2 \cdot 14.3}{g}} = \sqrt{\frac{2 \cdot 14.3}{9.81}} = 1.7075 \text{ s}$$

⇒ DE TRETTE BAKK 2 BEVEGET SÆR 1.7075 - 1.0 s

= 0.7075 s BRUK I LØSNEN  $x = x_0 - g \frac{t^2}{2}$

$$\Rightarrow x = 14.3 - \frac{1}{2} \cdot 9.81 \cdot (0.7075)^2 = 11.845 \text{ m}$$

Ans. 11.8 m

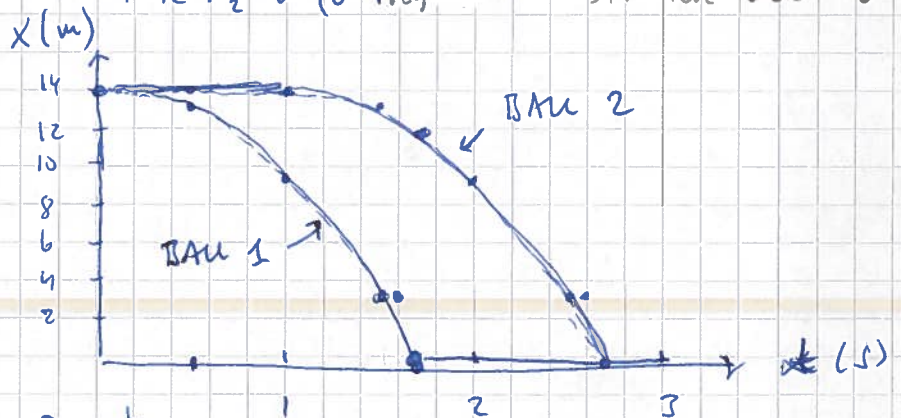
c)

BRUK  $x = x_0 - g \frac{t^2}{2}$  FOR  $x_1$ ,  $t = t$

FOR  $x_2$ ,  $t = (t - 1.0)$

STARTER VED  $t = 1$

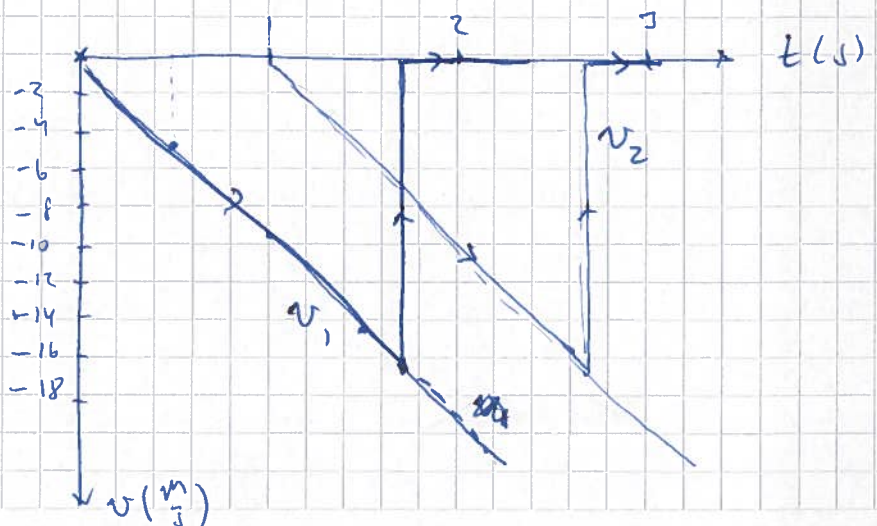
t	$x_1$	$x_2$
0	14.3	14.3
0.5	13.1	14.3
1.0	9.4	14.3
1.5	3.3	13.1
1.7075	0	11.8
2	0	9.4
2.5	0	3.3
2.7075	0	0



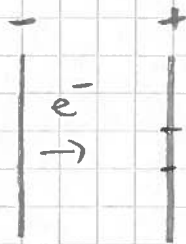
$v_1 = 0 - g t$   
 $v_2 = -g(t - 1.0); t > 1$

d)

t	$v_1$	$v_2$
0	0	0
0.5	-4.9	0
1.0	-9.8	0
1.5	-14.7	-4.9
1.7075	-16.8	-6.94
2.0	0	-9.8
2.5	0	-14.7
2.7	0	-16.8



LF-B12



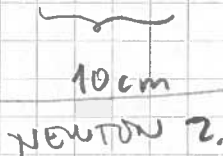
$$m_e = 9.11 \cdot 10^{-31} \text{ kg}$$

$$q_e = 1.609 \cdot 10^{-19} \text{ C}$$

$$3000 \frac{\text{V}}{\text{m}}$$

$$\Rightarrow E\text{-feld} = 3000 \frac{\text{V}}{\text{m}}$$

a)



$$F = q \cdot E = m \cdot a$$

$$\Rightarrow a = \frac{q \cdot E}{m} = \frac{1.609 \cdot 10^{-19} \cdot 3000}{9.11 \cdot 10^{-31}}$$

$$a = 5.299 \cdot 10^{14} \frac{\text{m}}{\text{s}^2}$$

Abwärtsweg  $10 \text{ cm} = 0.1 \text{ m} = \Delta x$

$$a(x - x_0) = \frac{1}{2}(v^2 - v_0^2)$$

$$\Rightarrow 5.299 \cdot 10^{14} \cdot 0.1 = \frac{1}{2} v^2$$

$$\Rightarrow v = \sqrt{5.299 \cdot 10^{14} \cdot 2} = 1.03 \cdot 10^7 \frac{\text{m}}{\text{s}}$$

$$v = \sqrt{2 \cdot a \cdot \Delta x}$$

Ans.  $1.0 \cdot 10^7 \frac{\text{m}}{\text{s}}$

b) NÄR ELEKTRODEN NÄR MAGNETFELDET RECHNET

NEB-ÜBER

NEU

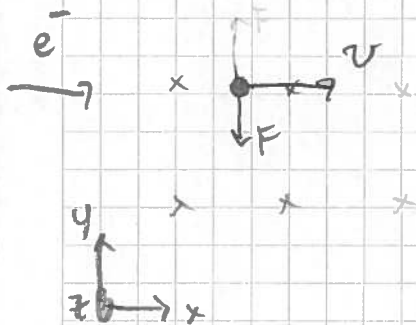
LADUNG

→

RECHNET

$$B = 0.1 \text{ T}$$

VON DER RECHNET



KRAFTEN RECHNET LEWIS - Y

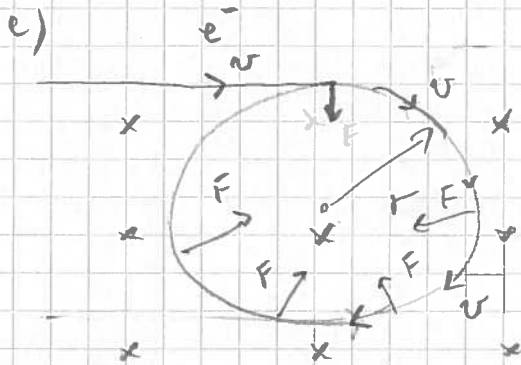
$$F = q v B = 1.609 \cdot 10^{-19} \cdot 1.03 \cdot 10^7 \cdot 0.1$$

$$= 1.66 \cdot 10^{-13} \text{ N}$$

Ans.  $1.7 \cdot 10^{-13} \text{ N}$



Diz furb.



ELEKTRONENGE DREHUN  
EN ZIRKULAREN BAHNE

$$F = m \cdot \frac{v^2}{r}$$

↑ ZENTRIFUGAL

AUS DEPRESSION

$$r = \frac{m \cdot v^2}{F} = \frac{9.11 \cdot 10^{-31} \cdot (1.03 \cdot 10^7)^2}{1.7 \cdot 10^{-13}}$$

$$= 5.69 \cdot 10^{-4} \text{ m} \approx 0.57 \text{ mm}$$

SYKLOTRON FREQUENZ.

$$v = 1.03 \cdot 10^7 \frac{\text{m}}{\text{s}}$$

1 RUMDE ER

Ans. SE FIG

$$r = 0.57 \text{ mm}$$



$$s = 2\pi \cdot r$$

$$T = \frac{s}{v} = \frac{2\pi r}{v} = \frac{2\pi \cdot 0.57 \cdot 10^{-3}}{1.03 \cdot 10^7} \approx 3.48 \cdot 10^{-10} \text{ s}$$

OMLUPSTID

$$\Rightarrow f = \frac{1}{T} = 2.88 \cdot 10^9 \text{ Hz}$$

Ans. SYKLOTRONFREKVENZ

$$2.9 \text{ GHz}$$

Se ligning er i boka: KAP. 21:

$$(27) \quad r = \frac{mv}{qB} = \frac{m \cdot \sqrt{2q \cdot \Delta x}}{qB} = \frac{m \sqrt{\frac{2q \cdot E \cdot \Delta x}{m}}}{qB} = \frac{1}{B} \cdot \sqrt{\frac{2 \cdot m \cdot E \cdot \Delta x}{q}} \approx 5.8 \cdot 10^{-4} \text{ m}$$

$$(28) \quad f = \frac{q \cdot B}{2\pi m} = \frac{1.609 \cdot 10^{-19} \cdot 0.1}{2\pi \cdot 9.1 \cdot 10^{-31}} = 2.8 \cdot 10^9 \text{ Hz}$$

LF-13.

$$f = 4 \text{ cm}$$

$$M_T = -2 = -\frac{s_i}{s_o} \Rightarrow s_i = 2s_o$$

$$\frac{1}{s_o} + \frac{1}{s_i} \neq \frac{1}{f} \Rightarrow \frac{2}{2s_o} + \frac{1}{2s_o} = \frac{1}{4}$$

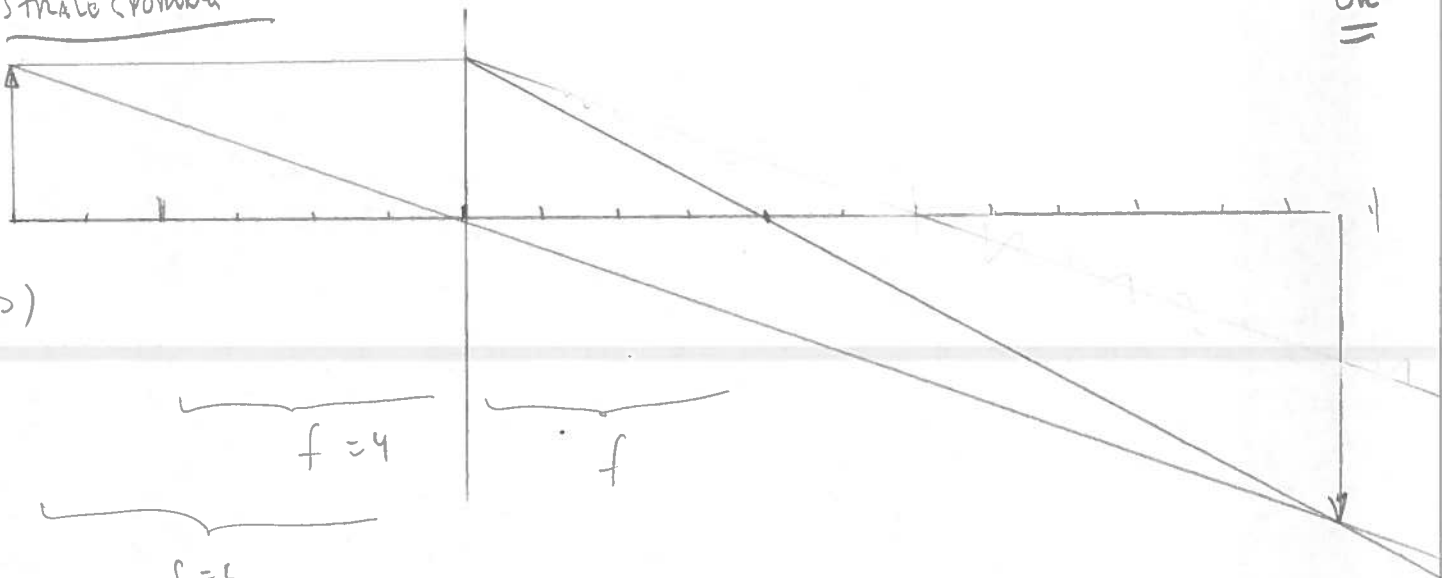
$$\frac{3}{2s_o} = \frac{1}{4} \Rightarrow \frac{4 \cdot 3}{2} = s_o = 6$$

a)  $\underline{s_o = 6}$

$$\frac{1}{6} + \frac{1}{s_i} = \frac{1}{4} \Rightarrow \frac{1}{s_i} = \frac{1}{3 \cdot 4} - \frac{1}{2 \cdot 6} = \frac{3-2}{12} = \frac{1}{12} \Rightarrow s_i = 12$$

$$\Rightarrow M_T = -\frac{s_i}{s_o} = -\frac{12}{6} = -2 \quad \underline{\underline{OK}}$$

STRALE SPOMINA

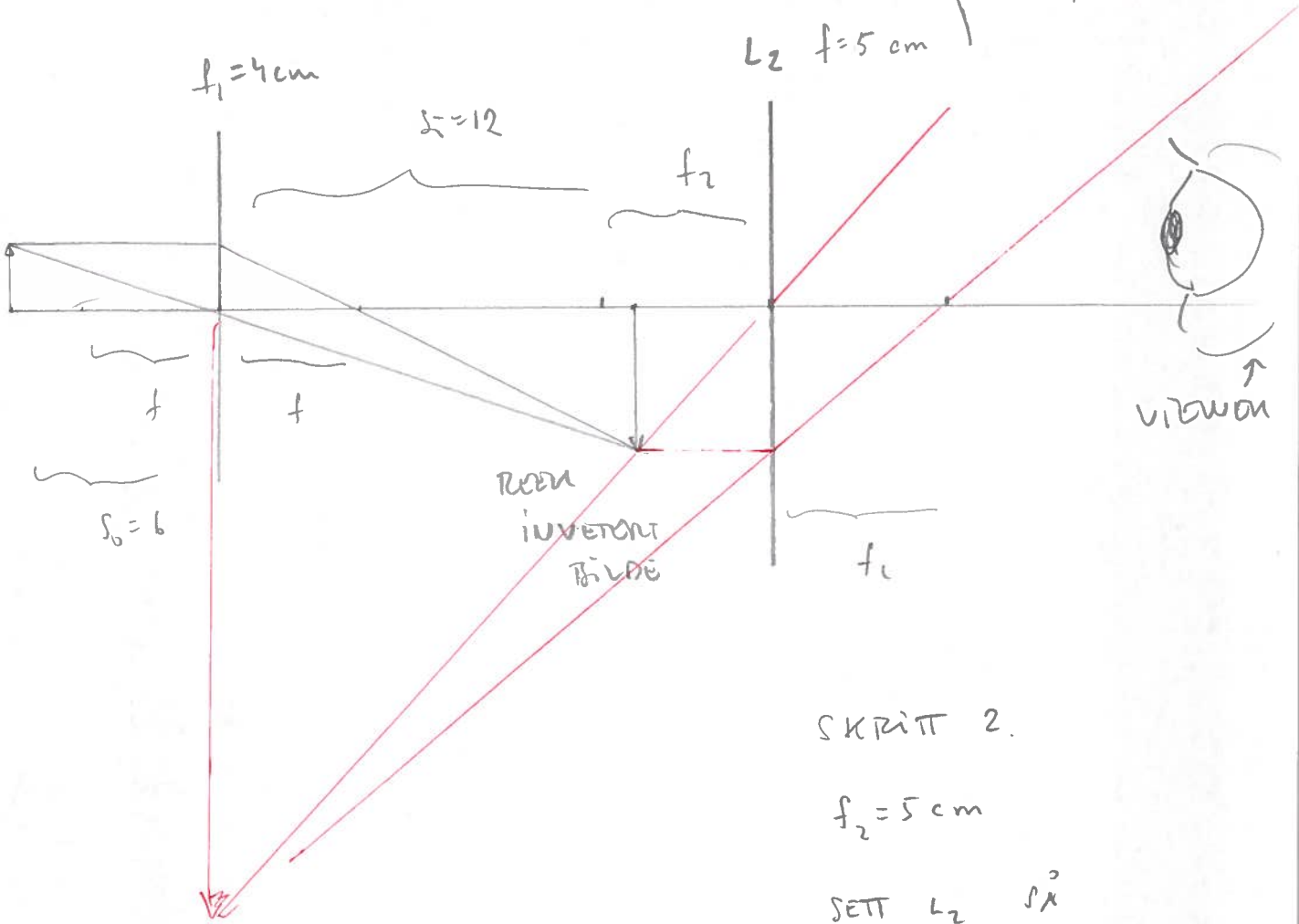


b)



c) PRINZIP-SKISSE FÜR  
MİKROSKOP OPTIK

SETT LINSE 2 SÅ  
RILDE FRA 1 KJEN INNOVRA  
TEKALPUNKTET.



VIRTUERT  
BILDE i  
LENS 2.

SKRITT 2.

$f_2 = 5 \text{ cm}$

SETT  $L_2$  SÅ  
 $s_{02} < f_2$  T.EK 4 cm

EKLIPPER MED  $s_{02} = 4$  :  $\frac{1}{4} + \frac{1}{s_i} = \frac{1}{5}$

$\frac{1}{s_i} = \frac{1}{5} - \frac{1}{4} = -\frac{1}{20}$

$s_i = -20$

↑ VIRTUERT  
BILDE

$$m_T = -\frac{s_i}{s_0}$$

$$= -\frac{-20}{4} = 5 \text{ GGR}$$

TOTAL FORSTØRRELSE  $m_{T1} \cdot m_{T2} = -2 \cdot 5 = -10$

10 GGR for størrelse