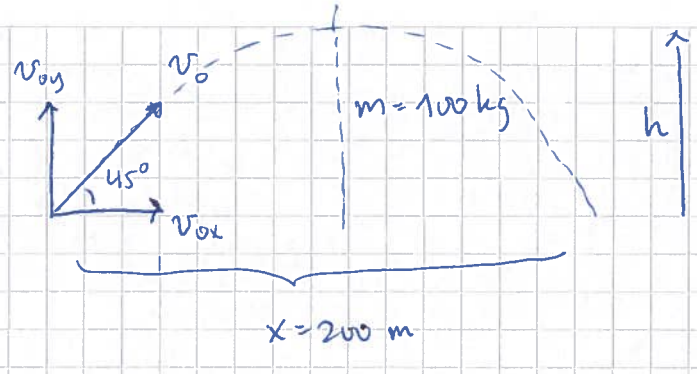
LF-A1



BRUK

$v = v_0 + a \cdot t$

$x = v \cdot t$

TID FOR Å NÅ HØYDE h = TID FOR Å KOMME $x = 100$ m

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

$v_y = v_{0y} - gt \quad \Rightarrow 0 = v_{0y} - gt$

$\uparrow_0$ @ $x = 100$

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

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

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

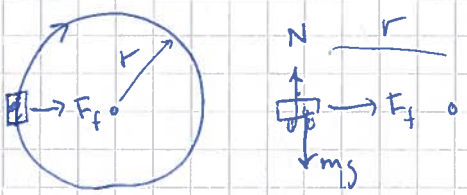
$v_0 = \sqrt{v_{0x}^2 + v_{0y}^2} \Rightarrow v_0 = \sqrt{2} \cdot \sqrt{100} \cdot \sqrt{g} = \sqrt{200 \cdot g} \simeq 44.3 \frac{m}{s}$

$\simeq 159.5$ km/h $\sim$ 160 km/h

(B)

LF-A2

FRA OPPTERN FRA SIDA



NEWTON 2:A; PENDELBEVEGELSE I SIRKEL $F_f = m \cdot a = m \cdot \frac{v^2}{r}$

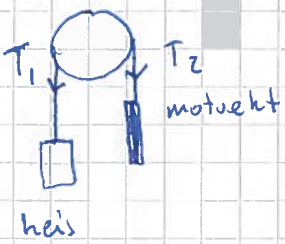
↑ SENTRIPETAL AKS

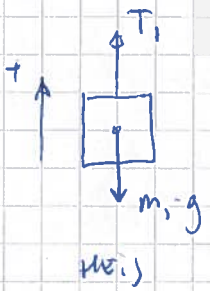
$F_f = \mu_s N = \mu_s \cdot mg \Rightarrow \mu_s \cancel{m} g = \cancel{m}\frac{v^2}{r} \Rightarrow v^2 = \mu_s g \cdot r$

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

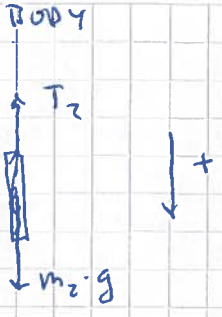
(C)

LF-A3





FREE BODY



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

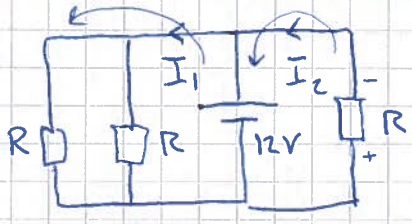
$- T_2 + m_2 \cdot g = m_2 \cdot a \quad \Rightarrow T_2 = m_2 (g - a)$

HVIS $\quad m_1 = m_2 = m \quad \Rightarrow \begin{cases} T_1 = m(g+a) \\ T_2 = m(g-a) \end{cases} \Rightarrow T_1 > T_2$

(A)

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

LF-A4



SLØYFE I_1: $\quad \frac{1}{R'} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$

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

KIRCHOFF: $\quad 2V - I_1 \cdot \frac{R}{2} = 0$

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

SLØYFE I_2 - KIRCHOFF

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

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

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

(D)

LF-A5

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

$\hat{j}$ RETNING POLARISASJON

$\hat{i}$ + TEGN $\Rightarrow$ RETN Z-RETNING

$-z$ $\quad \cos(kz \mp \omega t)$

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

$3.0\cdot 10^8 \ \frac{m}{s}$ $\quad \therefore v_{ph} = \frac{10\pi \cdot 10^{14}}{\frac{\pi}{3}\cdot 10^7} = 3\cdot 10^8$ (LYSHASTIGHET I VAKUM)

$k = \frac{2\pi}{\lambda} \Rightarrow \frac{\pi}{3}\cdot 10^7 = \frac{2\pi}{\lambda} \Rightarrow \lambda = 6\cdot 0^{-7} = 600 \text{ nm}$

$600\cdot 10^{-9}$ m $\quad$ ELLER $\quad 600\cdot 10^{-9}$ 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: $C_1 + C_2 + C_3 = C_C \Rightarrow C_C = 8$

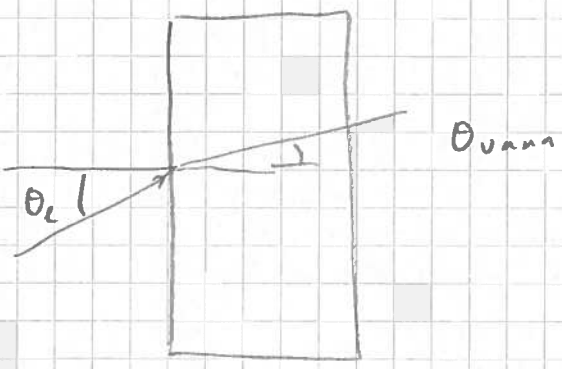
D: $\frac{1}{C_2} + \frac{1}{C_1 + C_3} = \frac{1}{C_D} \Rightarrow \frac{3\cdot 1}{3\cdot 2} + \frac{1}{6} = \frac{1}{C_D} \Rightarrow \frac{4}{6} = \frac{1}{C_D}$

$C_D = \frac{6}{4} = \frac{3}{2} = 1{,}5$

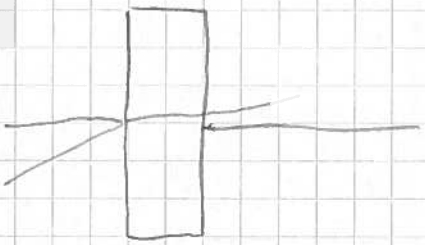
E: $\frac{1}{C_3} + \frac{1}{C_1 + C_2} = \frac{1}{C_E} \Rightarrow \frac{1}{5} + \frac{1}{3} = \frac{1}{C_E} \Rightarrow \frac{5+3}{15} = \frac{1}{C_E} \Rightarrow C_E = \frac{15}{8}$

(D)

OF-A 7.) LYS BRYTES ALTID MOT NORMALEN NÅR DET PASSERER FRA LAVT TIL HØYT BRYTNINGSINDEX



GLASS VANN GLASSET GIR EN LITEN FORSKYVNING



∴ EN (D) RETT

I DETALJE

LUFT → GLASS $\quad 1 \cdot \sin 20^\circ = 1.5 \cdot \sin\theta_2 \Rightarrow \theta_2 = 13.2^\circ$

GLASS → VANN $\quad 1.5 \cdot \sin 13.2^\circ = 1.33 \cdot \sin\theta_1$

$\Rightarrow \theta_1 = 14.92^\circ$

∴ $\theta_1 < \theta_{luft}$

LF-A8).

72 km/h

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

INELASTIK KOLLISION

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

$$20.000 \cdot 20 + 1500 \cdot 0 = 21500 \cdot v_3$$

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

(I)

BEWEGUNGSENERGIE (KINETISK)

$$E_{\text{KIN}} : 20.000 \cdot \frac{1}{2} 20^2 = 4000000 \text{ J}$$

$$E_{\text{KIN}} : 21.500 \cdot \frac{1}{2} \cdot (18.6^2) = 371970 \text{ J}$$

TAP: $\frac{4000000 - 371970}{4000000} = 0.07$ 7%

LF-A9

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

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

$I = 10$ A

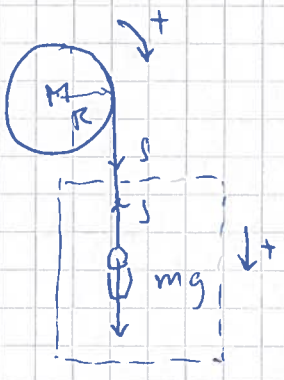
$r = 1.5 \text{ cm} = 0.015$ m

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

= 0,42 mT

RÄTSINA UT UR PLANET (D)

LF-A 10



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

HJUL: NEWTON FOR ROTASJON

(TREGHETSMOMENT)

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

(VINKEL-AKS)

(DREIE-MOMENT)

$\Downarrow$

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

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

KLOTE:

$-S + mg = m \cdot a$

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

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

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

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

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

B

N.B.

Vi ser om $M \gg m \Rightarrow a = \frac{2m}{M} \cdot g$

RIMELIG STOR M → TREG

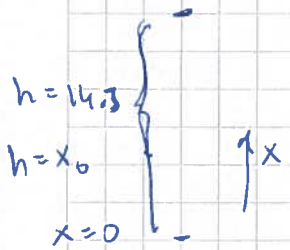
$m \gg M \Rightarrow a \simeq g$

m VELDIG TUNG → HJUL GJØR LITEN INNBREMS

LF-B 18 BRUK $x = x_0 + v_0 t + a\frac{t^2}{2}$ (med $v_0 = 0$) OG $v = v_0 + a \cdot t$ $a = -g$

$= -9.81 \frac{m}{s^2}$

a) ETTER EN SEKUND



$$x = x_0 - g \cdot \frac{t^2}{2} = 14.3 - 9.81 \cdot \frac{1}{2} = 9.195 \text{ m}$$

Ans 9,4 m

b) NÅR ER DEN FØRSTE I BAKKEN

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

$\Rightarrow$ DE BETYR BALL 2 TILBRUKT FØR $1.7075 - 1.0$ s

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

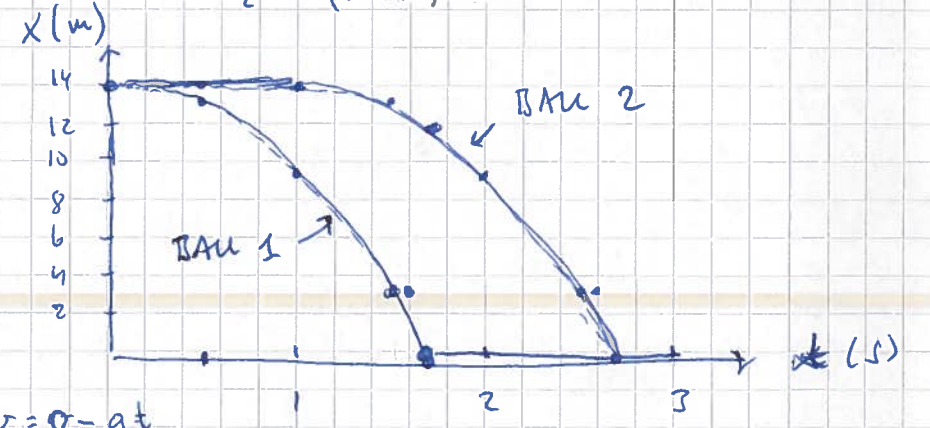
$$\Rightarrow x = 14.3 - \frac{1}{2} 9.81 \cdot (0.7075)^2 = 11.845 \text{ m}$$

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 $t = 1$ s

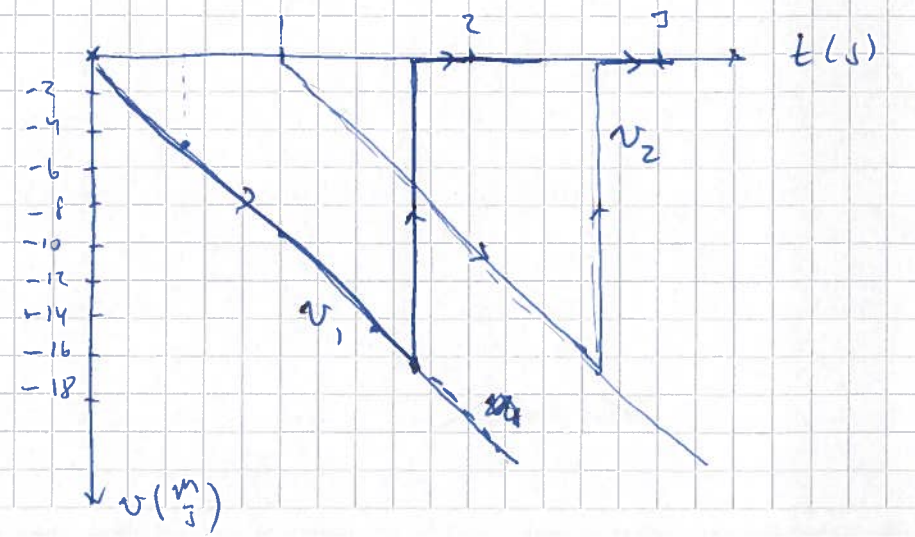
t	x_1	x_2
0	14.3	14.3
0.5	13.1	14.3
1.0	9.4	14.3
1.5	3.3	13.1
1.7075	0	11.8
2	0	9.4
2.5	0	3.3
2.7075	0	0



d) $v_1 = 0 - gt$

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

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

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

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

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

a) 10 cm

NEWTON 2. $F = q \cdot E = m \cdot a$

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

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

Akselerasjon 10 cm = 0.1 m = Δx

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

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

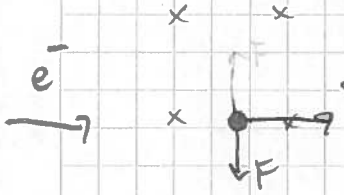
$$\Rightarrow v = \sqrt{5.299 \cdot 10^{13} \cdot 2} = 1.03 \cdot 10^7 \ \frac{m}{s}$$

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

(Ans $1.0 \cdot 10^7 \frac{m}{s}$)

b) NÅR ELEKTRONENE NÅR MAGNETFELTET RETTET NED-OVER ; NEG LADNING → HØYRE-HAND LOV → VENSTRE HAND LOV

B = 0.1 T

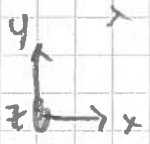


KRAFTEN RETTET LANGS −Y

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

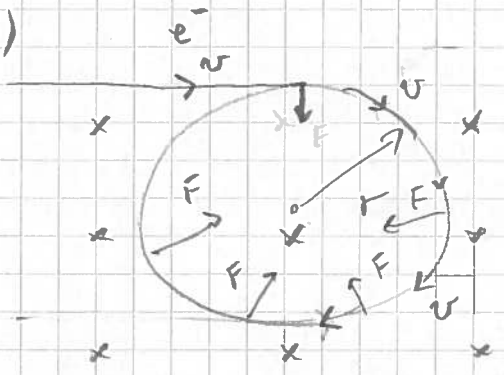
$$= 1.66 \cdot 10^{-13} \ N$$

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



Ø12 forts.

e)



ELEKTRONENE DRIVES EN JEVNLAGS BANE

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

↑ SENTRIPETAL AKSELERASJON

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

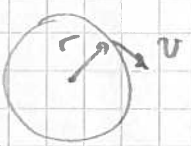
$$= 5.69 \cdot 10^{-4} \text{ m} \approx 0.57 \text{ mm}$$

SYKLOTRON FREKVENS.

$v = 1.03 \cdot 10^7 \frac{m}{s}$; 1 RUNDE ER

Anv. SE FIG

$r = 0.57 \text{ mm}$



$s = 2\pi \cdot r$

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

↑ OMLØPSTID

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

Anv. SYKLOTRONFREKVENS

2.9 GHz

Se ligninger i boka · KAP. 21:

(27) $$r = \frac{mv}{qB} = \frac{m \cdot \sqrt{2qV}}{qB} = \frac{m\sqrt{\frac{2q \cdot E}{m}V}}{qB} = \frac{1}{B} \cdot \sqrt{\frac{2 \cdot mEV}{q}} \approx$$

$\sim 5.8 \cdot 10^{-4}$ m

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

LF - 13.

$f = 4\ cm$

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

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

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

a) $s_o = 6$

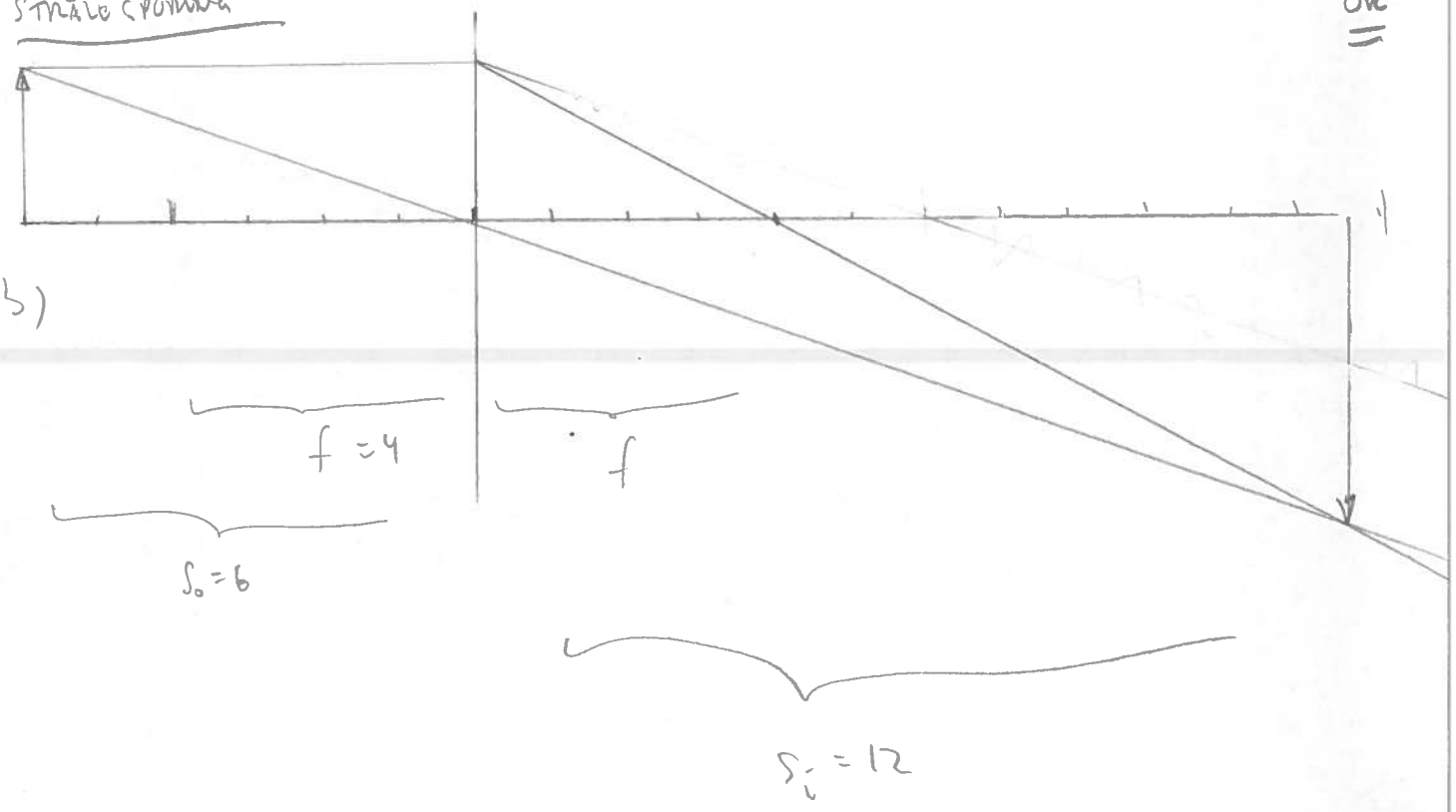
$\frac{1}{6} + \frac{1}{s_i} = \frac{1}{4} \Rightarrow \frac{1}{s_i} = \frac{1}{3 \cdot 4} - \frac{1}{2 \cdot 6} = \frac{3-2}{12} = \frac{1}{s_i} \Rightarrow s_i = 12$

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

STIGÃO CRESCENTE

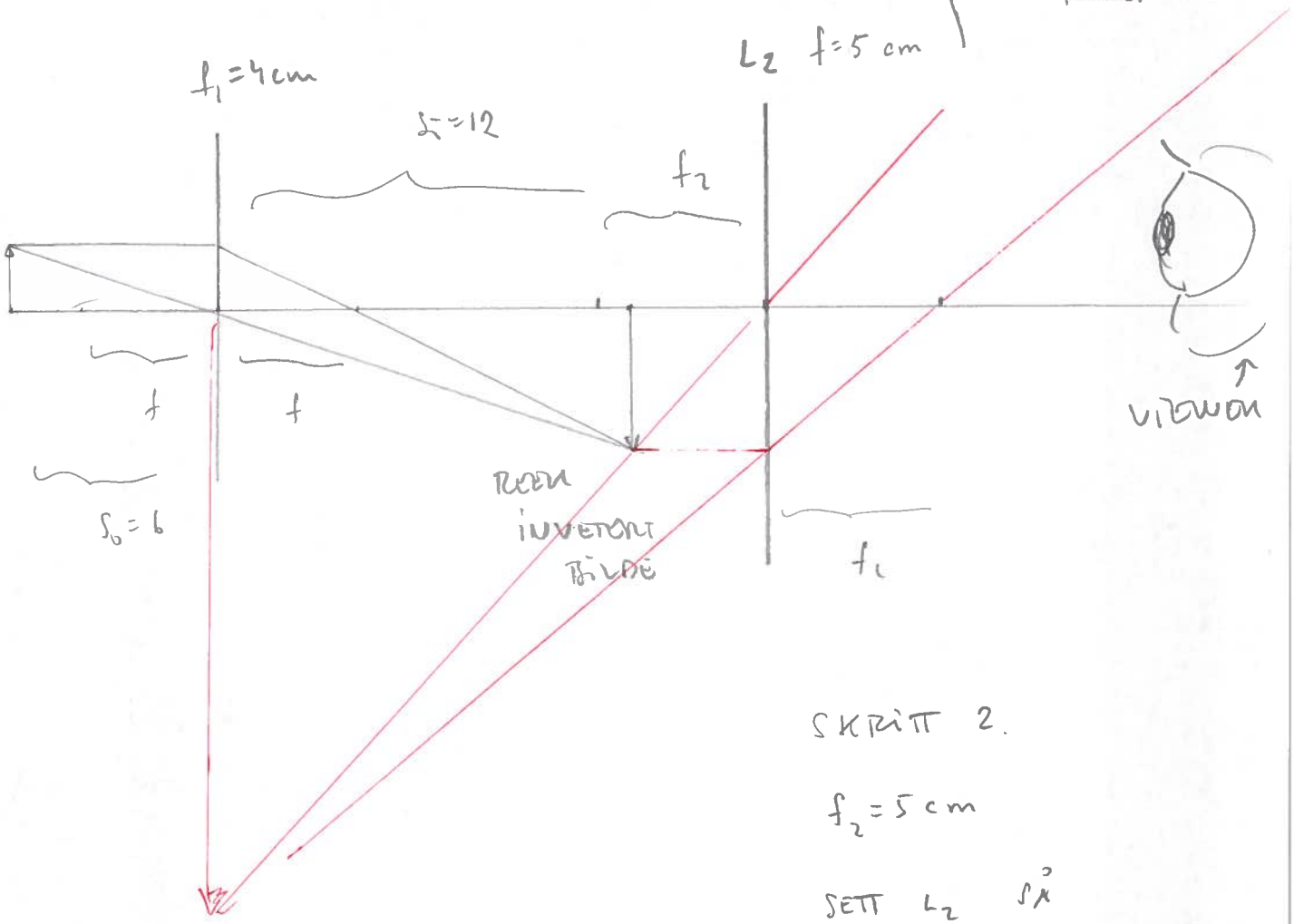
OU

b)



c) PRINSIPP-SKISSE FOR MIKROSKOP OPPSETT

SETT LINJE 2 SÅ BILDE FRA 1 KJEM INNAFOR BRENNPUNKTET.



VIRTUELT BILDE I LINS 2.

SKRITT 2.

$f_2 = 5$ cm

SETT L_2 SÅ $s_{02} < f_2$ T.EX 4 cm

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

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

$s_i = -20$

↑ VIRTUELT BILDE

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

$= -\frac{-20}{4} = 5$ GANGER

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

10 GANGER FORSTØRRELSE