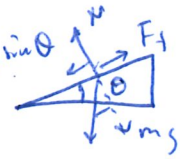
A1: 

BEVEGELSEN SKJER NÅR

$mg\sin\theta = F_f = \mu_s \cdot N = \mu_s \cdot mg\cos\theta$

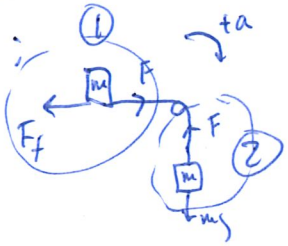
$\Rightarrow \mu_s = \frac{\sin\theta}{\cos\theta} = \tan\theta$ $\quad \mu_s = 0{,}29 \rightarrow \theta = 16^\circ$

(D)

A2: $m = 3.0\,kg$; $R = 3.0\,m$ $\quad I = mR^2$ for hvert messe

$\Rightarrow I_{tot} = 6I = 6mR^2 = 6\cdot 3\cdot 3^2 = 6\cdot 27 = 162$ (D)

A3:



① : $-F_f + F = m\cdot a$

② : $-F + mg = m\cdot a$

① + ② $\Rightarrow mg - F_f = 2ma$

$F_f = \mu_k \cdot N$ NÅR DEN SKLIR $\quad N = mg$ VED ①

$\Rightarrow mg - \mu_k \cdot N = 2ma \Rightarrow mg - \mu_k mg = 2ma$

$\Rightarrow a = \frac{1}{2}g(1-\mu_k) = \frac{1}{2}g\cdot(1-0.2) = 0.4g$

(D)

A4: BEVARINGSLOV : $mv_0 - 2mv_0 = 3mv_2 \Rightarrow -3mv_0 = 3mv_2$ $\quad (v_0 = v)$

$\Rightarrow v_2 = -\frac{v_0}{3}$ $\quad K_{før} = \frac{1}{2}(mv_0^2) + \frac{1}{2}(2mv_0^2) = \frac{1}{2}3mv_0^2 = \frac{3}{2}mv_0^2$

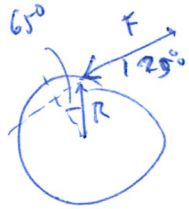
$K_{etter} = \frac{1}{2}\cdot 3mv_2^2 = \frac{1}{2}\cdot 3m\frac{v_0^2}{3^2} = \frac{1}{6}mv_0^2$ $\quad TAP = K_{før} - K_{etter}$

$TAP = \frac{3}{2}mv_0^2 - \frac{1}{6}mv_0^2 = \frac{9mv_0^2}{6} - \frac{1mv_0^2}{6} = \frac{8}{6}mv_0^2 = \frac{4}{3}mv_0^2 = \frac{4}{3}mv^2$ (E)

A5: ENERGIEN ER BEVART VED ELASTISK KOLLISJON

$\therefore K_{før} = K_{etter} = \frac{1}{2}2mv^2 = \frac{2}{2}mv^2 = mv^2$ (A)

A6:



$\tau = F\cdot R\cdot\sin\theta = F\cdot R\cdot\sin 65^\circ$

MEN $\quad \sin 65^\circ = \cos 25^\circ$

$\Rightarrow F\cdot R\cdot\cos 25^\circ$ (A)

FY0001

A7: $R_1 // R_2 \Rightarrow \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R_{//}} \Rightarrow \frac{1}{2} + \frac{1}{2} = \frac{1}{R_{//}} \Rightarrow R_{//} = 1\,\Omega$

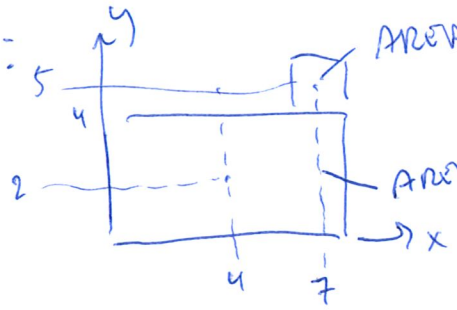
SERIEKOBLE TIL R_3 $\Rightarrow$ $R_3 + R_{//} = 10 + 1 = 11\,\Omega$ (E)

A8: $n_1 \sin\theta_1 = n_2 \sin\theta_2$ (VANN, LUFT)

$\Rightarrow 1.33 \cdot \sin 15^\circ = 1.0 \cdot \sin\theta_2$

$\Rightarrow \theta_2 = 20.1^\circ$ (C)

A9:



TOTAL AREA 36

x-retning: $\frac{1}{36}(7 \cdot 4 + 4 \cdot 32) = 4{,}3$

y-retning: $\frac{1}{36}(5 \cdot 4 + 2 \cdot 32) = 2{,}3$

$\therefore (x, y) = (4{,}3,\ 2{,}3)\,m$

VANN FØR MED UTELUKNINGS-METODEN

(E)

A10: $X = 0$ POSISJON

$\frac{dx}{dt} \geq 0$

$\frac{d^2x}{dt^2} \neq 0$ ($\frac{dx}{dt}$ IKKE KONSTANT)

SOM POSISJONEN TILTAKER ↓ NEDOVER

$\frac{d^2x}{dt^2} < 0$

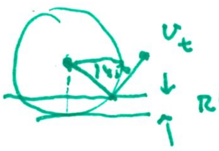
UTELUKNING GIR (B)

B11: $R = 0.40\ m$; $T = 0.50\ s$

a) I sirkulær bane med konstant fart => kun sentripetal-aks.

$$a_c = \frac{v_t^2}{R} = \frac{(\omega R)^2}{R} = \omega^2 R \quad \text{der } \omega = \frac{2\pi}{T} \Rightarrow a_c = \left(\frac{2\pi}{T}\right)^2 \cdot R = (2\pi)^2 \frac{0.40}{(0.5)^2} = 63\ \frac{m}{s^2}$$

b) Når snoret ryker $v_t = \omega \cdot R = \frac{2\pi}{T} \cdot R = 2\pi \frac{0.4}{0.5} = 5.025\ \frac{m}{s}$



Sett $(x_0, y_0) = (0, 0)$

$$v_{oy} = v_{ox} = \frac{v_{to}}{\sqrt{2}} = 3.55\ \frac{m}{s}$$

=> Ligningen: $x = v_{ox} t = 3.55t$

$y = v_{oy} t + \frac{1}{2} a_y t^2 = 3.55t - 4.9t^2$

Kula når bakken der $y = -R(1-\cos 45°) = -0.1171$

=> $-0.1171 = 3.55t - 4.9t^2$ => $t^2 - 0.7249t - 0.0239 = 0$ => $t = \frac{0.7249}{2} \pm \sqrt{\left(\frac{0.7249}{2}\right)^2 + 0.0239}$

=> $t_1 = 0.75649$ ← fysikalsk rett løsning

$t_2 = -0.3159$ neg tid

Ans. etter 0,76 s

c) Må bli nettopp som v_t, litt høyre

$v_x = v_{ox} = 3.55\ \frac{m}{s}$

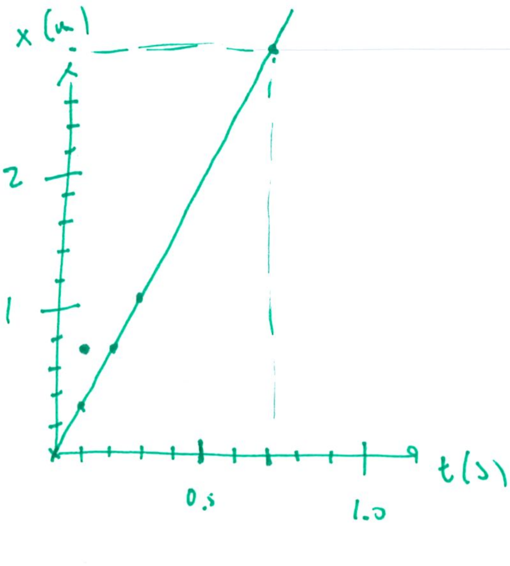
$v_y = \frac{dy}{dt} = v_{oy} - g \cdot t = 3.55 - 9.8 \cdot 0.75649 = 3.55 - 7.413602 = -3.86\ \frac{m}{s}$

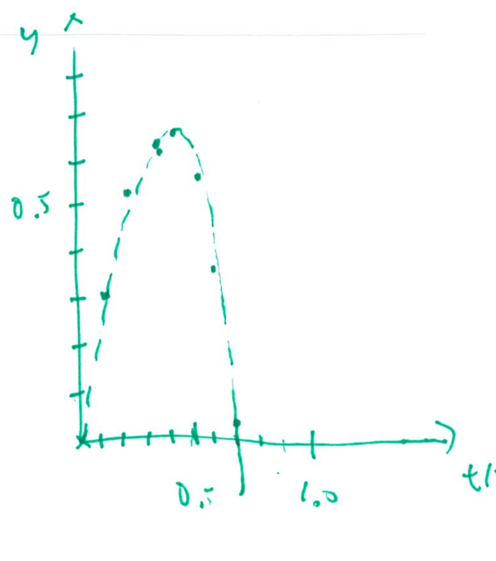
$\therefore v_{time} = \sqrt{3.55^2 + 3.86^2} \simeq 5.24\ \frac{m}{s}$

Ans. 5.2 $\frac{m}{s}$

d)

t	x	y
0	0	0
0.1	0.355	0.306
0.2	0.71	0.514
0.3	1.07	0.624
0.4	1.42	0.636
0.5	1.78	0.55
0.6	2.13	0.366
0.7	2.5	0.084
0.76	2.7	−0.1372





B12: $f = 6.0$ cm

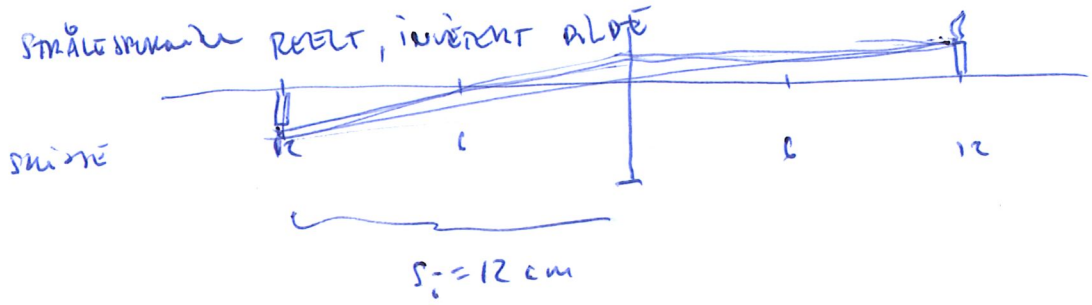
$s_o = 12$ cm

a)

$$\frac{1}{s_o} + \frac{1}{s_i} = \frac{1}{f} \Rightarrow \frac{1}{12} + \frac{1}{s_i} = \frac{1}{6} \Rightarrow \frac{1}{s_i} = \frac{2\cdot1}{2\cdot6} - \frac{1}{12} = \frac{1}{12} \Rightarrow s_i = 12$$

$$M = -\frac{s_i}{s_o} = -1$$

INVERTERT BILDE



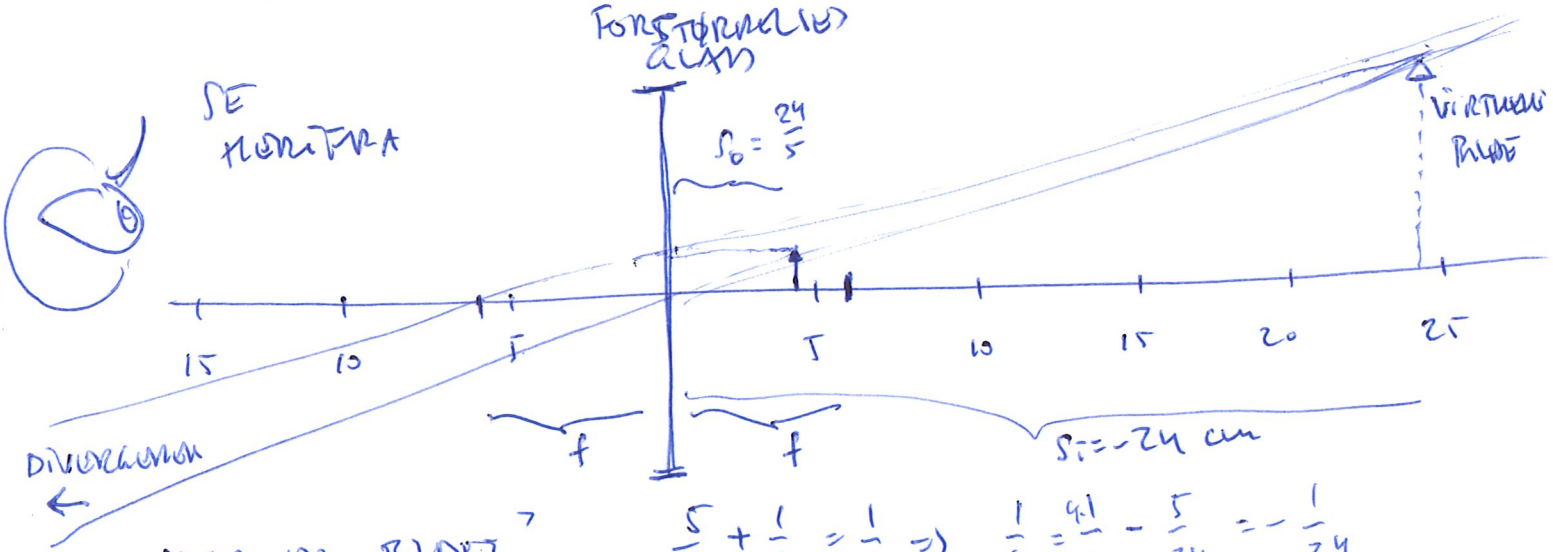
$s_i = 12$ cm

b) FORSTØRRELSESGLASS: BILDEN PLASSERES INNENFOR BRENNPUNKTAVSTANDEN OG ET VIRTUELT, OPPRETT BILDE OPPSTÅR PÅ SAMME SIDE

$$M = 5 = -\frac{s_i}{s_o} \Rightarrow 5 = -\frac{s_i}{s_o}$$

$$\Rightarrow s_i = -5s_o \Rightarrow \text{GAUSS-LOV}: \frac{1}{s_o} + \frac{1}{(-5s_o)} = \frac{1}{f} \Rightarrow \frac{5\cdot1}{5\cdot s_o} - \frac{1}{5s_o} = \frac{1}{6}$$

$$\Rightarrow \frac{4}{5s_o} = \frac{1}{6} \Rightarrow \frac{6\cdot4}{5} = s_o \simeq \frac{24}{5} = s_o \qquad s_o = 4.8$$



$s_i = -24$ cm

HVOR ER BILDET?

$$\frac{5}{24} + \frac{1}{s_i} = \frac{1}{6} \Rightarrow \frac{1}{s_i} = \frac{4\cdot1}{4\cdot6} - \frac{5}{24} = -\frac{1}{24}$$

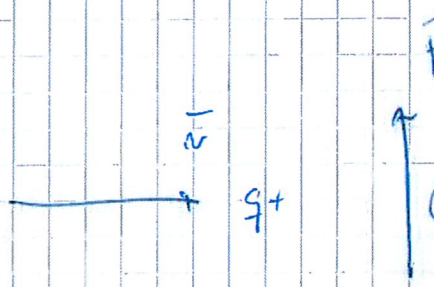
$\therefore s_i = -24$ FOR BILDE, VIRTUELT

SLUTTELIG $M = -\frac{s_i}{s_o} = \frac{-(-24)\cdot5}{25} = +5$ OM

B 11)

$\vec{F} = q(\vec{v} \times \vec{B})$

a)



$|\vec{F}| = 1.60 \cdot 10^{-19} C \cdot 6000 \frac{m}{s} \cdot 0.05 \cdot 10^{-3} T$

$= 4.8 \cdot 10^{-18} N$

SETT OVAN ifrån

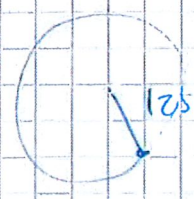
b)

Beräkna cirkelns radie

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

$= \frac{1.67 \cdot 10^{-27} \cdot 6000^2}{4.8 \cdot 10^{-18}}$

$= 125$ m



$t = \frac{s}{v}$

$T = \frac{2\pi \cdot 125}{6000}$ omloppstid

$1.314 \cdot 10^{-2}$ s $\Rightarrow f = 76$ Hz