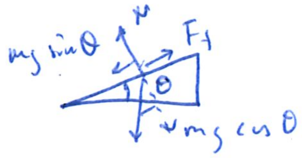
A1 :



BEGYNNER Å SKLI NÅR

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

$$\Rightarrow \mu_s = \frac{\sin\theta}{\cos\theta} = \tan\theta \qquad \mu_s = 0.29 \rightarrow \theta = 16^\circ$$

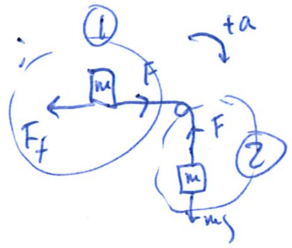
D

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

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

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)

$$\Rightarrow mg - \mu_k\cdot N = 2ma \Rightarrow \cancel{m}g - \cancel{m}g\mu_k = 2\cancel{m}a$$

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

D

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

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

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

$$\text{TAP} = \frac{3}{2}mv_0^2 - \frac{1}{6}mv_0^2 = \frac{9mv_0^2}{6} - \frac{1mv_0^2}{6} = \frac{8}{6}mv_0^2 = \underline{\underline{\frac{4}{3}mv_0^2}} = \frac{4}{3}mv^2$$

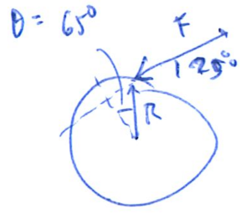
E

A5 : ENERGIEN ER BEVART VED ELASTISK KOLLISJON

$$\therefore K_{før} = K_{etter} = \frac{1}{2}2mv^2 = \underline{\frac{2}{2}mv^2 = mv^2}$$

A

A6 :



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

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

$$\Rightarrow \underline{F\cdot R\cdot\cos 25^\circ}$$

A

FY0001

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

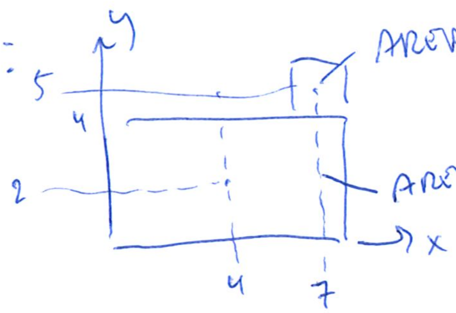
SERIEKOBLE TIL R_3 $\Rightarrow$ $R_3+R_{//}=10+1=11\,\Omega$ E

A8: $n_1 \sin\theta_1 = n_2 \sin\theta_2$ $\Rightarrow 1.33\cdot \sin 15^\circ = 1.0\cdot\sin\theta_2$

VANN LUFT

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

A9:



AREA 4 $=2\times2$

AREA $4\times8=32$

TOTAL AREA 36

x-retning: $\frac{1}{36}(7\cdot4+4\cdot32)=4.3$

y-retning: $\frac{1}{36}(5\cdot4+2\cdot32)=2.3$

$\therefore (x,y)=(4.3,\,2.3)\,m$ E

KAN SES MED UTELUKKINGS-METODEN

A10: $X=0$ POSISJON

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

$\frac{d^2x}{dt^2}\neq0$ ($\frac{dx}{dt}$ IKKE KONSTANT)

SOM POSISJONEN MERKER ↓ NEDOVER

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

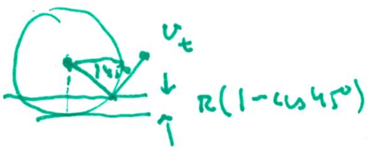
UTELUKNING GIR B

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

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

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

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

$v_{0y} = v_{0x} = \frac{v_{t0}}{\sqrt{2}} = 3.55\ \frac{m}{s}$

=> Ligningen: $x = v_{0x} t = 3.55t$

$y = v_{0y} t + \frac{1}{2} a_y t^2 = 3.55t - 4.9t^2$

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 nettop som v_t, litt høyre

$v_x = v_{0x} = 3.55\ \frac{m}{s}$

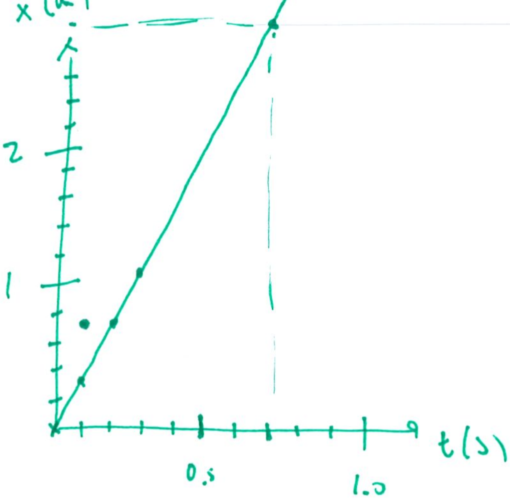
$v_y = \frac{dy}{dt} = v_{0y} - g \cdot t = 3.55 - 9.8 \cdot 0.75649 = 3.55 - 7.413602 = -3.86\ \frac{m}{s}$

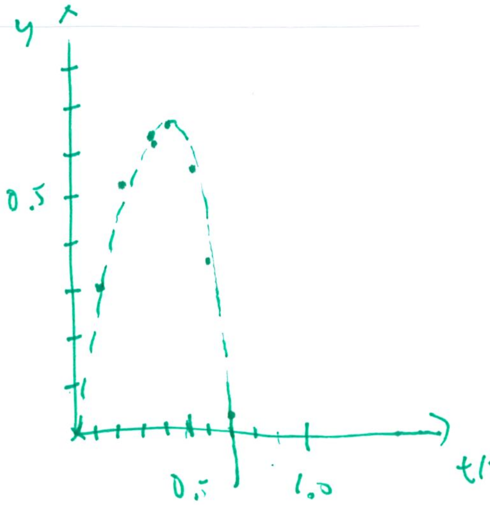
∴ $v_{time} = \sqrt{3.55^2 + 3.86^2} \approx 5.24\ \frac{m}{s}$

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	−0.1172





B12:

$f = 6.0$ cm

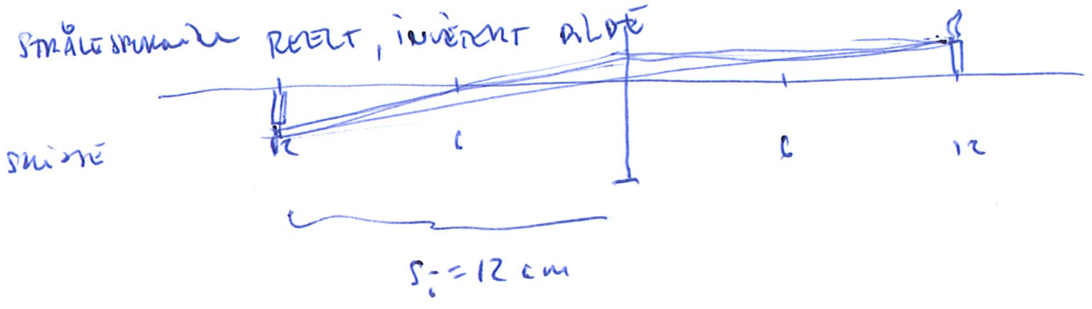
$s_o = 12$ cm

a)

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

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

INVERTERT BILDE



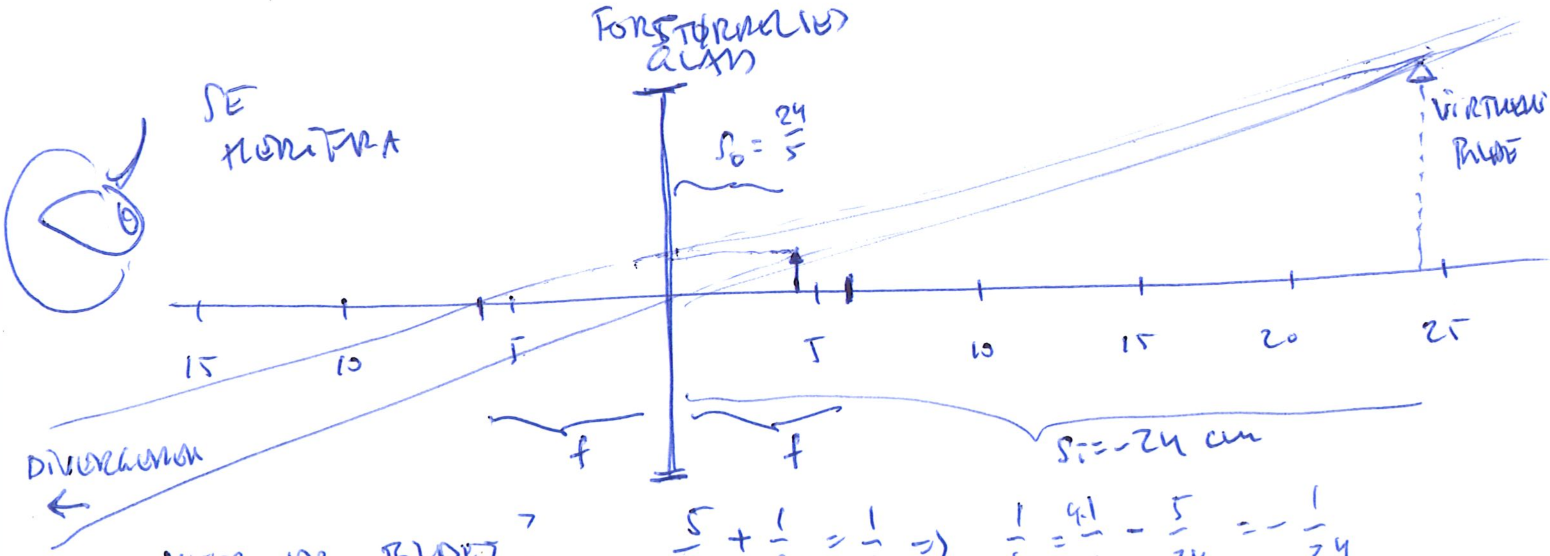
b) FORSTØRRELSESGLASS: BRUKER PLANOBJEKT INNENFOR FOKALLENGDEN OG ET VIRTUELT, OPPRETT BILDE OPPSTÅR PÅ SAMME SIDE

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

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

$$\Rightarrow \frac{4}{5s_o} = \frac{1}{6} \Rightarrow \frac{6\cdot 4}{5} = s_o \simeq \frac{24}{5} = s_o$$

$\underline{s_o = 4.8}$



HVOR ER BILDET?

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

$\therefore s_i = -24$

FOR BILDE, VIRTUELT

SJEKKE $M = -\frac{s_i}{s_o} = \frac{-(-24)\cdot 5}{25} = +5$ OK

B11)

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

a)

$\bar{v}$ → q+   ↑ $\bar{B}$ ⊙ F ut ur pappret

$|\bar{F}| = 1.60\cdot10^{-19}\,C\cdot 600\,000\,\frac{m}{s}\cdot 0.05\cdot10^{-3}\,T$

$= 4.8\cdot10^{-18}\,N$

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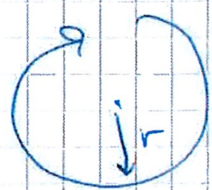
b)

SETT OVANIFRA

v → ⊙ B

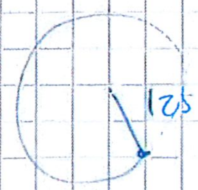
↓ F



Beveger om i sirkel

$F = m\cdot a_c$

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



$= \frac{1.673\cdot10^{-27}\cdot 600\,000^2}{4.8\cdot10^{-18}}$

$t = \frac{s}{v}$ $T = \frac{2\pi\cdot125}{600\,000}$ omloppstid $T.\cancel{[illegible]} = 125\,m$

$1.314\cdot10^{-3}\,s \Rightarrow f = 761\,Hz$