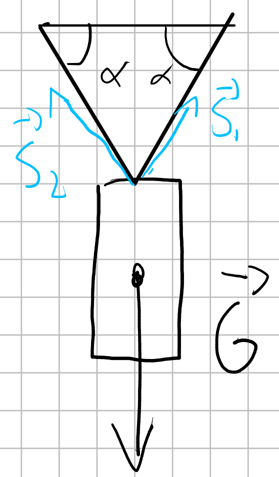
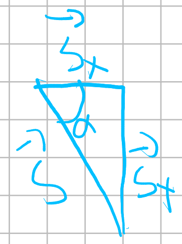
İFYTT1001, Øving 2, Nicolai H. Brand

(1)

$G = 218\,N$

$\alpha = 37^0$





Vet at:

$\sum F_y = 0$ og $\sum F_x = 0$ og $\vec{S}_1 = \vec{S}_2$ (symmetri)

$\vec{G} - \vec{S}_{1y} - \vec{S}_{2y} = 0$

$\vec{G} - 2\vec{S}_x = 0$

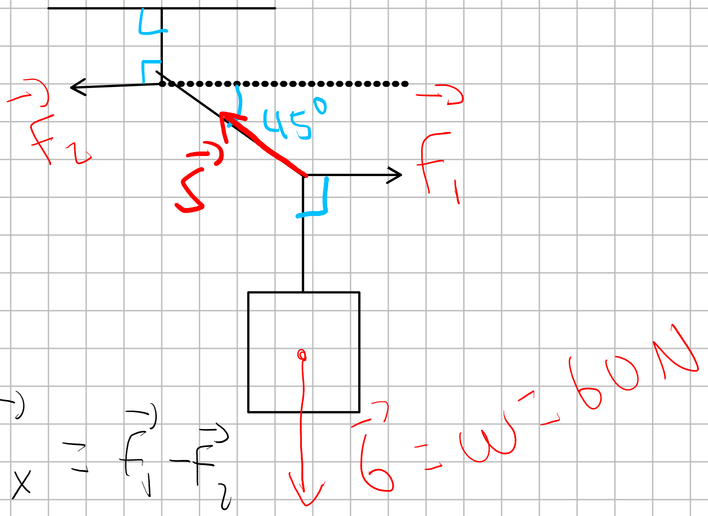
$\vec{S}_y = \frac{1}{2}\vec{G} = \frac{1}{2} \cdot 218N = \underline{109N}$

Vet at $\sin\alpha = \frac{\vec{S}_y}{\vec{S}} = \vec{S} = \frac{\vec{S}_y}{\sin\alpha} = \frac{109N}{\sin(37^0)}$

$= \underline{\underline{181N}}$

<u>Det virker en kraft på 181 N langs hvert tau</u>

② $w = 60N$

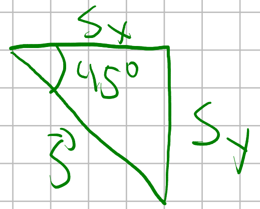


a)

Vet at:

1. $\sum F_x = 0 \Rightarrow \vec{S}_x = \vec{F}_1 - \vec{F}_2$

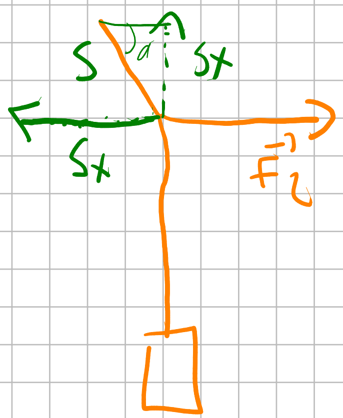
2. $\sum F_y = 0 = \vec{S}_y = \vec{G}$

3. 

$\sin\alpha = \frac{\vec{S}_y}{\vec{S}} \Rightarrow \vec{S} = \frac{\vec{S}_y}{\sin\alpha}$

$$\vec{S} = \frac{\vec{S}_y}{\sin\alpha} = \frac{\vec{G}}{\sin\alpha} = \frac{60N}{\sin(45°)} = \underline{60\sqrt{2}N} \approx 84,9N$$

b)



Ser x-komponenten til S har lik størrelse som $\vec{F}_2$ p.g.a. Newtons 2. lov.

1. $\tan\alpha = \frac{\vec{S}_y}{\vec{S}_x} \Rightarrow \vec{S}_x = \frac{\vec{S}_y}{\tan\alpha}$

2. $\vec{F}_2 = \vec{S}_x = \frac{\vec{S}_y}{\tan\alpha} = \frac{\vec{G}}{\tan\alpha} = \frac{60N}{\tan 45°} = \underline{\underline{60N}}$

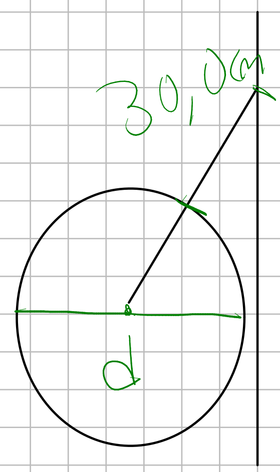
<u>$\vec{F}_1$ vil også ha lik størrelse som S_x, samme argument.</u>

(3)

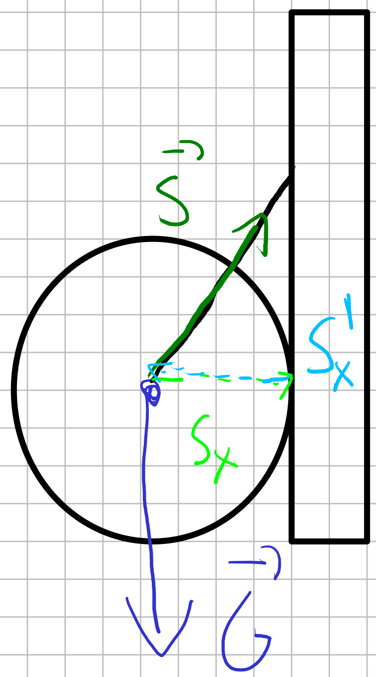
$m = 45{,}0\,kg$

$d = 32{,}0\,cm \Rightarrow r = 0{,}16\,m$

$L = 0{,}30\,m$



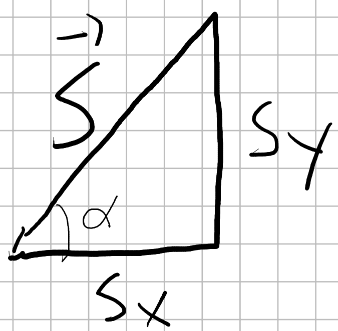
a)



$|S_x| = |S_x'|$

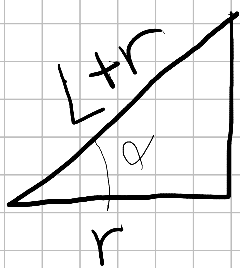
$|S_y| = |G|$

b)



$\sin\alpha = \frac{S_y}{\vec{S}}$

$\vec{S} = \sin\alpha\, mg$



$\cos\alpha = \frac{r}{L+r}$

$\alpha = \arccos \frac{r}{L+r}$

$$\vec{S} = \sin\left[\arccos\left(\frac{r}{L+r}\right)\right] mg$$

$$= \sin\left[\arccos\left(\frac{0{,}16\,m}{0{,}30\,m + 0{,}16\,m}\right)\right] \cdot 45\,kg \cdot 9{,}81\,m/s^2$$

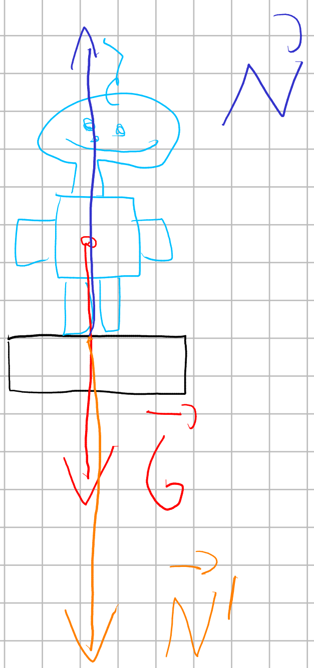
$$= \underline{\underline{471\,N}}$$

c)

$$\cos\alpha = \frac{S_x}{\vec{S}} \Rightarrow S_x = \cos\left[\arccos\left(\frac{r}{L+r}\right)\right] \cdot \vec{S}$$

$$S_x = \frac{r}{L+r} \cdot \vec{S} = \frac{0{,}16\,m}{0{,}30\,m + 0{,}16\,m} \cdot 471\,N = \underline{\underline{164\,N}}$$

4)



Antar badevekten måler motkraften til normalkraften

$$m = \frac{F}{a} = \frac{N'}{a}$$

Hvis $a \neq g$ vil vekten vise ulik mass enn forventet.

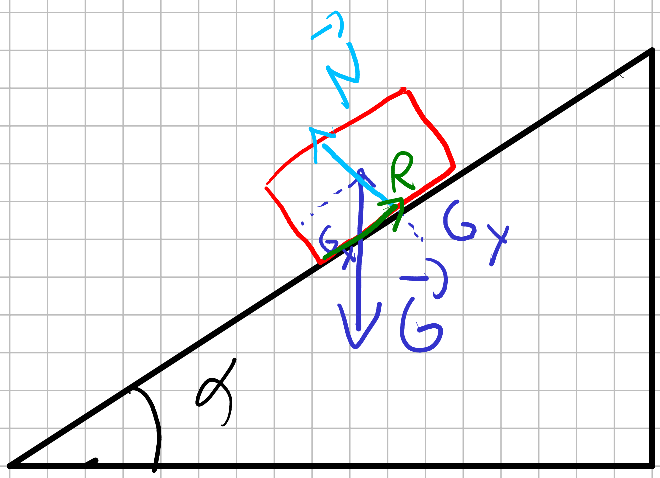
$a > g$ gir $m < M_{forventet}$

Dermed må en avlesning av $M > m_{forventet} \Rightarrow a < g$ og $a > 0$.

Dermed <u>kan</u> C, D, F være riktige.

(5) V er konstant

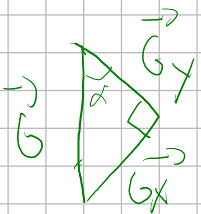
$\Downarrow$



1. $\sum F_x = 0$

$\vec{G}_x = \vec{R}$, vet $\vec{R} = \mu_k N$

$\sin \vec{G} = \mu_k \vec{N}$



$\sin \alpha = \frac{\vec{G}_x}{\vec{G}} \Rightarrow \vec{G}_x = \sin\alpha \vec{G}$

$\cos \alpha = \frac{\vec{G}_y}{\vec{G}} \Rightarrow \vec{G}_y = \cos\alpha \vec{G}$

2. $\sum F_y = 0$

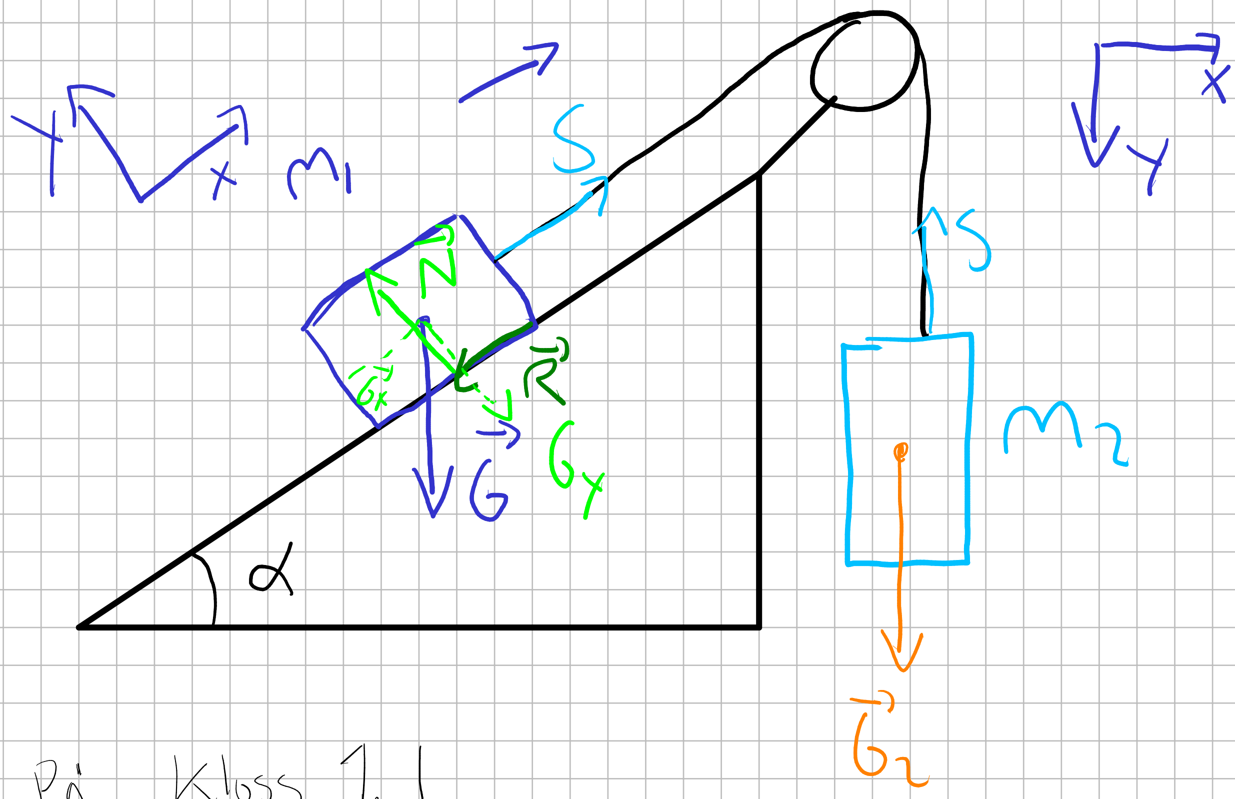
$\vec{G}_y = \vec{N}$

$\boxed{\cos\alpha \vec{G} = N}$

$\sin\alpha \vec{G} = \mu_k \cos\alpha G$

$\mu_k = \frac{\sin\alpha}{\cos\alpha} = \underline{\underline{\tan\alpha}}$

6



Ser på kloss 1.

$$\sum F_x = m_1 a$$

$$\vec{S} - \vec{G}_x - \vec{R} = m_1 a$$

$$\sum F_y = 0$$

$$\vec{N} = \vec{G}_y$$

Ser på kloss 2.

$$\sum F_y = m_2 a$$

$$\vec{G}_2 - \vec{S} = m_2 a$$

$$\Downarrow$$

$$\vec{S} = -m_2 a + m_2 g$$

$$-m_2 a + m_2 g - m_1 a = \mu \vec{G}_y - \vec{G}_x$$

$$-a(m_1 + m_2) = \mu \vec{G}_y - \vec{G}_x - m_2 g$$

$$a = g\left(\frac{m_2 - m_1 \sin\alpha - \mu m_1 \cos\alpha}{m_1 + m_2}\right)$$

$$\underline{\underline{a = 2{,}66\,m/s^2}}$$

b) Fra a) $\vec{S} = m_2 g - m_2 a$

$\vec{S} = 36{,}0\,kg(9{,}81\,m/s^2 - 2{,}66\,m/s^2)$

$\underline{\underline{\vec{S} = 257\,N}}$

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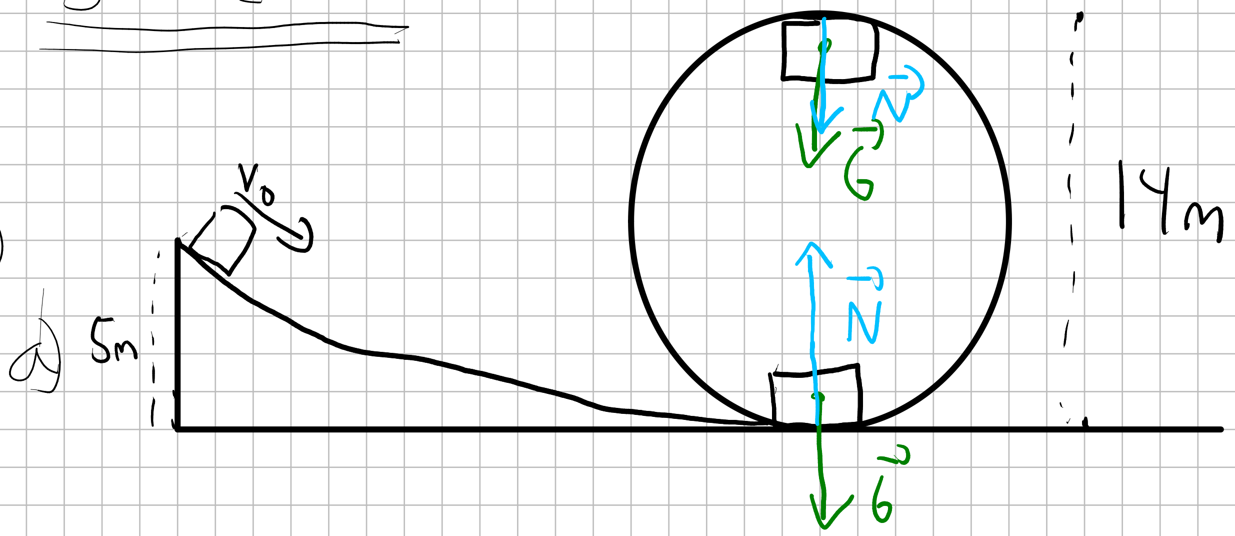

b)

$$\vec{N} - \vec{G} = ma = m\frac{v^2}{r}$$

$$\vec{N} = mg\left(\frac{v^2}{gr} + 1\right)$$

$$v = 70\,km/t = \frac{70}{3{,}6}\,m/s, \quad r = \frac{d}{2} = \frac{14\,m}{2} = 7\,m$$

$$\vec{N} = mg\left[\frac{\left(\frac{70}{3{,}6}\,m/s\right)^2}{9{,}81\,m/s^2 \cdot 7\,m} + 1\right]$$

$$\vec{N} = mg \cdot 6{,}505 = \underline{\underline{6{,}5\,G}}$$

c)

$$\vec{N}+\vec{G}=m\frac{v^2}{r} \qquad v_0=\frac{70}{3{,}6}\,m/s$$

$$\frac{1}{2}mv_0^2=\frac{1}{2}mv^2+mgh$$

$$\frac{1}{2}v^2=\frac{1}{2}v_0^2-gh$$

$$v=\sqrt{v_0^2-2gh}$$

$$\vec{N}=-mg+m\left[\frac{v_0^2-2gh}{r}\right]$$

$$\vec{N}=mg\left(\frac{v_0^2-2gh}{gr}-1\right)$$

$$\vec{N}=mg\left(\frac{\left[\frac{70}{3{,}6}m/s\right]^2-2\cdot 9{,}81m/s^2\cdot 14m}{9{,}81m/s^2\cdot 7m}-1\right)$$

$$\vec{N}=mg\cdot 0{,}5066=\underline{\underline{mg\cdot 0{,}516}}$$

d)

$\vec{N}=0$ i grensetilfellet

Fra c): $\frac{1}{2}v_0^2=\frac{1}{2}v^2+g\frac{r}{2}$

$$\underline{v_0=\sqrt{v^2+gr}}$$

$$\vec{G} = m\frac{v^2}{r}$$

$$g = \frac{v^2}{r} \Rightarrow \underline{v^2 = gr}$$

$$\underline{\underline{v_0 = \sqrt{2gr}}}$$