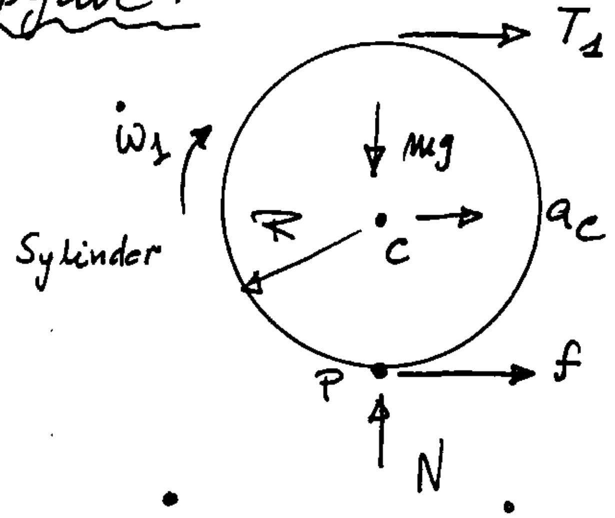
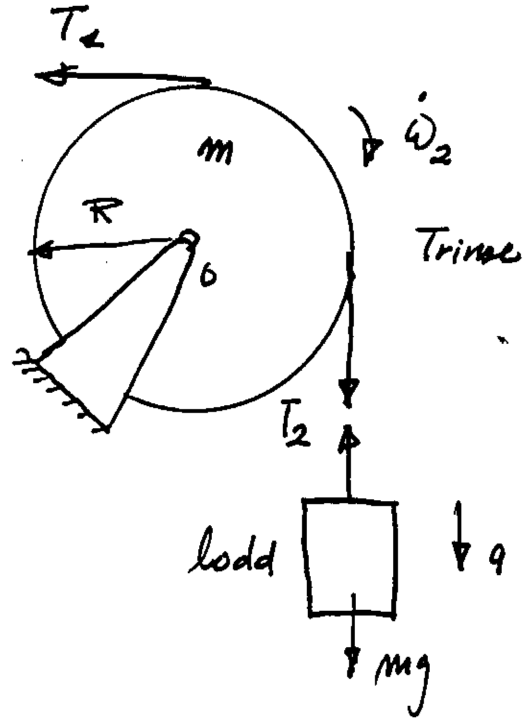
Oppgave 1





a) $a = \dot{\omega}_1 \cdot 2R$, $a_c = \dot{\omega}_1 \cdot R$

$\rightarrow \quad a_c = \frac{a}{2}, \quad \dot{\omega}_1 = \frac{a}{2R}, \quad \dot{\omega}_2 = \frac{a}{R}$

<u>For sylinder</u>

$$\Sigma M_P = I_P \dot{\omega}_1 \Rightarrow T_1 \cdot 2R = \left(\tfrac{1}{2}mR^2 + mR^2\right)\dot{\omega}_1 = \tfrac{3}{2}mR^2\dot{\omega}_1$$
$$= \tfrac{3}{2}mR^2 \cdot \tfrac{a}{2R} = \tfrac{3}{4}mR \cdot a$$

Derav: $T_1 = \frac{3}{8}ma \quad (1)$

<u>For trinse</u> $\Sigma M_0 = I_0 \dot{\omega}_2 \Rightarrow (T_2 - T_1)R = \frac{1}{2}mR^2 \cdot \frac{a}{R} \rightarrow$

$$T_2 - T_1 = \tfrac{1}{2}ma \quad (2)$$

<u>For lodd</u> $-T_2 + mg = ma \Rightarrow T_2 = mg - ma \quad (3)$

(1) og (3) innsatt i (2): $mg - ma - \frac{3}{8}ma = \frac{1}{2}ma \Rightarrow \; = \underline{\underline{\frac{8}{15}g}}$

Fra (1): $T_1 = \frac{3}{8}ma = \underline{\underline{\frac{mg}{5}}}$

b) Betingelse: $f \leq f_{maks} = \mu N = \mu mg$

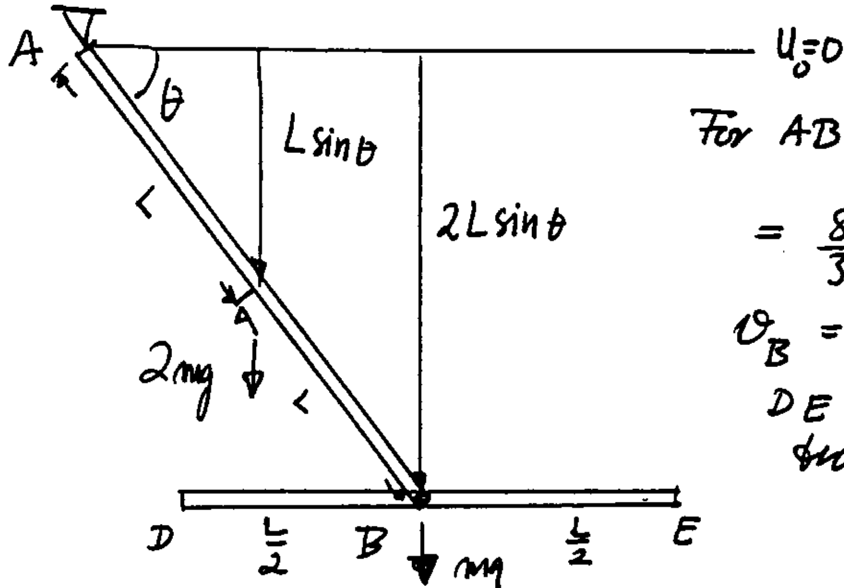
Newtons lov: $f + T_1 = m \cdot a_c = m\frac{a}{2} = \frac{4}{15}mg$

$f = \frac{4}{15}mg - T_1 = \frac{mg}{15} \Rightarrow \frac{mg}{15} \leq \mu mg$

Derav: $\underline{\underline{\mu \geq \frac{1}{15}}}$

Oppgave 2

a)



For AB: $I_A = \frac{1}{3}\, 2m(2L)^2$

$= \frac{8}{3} mL^2$

$v_B = 2L\cdot\dot\theta$

DE har bare translasjon.

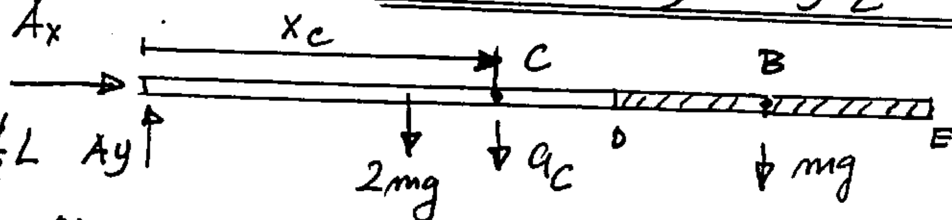
Bevarelse av energi: $K_\theta + U_\theta = K_0 + U_0 = 0$

$$K_\theta = \frac{1}{2} I_A \dot\theta^2 + \frac{1}{2} m v_B^2 = \frac{1}{2}\cdot\frac{8}{3} mL^2\dot\theta^2 + \frac{1}{2} m(2L\dot\theta)^2$$
$$= \frac{10}{3} mL^2\dot\theta^2$$

$$U_\theta = -2mgL\sin\theta - mg2L\sin\theta = -4mgL\sin\theta$$

$$\frac{10}{3} mL^2\dot\theta^2 = 4mgL\sin\theta \Rightarrow \underline{\underline{\dot\theta^2 = \frac{6}{5}\frac{g}{L}\sin\theta,\ \ddot\theta = \frac{3}{5}\frac{g}{L}\cos\theta}}$$

b) I) $\underline{\theta = 0°}$

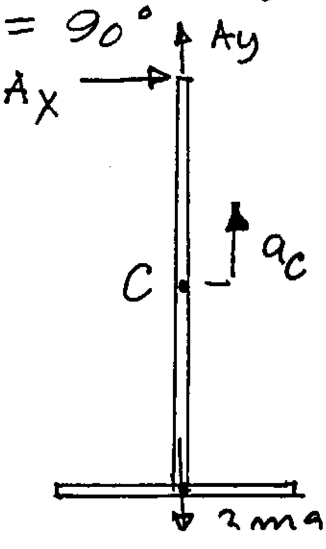


$$x_C = \frac{2mL + m2L}{3m} = \frac{4}{3}L$$

$$\theta = 0:\quad \dot\theta^2 = 0,\ \ddot\theta = \frac{3g}{5L} \rightarrow a_C = \frac{3g}{5L}\cdot\frac{4}{3}L = \frac{4}{5}g$$

$$\underline{\underline{A_x = 0}},\quad -A_y + 3mg = 3m\frac{4}{5}g \rightarrow \underline{\underline{A_y = \frac{3}{5}mg}}$$

II) $\theta = 90°$



$$\dot\theta^2 = \frac{6}{5}\frac{g}{L},\ \ddot\theta = 0 \Rightarrow \underline{\underline{A_x = 0}}$$

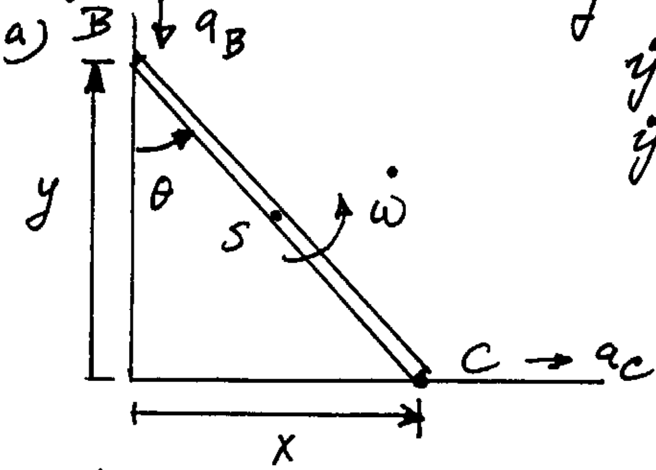
$$a_C = \frac{4}{3}L\dot\theta^2 = \frac{4}{3}L\cdot\frac{6}{5}\frac{g}{L} = \frac{8}{5}g$$

$A_y - 3mg = 3m\cdot\frac{8}{5}g$ som gir

$$\underline{\underline{A_y = \frac{39}{5}mg}}$$

Oppgave 3

a)



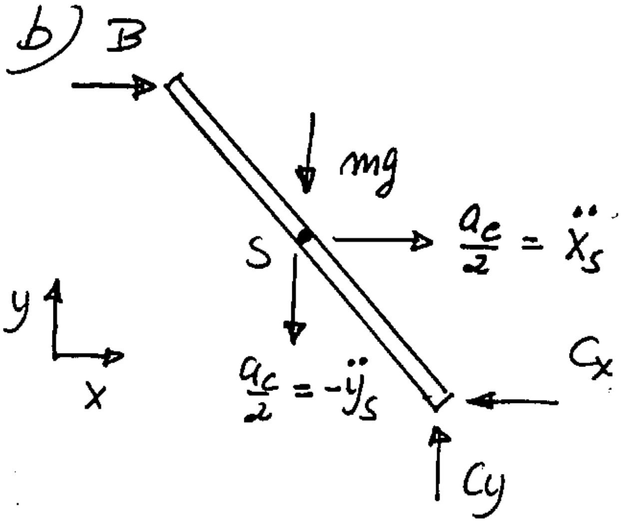
$$y = L\cos\theta \quad , \quad y_S = \frac{y}{2}$$
$$\dot{y} = -L\sin\theta\cdot\dot{\theta}$$
$$\ddot{y} = -L(\cos\theta\cdot\dot{\theta}^2 + \sin\theta\cdot\ddot{\theta})$$
$$x = L\sin\theta \; , \; \dot{x} = L\cos\theta\cdot\dot{\theta}$$
$$\ddot{x} = L(-\sin\theta\cdot\dot{\theta}^2 + \cos\theta\cdot\ddot{\theta})$$
$$x_S = \frac{x}{2}$$

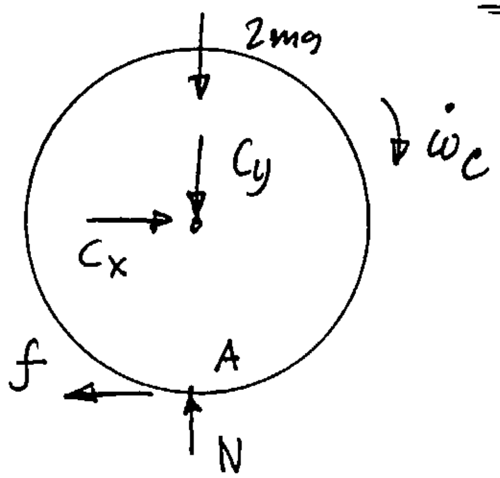
$\dot{\theta} = 0$ i startøyeblikket. Med $\ddot{y} = -a_B$, $\ddot{x} = a_C$, $\theta = 45^\circ$ og $\ddot{\theta} = \dot{\omega}$:

$$-a_B = -L\cdot\tfrac{1}{2}\sqrt{2}\,\dot{\omega} \Rightarrow a_B = \tfrac{L}{2}\sqrt{2}\,\dot{\omega}$$

$$a_C = L\tfrac{1}{2}\sqrt{2}\,\dot{\omega}$$. Derav: $\underline{\underline{a_B = a_C}}$ og $\underline{\underline{\dot{\omega} = \frac{a_C\sqrt{2}}{L}}}$

b)





For stang: x-retning: $B - C_x = \frac{ma_C}{2} \rightarrow B = \frac{ma_C}{2} + C_x \quad (1)$

y-retning: $C_y - mg = -\frac{ma_C}{2} \rightarrow C_y = mg - \frac{ma_C}{2} \quad (2)$

Spinnsats om S: $\frac{L}{2}\cdot\frac{1}{2}\sqrt{2}(C_y - C_x - B) = I_S\dot{\omega} = \frac{1}{12}mL^2\cdot\frac{a_C\sqrt{2}}{L}$

$\Rightarrow: C_y - C_x - B = \frac{m}{3}a_C \quad (3)$

For sylinder: Spinnsats om A: $C_x\cdot R = I_A\dot{\omega}_C = \frac{3}{2}\cdot 2mR^2\dot{\omega}_C = 3mR^2\dot{\omega}_C$

Ren rulling: $\dot{\omega}_C R = a_C \Rightarrow C_x = 3ma_C \quad (4)$

(4) innsatt i (1) gir $B = \frac{7}{2}ma_C \quad (5)$

(2),(4) og (5) innsatt i (3) gir: $mg - \frac{ma_C}{2} - 3ma_C - \frac{7}{2}ma_C = \frac{m}{3}a_C$

$\Rightarrow: a_C = \frac{3}{22}g \quad$ (2) og (4) gir: $C_x = \frac{9}{\ldots}mg \quad C_y = \frac{41}{\ldots}mg$