

oppgave 1:

1) 3 kpl] 2 LVL per kpl

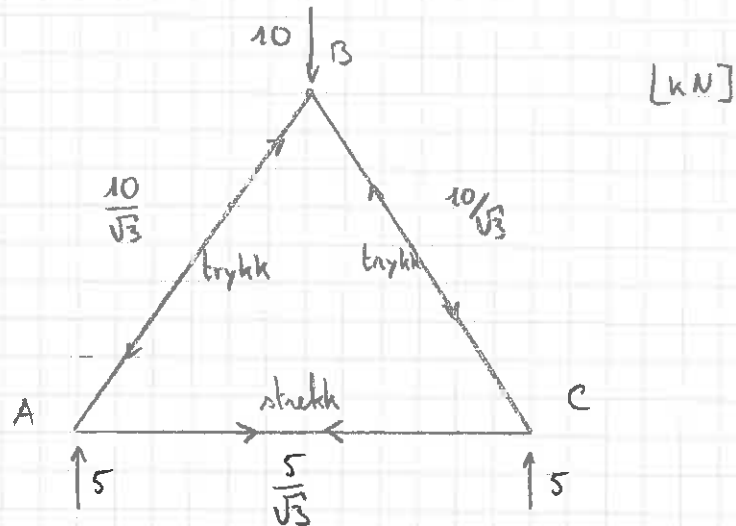
3 staver] 6 ukynte

3 reaksjoner]

$G(LVL) = 6 \text{ ukynte}$

\Rightarrow statisk bestemt

2.3)



4) $|\sigma_{max}|$: maximal normalspenning i fagverk

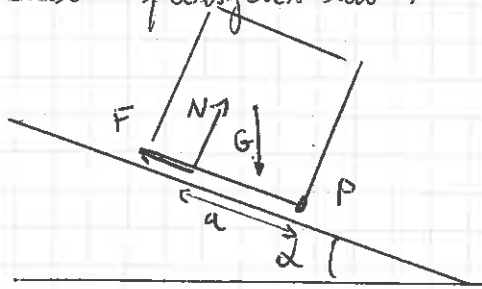
$$|\sigma_{max}| = \frac{10}{\sqrt{3}} \cdot \frac{1}{A} = 50 \text{ MPa}$$

$$n = \frac{150}{50} = 3 \quad (\text{sikkerhet mot flytning})$$

(Her: 1D problem, Tresca \Leftrightarrow Mises)

oppgave 2:

1) Coulomb friksjons lov: $F = \mu_s N$



likevekt gin: $F = G \sin \alpha$ og $N = G \cos \alpha$
lik for gliding $F = \mu_s N = \mu_s G \cos \alpha$

$$G \sin \alpha = \mu_s G \cos \alpha \Rightarrow \tan \alpha = \mu_s$$
$$\Rightarrow \underline{\alpha = 16,7^\circ}$$

2) $\alpha = 20^\circ$, $L = 1 \text{ m}$, $h = 2 \text{ m}$

likevekt om punkt P:

$$G \cos \alpha \frac{L}{2} - G \sin \alpha \frac{h}{2} - Na = 0$$

$$\Rightarrow a = \frac{L}{2} - \tan \alpha \frac{h}{2}$$

$$a = 0,14 \text{ m}$$

a er positiv \Rightarrow blokken glir

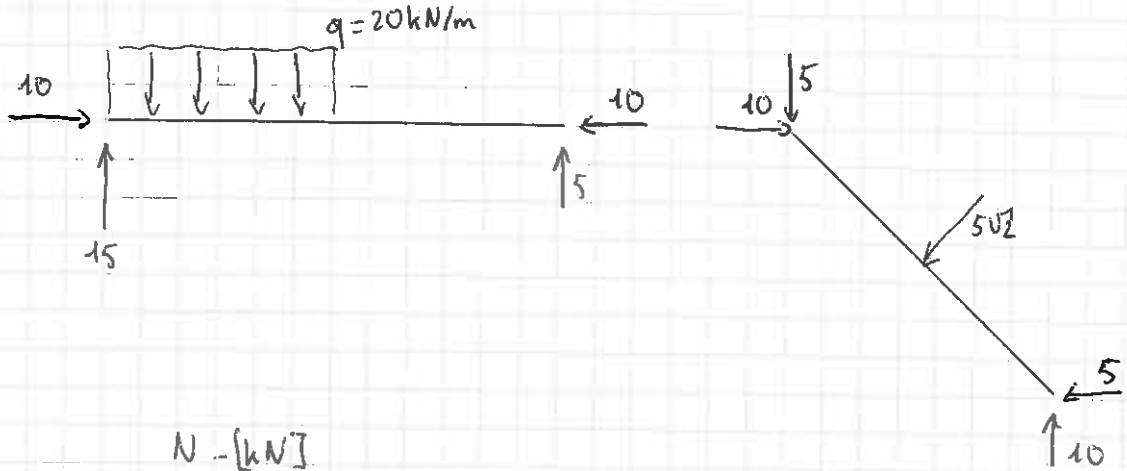
oppgave 3 :

1) 2 bjelker gir 6 LVL

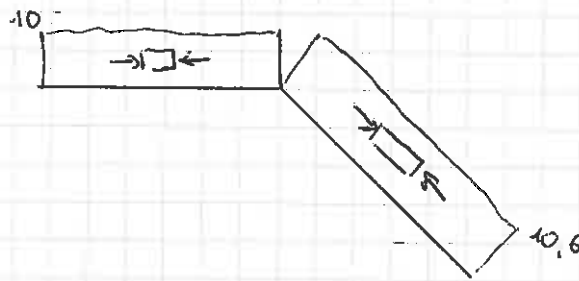
4 reaksjoner + 2 leddbryter : 6 ubekjente

=> statisk bestemt

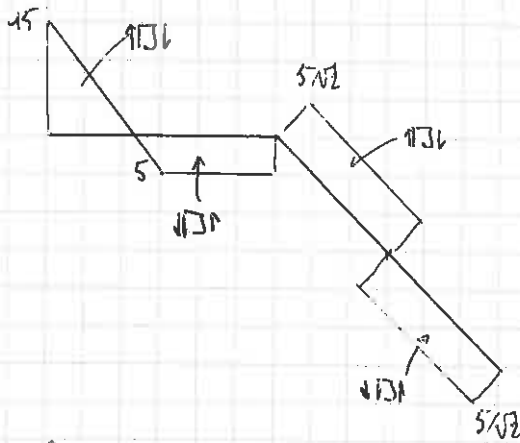
2)



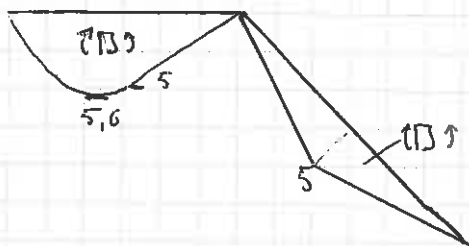
3)



V - $[\text{kN}]$



M - $[\text{kNm}]$

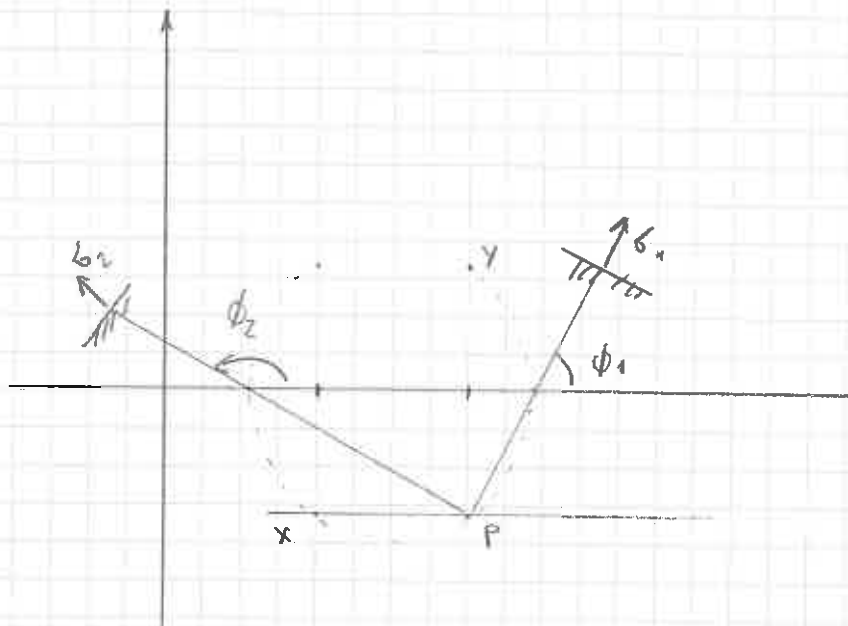


oppgave 4

$$1) \quad \sigma_x = \frac{p\lambda}{2t} = 100 \text{ MPa}$$

$$\sigma_y = \frac{p\lambda}{t} = 200 \text{ MPa}$$

$$\tau_{xy} = \frac{I}{2\sqrt{1+n^2}t} = 80 \text{ MPa}$$



$$2) \quad \sigma_{1,2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$\sigma_1 = 244 \text{ MPa} \quad \sigma_2 = 56 \text{ MPa}$$

$$\phi_1 = \arctan\left(\frac{\sigma_1 - \sigma_x}{\tau_{xy}}\right) = 61^\circ \quad \phi_2 = \phi_1 + 90^\circ = 151^\circ$$

$$3) \quad \sigma_z = \tau_{xz} = \tau_{yz} = 0$$

$$\epsilon_x = \frac{1}{E}(\sigma_x - \nu\sigma_y) = 2 \cdot 10^{-4}$$

$$\gamma_{xy} = \frac{1}{G}\tau_{xy} = 1.03 \cdot 10^{-3}$$

$$\epsilon_y = \frac{1}{E}(\sigma_y - \nu\sigma_x) = 8.5 \cdot 10^{-4}$$

$$\epsilon_{45} = \frac{\epsilon_x + \epsilon_y}{2} + \frac{1}{2}\gamma_{xy} = 1.04 \cdot 10^{-3}$$

$$4) \quad \Delta t = \epsilon_z t \quad (= \epsilon_r t)$$

$$\epsilon_z = -\frac{\nu}{E}(\sigma_x + \sigma_y) = -4.5 \cdot 10^{-4}$$

$$\Delta t = -4.5 \cdot 10^{-3} \text{ mm}$$

5) Når $T=0$ $\tau_{xy}=0$, σ_x og σ_y er hovedspenninger.

$$\sigma_y = \sigma_{\max}, \quad \sigma_{\min} = 0$$

$$\text{Tresca } \Leftrightarrow \sigma_{\max} - \sigma_{\min} = f_y \quad \Leftrightarrow \frac{p\lambda}{t} = f_y$$

$$p = 12.5 \text{ MPa}$$