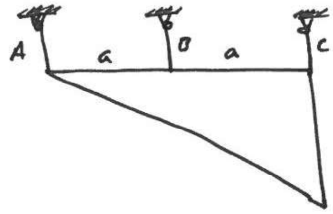
2.2.11.

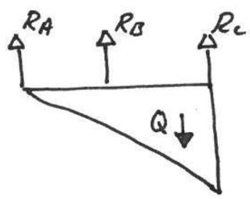
Givet Stel triangulär skiva
- × Tyngd Q
- × Lin. el. stänger



Sökt Krafter i stänger A, B, C
dvs N_A N_B N_C

Lösning

1. Frilägg



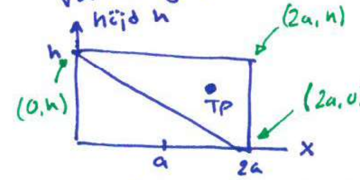
2. Jmv

$\uparrow: \; R_A + R_B + R_C - Q = 0$

$\rightarrow: \; \text{———}$

$\overset{\frown}{A}: \; a \cdot R_B + 2a \cdot R_C - \frac{4}{3} \cdot a \cdot Q = 0$

Vart angriper Q?



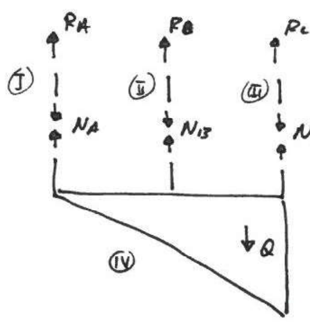
$$TP = \frac{(0,h) + (2a,h) + (2a,0)}{3}$$

$$= \left(\frac{4a}{3}, \frac{2h}{3}\right)$$

"x" "y"

all. finns som färdig formel...

3. Snitta



4. Jmv

$\uparrow_{I}: \; R_A - N_A = 0$

$\uparrow_{II}: \; R_B - N_B = 0$

$\uparrow_{III}: \; R_C - N_C = 0$

$$\Leftrightarrow \begin{cases} N_A = R_A \\ N_B = R_B \\ N_C = R_C \end{cases} \Longrightarrow \; \therefore \; \begin{aligned} N_A + N_B + N_C &= Q \\ N_B + 2N_C &= \frac{4}{3} Q \end{aligned}$$

Obs
Steg 1-4 kan göras effektivare genom att snitta/använda normalkrafter direkt...

5. Normalspänning

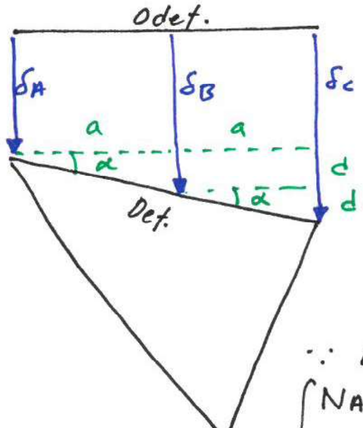
$$\left[\sigma = \frac{N}{A}\right] \Longrightarrow \sigma_A = \frac{N_A}{A} \; ; \; \sigma_B = \frac{N_B}{A} \; ; \; \sigma_C = \frac{N_C}{A}$$

6. Konstitutivt sb

Lin. el. mtrl... $\sigma = E\varepsilon \longrightarrow \varepsilon = \frac{\delta}{L}$ och $\sigma = \frac{N}{A} \Longrightarrow \delta = \frac{NL}{EA} \Longrightarrow \begin{cases} \delta_A = \frac{N_A \cdot L}{EA} \\ \delta_B = \frac{N_B \cdot L}{EA} \\ \delta_C = \frac{N_C \cdot L}{EA} \end{cases}$

7. Kompabilitet

Deformation:



$$\Longrightarrow \tan\alpha = \frac{d}{a} = \frac{2d}{2a}$$

större triangeln, där $2d = \delta_C - \delta_A$

mindre triangeln, där $d = \delta_B - \delta_A$

$$\Leftrightarrow \frac{\delta_B - \delta_A}{a} = \frac{\delta_C - \delta_A}{2a} \Longrightarrow \delta_B = \frac{\delta_C + \delta_A}{2}$$

vilket med δ_i från 6. ger sambandet

$$N_B = \frac{N_C + N_A}{2} \Leftrightarrow \frac{1}{2} N_A - N_B + \frac{1}{2} N_C = 0$$

$\therefore$ Ekvationer nu:

$$\begin{cases} N_A + N_B + N_C = Q \\ N_B + 2N_C = \frac{4}{3} Q \\ \frac{1}{2} N_A - N_B + \frac{1}{2} N_C = 0 \end{cases} \Leftrightarrow \begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ \frac{1}{2} & -1 & \frac{1}{2} \end{pmatrix} \cdot \begin{pmatrix} N_A \\ N_B \\ N_C \end{pmatrix} = \begin{pmatrix} 1 \\ 4/3 \\ 0 \end{pmatrix} \cdot Q \overset{\dots}{\Longrightarrow} \begin{aligned} N_A &= \frac{Q}{6} \\ N_B &= \frac{Q}{3} \\ N_C &= \frac{Q}{2} \end{aligned}$$