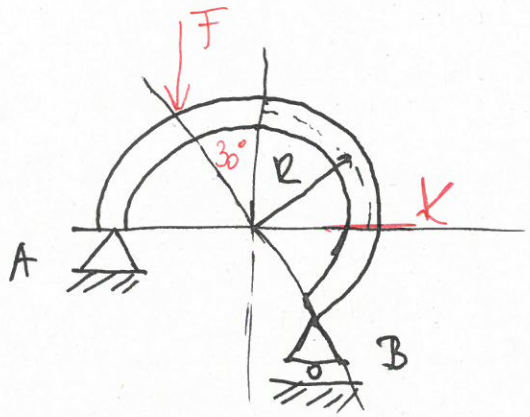
Szilárdságtan - 5. hét Plusz 2 megoldással

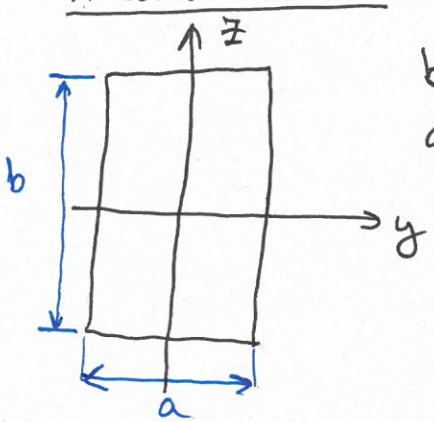


Adatok:

$F_1 = 30\,kN$

$R = 250\,mm$

A keresztmetszet:



$b = 100\,mm$

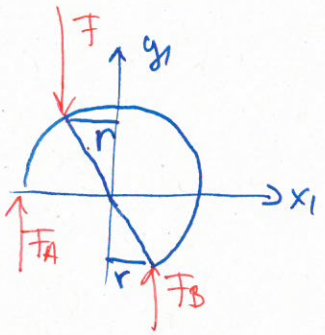
$a = 25\,mm$

Feladat:

↳ Igénybevételi ábrák

↳ K keresztmetszetben a fesz. eloszlás

Megoldás:



① Reakcióerők

↶ $\Sigma M_A = 0$

$-F \cdot r + F_B (R + r) = 0 \qquad r = R \cdot \sin 30° = \frac{R}{2}$

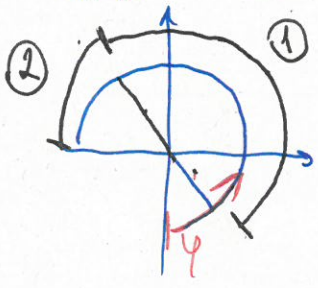
$-F \cdot \frac{R}{2} + F_B \cdot \frac{3}{2} R = 0$

$F_B = \frac{F}{3} = \underline{10\,kN}$

$\Sigma F_y = 0 \qquad F_A + F_B - F = 0$

↳ $F_A = F - F_B = \underline{20\,kN}$

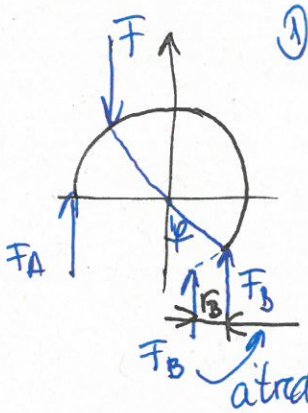
② Igénybevételi ábrák



Két részre osztjuk a tartót!

① $\varphi \in [30°, 210°]$

② $\varphi \in [210°, 270°]$



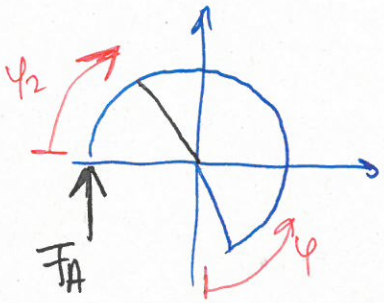
① es

$$N_1(\varphi) = -F_B \cdot \sin\varphi$$

$$V_1(\varphi) = F_B \cdot \cos\varphi$$

$$M_{h1}(\varphi) = F_B \underbrace{(R\sin\varphi - R\sin 30^\circ)}_{r_B}$$

② es → érdemes új φ_2 koordinátát alkalmazni



$$N_2(\varphi_2) = -F_A \cdot \cos\varphi_2$$

$$V_2(\varphi_2) = F_A \sin\varphi_2$$

$$M_{h2}(\varphi_2) = -F_A (R - R\cos\varphi_2)$$

Mi lesz a kapcsolat φ és φ_2 között?

↳ $\underline{\varphi_2 = 270^\circ - \varphi}$

Visszahelyettesítve és felhasználva

$$\cos(270^\circ - \varphi) = -\sin\varphi$$

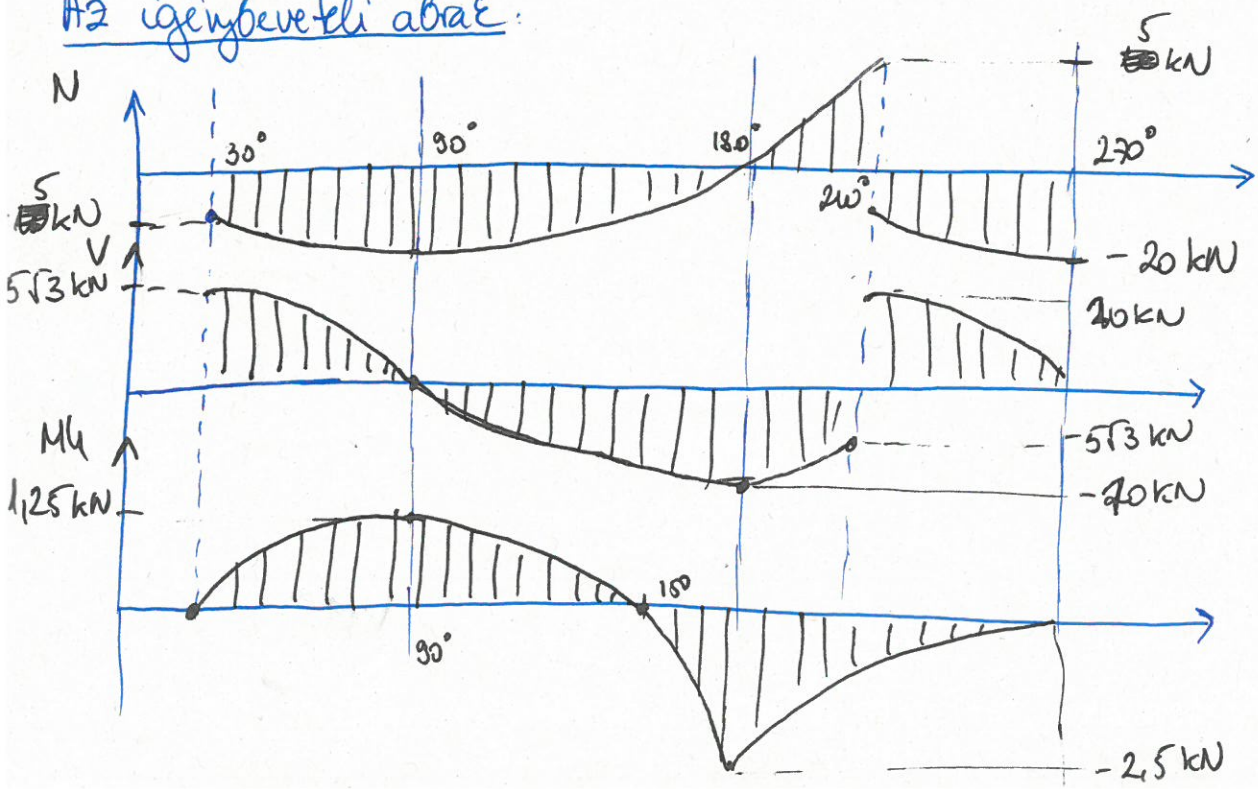
$$\sin(270^\circ - \varphi) = -\cos\varphi$$

$$N_2(\varphi) = F_A \sin\varphi$$

$$V_2(\varphi) = -F_A \cos\varphi$$

$$M_{h2}(\varphi) = -F_A (R + R\sin\varphi)$$

A2 igénybevételi ábrái:



K - keresztmetszet:

$N_K = -F_B = -10\,kN$

$M_{hK} = 1{,}25\,kNm = 1250000\,Nmm$

$\frac{R}{2e} = \frac{R}{b} = 2{,}5 \rightarrow$ Grasleof de $I_0 \approx I_y$

$A = a \cdot b = 2500\,mm^2$

$I_0 \approx I_y = \frac{ab^3}{12} = 2083333{,}3\,mm^4$

$\downarrow \sigma = \frac{N}{A} + \frac{M_h}{R \cdot A} + \frac{M_h}{I_y} \frac{Rz}{R+z}$

$\sigma(z) = -2 + 0{,}6 \cdot \frac{250z}{250+z}$

$\sigma(\frac{b}{2}) = -4{,}23\,MPa$

$\sigma(-\frac{b}{2}) = -39{,}5\,MPa$