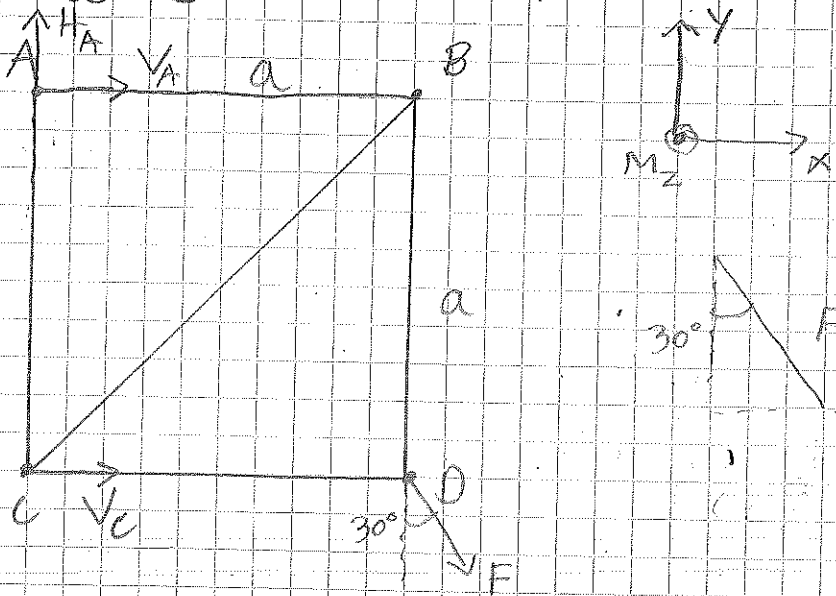


F.1

Friläggning i A och C:



Jämvikt ger:

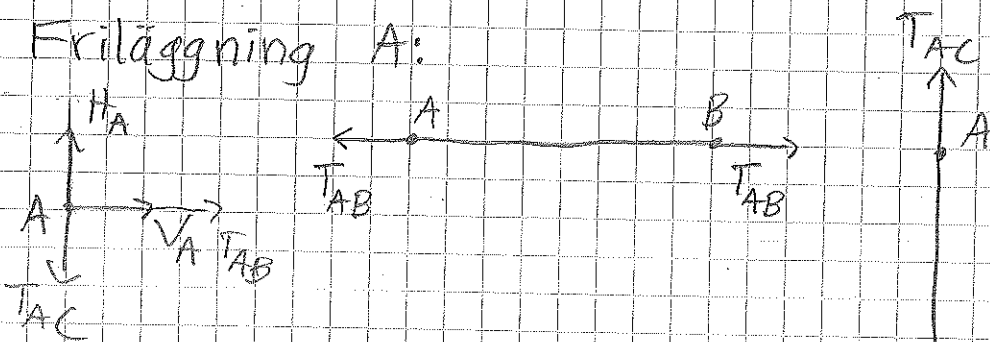
$$\rightarrow: V_A + V_C + F \sin 30^\circ = 0$$

$$\uparrow: H_A - F \cos 30^\circ = 0$$

$$\overset{\curvearrowleft}{M}_A: V_C \cdot a + F \sin 30^\circ \cdot a - F \cos 30^\circ \cdot a = 0$$

$$\Rightarrow \begin{cases} H_A = F \cos 30^\circ = \frac{\sqrt{3}}{2} F \\ V_C = F \cos 30^\circ - F \sin 30^\circ = \frac{\sqrt{3}}{2} F - \frac{1}{2} F = \frac{(\sqrt{3}-1)}{2} F \\ V_A = -V_C - F \sin 30^\circ = \left(\frac{1-\sqrt{3}}{2} \right) F - \frac{1}{2} F = \frac{-\sqrt{3}}{2} F \end{cases}$$

Friläggning A:



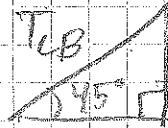
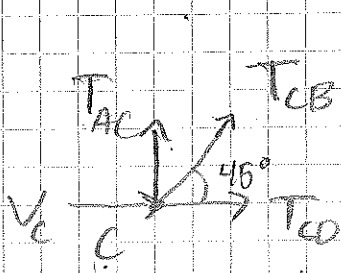
Jämvikt ger:

$$\rightarrow: T_{AB} + V_A = 0$$

$$\uparrow: H_A - T_{AC} = 0 \Rightarrow T_{AB} = -V_A = \frac{\sqrt{3}}{2} F \quad \text{drag}$$

$$T_{AC} = H_A = \frac{\sqrt{3}}{2} F \quad \text{drag}$$

F.1 (Fortsättning)



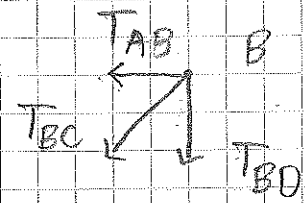
$$\rightarrow: T_{CD} + V_C + T_{CB} \cos 45^\circ = 0$$

$$\uparrow: T_{AC} + T_{CB} \sin 45^\circ = 0$$

$$\Rightarrow T_{CB} = -T_{AC} \cdot \sqrt{2} = \frac{\sqrt{3}}{2} F \quad \text{tryck (negativt tecken)}$$

$$T_{CD} = -\frac{T_{CB}}{\sqrt{2}} - V_C = \frac{\sqrt{3} \cdot F}{2} = -\left(\frac{\sqrt{3}-1}{2}\right) F$$

$$= \frac{\sqrt{3} F}{2} - \frac{\sqrt{3} F}{2} + \frac{1}{2} F = \frac{F}{2} \quad \text{drag}$$

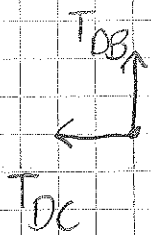


$$\rightarrow: -T_{AB} - \frac{T_{BC}}{\sqrt{2}} = 0$$

$$\uparrow: -T_{BD} - \frac{T_{BC}}{\sqrt{2}} = 0$$

$$\Rightarrow T_{AB} = -\frac{T_{BC}}{\sqrt{2}} = \frac{\sqrt{3}}{2} F \quad \text{drag}$$

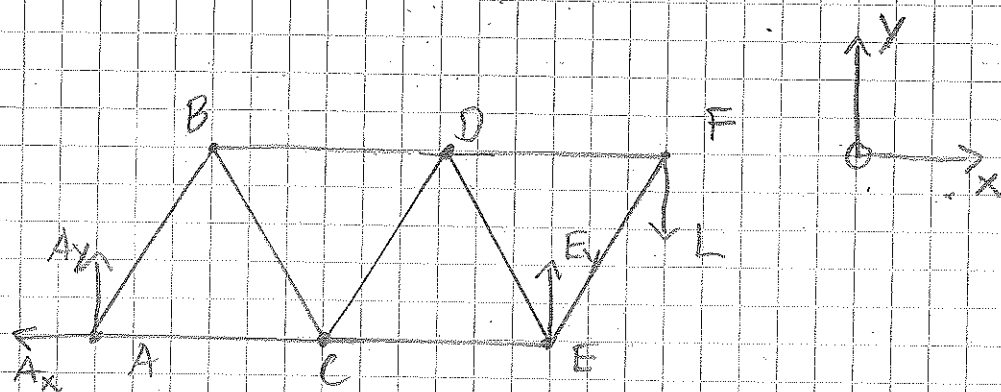
$$T_{BD} = \frac{\sqrt{3}}{2} F \quad \text{drag}$$



Redan löst innan.

F.2

Erläggning hela fackverket:



$$\rightarrow: -A_x = 0$$

$$\uparrow: A_y + E_y - L = 0$$

$$\overset{\curvearrowright}{M}_A: E_y \cdot 2d - L \cdot 2,5d = 0$$

$$\Rightarrow A_x = 0$$

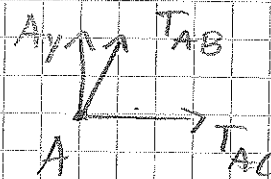
$$E_y = \frac{5}{2}L \cdot \frac{1}{2} = \frac{5L}{4}$$

$$A_y = L - \frac{5L}{4} = -\frac{L}{4}$$

Alla vinklar i trianglarna är 60° .

$$\cos 60^\circ = \frac{1}{2}$$

$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

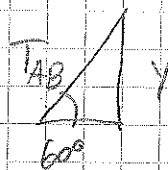


$$\rightarrow: T_{AC} + T_{AB} \cos 60^\circ = 0$$

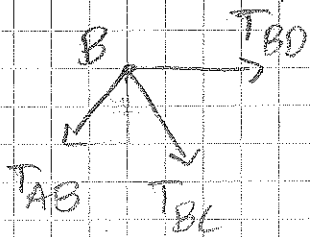
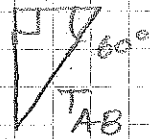
$$\uparrow: A_y + T_{AB} \sin 60^\circ = 0$$

$$\Rightarrow T_{AB} = -A_y \cdot \frac{2}{\sqrt{3}} = \frac{-L}{2\sqrt{3}} \text{ tryck}$$

$$T_{AC} = -T_{AB} \cdot \frac{1}{2} = \frac{-L}{4\sqrt{3}} \text{ drag}$$



E.2 (Fortsetzung)



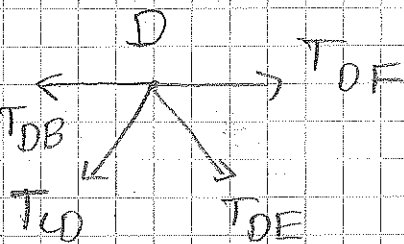
$$\rightarrow: T_{BD} - T_{AB} \cdot \cos 60^\circ + T_{BC} \cos 60^\circ = 0$$

$$\uparrow: -T_{AB} \sin 60^\circ - T_{BC} \sin 60^\circ = 0$$

$$\Rightarrow T_{BC} = -T_{AB} = \frac{-L}{2\sqrt{3}}$$

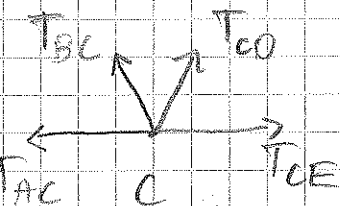
$$\underline{T_{BD}} = T_{AB} \cdot \frac{1}{2} - T_{BC} \cdot \frac{1}{2} = \frac{L}{4\sqrt{3}} + \frac{L}{4\sqrt{3}} = \frac{L}{2\sqrt{3}}$$

drag



$$\rightarrow: -T_{DB} + T_{DF} + T_{DE} \cos 60^\circ - T_{DC} \cos 60^\circ = 0$$

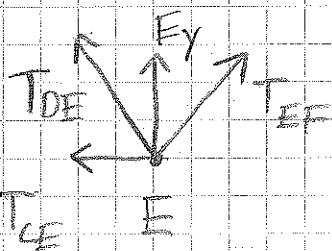
$$\uparrow: -T_{DC} \sin 60^\circ - T_{DE} \sin 60^\circ = 0$$



$$\rightarrow: -T_{AC} + T_{CE} + T_{CD} \cos 60^\circ - T_{BC} \cos 60^\circ = 0$$

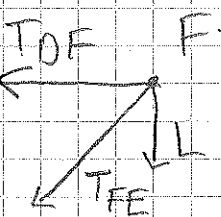
$$\uparrow: T_{BC} \sin 60^\circ + T_{CD} \sin 60^\circ = 0$$

$$\Rightarrow \underline{T_{CD}} = -T_{BC} = \frac{L}{2\sqrt{3}} \text{ drag}$$



$$\rightarrow: -T_{CE} - T_{DE} \cos 60^\circ + T_{EF} \cos 60^\circ = 0$$

$$\uparrow: E_y + T_{DE} \sin 60^\circ + T_{EF} \sin 60^\circ = 0$$



$$\rightarrow: -T_{DF} - T_{FE} \cos 60^\circ = 0$$

$$\uparrow: -L - T_{FE} \sin 60^\circ = 0$$

$$\Rightarrow T_{FE} = -\frac{2L}{\sqrt{3}} \quad / \quad T_{DF} = \frac{L}{\sqrt{3}}$$

F2

(Fortsättning)

$$T_{CE} = T_{EF} \cdot \frac{1}{2} - T_{DE} \cdot \frac{1}{2} = \frac{-L}{\sqrt{3}} - T_{DE} \cdot \frac{1}{2}$$

$$\frac{\sqrt{3} T_{DE}}{2} = -E_y - \frac{\sqrt{3}}{2} T_{EF}$$

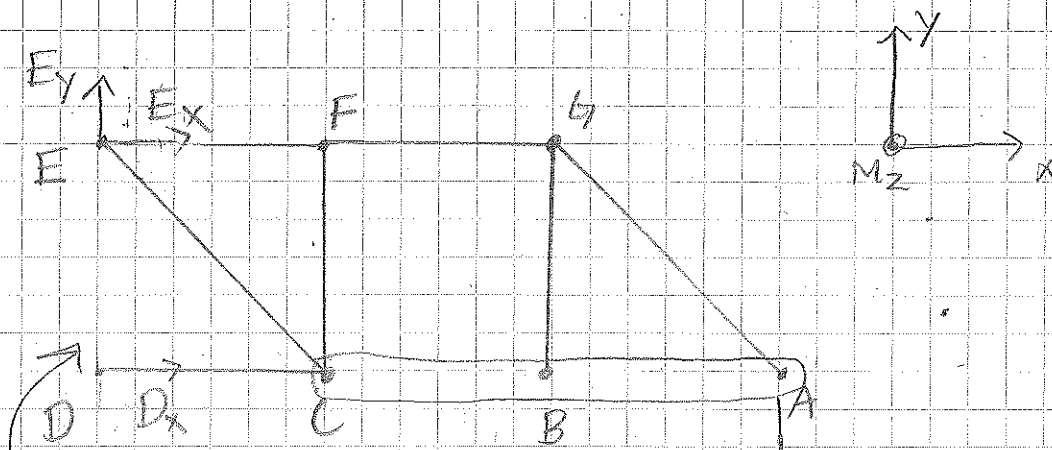
$$T_{DE} = -\frac{2E_y}{\sqrt{3}} - T_{EF} = -\frac{5L}{4} \cdot \frac{2}{\sqrt{3}} + \frac{2L}{\sqrt{3}} = -\frac{10L}{4\sqrt{3}} + \frac{8L}{4\sqrt{3}}$$

$$= -\frac{2L}{4\sqrt{3}} = -\frac{L}{2\sqrt{3}}$$

$$\underline{\underline{T_{CE}}} = \frac{-L}{\sqrt{3}} + \frac{L}{4\sqrt{3}} = \frac{-4L}{4\sqrt{3}} + \frac{L}{4\sqrt{3}} = \frac{-3L}{4\sqrt{3}} = \frac{-\sqrt{3}L}{4}$$

tryck

F3 Fritagging hela fackverket:



E_y och D_y går i samma axel, kan slå ihop dem.
 Jämvikt ger:

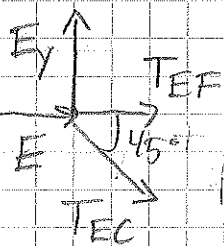
$$\rightarrow: E_x + D_x = 0$$

$$\uparrow: E_y - P = 0$$

$$\overset{\curvearrowleft}{M}_E: D_x \cdot 3 - 9P = 0 \Rightarrow D_x = 12 \text{ kN}$$

$$\overset{\curvearrowright}{M}_D: -E_x \cdot 3 - 9P = 0 \Rightarrow E_x = -12 \text{ kN}$$

$$E_y = P$$



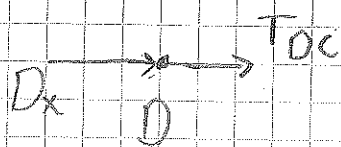
$$\rightarrow: T_{EF} + E_x + T_{EC} \cdot \frac{1}{\sqrt{2}} = 0$$

$$\uparrow: E_y - \frac{1}{\sqrt{2}} T_{EC} = 0$$

$$\Rightarrow T_{EC} = \sqrt{2} E_y = \sqrt{2} P$$

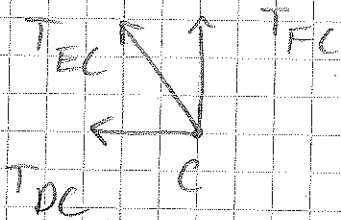
$$T_{EF} = -E_x - T_{EC} \cdot \frac{1}{\sqrt{2}} = 12 \text{ kN} - P = 16 \text{ kN}$$

F3 (Fortsetzung)



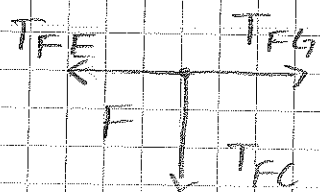
$$\rightarrow: T_{DC} + D_x = 0$$

$$\Rightarrow T_{DC} = -D_x = -12 \text{ kN}$$

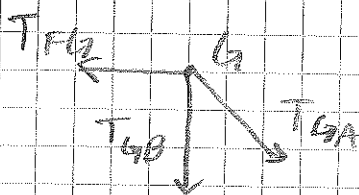


$$\uparrow: T_{FC} + T_{FC} \cdot \frac{1}{\sqrt{2}} = 0$$

$$\Rightarrow T_{FC} = -T_{FC} \cdot \frac{1}{\sqrt{2}} = -p$$



$$\rightarrow: T_{FG} = T_{FE} = 16 \text{ kN}$$

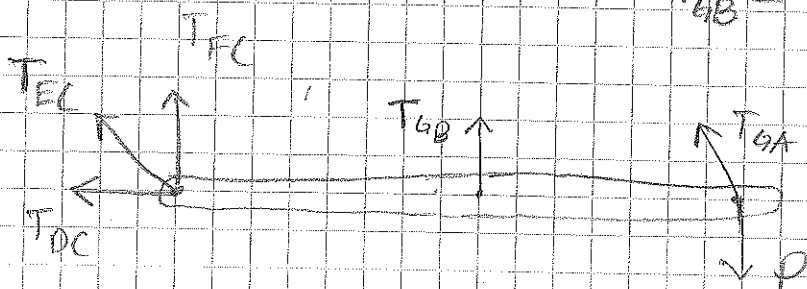


$$\rightarrow: -T_{FG} + T_{GA} \cdot \frac{1}{\sqrt{2}} = 0$$

$$\uparrow: -T_{GB} - \frac{1}{\sqrt{2}} \cdot T_{GA} = 0$$

$$\Rightarrow T_{GA} = -T_{FG} \cdot \sqrt{2} = -16 \text{ kN} \cdot \sqrt{2}$$

$$T_{GB} = -\frac{1}{\sqrt{2}} \cdot T_{GA} = 16 \text{ kN}$$



$$\rightarrow: -T_{DC} - T_{FC} \cdot \frac{1}{\sqrt{2}} - T_{GA} \cdot \frac{1}{\sqrt{2}} = 0$$

$$\uparrow: T_{FC} + T_{GB} + T_{GA} \cdot \frac{1}{\sqrt{2}} - P + T_{FC} \cdot \frac{1}{\sqrt{2}} = 0$$

$$\Rightarrow T_{GA} = -T_{DC} \cdot \sqrt{2} - T_{FC} = 12 \text{ kN} \cdot \sqrt{2} - \sqrt{2} \cdot p = 16 \text{ kN} \cdot \sqrt{2}$$

$$T_{GB} = P - T_{FC} \cdot \frac{1}{\sqrt{2}} - T_{GA} \cdot \frac{1}{\sqrt{2}} - T_{FC} = p - 0 + 16 \text{ kN} + p$$

$$F_{EL} = 12 \text{ kN}$$