

$$\cos d = 3/5 \quad \sin d = 4/5$$

$$\cos \beta = 1/\sqrt{5} \quad \sin \beta = 2/\sqrt{5}$$

$$\cos \gamma = 4/5 \quad \sin \gamma = 3/5$$

$$\cos \theta = 15/33,5$$

then $\theta = 30/33/5$

$$\Rightarrow R_D = -50$$

$$R_E = 12,67$$

$$R_F = 5,59$$

$$R_E = 72,67$$

$$R_F = S, S^9$$

Node D  $[F_{DA} = 50 \text{ k}] T$

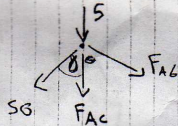
$$[F_{DA} = 50 \text{ K}] \text{ T}$$

$\vec{F}_{EC}$
 $[F_{EC} = -12,67]$ C
 $\vec{F}_E$
 $12,67$

A free body diagram of a particle. A central point represents the particle. Three force vectors originate from this point: F points up and to the left, F_c points up and to the right, and R points down and to the right.

$$[F_{RC} = -s, sq] \subset$$

Nodo A



X] $F_{AG} \cdot \text{sem } \Theta = SO \cdot \text{sem } \theta$

$$F_{AG} = 50 \cdot \frac{3}{5} \cdot \frac{33,5}{30}$$

$$[F_{AB} = 33,5] \text{ T}$$

$$\Sigma F_x = 0 \quad 5 + 50 \cdot \frac{4}{5} + 33,5 \cdot \frac{15}{33,5} + F_{Ax} = 0 \quad [F_{Ax} = -60 \text{ k}] \quad C$$

$$[F_{Ac} = -60 \text{ k}] \text{ C}$$

Nodo B



$$F_{BH} \cdot \frac{15}{37,5} = 5 \quad [F_{BH} = 11,17 \text{ k}] \quad T$$

$$[F_{\text{вн}} = 11,17 \text{ к}] \text{ Т}$$

$$11,11 \cdot \frac{30}{33,5} + F_{BI} = 0 \quad [F_{BI} = -10 \text{ k}] \quad C$$

$$[F_{BI} = -10 \text{ k}] \quad C$$

Nado I

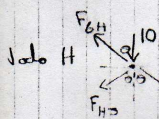
$$\Rightarrow \begin{bmatrix} F_{IH} = 0 \\ F_{IZ} = -10 \text{ k} \end{bmatrix} \text{ C}$$

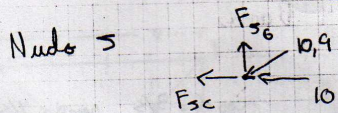
$$x) \quad 11,17 \cdot \frac{30}{33,5} - F_{GH} \cdot \frac{30}{33,5} - F_{HS} \cdot \frac{30}{33,5} = 0$$

$$F_{6H} + F_{H7} = 11,17$$

$$y) F_{GH} \cdot \frac{1s}{33,5} - F_{HD} \cdot \frac{1s}{33,5} = 10 + 11,17 \cdot \frac{1s}{33,5}$$

$$\begin{bmatrix} F_{GH} = 22,6 \text{ k} \\ F_{HS} = -10,9 \text{ k} \end{bmatrix} \begin{matrix} T \\ C \end{matrix}$$



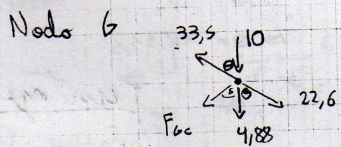


$$F_{56} = 10,9 \cdot \frac{16}{33,5}$$

$$[F_{56} = 4,88 \text{ k}] \text{ T}$$

$$F_{5c} + 10 + 10,9 \cdot \frac{30}{33,5} = 0$$

$$\Rightarrow [F_{5c} = -19,46 \text{ k}] \text{ C}$$

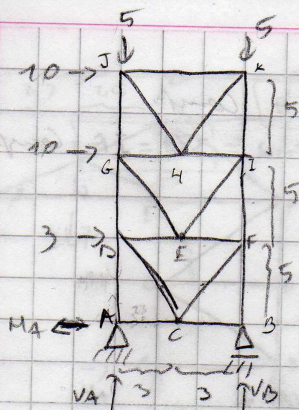


$$\sin \delta = \cos \delta = \frac{\sqrt{2}}{2}$$

$$X) \quad 22,6 \cdot \frac{30}{33,5} = F_{6c} \frac{\sqrt{2}}{2} + 33,5 \cdot \frac{30}{33,5}$$

$$[F_{6c} = -13,8 \text{ k}] \text{ C}$$

Punto P1 Torres 2.



$$\sum F_x \Rightarrow H_A = 23 \text{ ton f.}$$

$$\sum F_y \Rightarrow V_A + V_B = 10$$

$$\sum M_A = 0 \Rightarrow 6V_B - 6 \cdot 5 - 10 \cdot 15 - 10 \cdot 10 - 3 \cdot 5 = 0$$

$$6V_B = 295$$

$$V_B = 49,17$$

$$\Rightarrow V_A = -39,17$$



$$\text{sen } \alpha = \frac{5}{5,34} ; \cos \alpha = \frac{3}{5,34}$$

Esfuerzos:

Nudo A: $\Rightarrow AD = 39,17$; $AC = 23 \text{ ton}$
Tirac.

Nudo B: $CB = 0$; $BF = 49,17 \text{ ton}$
Comp.

Nudo C:

$$\sum F_x = CF \cos \alpha + CD \cos \alpha = 23$$

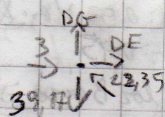
$$CF + CD = \frac{23 \sqrt{34}}{3}$$

$$CF = \frac{23 \sqrt{34}}{6} \approx 22,35$$

$$\sum F_y = CF \sin \alpha = CD \sin \alpha \Rightarrow CD = CF$$

Comp. Tirac.

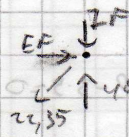
Nudo D:



$$\sum F_x \Rightarrow 3 + DE = 22,35 \cos \alpha \Rightarrow DE = 8,5 \text{ Tirac.}$$

$$\sum F_y \Rightarrow DG = 39,17 - 22,35 \sin \alpha \Rightarrow DG = 20 \text{ Tirac.}$$

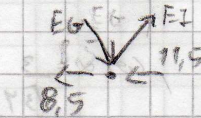
Nudo F



$$\sum F_x \Rightarrow EF = 22,35 \cos \alpha = 11,5 = EF \quad \text{Comp}$$

$$\sum F_y \Rightarrow IF = 49,12 - 22,35 \tan \alpha = 30 = IF \quad \text{Comp}$$

Nudo E

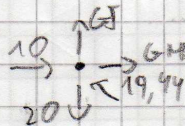


$$\sum F_x \Rightarrow EG = EI$$

$$\sum F_x \Rightarrow 11,5 + 8,5 = (EG + EI) \cos 2$$

$$20 = 2EG \Rightarrow EG = EI = 19,44$$

Nudo G

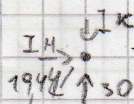


$$\sum F_x \Rightarrow GH = 19,44 \cos \alpha - 10 = 0$$

$$\sum F_y \Rightarrow GI = 20 - 19,44 \tan \alpha$$

$$GI = 3,33 \quad \text{Trace}$$

Nudo I



$$\sum F_x \Rightarrow IH = 19,44 \cos \alpha = IH = 10 \quad \text{Comp}$$

$$\sum F_y \Rightarrow IK = 30 - 19,44 \tan \alpha = 13,33 = IK \quad \text{Comp}$$

Nudo H

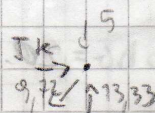


$$\sum F_x \Rightarrow (HJ + IJ) \cos \alpha = 10 \Rightarrow HJ = IJ = \frac{10}{2 \cos \alpha} = 9,72$$

$$\sum F_y \Rightarrow HK = IJ$$

$$\text{Trace} \quad \text{Comp}$$

Nudo K



$$\sum F_x \Rightarrow JK = 9,72 \cos \alpha = 5 \quad \text{Comp}$$

Punteo

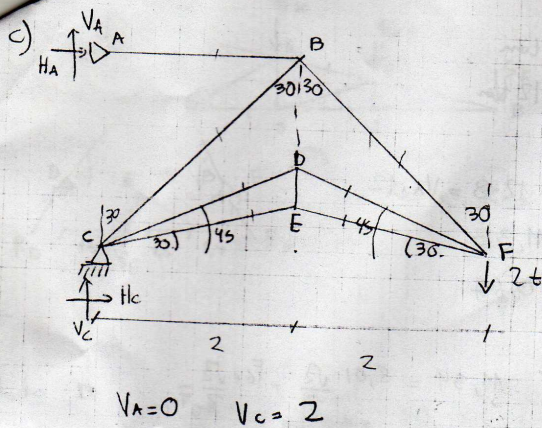
$$VA: 0,5 \quad VB: 0,5$$

$$HA: 0,45$$

$$Valor Barro: 0,15$$

$$Toc: 0,1$$

8 barras



$$V_A + V_C = 2$$

$$H_A + H_C = 0$$

$$\sum M_A = 0$$

$$-2 \cdot 4 + H_C \cdot 7\sqrt{3} = 0$$

$$H_C = \frac{4}{\sqrt{3}}$$

$$H_C = 2,31$$

$$H_A = -2,31$$

$$V_A = 0 \quad V_C = 2$$

Pteje
0,5 Rescuer
0,4 Valor barco
0,1 ioc.

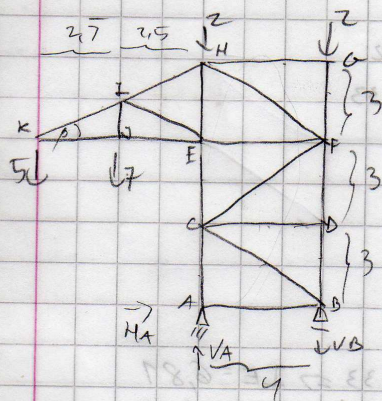
A) $\leftarrow \rightarrow F_{AB}$
2,31 $[F_{AB} = 2,31] T$

B) $\begin{matrix} 2,31 \\ \swarrow \searrow \\ F_{BC} \quad F_{BF} \end{matrix}$
 $F_{BC} + F_{BF} = 0$
 $2,31 + F_{BC} \cdot 0,5 - 0,5 \cdot F_{BF} = 0$
 $\begin{cases} F_{BC} = -2,31 \\ F_{BF} = 2,31 \end{cases} \begin{matrix} C \\ T \end{matrix}$

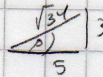
E) $\begin{matrix} 2,31 \\ \swarrow \searrow \\ F_{DF} \quad F_{EF} \end{matrix}$
 $\downarrow 2$
 $\begin{matrix} Y) & 2 = 2,31 \cdot 0,866 + F_{DF} \frac{\sqrt{3}}{2} + F_{EF} \cdot 0,5 \\ X) & 2,31 \cdot 0,5 + F_{DF} \frac{\sqrt{3}}{2} + F_{EF} \cdot 0,866 = 0 \end{matrix}$
 $\begin{cases} F_{DF} = 2,23 \\ F_{EF} = -3,16 \end{cases} \begin{matrix} T \\ C \end{matrix}$

C) $\begin{matrix} 30 \quad 2,31 \\ \swarrow \searrow \\ F_{CD} \quad F_{CE} \end{matrix}$
 $\downarrow 2$
 $\begin{matrix} Y) & F_{CD} \frac{\sqrt{3}}{2} + F_{CE} \cdot 0,5 = 2,31 \cdot 0,866 \\ X) & F_{CD} \frac{\sqrt{3}}{2} + F_{CE} \cdot 0,866 = 2,31 \cdot 0,5 \end{matrix}$
 $\begin{cases} F_{CD} = 4,46 \\ F_{CE} = -2,31 \end{cases} \begin{matrix} T \\ C \end{matrix}$

D) $\begin{matrix} 4,46 \quad 2,23 \\ \swarrow \searrow \\ F_{DE} \end{matrix}$
 $\downarrow 2$
 $F_{DE} = -4,46 \frac{\sqrt{3}}{2} - 2,23 \frac{\sqrt{3}}{2}$
 $[F_{DE} = -4,73 t] C$



$$\sin \alpha = 0,6 \quad \cos \alpha = 0,8$$



$$\sin \beta = \frac{3}{\sqrt{34}} \quad \cos \beta = \frac{5}{\sqrt{34}}$$

$$\sum F_y \Rightarrow V_A + V_B = 5 + 7 + 5 + 2 = 19$$

$$\sum F_x \Rightarrow H_A = 0$$

$$\sum M_A = 0; \quad -V_B \cdot 4 - 2 \cdot 4 + 7 \cdot 2,5 + 5 \cdot 5 = 0$$

$$34,5 = 4V_B$$

$$V_B = 8,63 \Rightarrow V_A = 10,37$$

Nudo A

$$\begin{aligned} & \downarrow AC \quad AC = 10,37 \\ & \rightarrow AB \quad AB = 0 \\ & \uparrow 10,37 \end{aligned}$$

Nudo B

$$\begin{aligned} & \uparrow CB \quad CB = 8,63 \\ & \downarrow 8,63 \end{aligned} \quad \begin{aligned} & CB \cos \alpha = 0 \Rightarrow CA = 0 \\ & BD = 8,63 \end{aligned}$$

Nudo D

$$\begin{aligned} & \rightarrow DE \quad DE = 0 \\ & \downarrow 8,63 \end{aligned} \quad \begin{aligned} & DC = 0 \\ & DF = 8,63 \end{aligned}$$

Nudo C

$$\begin{aligned} & \rightarrow CE \quad CE = 10,37 \\ & \uparrow 10,37 \end{aligned} \quad \begin{aligned} & CF = 0 \\ & CD = 10,37 \end{aligned}$$

Nudo G

$$\begin{aligned} & \downarrow HG \quad HG = 0 \\ & \uparrow GF \quad GF = 2 \end{aligned}$$

Nudo F

$$\begin{aligned} & \rightarrow HF \quad HF = 8,63 / 2 \Rightarrow HF = 4,315 \\ & \downarrow 8,63 \end{aligned} \quad \begin{aligned} & EF = HF \cos \alpha \\ & EF = 4,315 \cdot 0,8 \\ & EF = 3,452 \end{aligned}$$

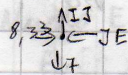
Nudo K



$$\sum F_y \Rightarrow KI \cos \beta = 5 \Rightarrow KI = 9,72$$

$$\sum F_x \Rightarrow KI \sin \beta = KJ \Rightarrow KJ = 8,33$$

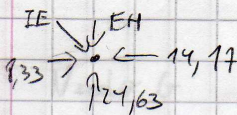
Nudo J



$$\sum F_x \Rightarrow JE = 8,33$$

$$\sum F_y \Rightarrow IJ = 7$$

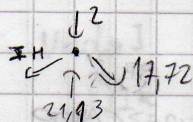
Nudo E



$$\sum F_x \Rightarrow IE \cos \beta = 14,17 - 8,33 \Rightarrow IE = 6,81$$

$$\sum F_y \Rightarrow EH + IE \sin \beta = 24,63 \Rightarrow EH = 21,13$$

Nudo H



$$IH \cos \beta = 17,72 \cos \alpha$$

$$IH = 16,53$$

$$16,53 \sin \beta + 17,72 \sin \alpha = 19,13 = 21,13 - 2$$

PTje

$$VA; VB = 0,6$$

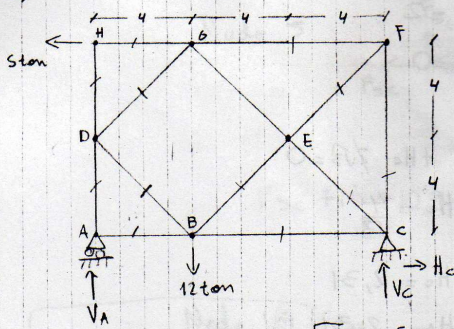
$$MA = 0,55$$

$$\text{Valor barrera } 0,15$$

$$T \text{ o } C = 0,1$$

Parte E)

13 barras



$$H_c = 5 \text{ ton}$$

$$V_A + V_C = 12 \text{ ton}$$

$$\sum M_c = 0$$

$$5 \cdot 8 + 12 \cdot 8 = V_A \cdot 12$$

$$V_A = 11,33$$

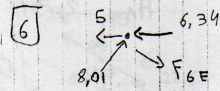
$$V_C = 0,67$$

$$F_{HG} = 5 \text{ T}$$

$$F_{HD} = 0$$

$$F_{AD} = -11,33 \text{ C}$$

$$F_{AB} = 0$$



$$11,34 = 8,01 \cdot \frac{\sqrt{2}}{2} + F_{GE} \frac{\sqrt{2}}{2}$$

$$[F_{GE} = 8,02] \text{ T}$$

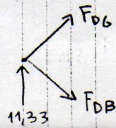
Puntaje

Valor Barro 0,25

TSC 0,1

Reacc: 0,95 C/U

D)

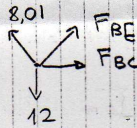


$$F_{DB} \frac{\sqrt{2}}{2} + 11,33 - F_{BG} \frac{\sqrt{2}}{2} = 0$$

$$F_{DB} \frac{\sqrt{2}}{2} + F_{BG} \frac{\sqrt{2}}{2} = 0$$

$$[F_{DB} = -8,01 \text{ C} \quad F_{BG} = 8,01 \text{ T}]$$

B)

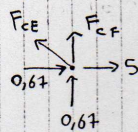


$$F_{BC} + F_{CE} \frac{\sqrt{2}}{2} = 8,01 \frac{\sqrt{2}}{2}$$

$$F_{BC} \frac{\sqrt{2}}{2} + 8,01 \frac{\sqrt{2}}{2} = 12$$

$$[F_{BC} = 8,96 \text{ T} \quad F_{CE} = -0,67 \text{ C}]$$

C)

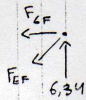


$$5 + 0,67 = F_{DE} \frac{\sqrt{2}}{2} \quad [F_{DE} = 8,02] \text{ T}$$

$$F_{EF} + 8,02 \frac{\sqrt{2}}{2} + 0,67 = 0$$

$$[F_{EF} = -6,34 \text{ ton}] \text{ C}$$

E)



$$F_{FE} \frac{\sqrt{2}}{2} = 6,34$$

$$F_{DF} + 8,97 \frac{\sqrt{2}}{2} = 0$$

$$[F_{FE} = 8,97 \text{ ton}] \text{ T} \quad [F_{DF} = -6,34] \text{ C}$$