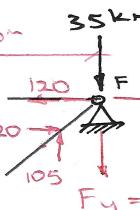
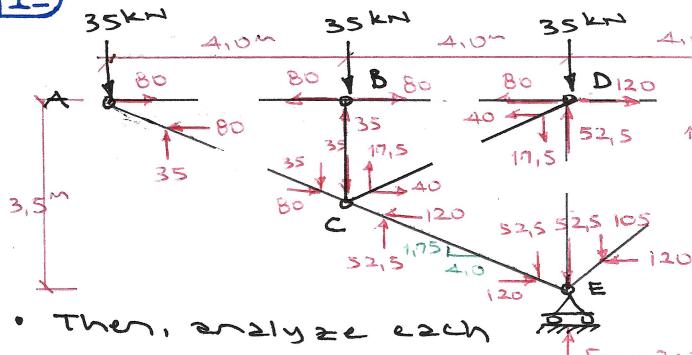




Problem Set 6 (P56)

SOLUTION

1-



• First, find the support reactions using the whole truss.

$$\sum M_F = 0 \Rightarrow 35 \cdot 12,0^m + 35 \cdot 8,0^m + 35 \cdot 4,0^m - E_y \cdot 4,0^m = 0 \\ \Rightarrow E_y = 210 \text{ kN}$$

- Then, analyze each joint individually.

Follow the order of joint A, B, F, D, E and check the equilibrium at C before completing the solution.

$$\sum F_y = 0 \Rightarrow F_y = 210 - 35 \cdot 4 = 70 \text{ kN}$$

$$\sum F_n = 0 \Rightarrow F_n = 0$$

- Note: Joint C includes two inclined members. Analyzing it will require solving simultaneous equations. Therefore, I left it out and solved all other joints.

$$\text{at } C : \sum F_n = 80 + 40 - 120 = 0 \quad \boxed{\text{OK}}$$

$$\sum F_y = 52,5 + 17,5 - 35 - 35 = 0 \quad \boxed{\text{OK}}$$

ANSWERS

$$F_{AB} = +80 \text{ kN (T)} ; F_{BC} = -35 \text{ kN (C)}$$

$$F_{AC} = -\sqrt{80^2 + 35^2} = -87,3 \text{ kN (C)}$$

$$F_{CE} = -\sqrt{120^2 + 52,5^2} = -131,0 \text{ kN (C)}$$

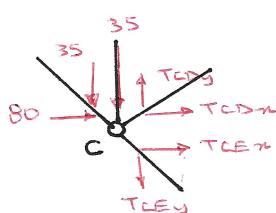
$$F_{CD} = +\sqrt{40^2 + 17,5^2} = +43,7 \text{ kN (T)}$$

$$F_{BD} = +80 \text{ kN (T)} ; F_{DF} = +120 \text{ kN (T)}$$

$$F_{EF} = -\sqrt{105^2 + 120^2} = -159,5 \text{ kN (C)} ; F_{DE} = -52,5 \text{ kN (C)}$$

- Member Forces (9 members in total)

- If one attempts to solve the truss with the order of: A, B, C, D, F, E (without skipping C), more work will be involved as follows:



$$\sum F_n = 0 \Rightarrow 80 + T_{CDn} + T_{CEn} = 0$$

$$\sum F_y = 0 \Rightarrow T_{CDy} - T_{CEy} - 70 = 0$$

$$T_{CDy} = \frac{17,5}{4,0} T_{CDn} \Rightarrow T_{CDy} = 0,4375 T_{CDn}$$

$$T_{CEy} = \frac{17,5}{4,0} T_{CEn} \Rightarrow T_{CEy} = 0,4375 T_{CEn}$$

4 eq's and 4 unknowns. Solving:

$$T_{CDn} = 40 \text{ kN} ; T_{CDy} = 17,5 \text{ kN} ; T_{CEn} = -120 \text{ kN}$$

T_{CEy} = -52,5 kN (-ve sign indicates assumed direction is wrong. Fix the direction of the FBD above.)



NAME

S. Guner

COURSE NO.

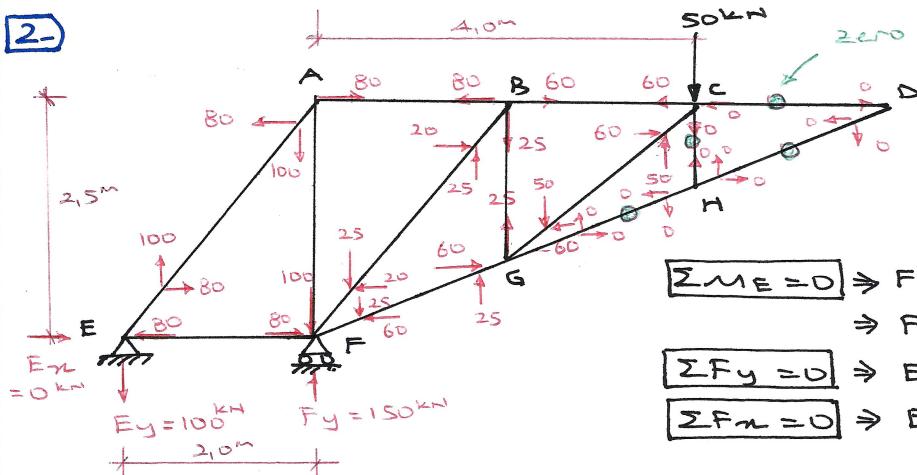
CIV100F

COURSE NAME

Mechanics

2 std. no
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2-



zero force members

- First, find the support reactions using the whole system.

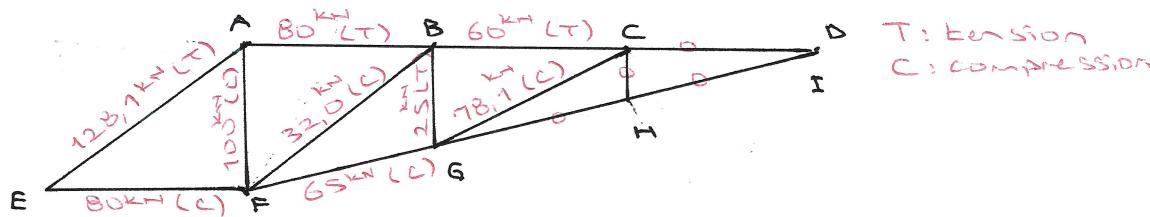
$$\sum M_E = 0 \Rightarrow F_y \cdot 2,0^m - 50 \text{ kN} \cdot 6,0^m = 0 \\ \Rightarrow F_y = 150 \text{ kN}$$

$$\sum F_y = 0 \Rightarrow E_y = 150 - 50 = 100 \text{ kN}$$

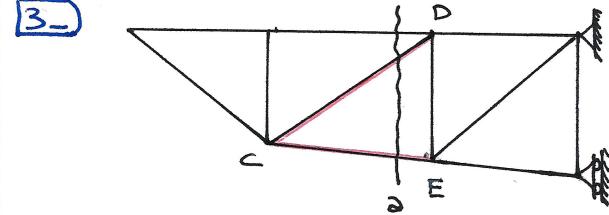
$$\sum F_x = 0 \Rightarrow E_x = 0$$

- Then analyze each joint individually on a FBD. My order is D, H, C, G, B, A, E
+ check if $\sum F_x = 0$ and $\sum F_y = 0$

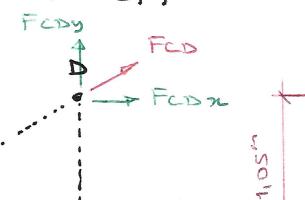
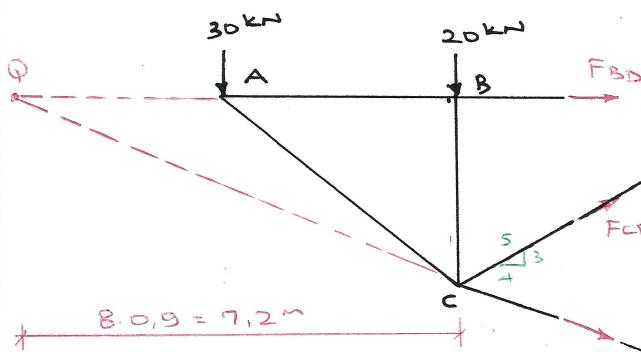
Answer:



3-



- Members CD and CE are of interest. Get a section cut involving those members. (Section a-a) Analyze the left hand side to avoid having to calculate the support reactions.



- Intersect F_CD and F_CE at Q. Move F_CD to point D.

$$\sum M_Q = 0 \Rightarrow F_{CDx} \cdot B, 4^m - 30 \cdot 6,0^m - 20 \cdot 7,2^m = 0 \\ \Rightarrow F_{CDx} = 38,6 \text{ kN}$$

$$\Rightarrow F_{CDy} = \frac{4}{3} \cdot 38,6 = 51,5 \text{ kN}$$

$$\Rightarrow F_{CD} = 64,3 \text{ kN (T)}$$

- move F_CE to point E.

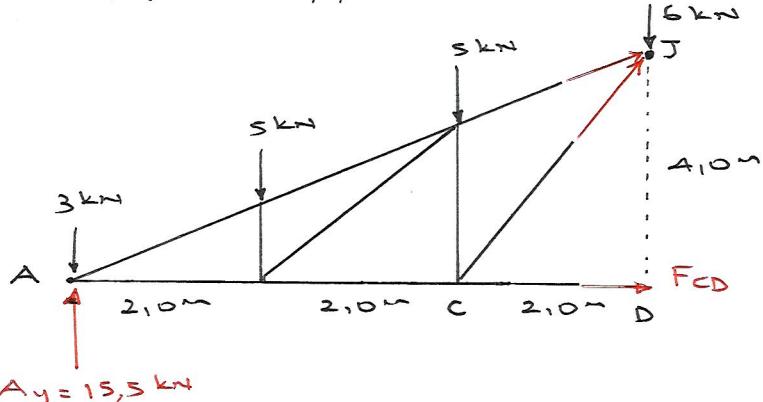
$$\sum M_D = 0 \Rightarrow F_{CEy} \cdot 1,05 + 30 \text{ kN} \cdot 2,4^m + 20 \text{ kN} \cdot 1,2^m = 0 \\ \Rightarrow F_{CEy} = -91,4 \text{ kN}$$

$$F_{CEy} = -11,4 \text{ kN}$$

$$\underline{\underline{F_{CE} = -92,1 \text{ kN (C)}}}$$

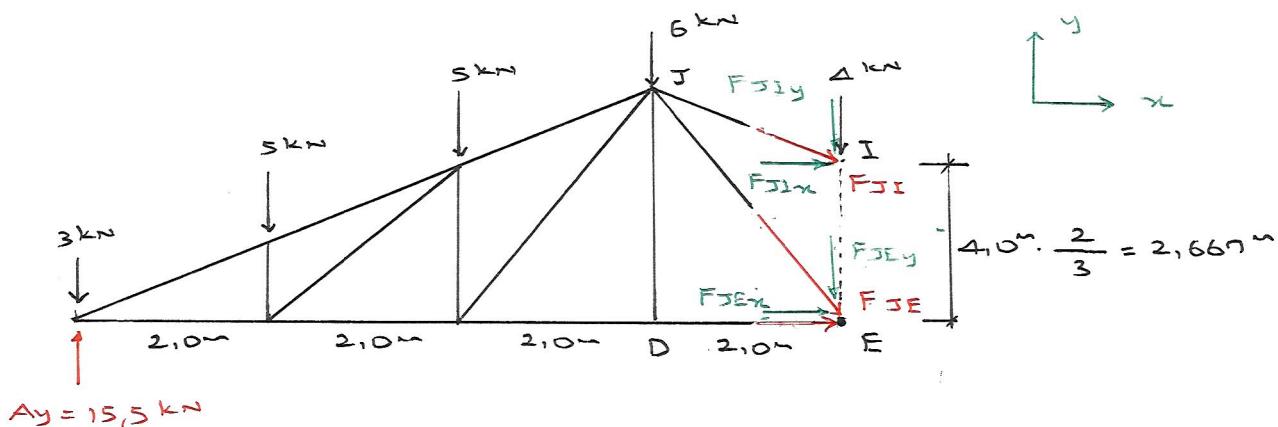


4. First, find support reactions. $\sum M_G = 0 \Rightarrow A_y = 15,5 \text{ kN}$



- $\sum M_J = 0 \Rightarrow F_{CD} \cdot 4,0 \text{ m} + 3 \text{ kN} \cdot 6,0 \text{ m} + 5 \text{ kN} \cdot 4,0 \text{ m} + 6 \text{ kN} \cdot 2,0 \text{ m} - 15,5 \text{ kN} \cdot 6,0 \text{ m} = 0$

$$\Rightarrow \underline{\underline{F_{CD} = +11,25 \text{ kN (T)}}}$$



- $\sum M_E = 0 \Rightarrow 3,0 \text{ kN} \cdot 8,0 \text{ m} + 5 \text{ kN} \cdot 6,0 \text{ m} + 5 \text{ kN} \cdot 4,0 \text{ m} + 6 \text{ kN} \cdot 2,0 \text{ m} - 15,5 \text{ kN} \cdot 8,0 \text{ m} - F_{JIx} \cdot 2,667 \text{ m} = 0$

$$\Rightarrow F_{JIx} = -14,25 \text{ kN}$$

$$F_{JIy} = -14,25 \text{ kN} \cdot \frac{4,0 \text{ m}}{6,0 \text{ m}} = -9,50 \text{ kN}$$

$$F_{JI} = \sqrt{F_{JIx}^2 + F_{JIy}^2} \Rightarrow \underline{\underline{F_{JI} = -17,13 \text{ kN (C)}}}$$

- $\sum F_y = 0 \Rightarrow 15,5 + 9,50 - 3 - 5 - 5 - 6 - F_{EJy} = 0$

$$\Rightarrow F_{EJy} = 6,0 \text{ kN}$$

$$F_{EJx} = 6,0 \cdot \frac{2,0 \text{ m}}{4,0 \text{ m}} = 3,0 \text{ kN}$$

$$F_{JE} = \sqrt{F_{EJx}^2 + F_{EJy}^2} \Rightarrow \underline{\underline{F_{JE} = +6,71 \text{ kN (T)}}}$$