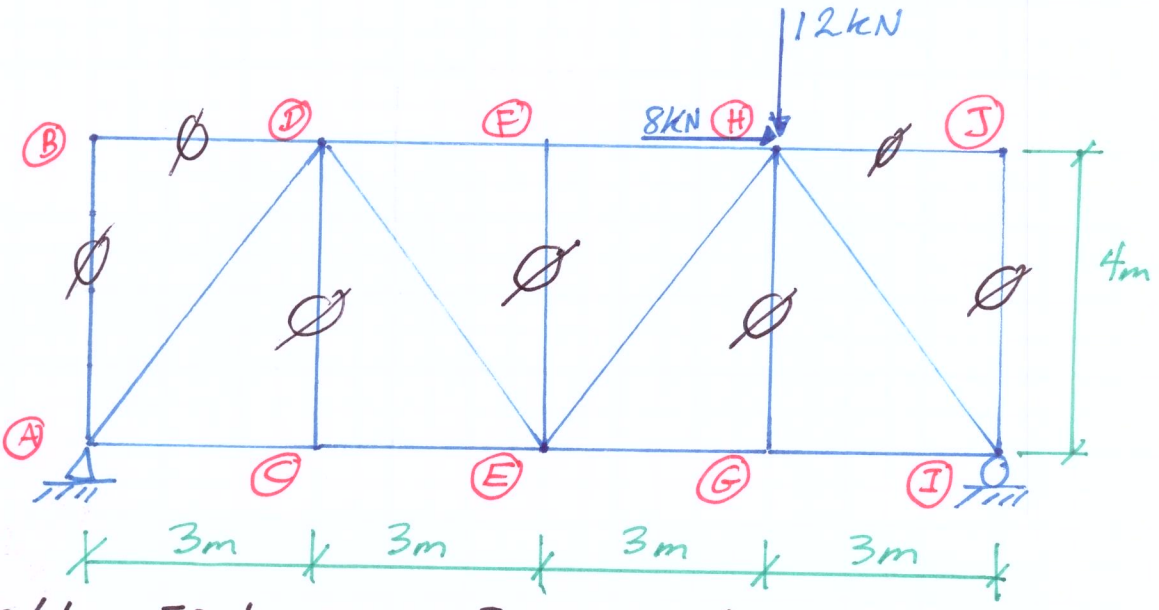
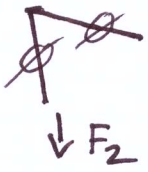
FOR THE TRUSS BELOW:
- ASSES DETERMINACY + STABILITY
- SOLVE FOR ALL MEMBER FORCES



Let's Find zero-force members

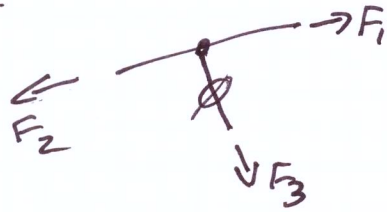
- Case 1



- 2 members at an angle
- no force or reaction

Both members are zero-force

- Case 2

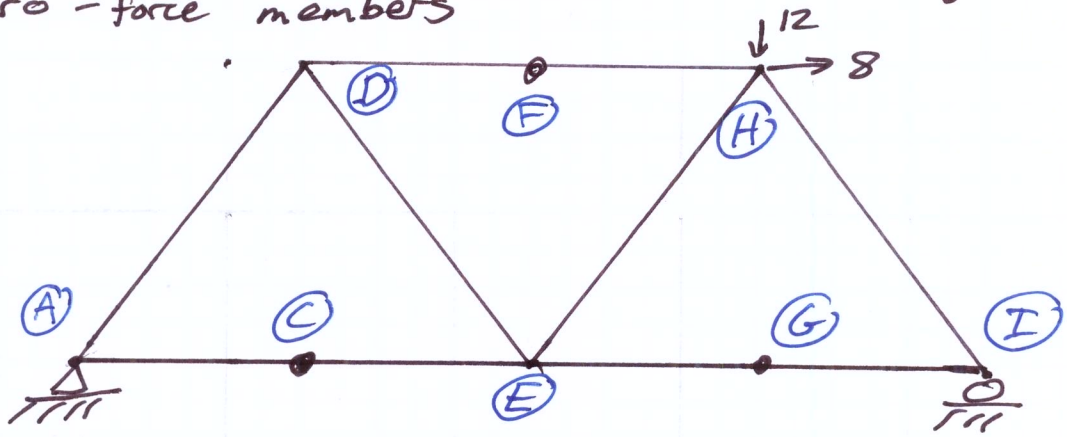


- 3 members
- 2 colinear
- no exteral force or reaction

The non-colinear member is zero-force

Joint	Member	Case
B	BA, BD	Case 1
J	JH, JI	Case 1
C	CD	Case 2
F	FE	Case 2
G	GH	Case 2

- Let's redraw our structure accounting for zero-force members



Stability + Determinacy

- Assessed with original truss

Determinacy: $SI = b + r - 2j$ $\quad b = 17,\ r = 3,\ j = 10$

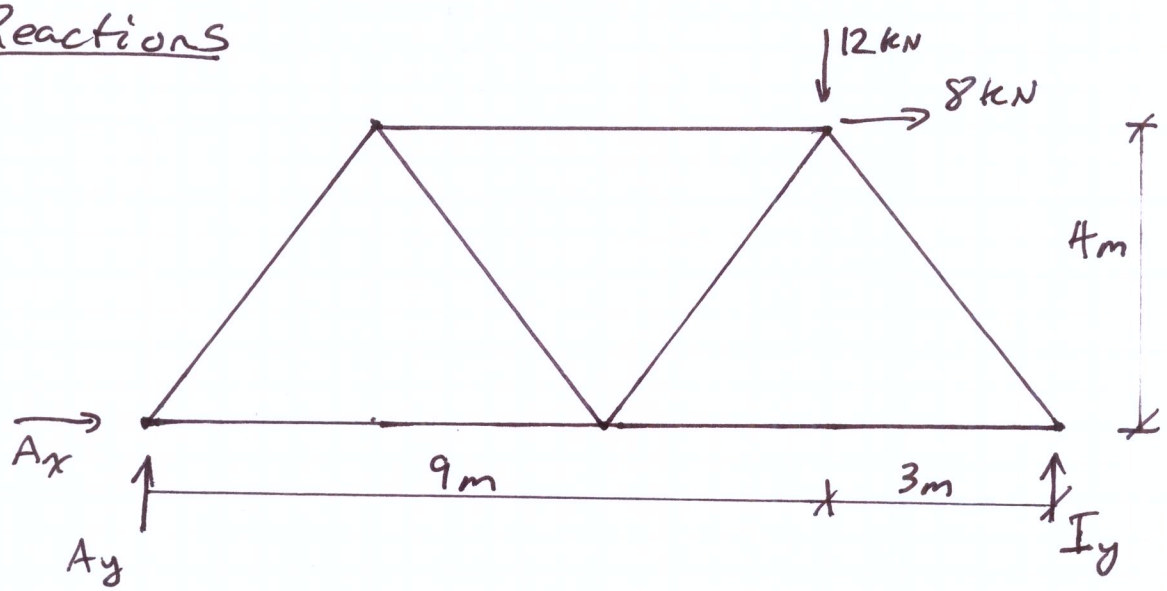
$SI = 17 + 3 - 2(10)$

$SI = 0$

∴ Determinate

Stability:
- $SI \geq 0$ ✓
- Reactions not all • parallel ✓
  • concurrent ✓
- No internal collapse mechanism ✓

Reactions



$\Sigma F_x = 0 \qquad A_x + 8 = 0$

$A_x = -8\,kN \leftarrow$

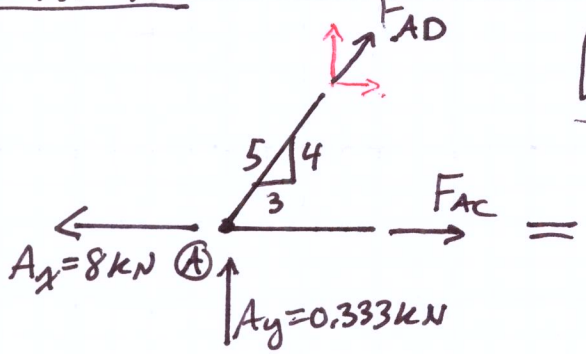
$\Sigma M_A = 0 \qquad I_y(12) - 12\,kN(9) - 8\,kN(4m) = 0$

$I_y = +11.667\,kN \uparrow$

$\Sigma F_y = 0 \qquad A_y + I_y - 12 = 0$

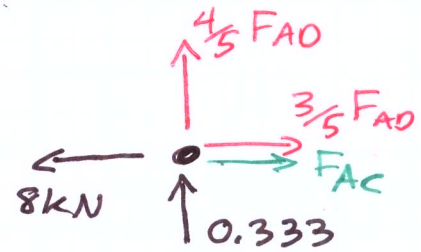
$A_y = 12 - 11.667 = \quad A_y = 0.333\,kN \uparrow$

Joint A



$F_{AD_x} = 3/5\ F_{AD}$

$F_{AD_y} = 4/5\ F_{AD}$



$\left.\begin{matrix}\Sigma F_x = 0 \\ \Sigma F_y = 0\end{matrix}\right\}$ Equilibrium of a joint

$\Sigma F_y = 0 \rightarrow \quad +\frac{4}{5}F_{AD} + 0.333 = 0$

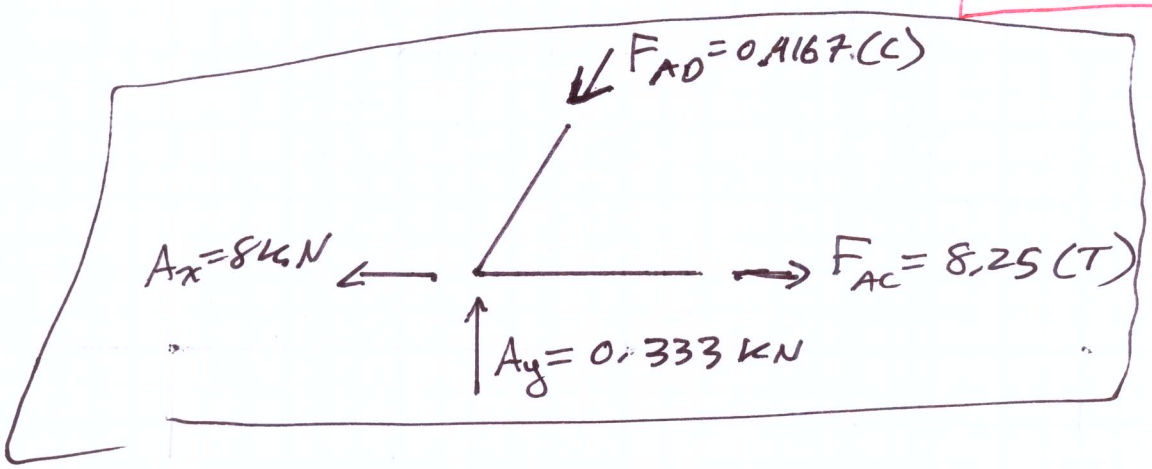
$F_{AD} = -0.4167\,kN$

$F_{AD} = 0.4167\,kN\ (C)$

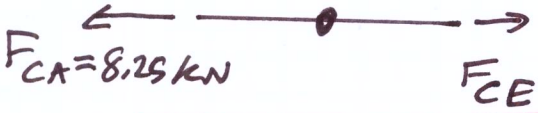
$\Sigma F_x = 0 \rightarrow F_{AC} + \frac{3}{5}F_{AD} - 8 = 0$

$F_{AC} + (\frac{3}{5})(-0.4167) - 8 = 0$

$F_{AC} = +8.25\,kN\ (T)$



Joint C



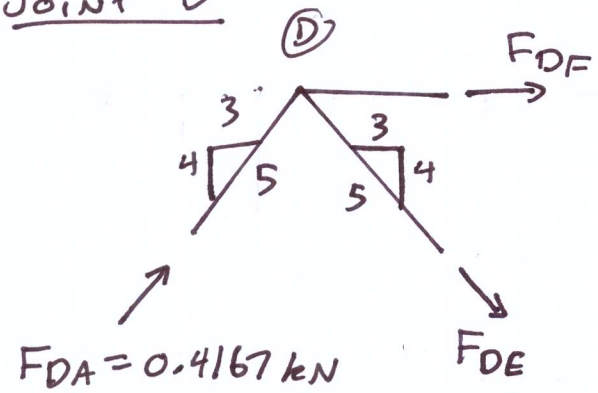
$\Sigma F_x = 0$

$F_{CE} - 8.25 = 0$

$F_{CE} = +8.25\,kN\ (T)$

JOINT	LHS		RHS
C	F_{CA}	=	F_{CE}
F	F_{FD}	=	F_{FH}
G	F_{GE}	=	F_{GI}

Joint D



$F_{DA_x} = \frac{3}{5}F_{DA} = 0.25\,kN$

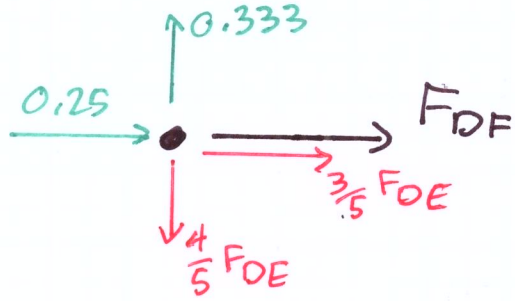
$F_{DA_y} = \frac{4}{5}F_{DA} = 0.333\,kN$

$F_{DE_x} = \frac{3}{5}F_{DE}$

$F_{DE_y} = \frac{4}{5}F_{DE}$

$\Sigma F_y = 0 \rightarrow 0.333 - \frac{4}{5}F_{DE} = 0$

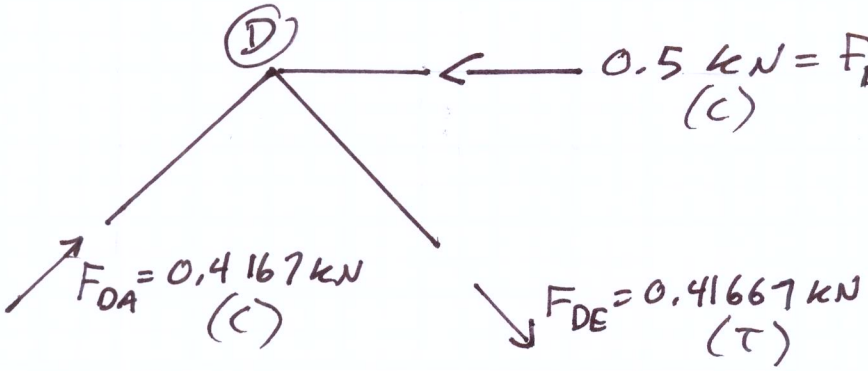
$F_{DE} = +0.41667\,kN\ (T)$



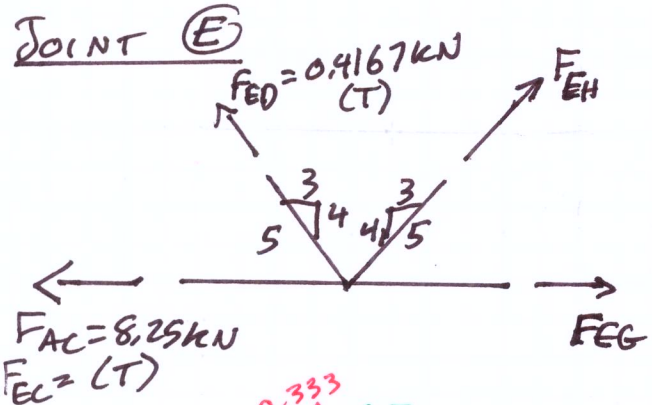
$\Sigma F_x = 0 \quad 0.25 + \frac{3}{5}(0.41667) + F_{DF} = 0$

$F_{DF} = -0.5\,kN$

$F_{DF} = 0.5\,kN\ (C)$



JOINT (E)

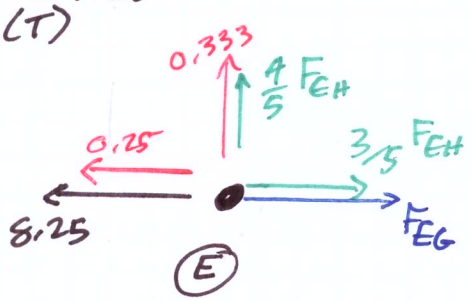


$$F_{EDx} = \frac{3}{5} F_{ED} = 0.25\,kN$$

$$F_{EDy} = \frac{4}{5} F_{ED} = 0.333\,kN$$

$$F_{EHx} = \frac{3}{5} F_{EH}$$

$$F_{EHy} = \frac{4}{5} F_{EH}$$



$$\Sigma F_y = 0 \rightarrow +0.333 + \frac{4}{5} F_{EH} = 0$$

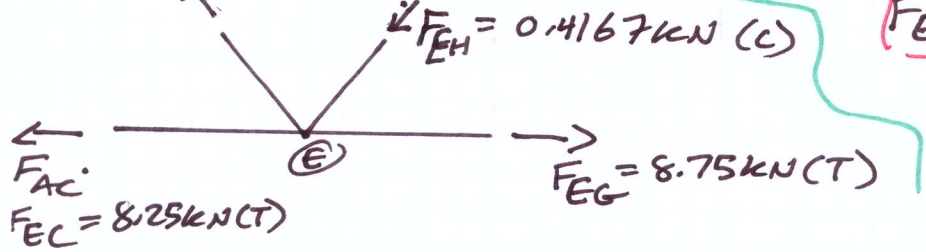
$$F_{EH} = -0.4167\,kN$$

$$F_{EH} = 0.4167\,kN\ (C)$$

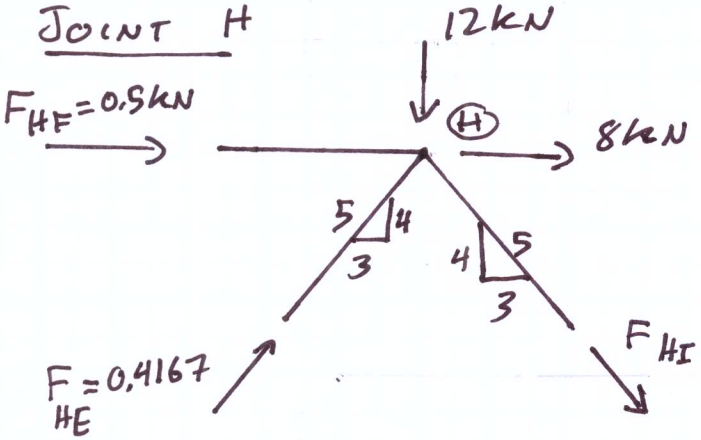
$$\Sigma F_x = 0 \rightarrow F_{EG} + \frac{3}{5} F_{EH} - 0.25 - 8.25 = 0$$

$$F_{EG} + \frac{3}{5}(-0.4167) - 0.25 - 8.25 = 0$$

$$F_{EG} = +8.75\,kN\ (T)$$



JOINT H

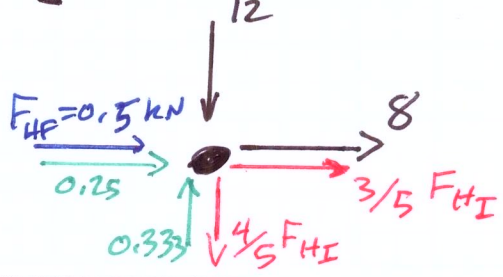


$$F_{HEx} = \frac{3}{5} F_{HE} = 0.25\,kN$$

$$F_{HEy} = \frac{4}{5} F_{HE} = 0.333\,kN$$

$$F_{HIx} = \frac{3}{5} F_{HI}$$

$$F_{HIy} = \frac{4}{5} F_{HI}$$



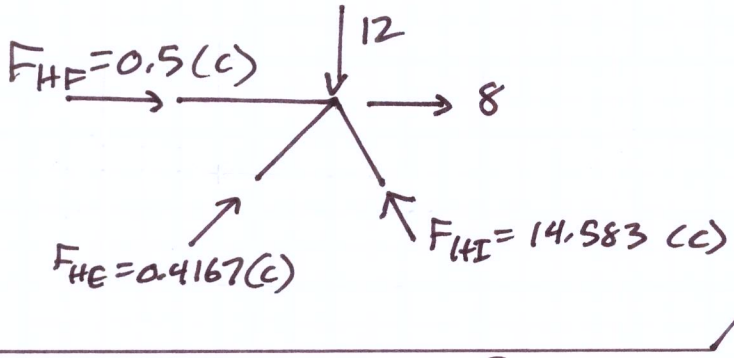
$\Sigma F_x = 0 \rightarrow 0.5 + 0.25 + 8 + \frac{3}{5} F_{HI} = 0$

$F_{HI} = -14.583\,kN$

$F_{HI} = 14.583\,kN\ (C)$

check with $\Sigma F_y = 0$

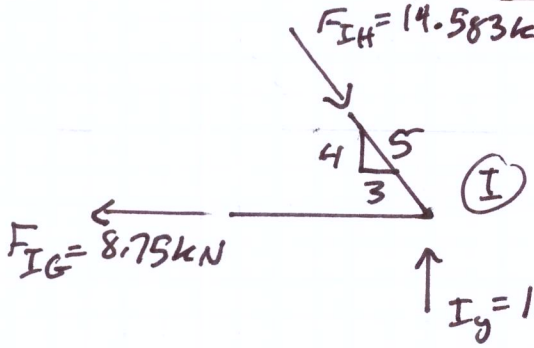
$0.333 - 12 - \frac{4}{5} F_{HI} = 0 \rightarrow F_{HI} = -14.583$ ✓



$F_{IH_x} = \frac{3}{5} F_{IH} = 8.75$

$F_{IH_y} = \frac{4}{5} F_{IH} = 11.667$

- We now know every force.
- Let's check with Joint I



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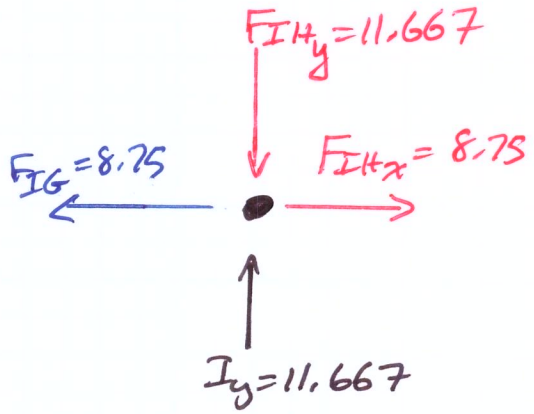
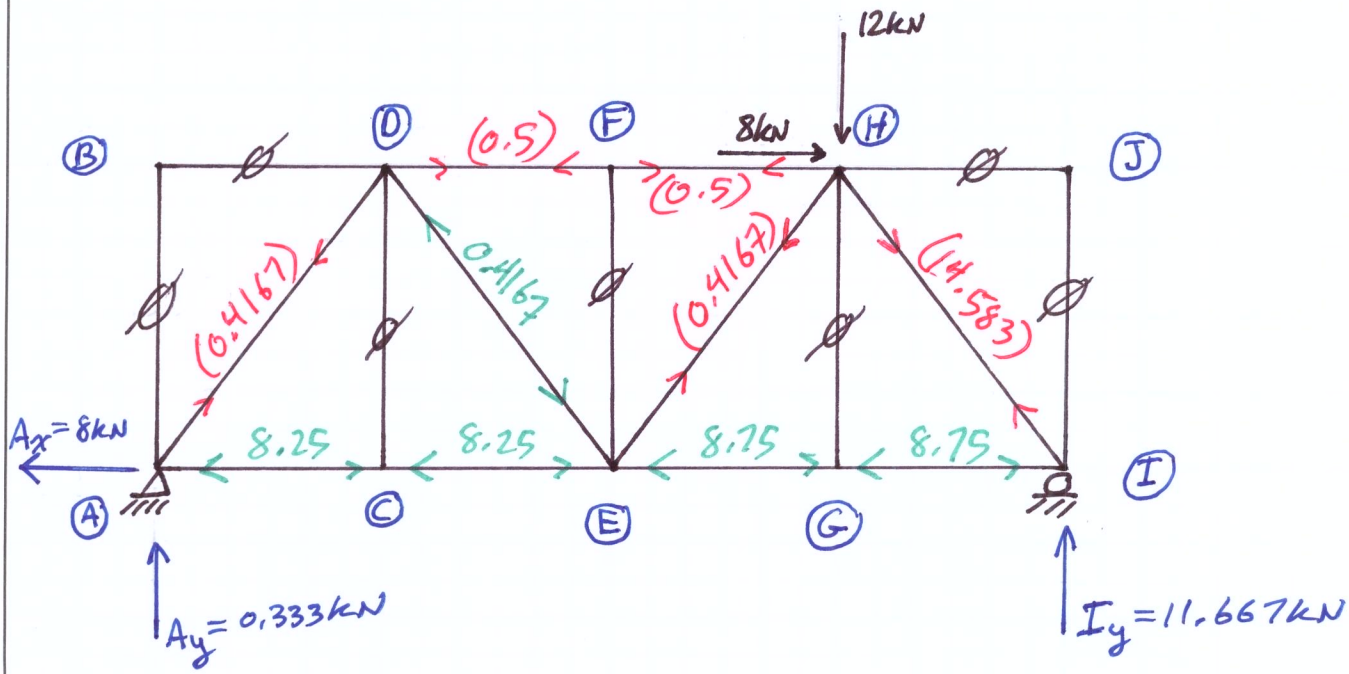


$\Sigma F_x = 0 \rightarrow 8.75 - 8.75 = 0$ ✓

$\Sigma F_y = 0 \rightarrow 11.667 - 11.667 = 0$ ✓

OK

SUMMARY DIAGRAM



(Compression)
Tension

Ø → Zero-force