Lecture 17

Monday, October 9, 2017 11:58

To do ...

- Go to discussion – 8% of your grade!
- Check your grades on compass (-- ≠ 0)
- Sign up for Quiz 4 (CBTF next week)

- HW 12 PL due **Tues**
- HW 13 ME due **Thurs**
- WA 2 due **Fri**
  - **Read instructions!!**

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Method of sections

Q: force in that member...

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Method of sections

or that one...

or that one...

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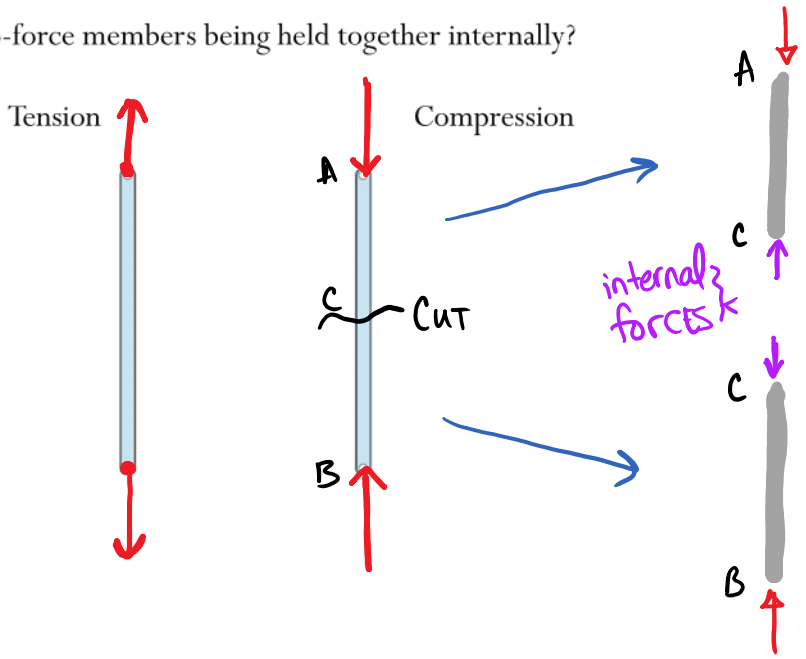
Internal forces

- How are two-force members being held together internally?



* the rigid Bodies must be in equilibrium,

$\Sigma F_x = 0$

$\Sigma F_y = 0$

$\Sigma M_0 = 0$

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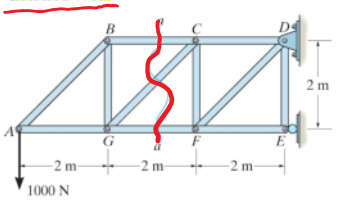
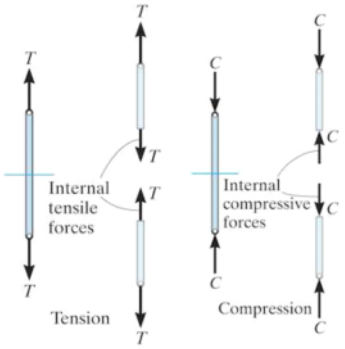
Method of sections

- Determine external support reactions
- "Cut" the structure at a section of interest into two separate pieces and set either part into force and moment equilibrium
- your cut should be such that you have up to three unknowns





* If a truss is in equilibrium, then each of its segments are in equilibrium

* Internal forces become external forces

* method useful for finding unknown forces in only a few bars!

Approach:

↳ decide how to "cut" truss based on where you need to determine forces

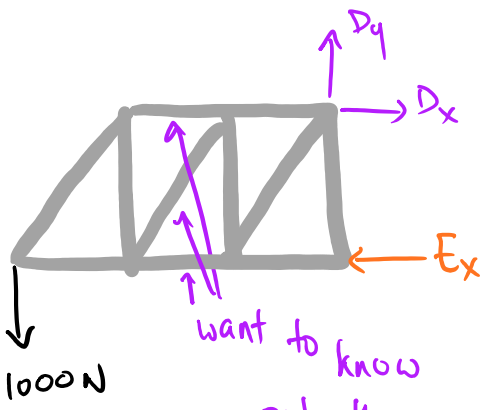
→ make a cut through truss
- ↳ become sections
- ↳ cut through bars not joints
- → each section is a rigid body!

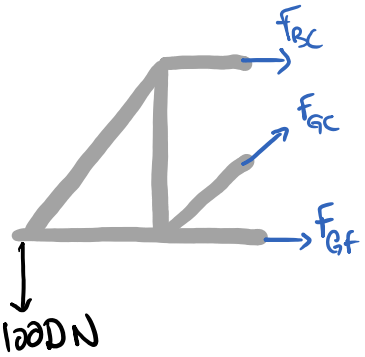
→ expose no more than 3 bars!

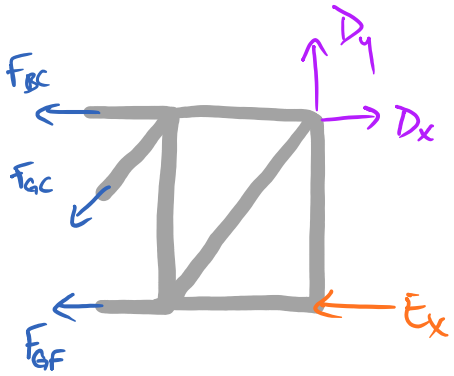
→ Assume all internal loads are tensile

→ use equations of equilibrium. $\Sigma f_x = 0$ $\Sigma f_y = 0$

$\Sigma M_o = 0$







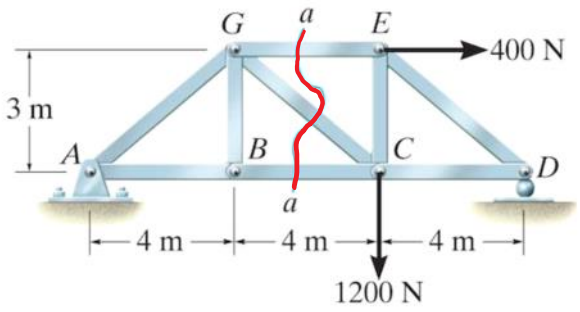
3 unknowns

6 unknowns

Solve either using $\Sigma F_x = 0$

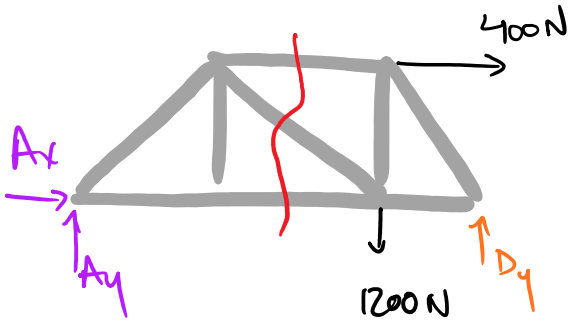
$\Sigma F_y = 0$

$\Sigma M_o = 0$



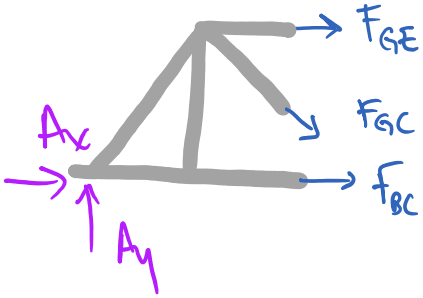
Determine the force in member GC and GE of the truss and state if the members are in tension or compression.

1. Draw FBD of truss
2. Draw FBD of sections

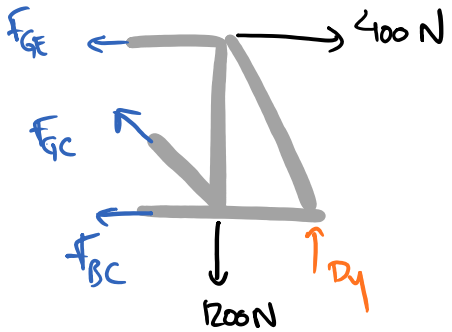


$$\Sigma M_A: \quad -3(400) - 8(1200) + 12D_y = 0$$

$$D_y = \frac{3(400) + 8(1200)}{12} = 900\ N$$

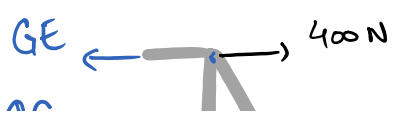


5 unknowns



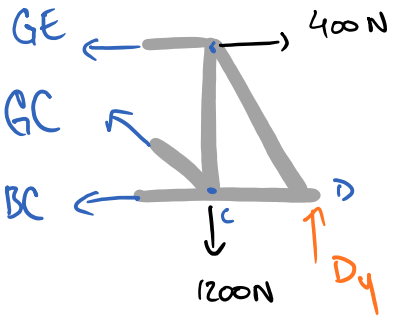
4 unknowns

Solve using the right section:



moments about C:

$$\Sigma M_C: \quad 4(900) - 3(400) + 3G_E = 0$$



Moments about C:

$$\Sigma M_C: \quad 4(900) - 3(400) + 3\,GE = 0$$

$$GE = \frac{3(400) - 4(900)}{3} = -800\ N\ (C)$$

Moments about G:

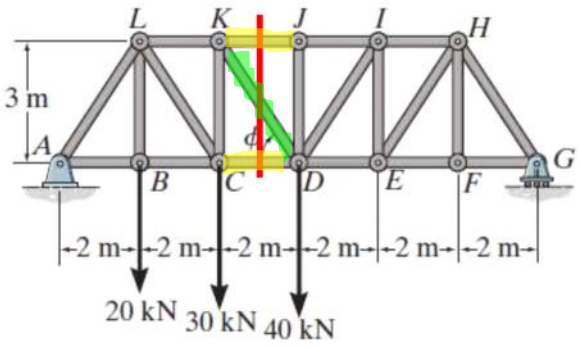
$$\Sigma M_G: \quad -3\,BC - 4(1200) + 8(900) = 0$$

$$BC = \frac{8(900) - 4(1200)}{3} = 800\ N\ (T)$$

Sum forces in y-direction:

$$\Sigma F_y: \quad D_y - 1200 + \frac{3}{5} GC = 0$$

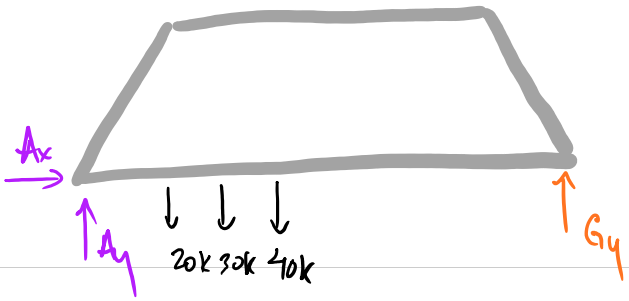
$$GC = \frac{5}{3}\left(1200 - D_y\right) = 500\ N\ (T)$$



Find the force in members KJ, KD, and CD.

1. Draw FBD truss
2. Draw FBD of sections

* use global equilibrium to solve for support REACTION



ΣF_x: $A_x = 0$

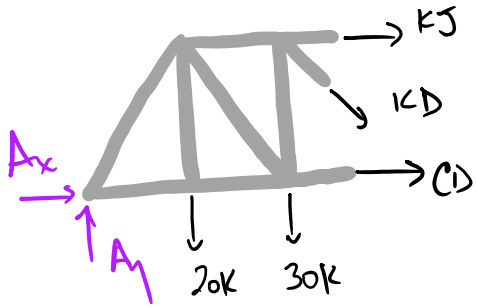
ΣF_y: $A_y + G_y - 20k - 30k - 40k = 0$

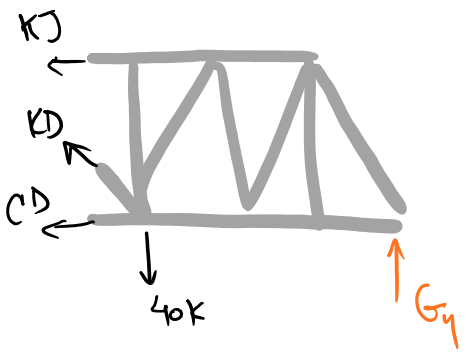
Sum moments About A.

ΣM_A: $12\,G_y - 2(20k) - 4(30k) - 6(40k) = 0$

$G_y = \dfrac{2(20k) + 4(30k) + 6(40k)}{12} = 33.3\ kN$

DRAW FBD of sections:



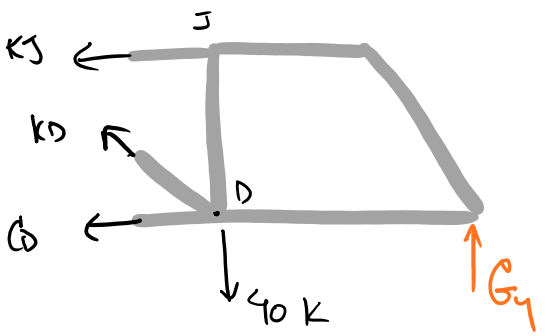


5 unknowns!

4 unknowns!

can use either section, but use the one with less unknowns.

using the right section:



take the moment about D:

ΣM_D: $3KJ + 6G_y = 0$

$KJ = -\frac{6G_y}{3} = -66.7\ kN\ (C)$

take the moment about K:

ΣM_K: $8G_y - 2(40K) - 3CD = 0$

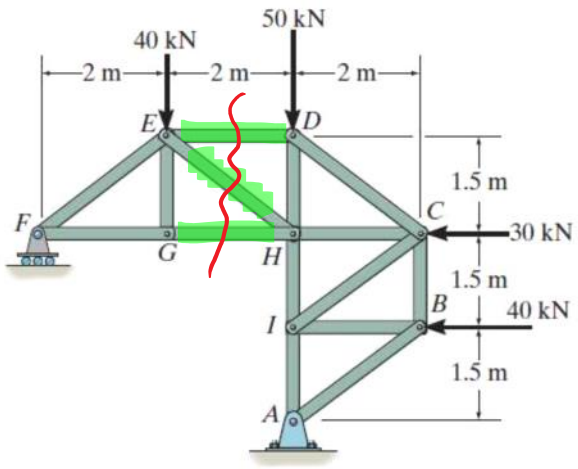
$CD = \frac{8G_y - 2(40K)}{3} = 62.1\ kN\ (T)$

Sum forces in x or y

ΣF_y: $G_y - 40K + \frac{3}{\sqrt{13}} KD = 0$

$KD = \frac{\sqrt{13}}{3}(40K - G_y) = 8.05\ kN\ (T)$

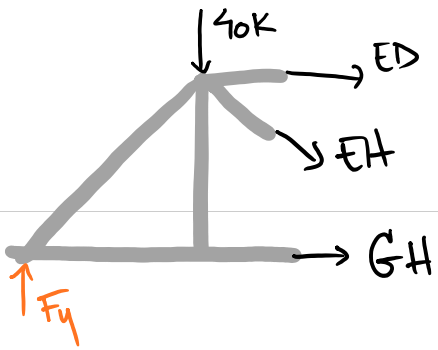
Wednesday, October 5, 2016 11:05

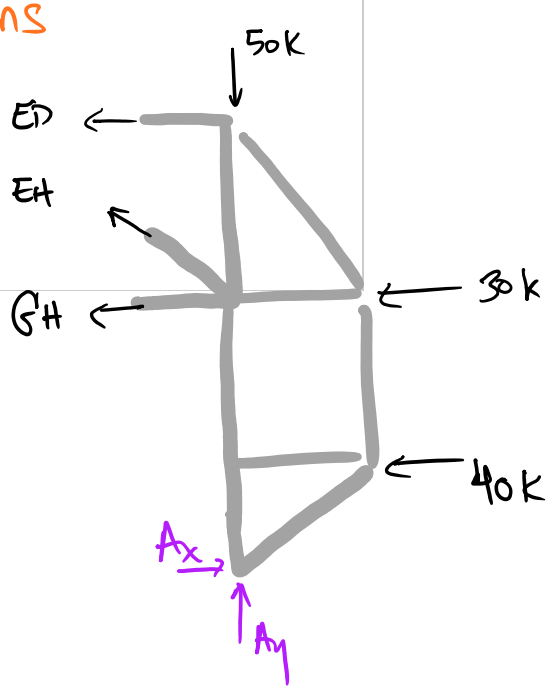


Find the force in members ED, EH, and GH.

1. Draw FBD of sections
2. Draw FB of truss

the FBD of the sections



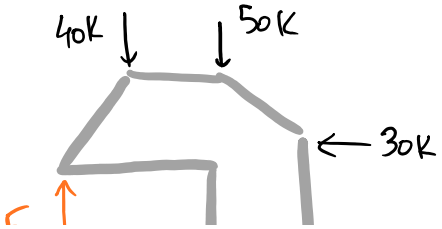


4 unknowns!

5 unknowns!

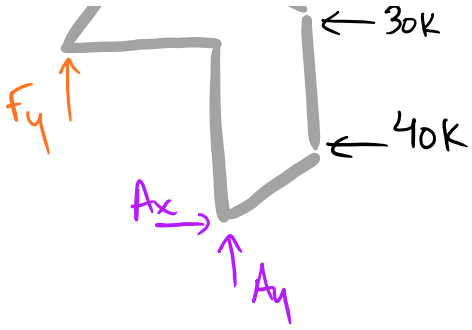
use left section

DRAW FBD of truss to solve for support!



Sum moments about A:

ΣM_A:

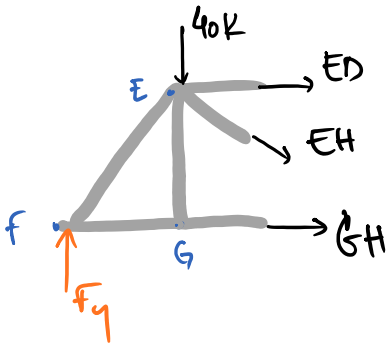


ΣM_A:

$$1.5(40K) + 3(30K) + 2(40K) - 4F_y = 0$$

$$F_y = \frac{1.5(40K) + 3(30K) + 2(40K)}{4} = 57.5 \text{ kN}$$

using the left section:



take moment About E:

ΣM_E: $1.5\,GH - 2F_y = 0$

$$GH = \frac{2F_y}{1.5} = 76.7 \text{ kN (T)}$$

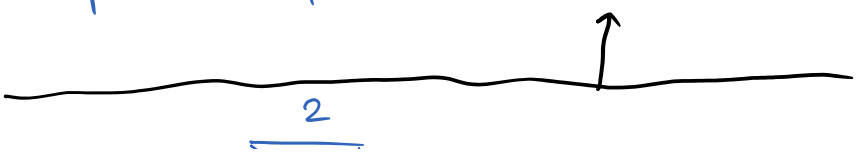
take the moment about H:

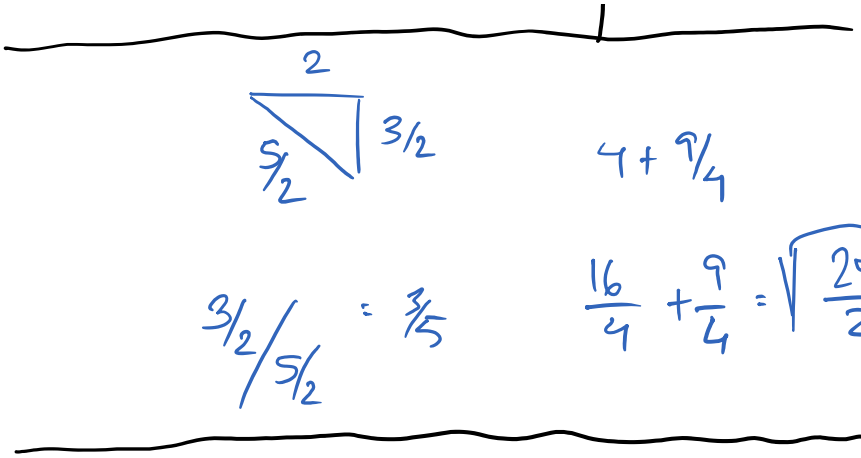
ΣM_H: $2(40K) - 4F_y - 1.5\,ED = 0$

$$ED = \frac{2(40K) - 4F_y}{1.5} = -100 \text{ kN (C)}$$

Sum the forces in x or y direction:

ΣF_y: $F_y - 40k - \frac{3}{5} EH = 0$





$$EH = \frac{5}{3}(F_4 - 40k) = 29.2\ kN\ (T)$$