Recitation 004

10/04/2024

GSI Info

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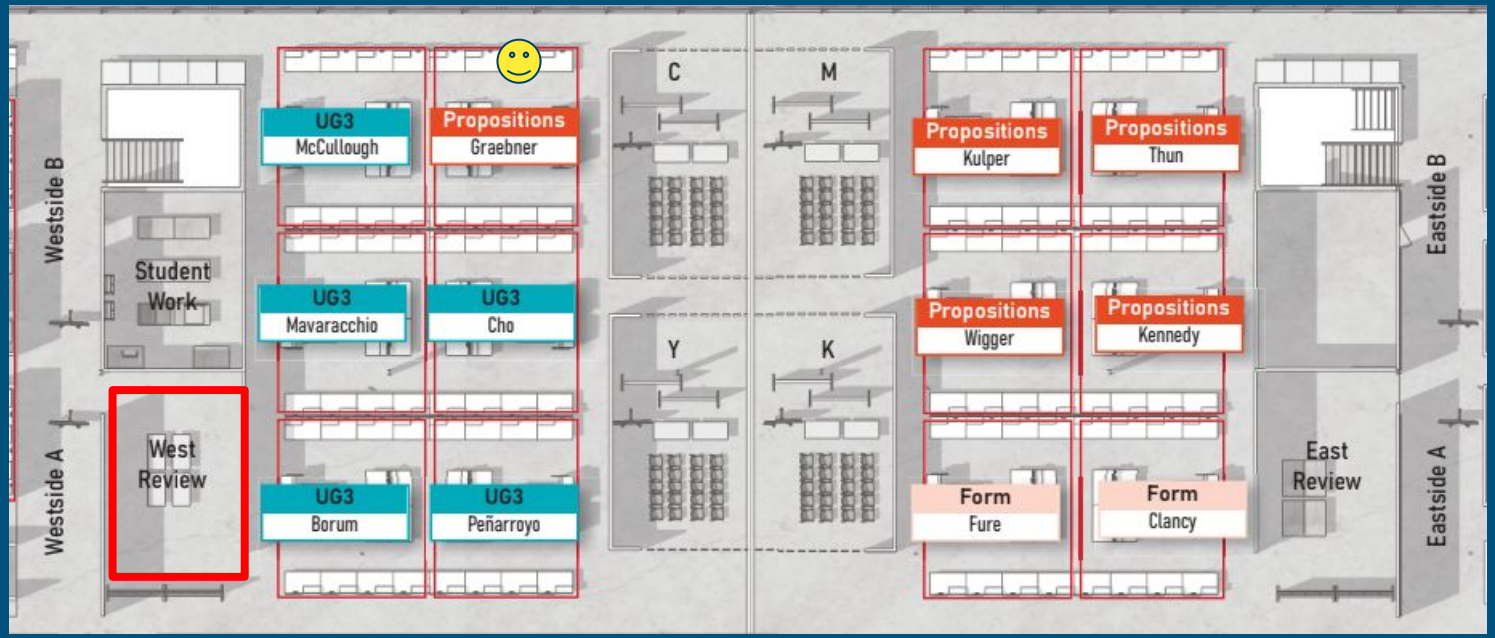
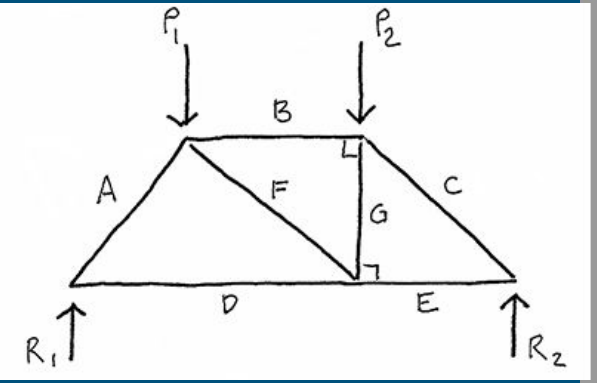


Questions

HW #7



7. Truss Systems

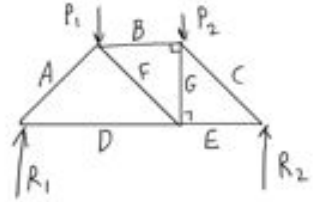
Find the internal forces in members: A, B, C, D, E, F and G.

DATASET: 1 -2- -3-

Length B	3 FT
Length D	9 FT
Length E	8 FT
Length G	6 FT
Load P1	350 LBS
Load P2	350 LBS

#	Question
1	End reaction R1 (positive is upward)
2	End reaction R2 (positive is upward)
3	Horizontal component of force in member A (absolute value)
4	Vertical component of force in member A (absolute value)
5	Total axial force in member A (absolute value)
6	Sign for member A (1 for tension or -1 for compression)
7	Total axial force in member B (absolute value)
8	Sign for member B (1 for tension or -1 for compression)
9	Horizontal component of force in member C (absolute value)
10	Vertical component of force in member C (absolute value)
11	Total axial force in member C (absolute value)
12	Sign for member C (1 for tension or -1 for compression)
13	Total axial force in member D (absolute value)
14	Sign for member D (1 for tension or -1 for compression)
15	Total axial force in member E (absolute value)
16	Sign for member E (1 for tension or -1 for compression)
17	Horizontal component of force in member F (absolute value)
18	Vertical component of force in member F (absolute value)
19	Total axial force in member F (absolute value)
20	Sign for member F (1 for tension or -1 for compression)
21	Total axial force in member G (absolute value)
22	Sign for member G (1 for tension or -1 for compression)

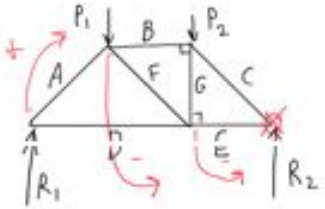
Due 10/6/24



B = 3' P1 = 350 lbs
D = 9' P2 = 350 lbs
E = 8'
G = 6'

1.) End Reaction R1

$M_{R2} = 0 = M_{R_1} + MP_1 + MP_2$



$0 = R_1(D+E) - P_1(B+E) - P_2(E)$

$0 = R_1(9' + 8') - 350\ lbs\ (3' + 8') - 350\ lbs\ (8')$

$-R1 = \frac{-3850 - 2800}{17'} = 391.1765\ lbs$

2.) End Reaction R_2

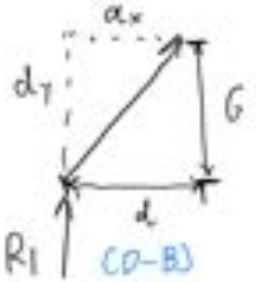
$$\Sigma F_y = 0 = R_1 + R_2 - P_1 - P_2$$

$$0 = 391.1765 \text{ lbs} + R_2 - 350 \text{ lbs} - 350 \text{ lbs}$$

↑ From #1

$$R_2 = 308.8235 \text{ lbs}$$

3.) Vertical Component of A



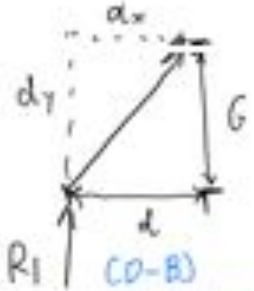
$\Sigma F_y = 0 = R_1 + a_y$

$a_y = -R_1$ ← #4

$a_y = -391.177$ ↑ from #1

Negative means in compression

4.) Horizontal Component of Member A



$\frac{F}{F} : \frac{d}{d}$

$\frac{a_x}{a_y} = \frac{D\text{-}B}{G}$ (9'-3')

$\frac{a_x}{391.177} : \frac{6'}{6'}$

$a_x = 391.177$ lb

#3. ↑

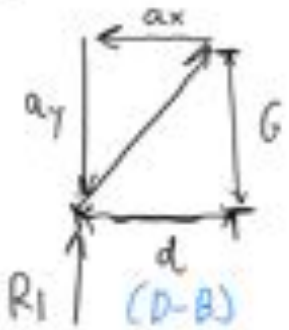
5.) Total Axial force in A

$$\sqrt{a_x^2 + a_y^2} =$$

$$\sqrt{391.177^2 + 391.177^2} = 553.2064 \text{ lbs}$$

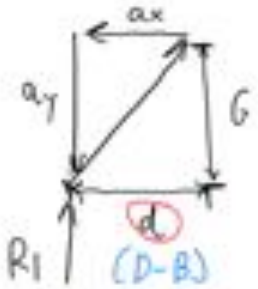
From #3 ↑ ↑ From #4

6.) Compression or Tension



Compression since it acts toward the Joint (Ref. #3)

7.) Calculate axial Force D

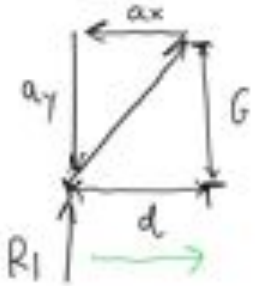


$\Sigma F_x = 0 = d - a_x$

$d = 391.177$ lbs

From #3 ↑ ↑ #13

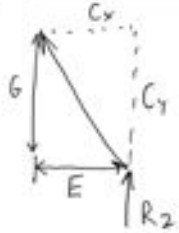
8.) Tension or Compression



force goes away from Joint so in tension

↑ #14

9.) Solve for Components of C



$\Sigma F_y = 0 = C_y + R_2$ ✓ #10.

$C_y = -308.824$ lbs ← From #2.

$$\frac{C_x}{C_y} : \frac{E}{G} = \frac{C_x}{308.824} : \frac{8'}{6'}$$

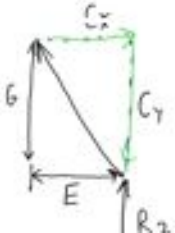
$C_x = 411.7653$ lbs ← #9.

10.) Total axial force C

$$\sqrt{C_x^2 + C_y^2} =$$

$$\sqrt{411.7653^2 + 308.824^2} = 514.7066 \text{ lbs}$$ ← #11

11.) Tension or Compression

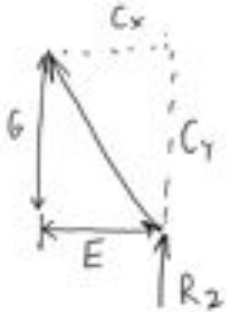


← #12.

Compression since it acts toward the joint

12.) Axial force in E

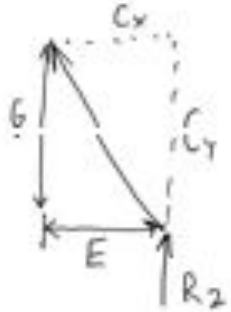
$\Sigma F_x = 0 = C_x - E$



$E = 911.765$ lbs

From #9. ↑ ↑ #15

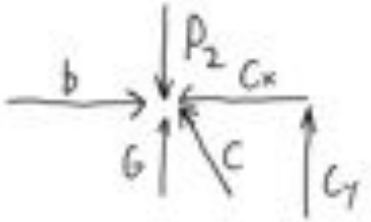
13.) Compression or Tension



force goes away from Joint so in tension

↑ #16.

14.) Axial Force in B

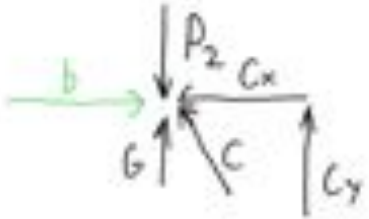


$\Sigma F_x = 0 = B - C_x$

$B = 411.765$ lbs

From #9 ↑ ↑ #7

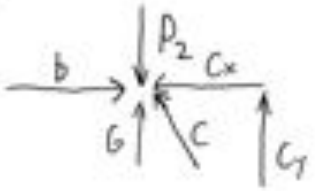
15.) Compression or Tension



#8

Compression since it acts toward the joint

16.) Axial Force in G



$\Sigma F_y = 0 = C_y - G - P_2$

$G = C_y - P_2$

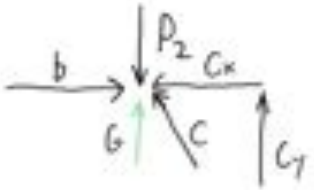
$= 308.824 - 350$ lbs

From #10 ↑ ↙ #21

$G = -41.176$ lbs

↑ negative means compression

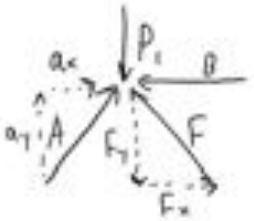
17.) Compression or Tension



↙ #22

Compression since it pushes toward the joint

18.) Components of F



$\Sigma F_x = 0 = f_x + a_x - B$

$f_x = B - a_x$

$= 411.765 - 391.176$

From # 7 ↑ ↑ From #3

$f_x = 20.589$ lbs

↑ # 17

$\Sigma F_y = 0 = f_y + a_y - P_1$

$f_y = P_1 - a_y$

$= 350 - 391.176$

↑ From # 4

$= -41.176$ lbs

↑ # 18.

19. Total Axial Force F

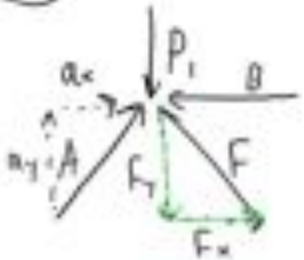
$$\sqrt{F_x^2 + F_y^2} =$$

$$\sqrt{20.589^2 + 41.176^2} = 46.0366 \text{ lbs}$$

From #17 ↑ ↑ From #18

#19 ↙

20. Compression or Tension



force goes away from Joint so in tension

↳ #16.

LAB