Recitation 004

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GSI Info

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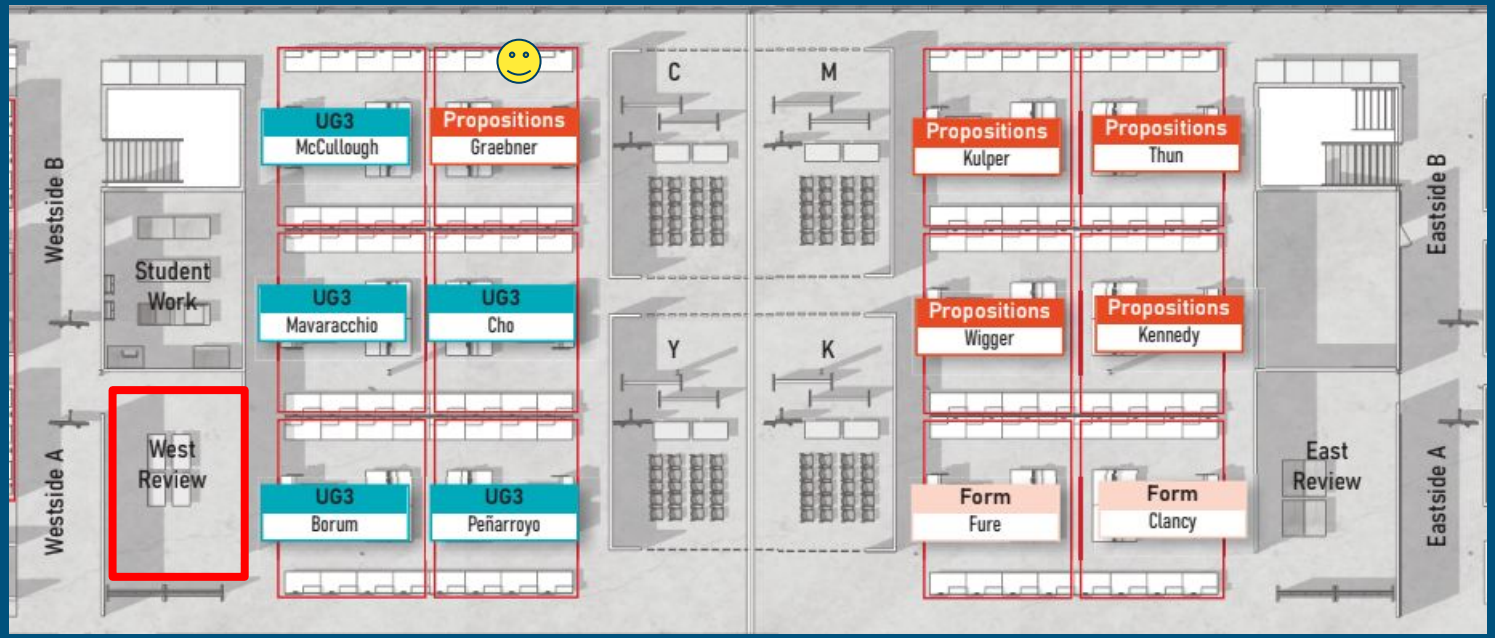


Questions

Class Evaluations

HW #14

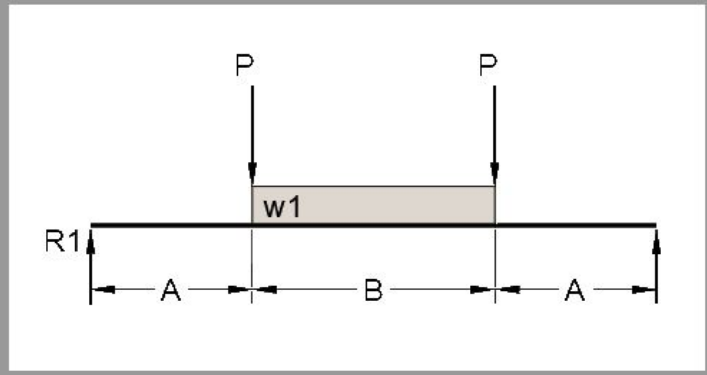
#	Question
1	R1 (+ = upward)
2	Shear at reaction (V1)
3	Shear at point load (V2)
4	Moment at point load (M1)
5	Moment at center line (M2)
6	Area under moment diagram (MA1)
7	Area under moment diagram (MA2)
8	Area under moment diagram (MA3)
9	Slope(EI) at reaction (S1). Give absolute value.
10	Slope(EI) at point load (S1). Give absolute value.
11	Area under slope(EI) diagram (SA1)
12	Area under slope(EI) diagram (SA2)
13	Area under slope(EI) diagram (SA3)
14	Centerline deflection. Give absolute value in INCHES.

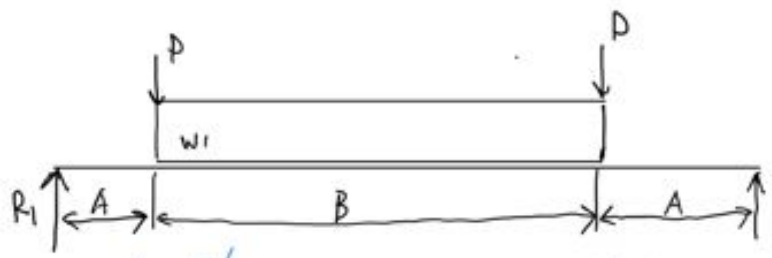
14. Beam Deflection

For the given simple span beam, use shear, moment, slope and deflection diagrams to determine the slope at each end, the deflection at points A and B distance from left, and the maximum deflection at the centerline. Remember to divide out EI to get deflection in inches. Be sure to correct errors at each step to maintain accuracy.

DATASET: 1 -2- -3-

Length A	11 FT
Length B	10 FT
Point Load P	13 KIPS
Uniform Load w	1 KLF
Modulus of Elasticity	29000 KSI
Moment of Inertia	820 IN^4





A = 11'
B = 10'
P = 13 kips

Uniform load w_1 = 1 KLF
modulus of Elasticity = 29000 KSI
moment of inertia = 820 in^4

1.) Find R1

$$M_{R_2} = 0 = A(P) + \left(\frac{B}{2} + A\right)(w_1(B)) + (A+B)(P) - (A+A+B)R1$$

$$0 = 11'(13k) + \left(\frac{10'}{2} + 11'\right)(1k/ft(10')) + (11'+10')(13k) - (11'+11'+10')R1$$

$$R1 = 18 \text{ kips}$$

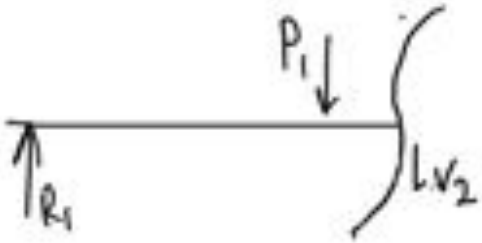
↑ #1.

2.) Shear at Reaction (V_1)

$V_1 = R_1 = 18 \text{ kips}$ ← #2.

↑ from #1

3.) Shear at Point load (V_2)

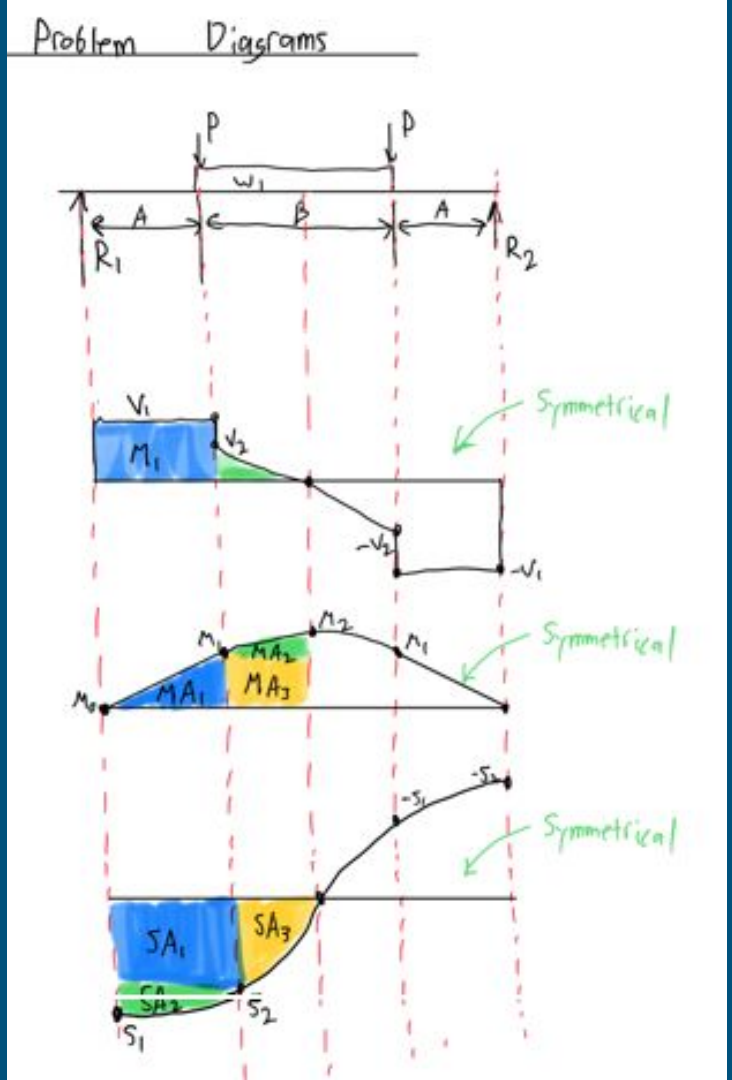


$$\Sigma F_y = R_1 - P - V_2 = 0$$

$$V_2 = R_1 - P = 0$$

From #2 ← ±3

$$V_2 = 18_{kips} - 13_{kips} = 5 \text{ kips}$$


Problem Diagrams
P
P
w
A
B
A
R1
R2
V1
V2
M1
Symmetrical
-V2
-V1
M0
M1
M2
MA1
MA2
MA3
Symmetrical
-S1
-S2
SA1
SA3
S2
S1
Symmetrical

4.) Moment at Point load (M_1)

$$M_1 = V_1 (A)$$

From #2

$$M_1 = = 18_{kips} (11') = 198 \text{ kips ft.}$$

← #4

5.) Moment at Centerline (M_2)

$$M_b = \frac{1}{2}\left(\frac{B}{2}\right)(V_2)$$

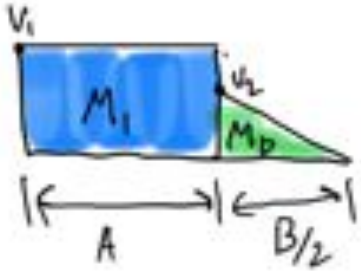
$$M_2 = M_1 + \frac{V_2 B}{4}$$

← from #5

From #4 ↑

$$M_2 = 198\ \text{kips} + \frac{S_{\text{kips}}(10')}{4} = 210.5\ \text{k'ips} - \text{ft.}$$

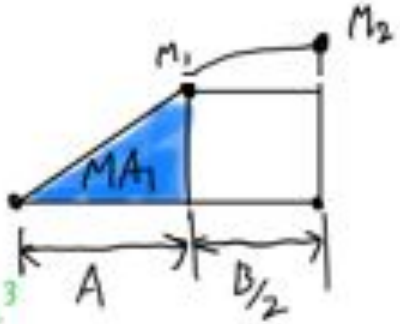
↑ #5



6.) Area under the Moment diagram (MA1)

$$MA_1 = \frac{1}{2}(M_1)(A)$$

↑ From #4



$$= \frac{1}{2}(198)(11') = 1089 \text{ k}_{ip}\text{ ft}^3$$

↑ #6

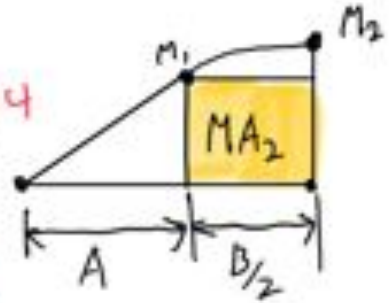
7.) Area under the Moment diagram (MA_2)

$$MA_2 = \frac{2}{3}\left(\frac{B}{2}\right)(M_2 - M_1)$$

From #5 ↑ ↑ From #4

$$= \frac{2}{3}\left(\frac{10'}{2}\right)(210.5 - 198) = 41.67 \text{ kip ft}^2$$

↑ #7.



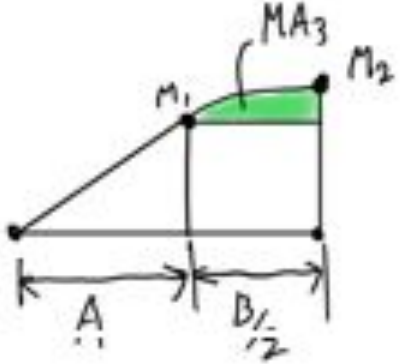
8.) Area under the Moment diagram (MA_3)

$$MA_3 = \frac{B}{2}(M_1)$$

↑ From #4

$$= \frac{10'}{2}(198) = 990 \text{ kip ft}^2$$

↑ #8



9.) Slope at Reaction (S1)

$$S1 = MA_1 + MA_2 + MA_3$$

MA_3 ← From #8

MA_2 ← From #7

MA_1 ← From #6

$$S_1 = 1089 \text{ k·p ft}^2 + 41.67 \text{ k·p ft}^2 + 990 \text{ k·p ft}^2 = 2120.667 \text{ kip ft}^2$$

#9.

(g) Slope at Point load (S2)

$$S_2 = S1 - MA_1$$

From #9 → S1 ; From # → MA_1

$$S_2 = 2120.67 \text{ kip ft}^2 - 1089 \text{ kip ft}^2 = 1031.67 \text{ kip ft}^2$$

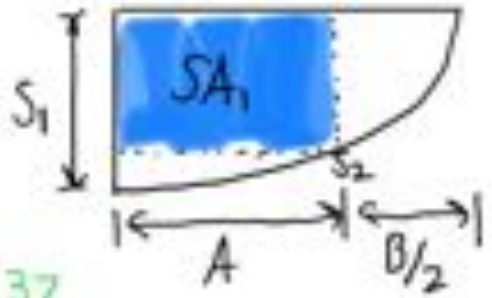
11.) Area under the Slope diagram (SA)

$SA_1 = S_2(A)$

↑ From #10

$= 1031.67(11') = 11348.37$ kip ft³

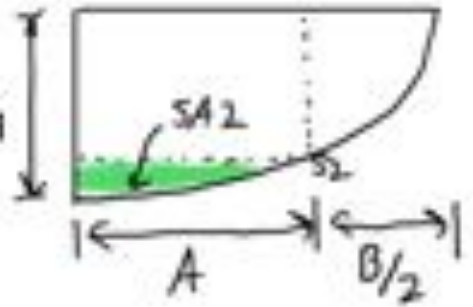
↑ #11



12) Area under the Slope diagram (SA2)

$$SA_2 = \frac{2}{3}(S_1 - S_2)(A)$$

S_1: From #9 ↑ S_2: From #10 ↑



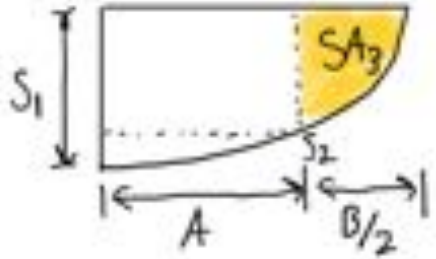
$$= \frac{2}{3}(2120.67 - 1031.67)(11') = 7986 \text{ kip ft}^3$$

↑ #12

13.) Area under the Slope diagram (SA3)

$$SA_3 = \frac{1}{2}\left(\frac{B}{2}\right)(S_2)$$

From #10



$$= \frac{1}{2}\left(\frac{10'}{2}\right)(1031.67) = 2579.175 \text{ kip ft}^3$$

↑ #13.

14.) Centerline deflection

From #11

From #12

From #13

Convert ft^3 to inches

$$\Delta = \frac{SA_1 + SA_2 + SA_3}{EI} \times \frac{12^3 (in^3)}{ft^3}$$

$$\Delta = \frac{11348.4 + 7986 + 2579.18}{(29{,}000\ ksi)\ 820\ in^4} \times \frac{12^3 (in^3)}{ft^3} = 1.5924''$$

↑ #14

LAB