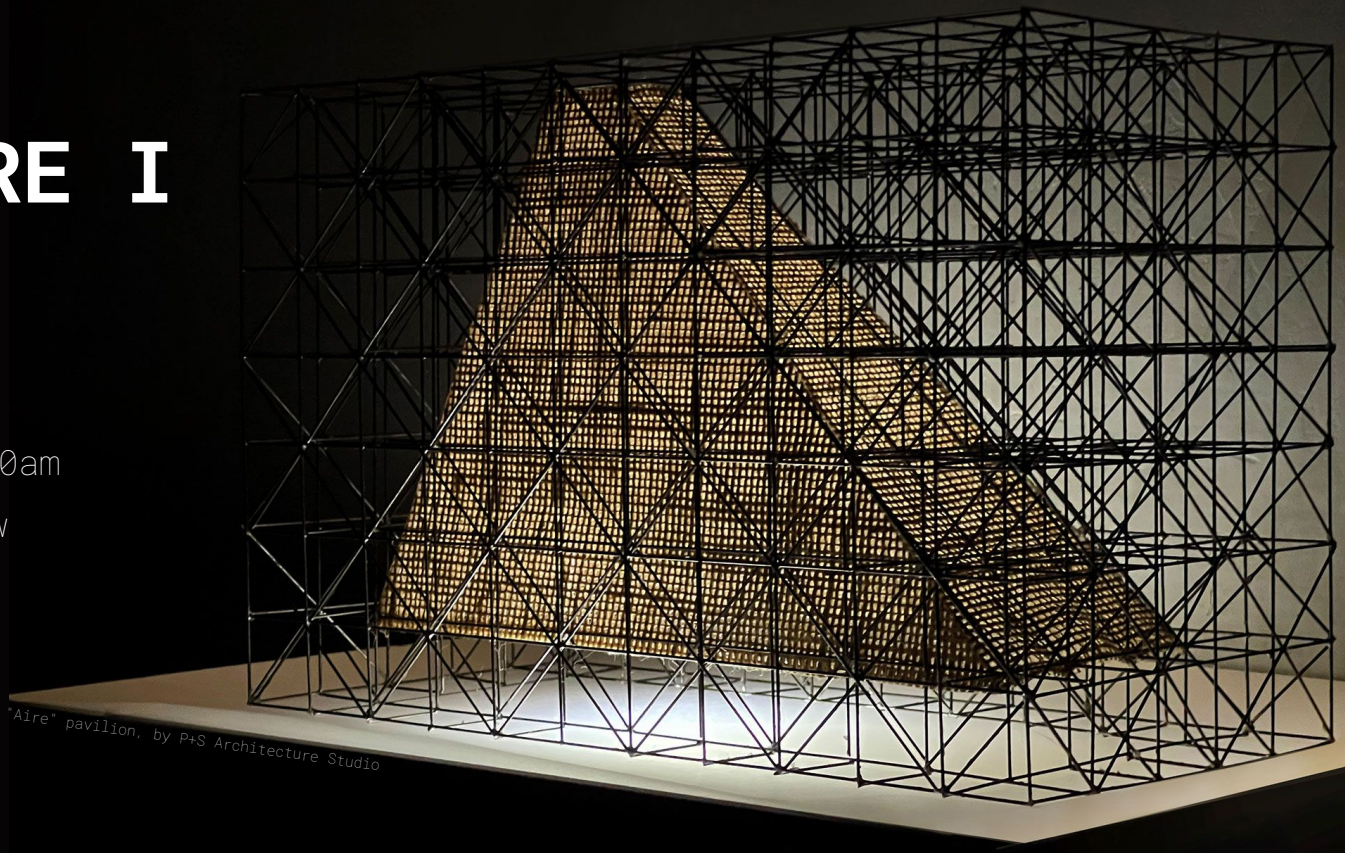
STRUCTURE I

ARCH-314

9:30am - 10:30am

East Review


"Aire" pavilion, by P+S Architecture Studio

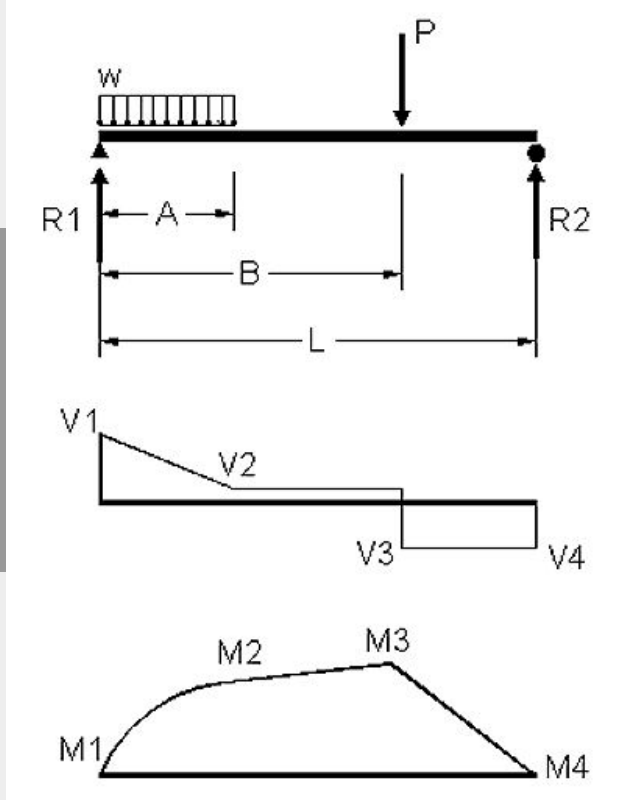
Today:

- Problem No.12: Moment of Inertia
- Lab 10: Shear & Bending

PROBLEM NO.11

DATASET: 1 -2- -3-

Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS



PROBLEM NO.12

Question 2: **Right Reaction (R2) (+ is upward; - is downward)**

$$F = w \times A$$

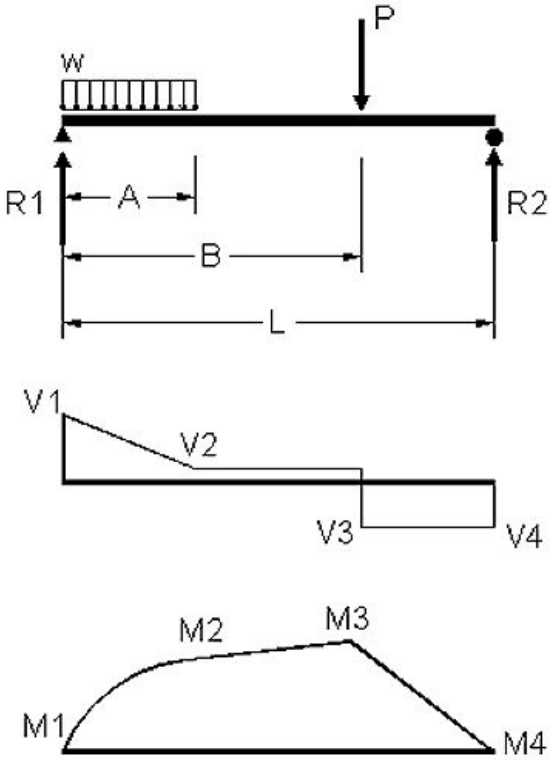
$$F = 180 \times 13 = 2340\ lbs$$

$$\sum M_{R1} = 0$$

$$+ F \times \frac{A}{2} + P \times B - R_2 \times L = 0$$

$$+ 2340 \times \frac{13}{2} + 510 \times 22 - R_2 \times 27 = 0$$

$$R_2 = 978.88\ lbs$$



DATASET: 1	-2-	-3-
Total Span L		27 FT
Length A		13 FT
Length B		22 FT
Uniform Load on Length A (w)		180 PLF
Point Load (P)		510 LBS

PROBLEM NO.12

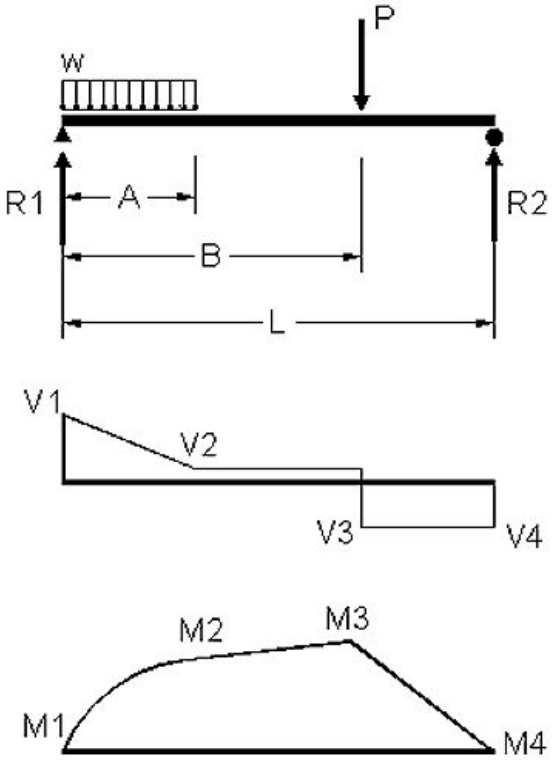
Question 1: **Left Reaction (R1) (+ is upward; - is downward)**

$$\sum_{F_y} = 0$$

$$R_1 + R_2\,(Question2) - F - P = 0$$

$$R_1 + 978.88 - 2340 - 510 = 0$$

$$R_1 = 1871.12\ lbs$$



DATASET: 1 -2- -3-

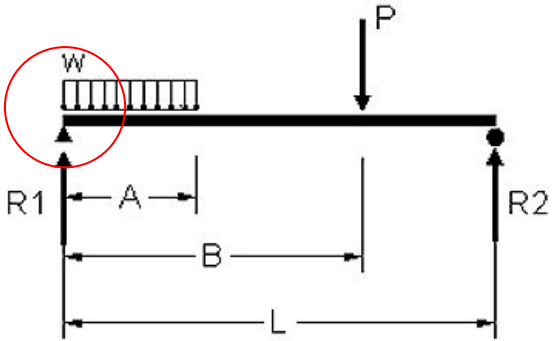
Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

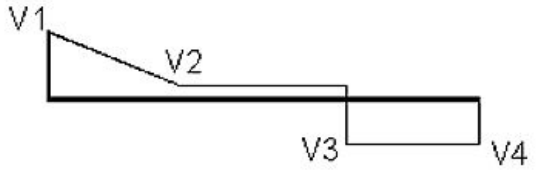
PROBLEM NO.12

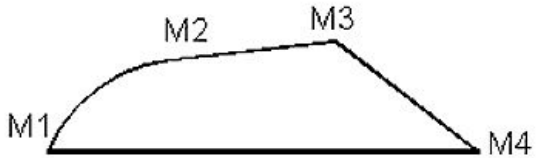
Question 3: **Peak Shear value at R1 (V1) (use + or - sign)**

$V_1 = R_1 (\ Question\ 1)$

$V_1 = 1871.12\ lbs$







DATASET: 1 -2- -3-

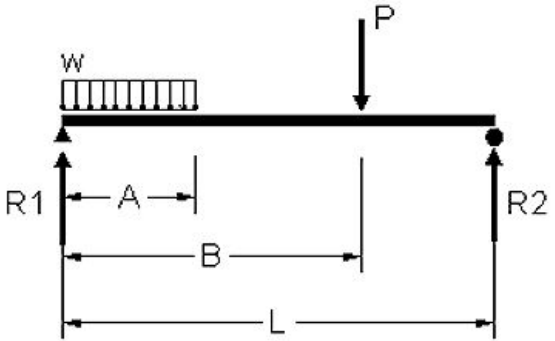
Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

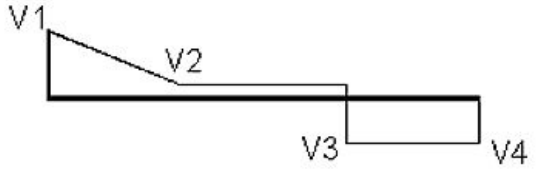
PROBLEM NO.12

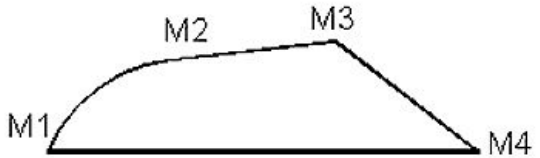
Question 4: **Moment value at R1 (M1)**

$$M_1 = 0$$

(Pinned Support)







DATASET: 1 -2- -3-

Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

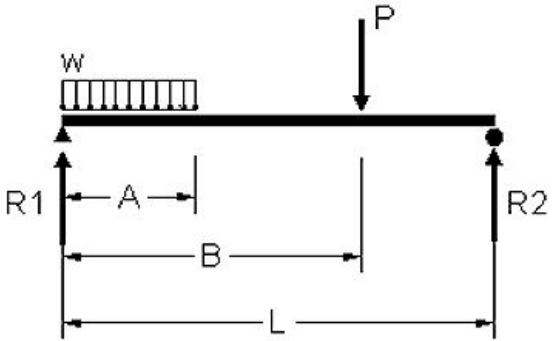
PROBLEM NO.12

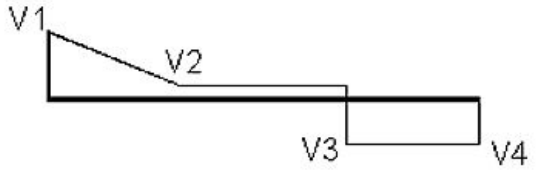
Question 5: **Shear value at A distance from R1 (V2) (use + or - sign)**

$$V_2 = V_1(\ Question 3) - F$$

$$V_2 = 1871.12 - 23.40$$

$$V_2 = -468.88\ lbs$$





DATASET: 1 -2- -3-

Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

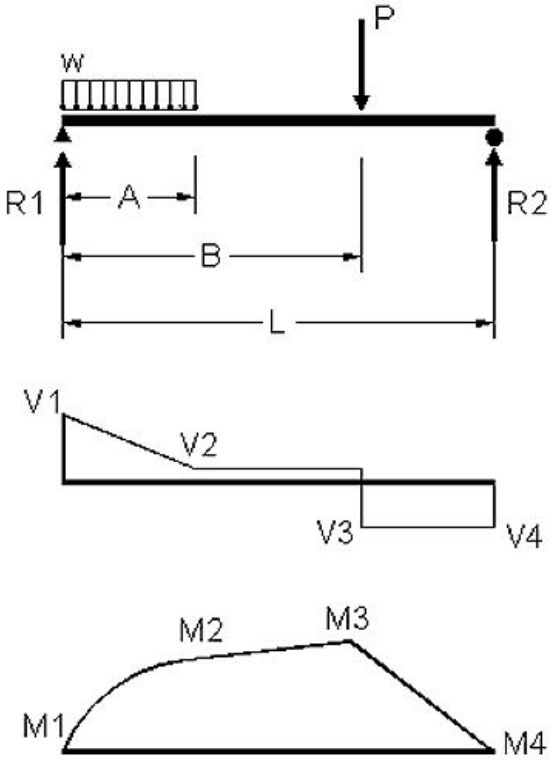
PROBLEM NO.12

Question 6: **Moment value at A dist. from R1 (M2 tension on bottom is +)**

$$M_2 = R_1(Question1) \times A - w \times A \times \frac{A}{2}$$

$$M_2 = 1871.12 \times 13 - 180 \times 13 \times \frac{13}{2}$$

$$M_2 = 9114.56 \; ft.lbs$$



DATASET: 1 -2- -3-	
Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

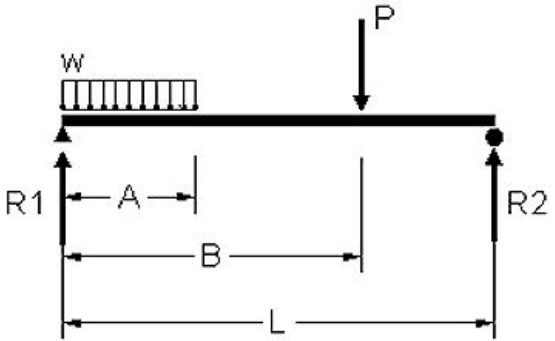
PROBLEM NO.12

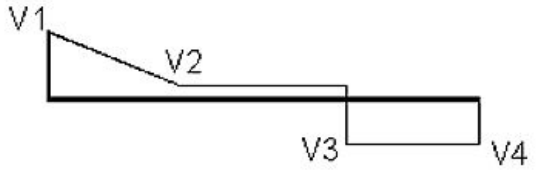
Question 7: **Peak Shear value at B distance from R1 (V3) (use + or - sign)**

$$V_3 = V_2\,(Question5) - P$$

$$V_3 = -468.88 - 510$$

$$V_3 = -978.88\ lbs$$





DATASET: 1 -2- -3-

Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

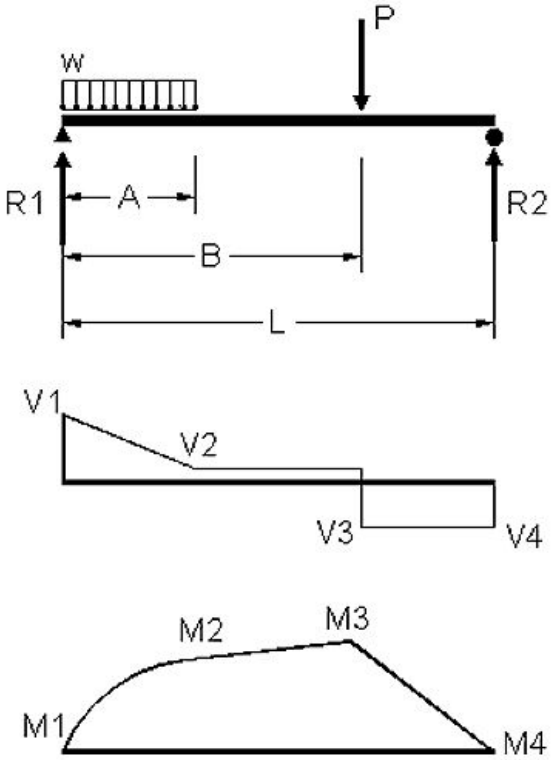
PROBLEM NO.12

Question 8: **Moment value at B dist. from R1 (M3 tension on bottom is +)**

$$M_3 = M_2(\,Question6) - \left| V_2(\,Question5) \times (B - A) \right|$$

$$M_3 = 9114.56 - \left| -468.88 \times (22 - 13) \right|$$

$$M_3 = 4894.64\, ft.lbs$$



DATASET: 1 -2- -3-

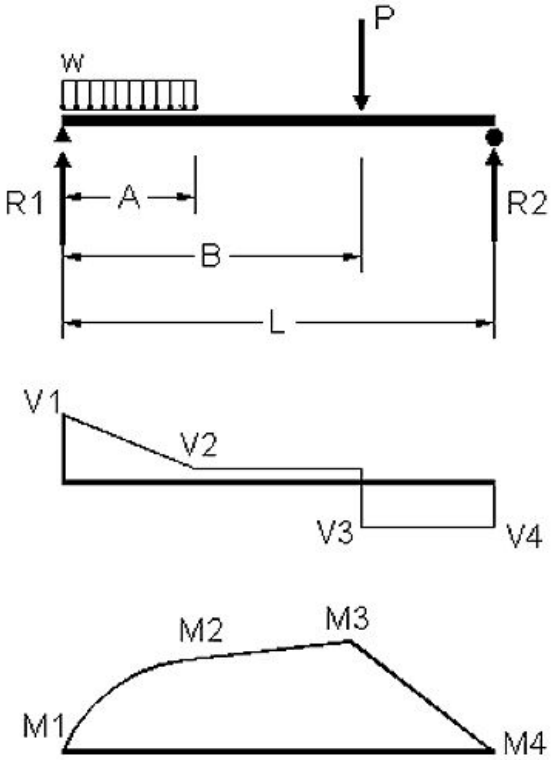
Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

PROBLEM NO.12

Question 9: **Peak Shear value at R2 (V4) (use + or - sign)**

$V_4 = V_3 (\ Question 7)$

$V_4 = -978.88\ lbs$



DATASET: 1 -2- -3-

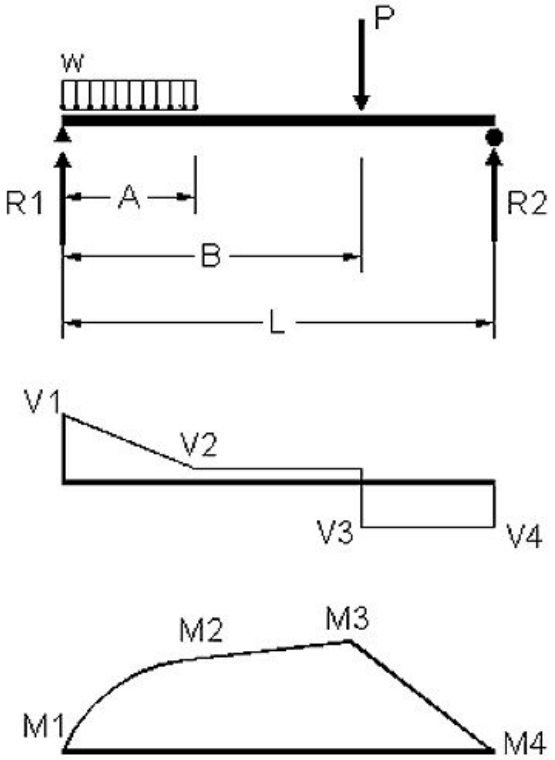
Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

PROBLEM NO.12

Question 10: **Moment value at R2 (M4)**

$$M_4 = 0$$

(Roller Support)



DATASET: 1 -2- -3-

Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

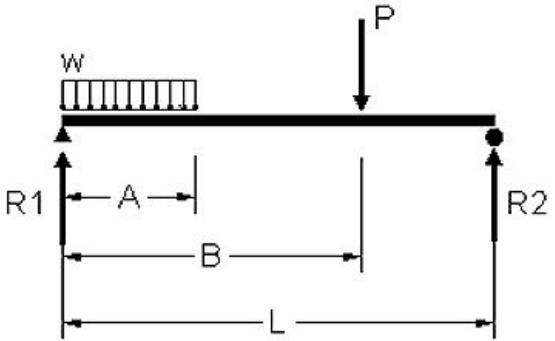
PROBLEM NO.12

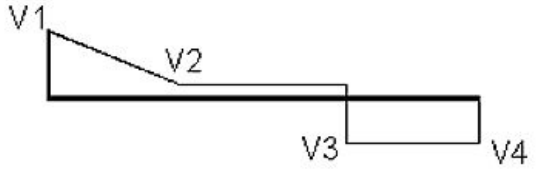
Question 12: **Distance from Left to Max. Moment in (decimal)**

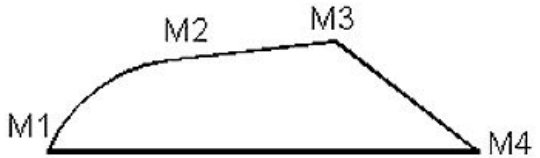
$$d = \frac{V_1(\ Question3)}{w}$$

$$d = \frac{1871.12}{180}$$

$$d = 10.395\ ft$$







DATASET: 1 -2- -3-	
Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

PROBLEM NO.12

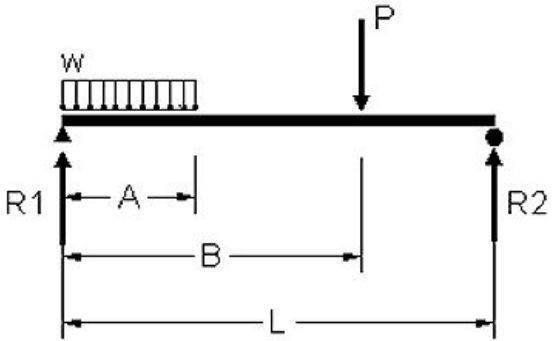
Question 11: **Maximum Moment (tension on bottom is +)**

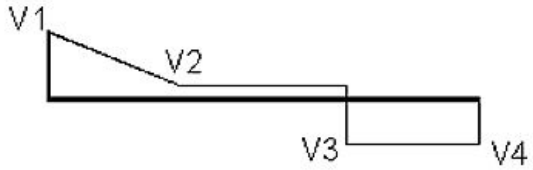
$$d = \frac{V_1(\ Question 3)}{w}$$

$$M_{max} = V_1(\ Question 3) \times \frac{d(\ Question 12)}{2}$$

$$M_{max} = 1871.12 \times \frac{10.395}{2}$$

$$M_{max} = 9725.14\ ft.lbs$$





DATASET: 1 -2- -3-	
Total Span L	27 FT
Length A	13 FT
Length B	22 FT
Uniform Load on Length A (w)	180 PLF
Point Load (P)	510 LBS

Lab 10: Shear & Bending

Structures I

Arch 314

Name 1 _____

Name 2 _____

Name 3 _____

Moment Diagrams

Description

This project compares a calculated moment diagram with one constructed with a weighted string.

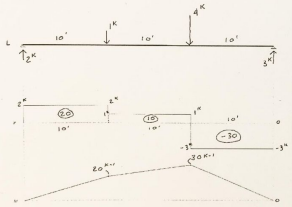
Goals

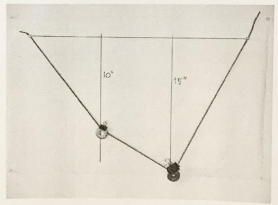
To measure the distances to the weights on a catenary model.

To compare the scaled height of the string model with the calculate heights on the diagram.

Procedure

1. Check the shear and moment diagrams for the beam below.
2. Place the same load on the string and measure the deflection at the weights.
3. Compare the string model with the moment diagram and determine the scale factors.





Scale factors

$$\frac{A\ in}{B\ in} : \frac{20\ k-ft}{30\ k-ft}$$

Scale = 1 in. to _____ k-ft

Scale = 1 in. to _____ k-ft