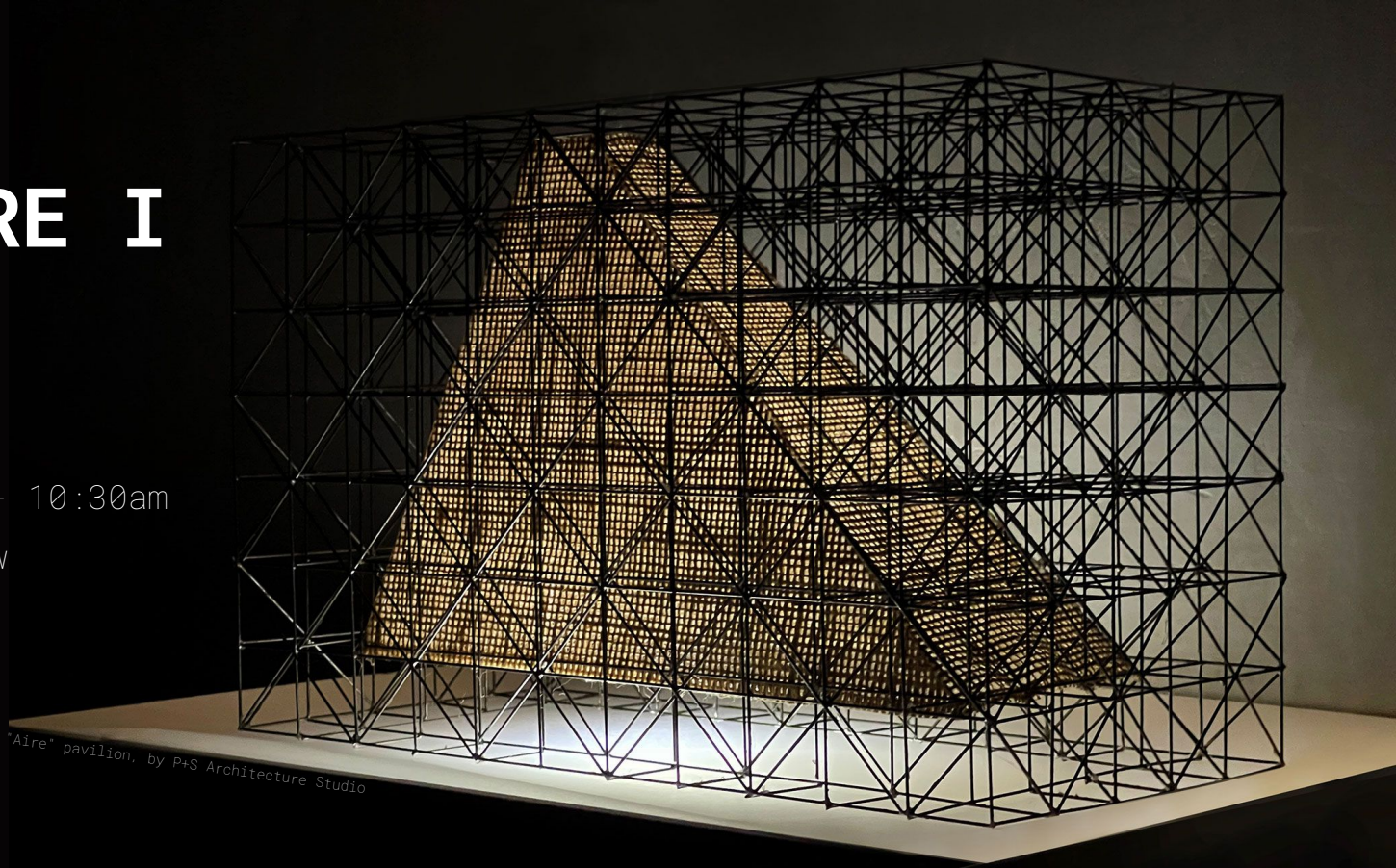
STRUCTURE I

ARCH-314

Friday(s): 9:30am - 10:30am

West Review



"Aire" pavilion, by P+S Architecture Studio

Today:

- Problem set No.6
- Lab Activity: Cable Systems

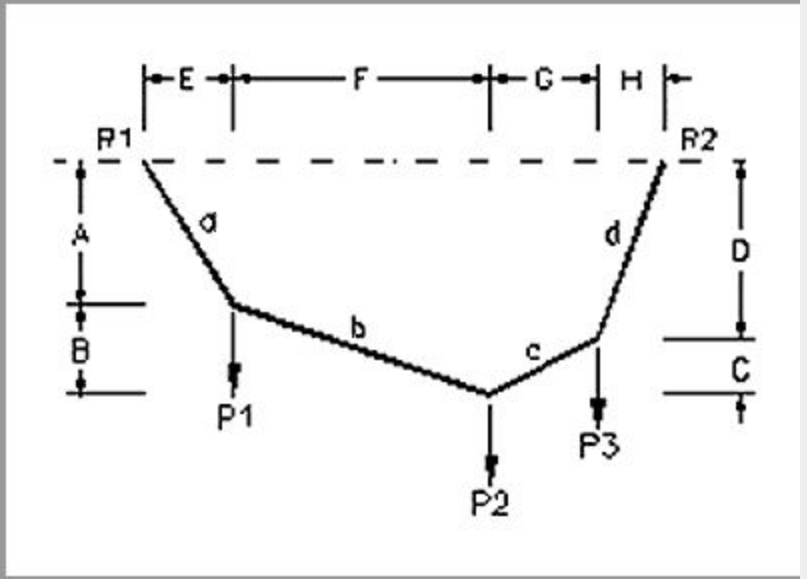
PROBLEM NO.6

6. Cable Systems

For the cable loaded as shown, determine the horizontal and vertical components of each end reaction, and the tensile force in each cable segment.

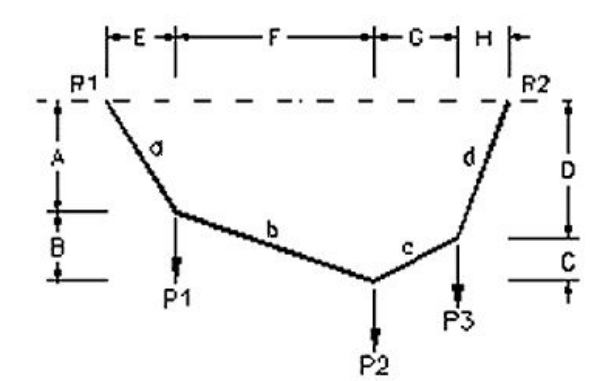
DATASET: 1 -2- -3-

Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS



PROBLEM NO.6

Question 4: **VERTICAL component of R2 (+ = upward)**



DATASET: 1 -2- -3-	
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

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

$$2\times 11+7\times(17+11)+9\times(17+17+11)-R_{2Y}\times(11+17+17+11)$$

$$R_{2Y}=11.125\ KIPS$$

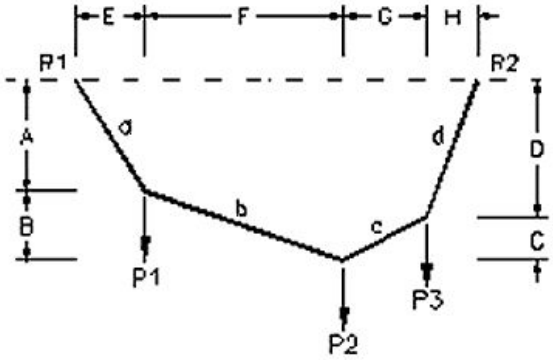
PROBLEM NO.6

Question 2: **VERTICAL component of R1 (+ = upward)**

$$\sum_{F_Y} = 0$$

$$R_{1Y} - 2 - 7 - 9 + 11.125 = 0$$

$$R_{1Y} = 6.875\ KIPS$$



DATASET: 1 -2- -3-

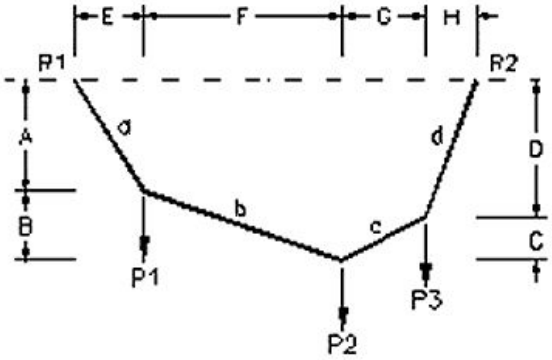
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

PROBLEM NO.6

$$\sum_{F_X} = 0$$

$$-R_{1X} + R_{2X} = 0$$

$$R_{1X} = R_{2X}$$



DATASET: 1 -2- -3-	
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

PROBLEM NO.6

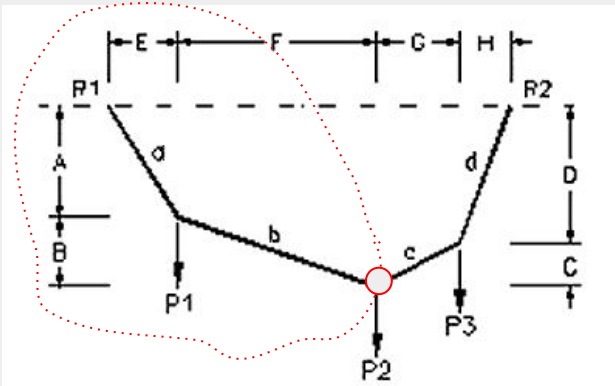
Question 1&3: **HORIZONTAL component of R1 & R2 (+ = to the right)**

$$\sum_M = 0$$

$$R_{1X} \times 28 + 6.875 \times (11 + 17) - 2 \times 17 = 0$$

$$R_{1X} = -5.66\ KIPS$$

$$R_{2X} = +5.66\ KIPS$$

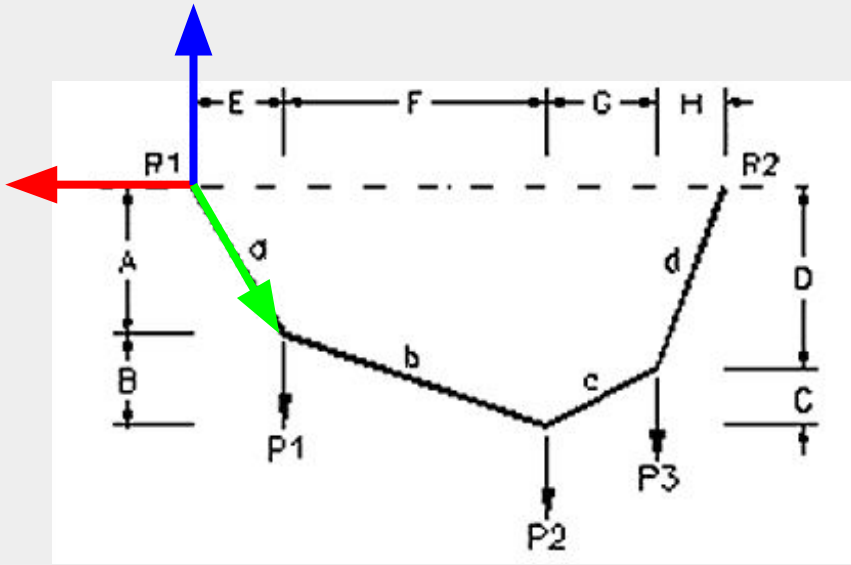


DATASET: 1 -2- -3-

Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

PROBLEM NO.6

Question 5: **Total Force in member 'a' (+ = tension)**



$$T_a = \sqrt{R^2_{1Y} + R^2_{1X}}$$

$$T_a = \sqrt{(6.875)^2 + (5.66)^2}$$

$$Ta = 8.90\ KIPS$$

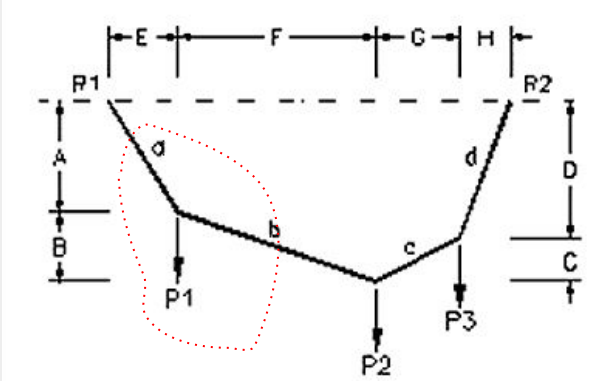
PROBLEM NO.6

Question 6: **Horiz. Force in member 'b' (absolute value)**

$$\sum Fx = 0$$

$$T_{bx} - T_{ax} = 0$$

$$T_{bx} = 5.66\ KIPS$$



DATASET: 1 -2- -3-

Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

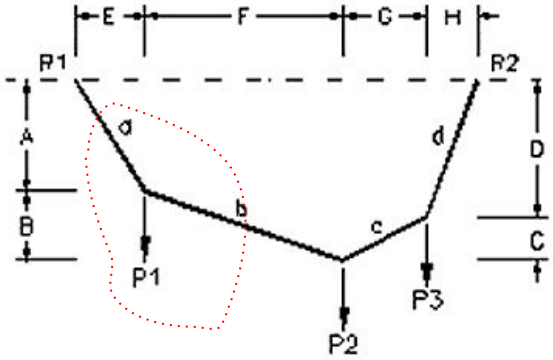
PROBLEM NO.6

Question 7: **Vert. Force in member 'b' (absolute value)**

$$\sum Fy = 0$$

$$T_{ay} - T_{by} - 2 = 0$$

$$T_{by} = 4.875\ KIPS$$

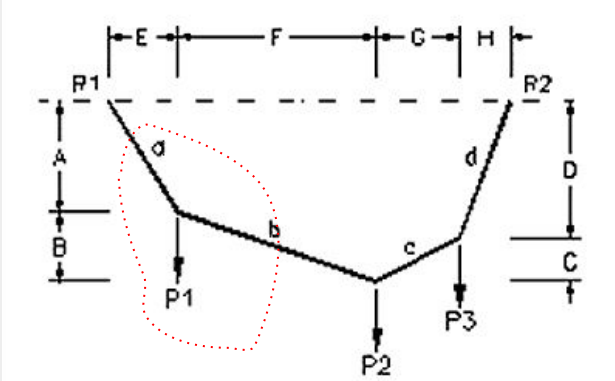


DATASET: 1 -2- -3-

Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

PROBLEM NO.6

Question 8: **Total Force in member 'b' (+ = tension)**



DATASET: 1 -2- -3-

Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

$$T_b = \sqrt{T^2_{bx} + T^2_{by}} = \sqrt{(5.66)^2 + (4.875)^2}$$

$$Tb = 7.47 KIPS$$

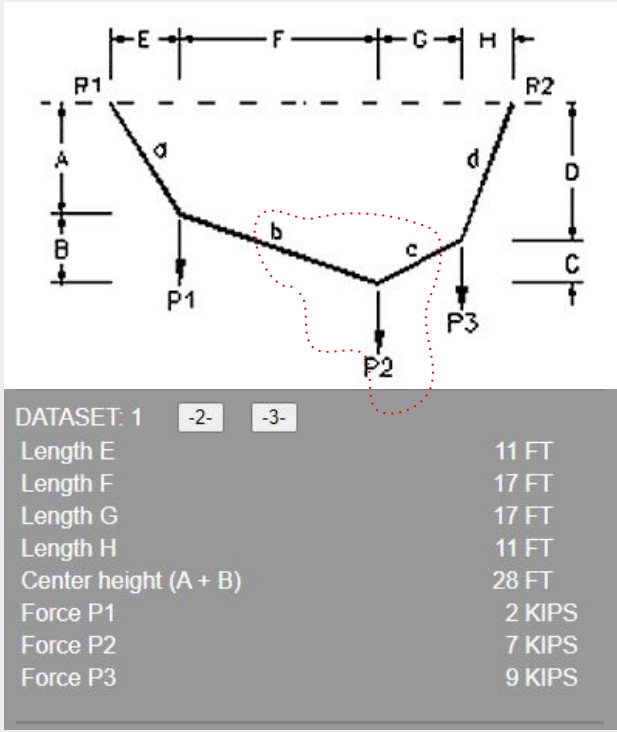
PROBLEM NO.6

Question 9: **Horiz. Force in member 'c' (absolute value)**

$$\sum Fx = 0$$

$$-T_{bx} + T_{cy} = 0$$

$$T_{cx} = 5.66 KIPS$$



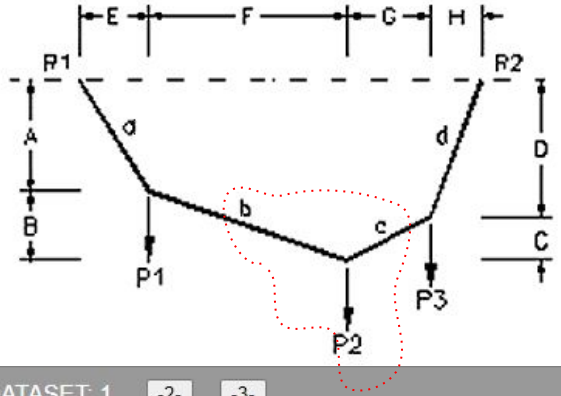
PROBLEM NO.6

Question 10: **Vertical Force in member 'c' (absolute value)**

$$\sum Fy = 0$$

$$T_{by} + T_{cy} - 7 = 0$$

$$T_{cy} = 2.125 KIPS$$



DATASET: 1 -2- -3-

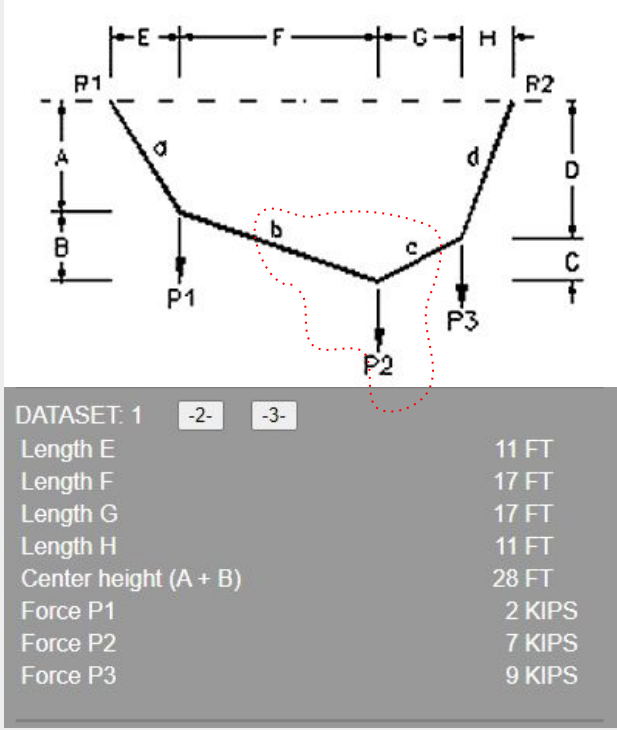
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

PROBLEM NO.6

Question 11: **Total Force in member 'c' (+ = tension)**

$$Tc = \sqrt{T^2_{cx} + T^2_{cy}} = \sqrt{(5.66)^2 + (2.125)^2}$$

$$T_C = 6.04 KIPS$$

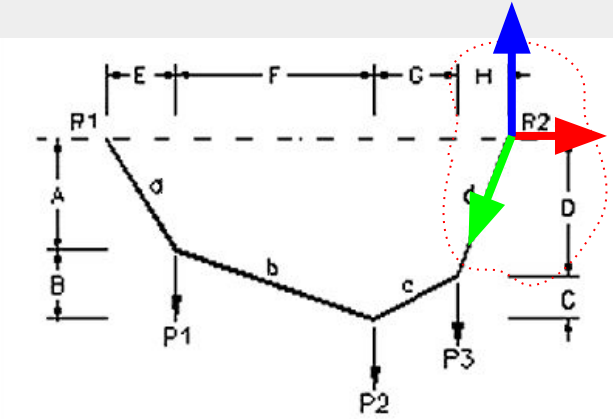


PROBLEM NO.6

Question 12: **Total Force in member 'd' (+ = tension)**

$$T_d = \sqrt{R_{2x}{}^2 + R_{2y}{}^2} = \sqrt{(5.66)^2 + (11.125)^2}$$

$$T_d = 12.48 \; KIPS$$



DATASET: 1 -2- -3-	
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

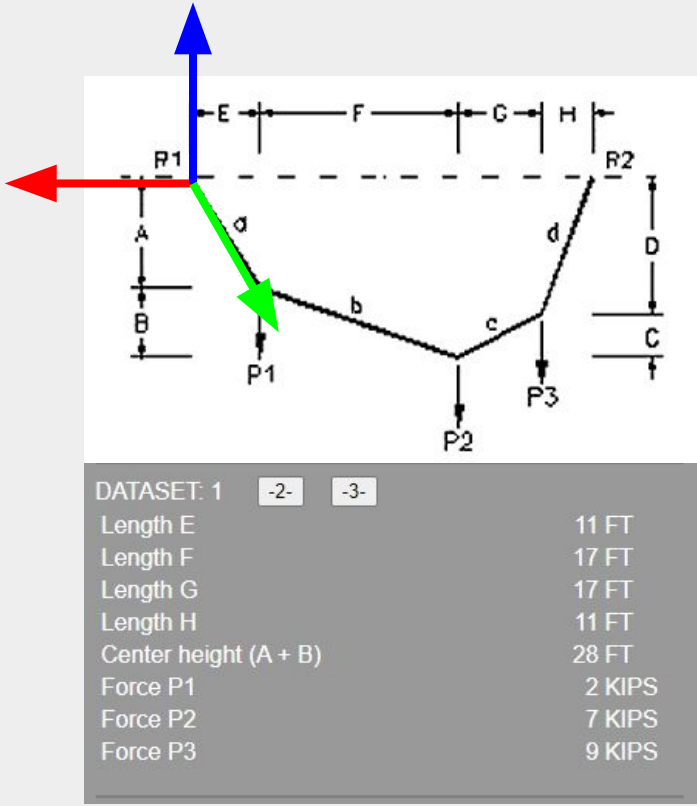
PROBLEM NO.6

Question 13: **Height A**

$$tan(\theta) = \frac{R_{1y}}{R_{1X}} = \frac{A}{11}$$

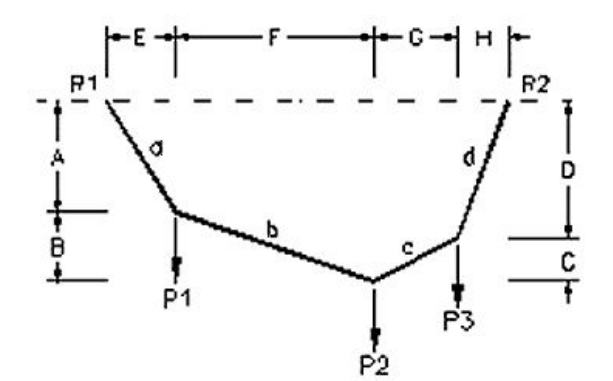
$$\frac{6.875}{5.66} = \frac{A}{11}$$

$$A = 11 \times \frac{6.875}{5.66} = 13.36\ FT$$



PROBLEM NO.6

Question 14: **Height B**



DATASET: 1 -2- -3-	
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

$$B = 28 - A = 28 - 13.36$$

$$B = 14.64\ FT$$

PROBLEM NO.6

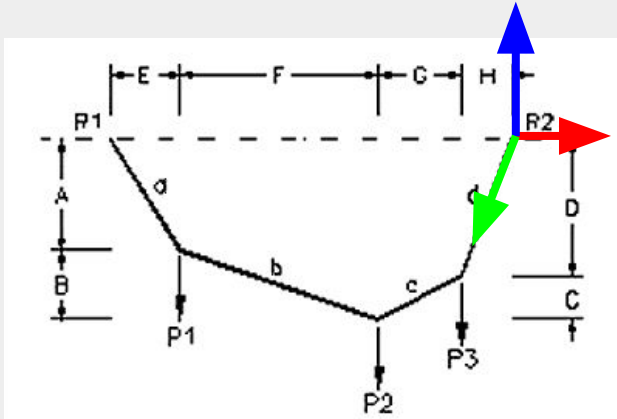
Question 16: **Height D**

$$\tan\theta = \frac{R_{2y}}{R_{2X}} = \frac{D}{11}$$

$$\frac{11.125}{5.66} = \frac{D}{11}$$

$$D = 11 \times \frac{11.125}{5.66}$$

$$D = 21.62\ FT$$



DATASET: 1 -2- -3-	
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

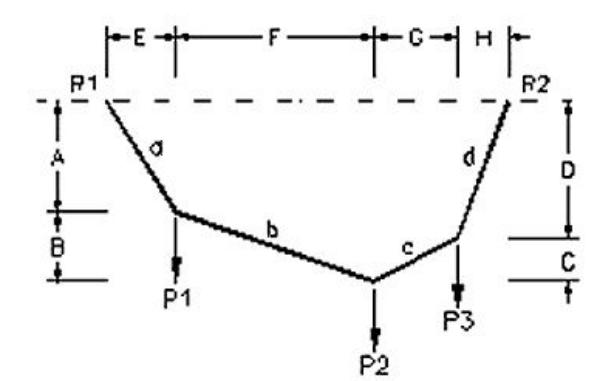
PROBLEM NO.6

Question 15: **Height C**

$$C = 28 - D$$

$$C = 28 - 21.62$$

$$C = 6.38\ FT$$



DATASET: 1 -2- -3-	
Length E	11 FT
Length F	17 FT
Length G	17 FT
Length H	11 FT
Center height (A + B)	28 FT
Force P1	2 KIPS
Force P2	7 KIPS
Force P3	9 KIPS

Lab.4: Truss Systems

Procedure

1. Use the truss stability equation, k=2j-r , to determine whether Truss 1 is unstable, stable, or indeterminate.
2. Make a sketch of Truss 1 with member A removed. Based on the stability equation, what is the status of the truss now? Would you agree?
3. Now repeat this for each of members in Truss 1 one at a time. Does the truss remain stable in each case?
4. Use the truss stability equation to determine whether Truss 2 is unstable, stable, or indeterminate.
5. Make a sketch of Truss 2 with member A removed. Based on the stability equation, what is the status of the truss now? Would you agree?
6. Make another sketch of Truss 2 with member B removed. Based on the stability equation, what is the status of the truss now? Would you agree?
7. Try removing other members from Truss 2. Make a sketch of two of these showing one which remains stable and one which becomes unstable with one member removed.