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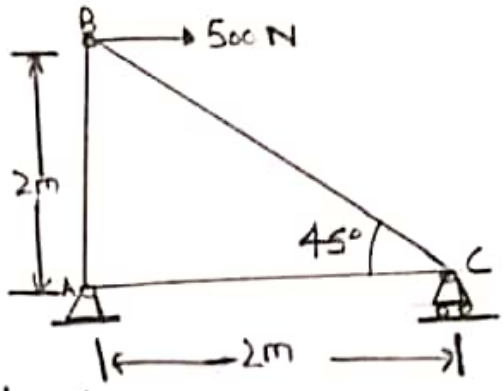
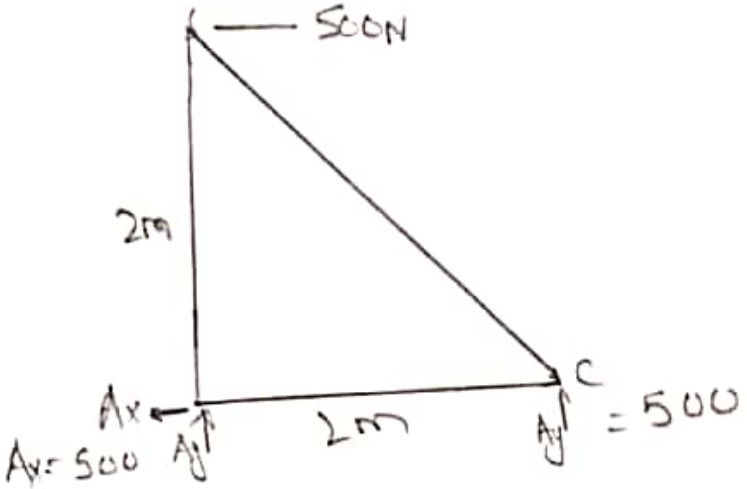
Subject :- Theory of Structure

Department :- B. Tech (Civil)

(Q1) Example 06: analyze the following truss.

r = 3
b = 3
j = 3
r + b = 2xj
3 + 3 = 2x3
6 = 6, Statically determinate.





Reaction $\Sigma M_A = 0 \circlearrowleft^+$

$500 \times 2 - C_y \times 2 = 0$

$C_y = \frac{1000}{2}$

$C_y = 500$

$\Sigma F_x = 0 \rightarrow^+$

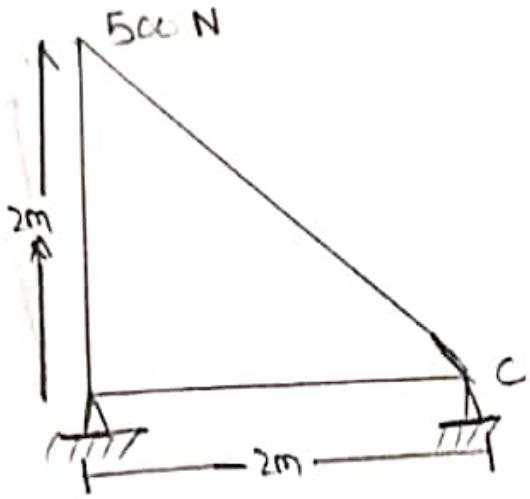
$= A_x - 500 = 0$

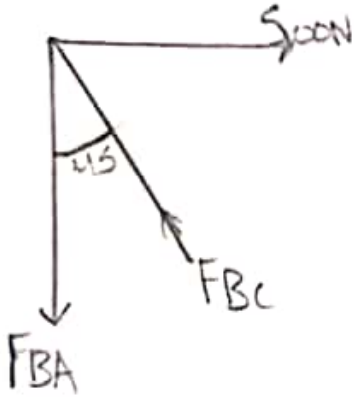
$A_x = +500\,N$

$\Sigma F_{xy} = 0 \uparrow^+$

$$-A_y + 500 = 0$$

$$A_y = 500N$$





$\sum F_x = 0 \rightarrow$

$$500 - F_{BC} \sin 45 = 0$$

$$F_{BC} = \frac{+500}{\sin 45}$$

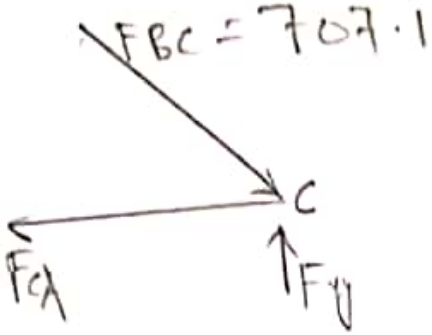
$$F_{BC} = 707.1\ N$$

$\sum F_y = \uparrow^{+} 0$

$$F_{BC} \cos 45^\circ - F_{AB} = 0$$

$$F_{AB} = 707.1 \cos(45^\circ)$$

$$F_{AB} = 500N\ (T)$$



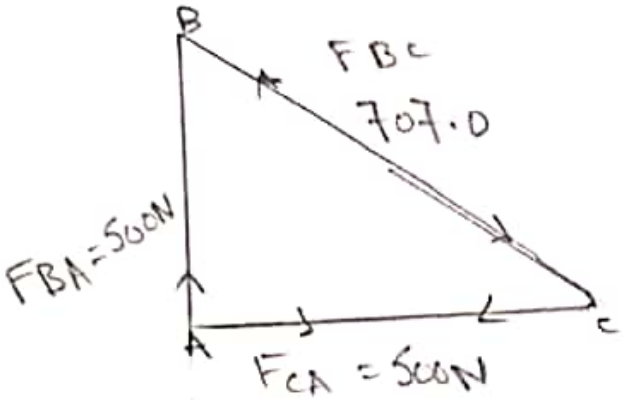
$\Sigma F_x = 0 \rightarrow +$

$-F_{CA} + F_{BC} \cos(45°)$

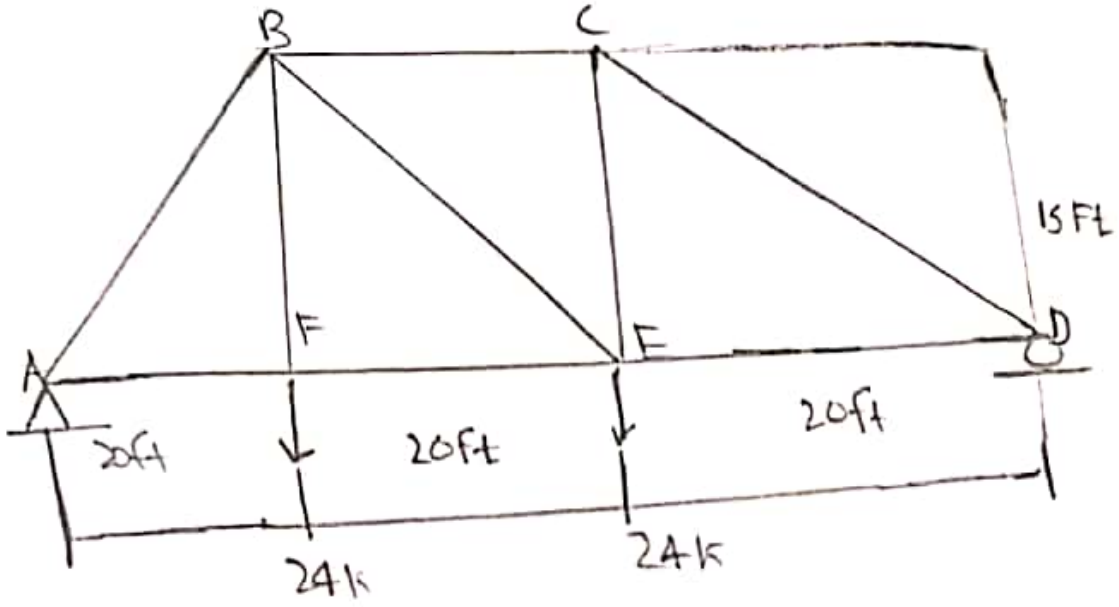
$-F_{CA} + 707.1 \cos(45°)$

$F_{CA} = 707.1 \cos(45°)$

$F_{CA} = 500N \quad (T)$



(Q2) Example: Determine the force in each Member of the truss shown in the figure:



Solution

24k
15ft

$+\Sigma F_y = 0$

$$75 - 10x - \left[\frac{1}{2}(20)\left(\frac{x}{9}\right)x\right] - V = 0$$

$$V = 75 - 10x - 1.11x^2$$

$$+\circlearrowleft \Sigma M_x = 0 \quad -75 \times 5x + (10x)\left(\frac{x}{2}\right) + \left[\frac{1}{2}\left(\frac{x}{9}\right)x\right]\left(\frac{x}{3}\right) + M = 0$$

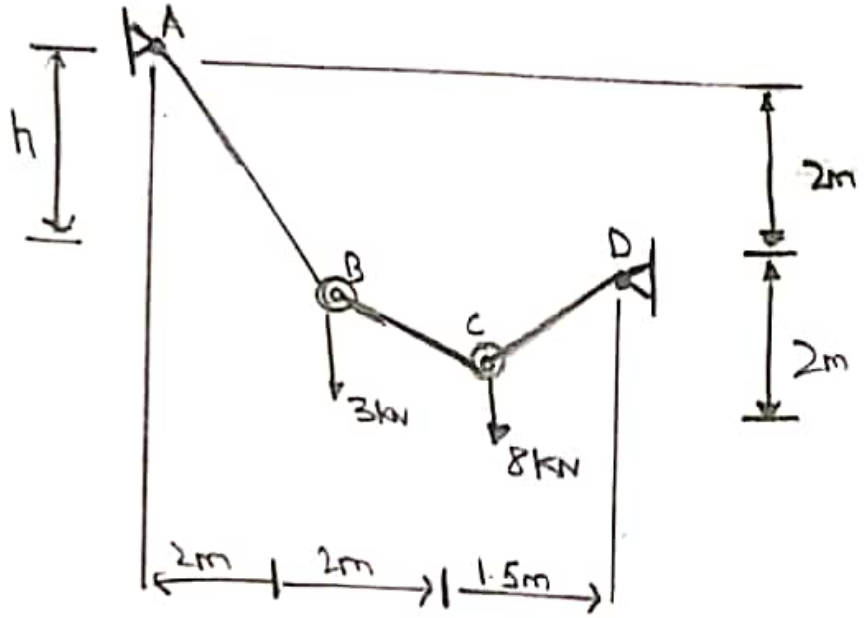
$$M = 75x - 5x^2 - 0.37x^3$$

$$\curvearrowleft + \Sigma M_y = 0; \quad -30(5.20) + \frac{1}{2}\left[20\left(\frac{5.20}{9}\right)\right](5.20)\left(\frac{5.20}{3}\right) + M = 0$$

$$N = 104 \text{ kN.m}$$

(Q3)

Determine the tension in each segment of the cable shown in figure. Also. What is the dimension h?



$$\sum M_A = 0$$

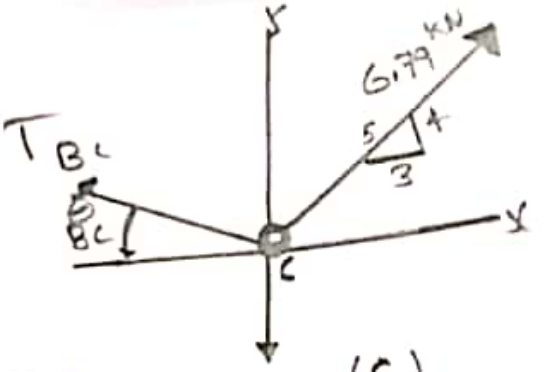
$$T_{CD}(3/5)(2m) + T_{CD}(4/5)(5.5m) - 3kN(2m) - 8kN(4m) = 0$$

$$T_{CD} = 6.79kN$$

Equilibrium of point C and B in sequence. Point C fig(5.2c)

$$\pm \sum F = 0$$

$$6.79\,kN(3/5) - T_{BC}\cos\theta_{BC} = 0$$



(C)

$+\uparrow \Sigma F_y = 0$

$6.79\text{kN}\,(4/5) - 8\text{kN} + T_B \sin\theta_B = 0$

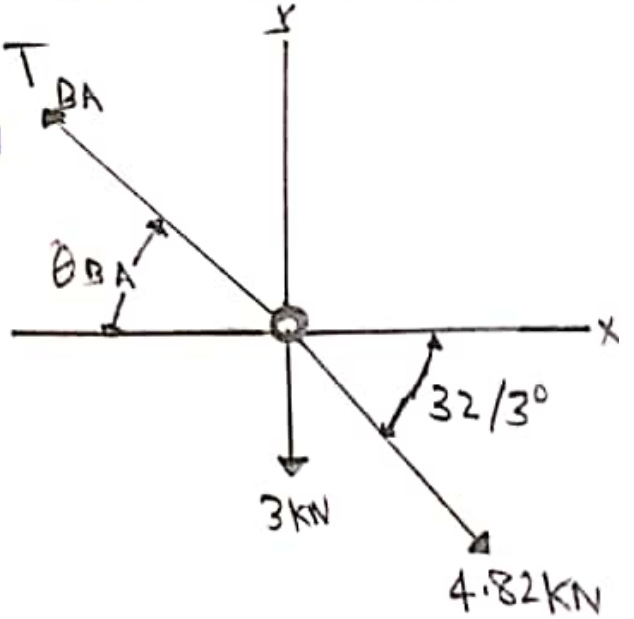
$\theta_{BC} = 32.3°$ and $T_{BC} = 4.82\text{kN}$

Point B (Fig 5.2d)

$\pm\rightarrow \Sigma F_x = 0; \Rightarrow -T_{BA}\cos\theta_{BA} + 4.82\text{kN}\cos 32.3° = 0$

$+\uparrow \Sigma F_y = 0; \Rightarrow T_{BA}\sin\theta_{BA} - 4.82\text{kN}\sin 32.3° - 3\text{kN} = 0$

$\theta_{BA} = 53.8°$ and $T_{BA} = 6.90\text{kN}$



Hence from Fig (5.2(a))

$h = (2\text{m})\tan 53.8° = 2.74\text{m}$