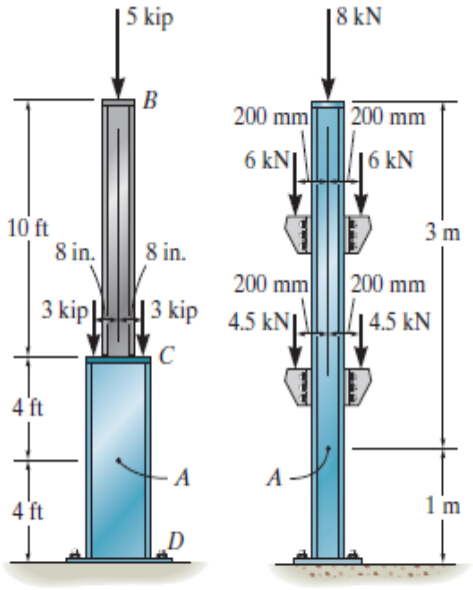
1–1. Determine the resultant internal normal force acting on the cross section through point A in each column. In (a), segment BC weighs 180 lb/ft and segment CD weighs 250 lb/ft. In (b), the column has a mass of 200 kg/m.

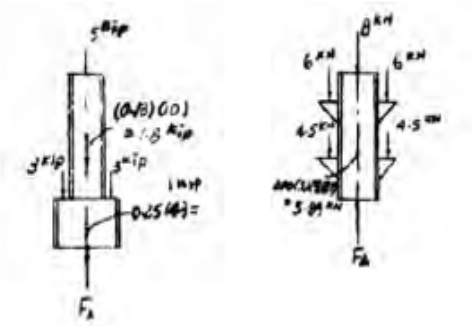


(a) $+\uparrow \Sigma F_y = 0; \quad F_A - 1.0 - 3 - 3 - 1.8 - 5 = 0$

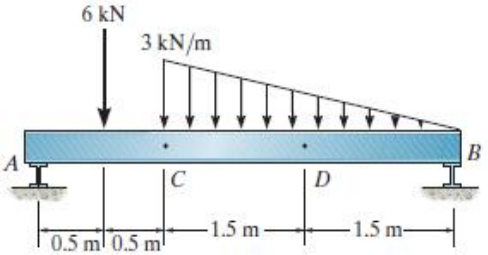
$$F_A = 13.8 \text{ kip}$$ **Ans.**

(b) $+\uparrow \Sigma F_y = 0; \quad F_A - 4.5 - 4.5 - 5.89 - 6 - 6 - 8 = 0$

$$F_A = 34.9 \text{ kN}$$ **Ans.**



•1–9. Determine the resultant internal loadings on the cross section through point D. Assume the reactions at the supports A and B are vertical.



Referring to the FBD of the entire beam, Fig. *a*,

$$\zeta + \Sigma M_A = 0; \quad B_y(4) - 6(0.5) - \frac{1}{2}(3)(3)(2) = 0 \quad B_y = 3.00 \text{ kN}$$

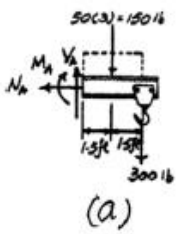
Referring to the FBD of this segment, Fig. *b*,

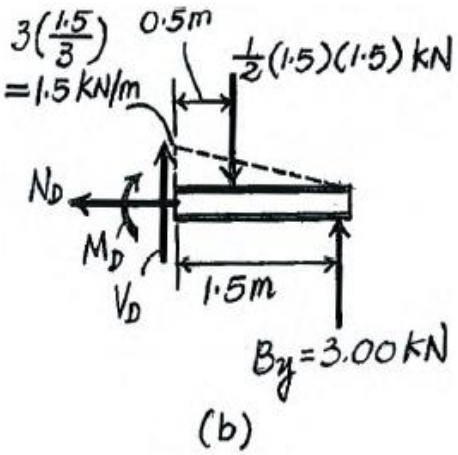
$$\stackrel{+}{\rightarrow} \Sigma F_x = 0; \quad N_D = 0$$ **Ans.**

$$+\uparrow \Sigma F_y = 0; \quad V_D - \frac{1}{2}(1.5)(1.5) + 3.00 = 0 \quad V_D = -1.875 \text{ kN}$$ **Ans.**

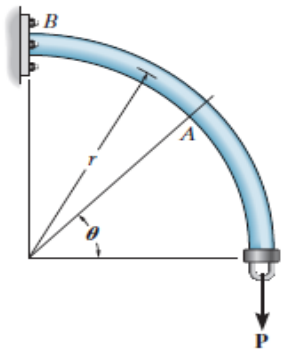
$$\zeta + \Sigma M_D = 0; \quad 3.00(1.5) - \frac{1}{2}(1.5)(1.5)(0.5) - M_D = 0 \quad M_D = 3.9375 \text{ kN} \cdot \text{m}$$

$$= 3.94 \text{ kN} \cdot \text{m}$$ **Ans.**





•1–29. The curved rod has a radius r and is fixed to the wall at B. Determine the resultant internal loadings acting on the cross section through A which is located at an angle θ from the horizontal.



Equations of Equilibrium: For point A

$\searrow+\Sigma F_x = 0;\quad P\cos\theta - N_A = 0$

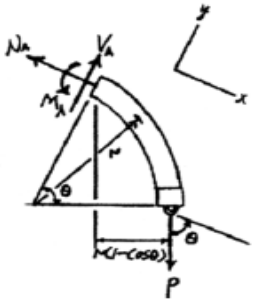
$$N_A = P\cos\theta \qquad \textbf{Ans.}$$

$\nearrow+\Sigma F_y = 0;\quad V_A - P\sin\theta = 0$

$$V_A = P\sin\theta \qquad \textbf{Ans.}$$

$\circlearrowleft+\Sigma M_A = 0;\quad M_A - P[r(1-\cos\theta)] = 0$

$$M_A = Pr(1-\cos\theta) \qquad \textbf{Ans.}$$



Question F1-7:-

Solution:-

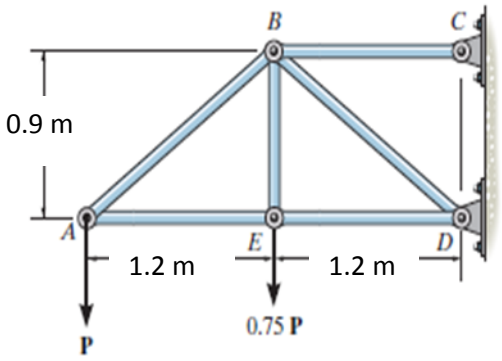
$\boldsymbol{For\ Beam}:-\quad \sum M_A = 0, T_{CD} = 2w\ ; \qquad \sum F_y = 0, T_{AB} = w\ ;$

$\boldsymbol{For\ Rod\ AB}:-\quad \sigma = \frac{P}{A}\ ;\quad 300\ (10^3) = \frac{w}{10};\quad \rightarrow \boldsymbol{w = 3\frac{N}{m}}\qquad \boldsymbol{Ans.}$

$\boldsymbol{For\ Rod\ CD}:-\quad \sigma = \frac{P}{A}\ ;\quad 300\ (10^3) = \frac{2w}{15};\quad \rightarrow \boldsymbol{w = 2.25\frac{N}{m}}\qquad Ans.$

1-35. The bars of the truss each have a cross-sectional area of 780 mm2. Determine the average normal stress in each member due to loading P = 40 KN. State whether the stress is tensile or compressive.

Solution:-



From the nodes A, E, and B;

F_{BA} =67 KN, F_{AE} =53.7 KN

F_{BE} =30 KN ; F_{ED} =53.7KN

F_{DB}=117.19 KN ; F_{BC} =147.7 KN

The stress in any member = P/Area

σ_{BA} =67*10^3/780 = 85.9 MPa T. Ans.

σ_{AE} =53.7*10^3/780 = 68.8 MPa C. Ans.

σ_{BE} =30*10^3/780 = 38.5 MPa T. Ans.

σ_{ED} =53.7*10^3/780 = 68.8 MPa C. Ans.

σ_{BD} =117.19*10^3/780 = 150.2 MPa C. Ans.

σ_{BC} =147.7*10^3/780 = 189.4 MPa T. Ans.