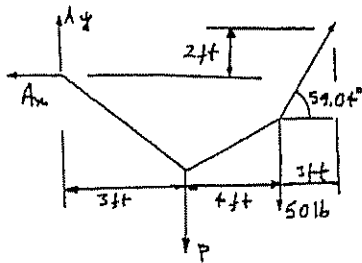
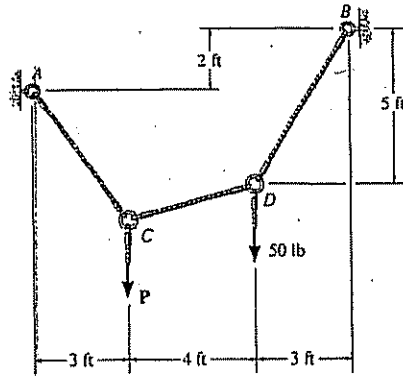


*5-4. If each cable segment can support a maximum tension of 75 lb, determine the largest load P that can be applied.



$$(+\Sigma M_A = 0; \quad T_{BD} (\cos 59.04^\circ)(3) + T_{BD} (\sin 59.04^\circ)(7) - 50(7) - P(3) = 0$$

$$T_{BD} = 0.39756 P + 46.383$$

$$\rightarrow \Sigma F_x = 0; \quad -A_x + T_{BD} \cos 59.04^\circ = 0$$

$$+\uparrow \Sigma F_y = 0; \quad A_y - P - 50 + T_{BD} \sin 59.04^\circ = 0$$

Assume maximum tension is in cable BD .

$$T_{BD} = 75 \text{ lb}$$

$$P = 71.98 \text{ lb}$$

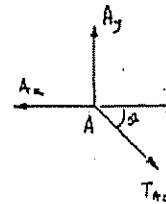
$$A_x = 38.59 \text{ lb}$$

$$A_y = 57.670 \text{ lb}$$

Pin A:

$$T_{AC} = \sqrt{(38.59)^2 + (57.670)^2} = 69.39 \text{ lb} < 75 \text{ lb} \quad \text{OK}$$

$$\theta = \tan^{-1}\left(\frac{57.670}{38.59}\right) = 56.21^\circ$$



Joint C:

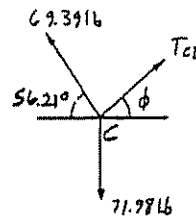
$$\rightarrow \Sigma F_x = 0; \quad T_{CD} \cos \phi - 69.39 \cos 56.21^\circ = 0$$

$$+\uparrow \Sigma F_y = 0; \quad T_{CD} \sin \phi + 69.39 \sin 56.21^\circ - 71.98 = 0$$

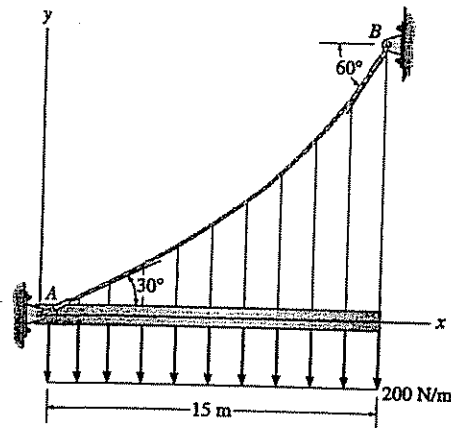
$$T_{CD} = 41.2 \text{ lb} < 75 \text{ lb} \quad \text{OK}$$

$$\phi = 20.3^\circ$$

Thur. $P = 72.0 \text{ lb}$ Ans



5-17. The cable AB is subjected to a uniform loading of 200 N/m . If the weight of the cable is neglected and the slope angles at points A and B are 30° and 60° , respectively, determine the curve that defines the cable shape and the maximum tension developed in the cable.



Here the boundary conditions are different from those in the text.

Integrate Eq. 5-2,

$$T \sin \theta = 200x + C_1$$

Divide by Eq. 5-4, and use Eq. 5-3

$$\frac{dy}{dx} = \frac{1}{F_H}(200x + C_1)$$

$$y = \frac{1}{F_H}(100x^2 + C_1x + C_2)$$

$$\text{At } x = 0, \quad y = 0; \quad C_2 = 0$$

$$\text{At } x = 0, \quad \frac{dy}{dx} = \tan 30^\circ; \quad C_1 = F_H \tan 30^\circ$$

$$y = \frac{1}{F_H}(100x^2 + F_H \tan 30^\circ x)$$

$$\frac{dy}{dx} = \frac{1}{F_H}(200x + F_H \tan 30^\circ)$$

$$\text{At } x = 15 \text{ m}, \quad \frac{dy}{dx} = \tan 60^\circ; \quad F_H = 2598 \text{ N}$$

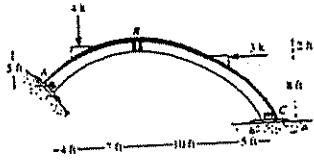
$$y = (38.5x^2 + 577x)(10^{-3}) \text{ m} \quad \text{Ans}$$

$$\theta_{\max} = 60^\circ$$

$$T_{\max} = \frac{F_H}{\cos \theta_{\max}} = \frac{2598}{\cos 60^\circ} = 5196 \text{ N}$$

$$T_{\max} = 5.20 \text{ kN} \quad \text{Ans}$$

5-27. Determine the horizontal and vertical components of reaction at A , B , and C of the three-hinged arch. Assume A , B , and C are pin connected.



Member AB:
 $\sum M_A = 0; \quad B_x(5) + B_y(11) - 4(4) = 0$

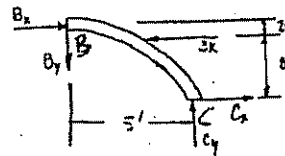
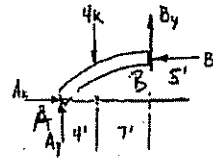
Member BC:
 $\sum M_C = 0; \quad -B_x(10) + B_y(15) + 3(8) = 0$

Solving,
 $B_x = 0.216k, \quad B_y = 2.72k \quad \text{Ans}$

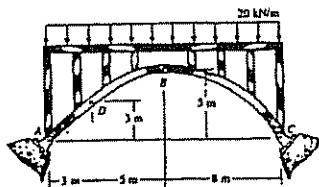
Member AB:
 $\sum F_x = 0; \quad A_x - 2.7243 = 0 \quad \text{Ans}$
 $A_x = 2.72k$

$\sum F_y = 0; \quad A_y - 4 + 0.216216 = 0$
 $A_y = 3.78k \quad \text{Ans}$

Member BC:
 $\sum F_x = 0; \quad C_x + 2.7243 - 3 = 0$
 $C_x = 0.276k \quad \text{Ans}$
 $\sum F_y = 0; \quad C_y - 0.216216 = 0$
 $C_y = 0.216k \quad \text{Ans}$



5-28. The three-hinged spandrel arch is subjected to the uniform load of 20 kN/m. Determine the internal moment in the arch at point D .



Member AB:
 $\sum M_A = 0; \quad B_x(5) + B_y(8) - 160(4) = 0$

Member BC:
 $\sum M_C = 0; \quad -B_x(5) + B_y(8) + 160(4) = 0$

Solving,
 $B_x = 128kN, \quad B_y = 0$

Segment DB:
 $\sum M_D = 0; \quad 128(2) - 100(2.5) - M_D = 0$
 $M_D = 6.00kN \cdot m \quad \text{Ans}$

