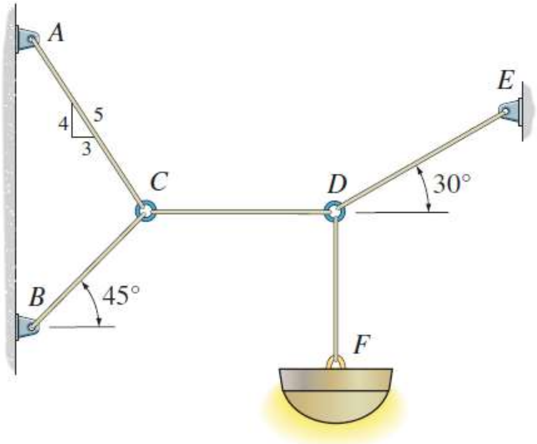
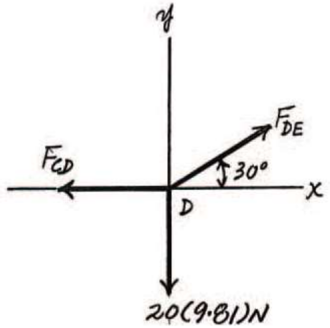
Determine the tension developed in each cord required for equilibrium of the 20-kg lamp.



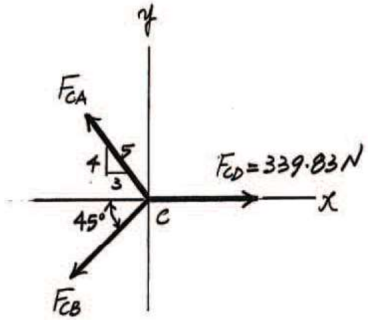


$$\xrightarrow{+} \Sigma F_x = 0; \quad 392.4 \cos 30^\circ - F_{CD} = 0$$

$$F_{CD} = 339.83 \text{ N} = 340 \text{ N}$$

$$+\uparrow \Sigma F_y = 0; \quad F_{DE} \sin 30^\circ - 20(9.81) = 0$$

$$F_{DE} = 392.4 \text{ N} = 392 \text{ N}$$



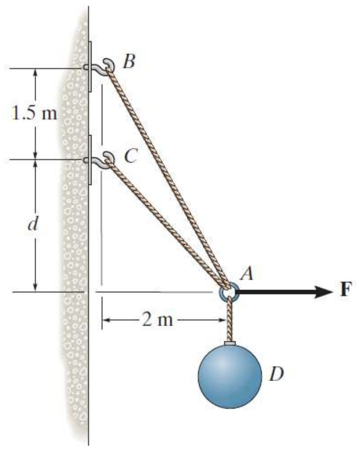
$$\xrightarrow{+} \Sigma F_x = 0; \quad 339.83 - F_{CA}\left(\frac{3}{5}\right) - F_{CB} \cos 45^\circ = 0$$

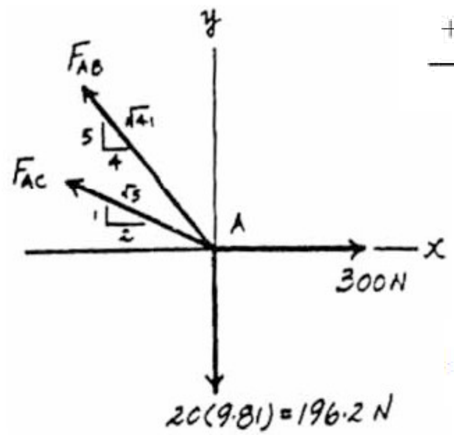
$$+\uparrow \Sigma F_y = 0; \quad F_{CA}\left(\frac{4}{5}\right) - F_{CB} \sin 45^\circ = 0$$

$$F_{CB} = 275 \text{ N}$$

$$F_{CA} = 243 \text{ N}$$

Determine the forces in cables AC and AB needed to hold the 20-kg ball D in equilibrium. Take $F = 300$ N and $d = 1$ m.





$$\xrightarrow{+} \Sigma F_x = 0; \quad 300 - F_{AB}\left(\frac{4}{\sqrt{41}}\right) - F_{AC}\left(\frac{2}{\sqrt{5}}\right) = 0$$

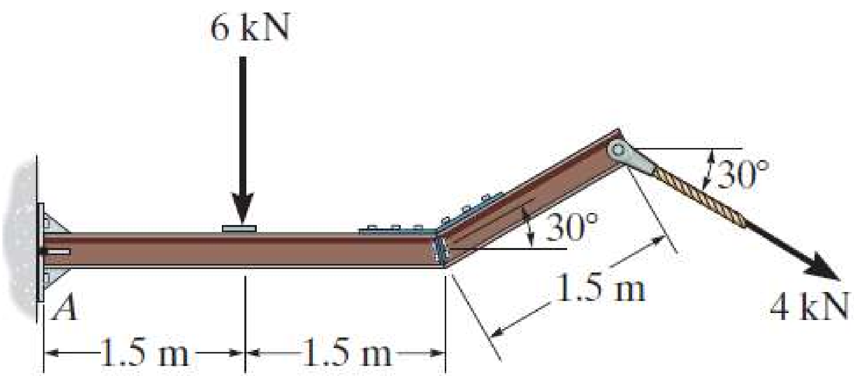
$$06247F_{AB} + 0.8944F_{AC} = 300$$

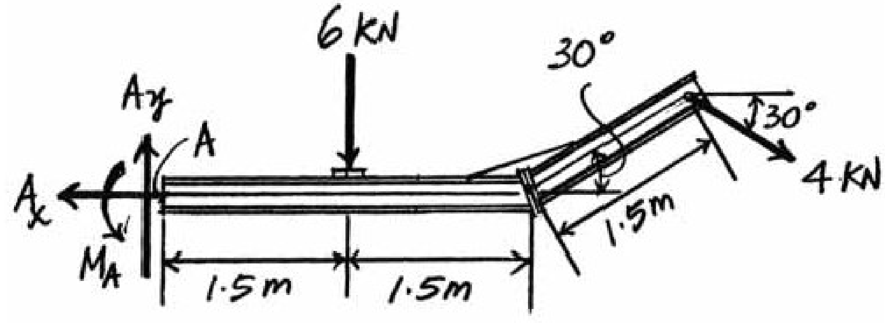
$$+\uparrow \Sigma F_y = 0; \quad F_{AB}\left(\frac{5}{\sqrt{41}}\right) + F_{AC}\left(\frac{1}{\sqrt{5}}\right) - 196.2 = 0$$

$$0.7809F_{AB} + 0.4472F_{AC} = 196.2$$

$$F_{AB} = 98.6\text{ N} \qquad F_{AC} = 267\text{ N}$$

Determine the components of the support reactions at the fixed support A on the cantilevered beam.





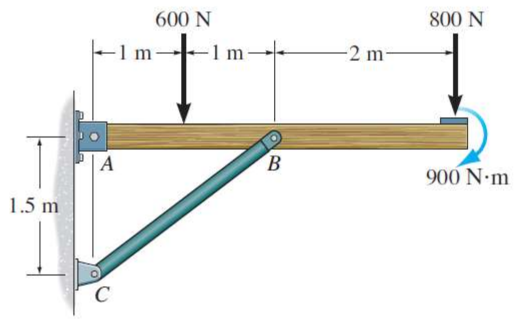
$\xrightarrow{+} \Sigma F_x = 0;\quad 4\cos 30° - A_x = 0 \qquad A_x = 3.46\text{ kN}$

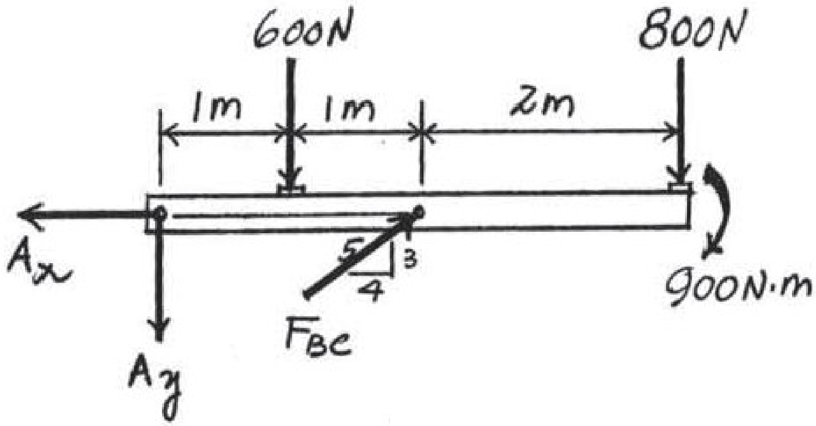
$+\uparrow \Sigma F_y = 0;\quad A_y - 6 - 4\sin 30° = 0 \quad A_y = 8\text{ kN}$

$\circlearrowleft + \Sigma M_A = 0;\quad M_A - 6(1.5) - 4\cos 30°\,(1.5\sin 30°) - 4\sin 30°(3 + 1.5\cos 30°) = 0$

$M_A = 20.2\text{ kN}\cdot\text{m}$

The overhanging beam is supported by a pin at A and the two-force strut BC. Determine the horizontal and vertical components of reaction at A and the reaction at B on the beam.



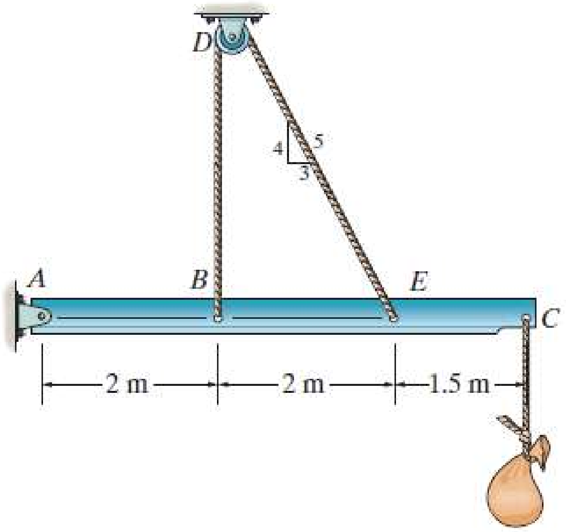


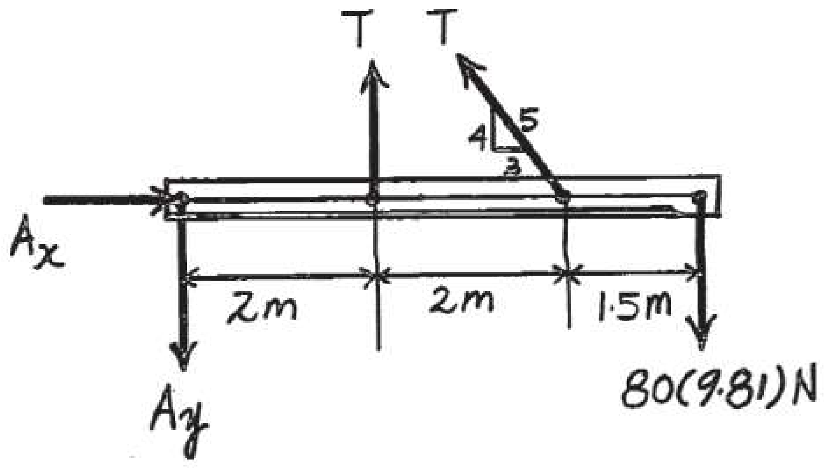
$$\circlearrowleft + \Sigma M_A = 0; \quad F_{BC}\left(\frac{3}{5}\right)(2) - 600(1) - 800(4) - 900 = 0 \qquad F_{BC} = 3916.67 \text{ N} = 3.92 \text{ kN}$$

$$\overset{+}{\rightarrow} \Sigma F_x = 0; \quad 3916.67\left(\frac{4}{5}\right) - A_x = 0 \qquad A_x = 3133.33 \text{ N} = 3.13 \text{ kN}$$

$$+\uparrow \Sigma F_y = 0; \quad -A_y - 600 - 800 + 3916.67\left(\frac{3}{5}\right) = 0 \qquad A_y = 950 \text{ N}$$

Draw the free-body diagram of the beam which supports the 80-kg load and is supported by the pin at *A* and a cable which wraps around the pulley at *D*.
Determine the support reactions.



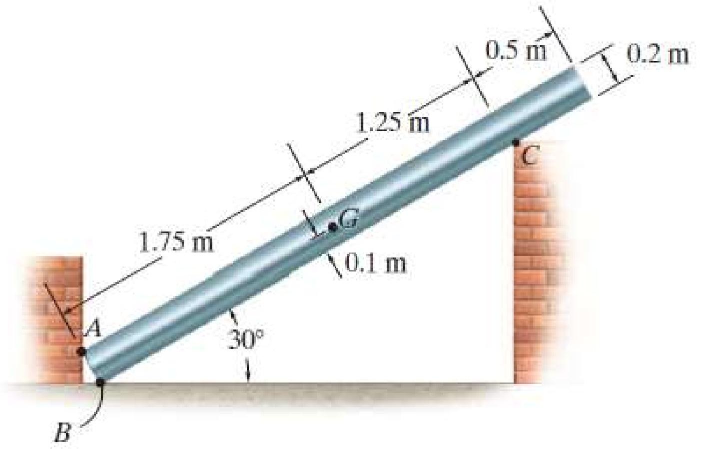


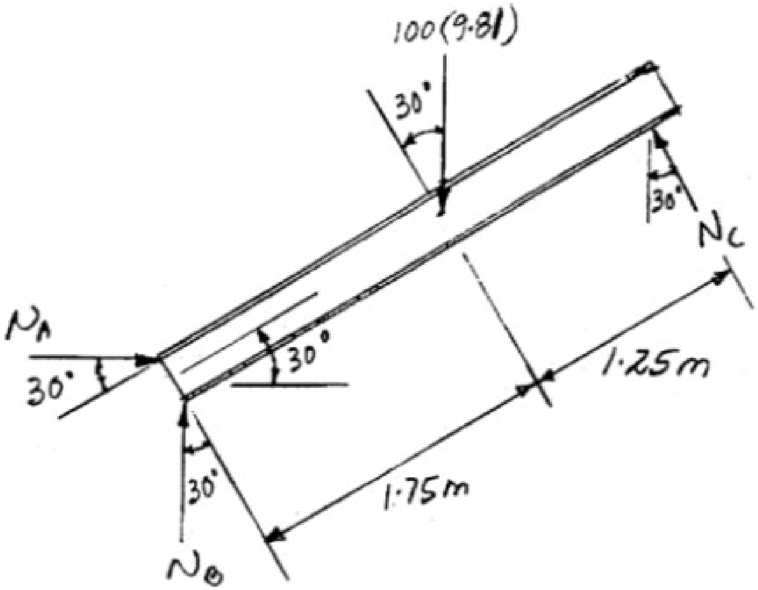
$$\circlearrowleft + \Sigma M_A = 0; \quad T(2) + \frac{4}{5}T(4) - 80(9.81)(5.5) = 0 \qquad T = 830\ N$$

$$\Sigma F_x = 0 \quad A_x - \frac{3}{5}T = 0 \qquad A_x = 498\ N$$

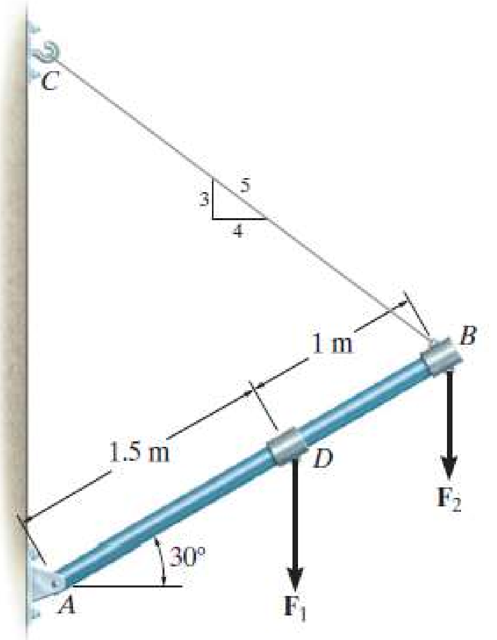
$$\Sigma F_y = 0 \quad -A_y + T + \frac{4}{5}T - 80(9.81) = 0 \qquad A_y = 709\ N$$

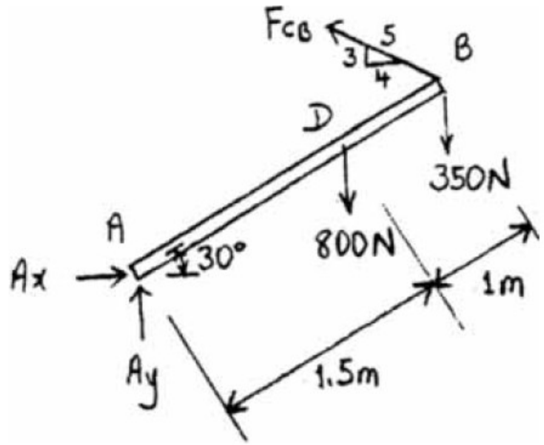
Draw the free-body diagram of the uniform bar, which has a mass of 100 kg and a center of mass at *G*. The supports *A*,*B*, and *C* are smooth.





The boom supports the two vertical loads. Neglect the size of the collars at *D* and *B* and the thickness of the boom, and compute the horizontal and vertical components of force at the pin *A* and the force in cable *CB*. Set F1 = 800 N and F2 = 350 N.



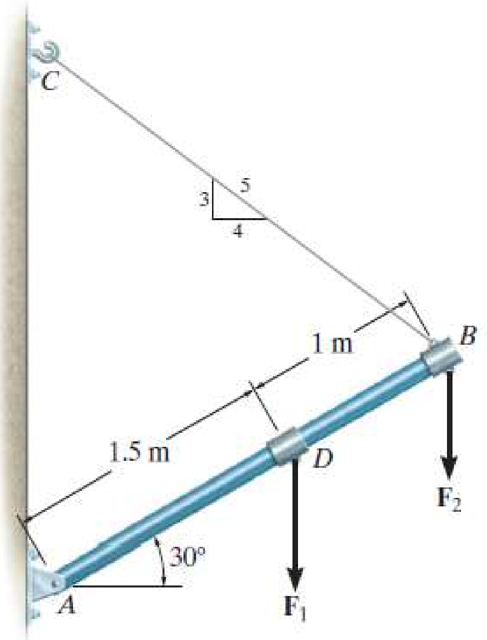


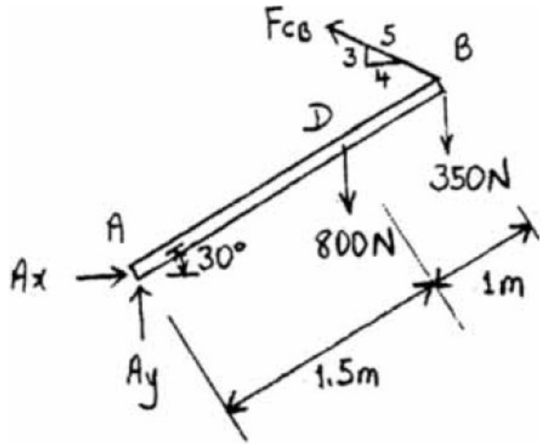
$$\circlearrowleft + \Sigma M_A = 0; \qquad -800(1.5\cos 30^\circ) - 350(2.5\cos 30^\circ)$$

$$+\frac{4}{5}F_{CB}(2.5\sin 30^\circ) + \frac{3}{5}F_{CB}(2.5\cos 30^\circ) = 0$$

$$F_{CB} = 781.6 = 782\text{ N}$$

The boom supports the two vertical loads. Neglect the size of the collars at *D* and *B* and the thickness of the boom, and compute the horizontal and vertical components of force at the pin *A* and the force in cable *CB*. Set F1 = 800 N and F2 = 350 N.





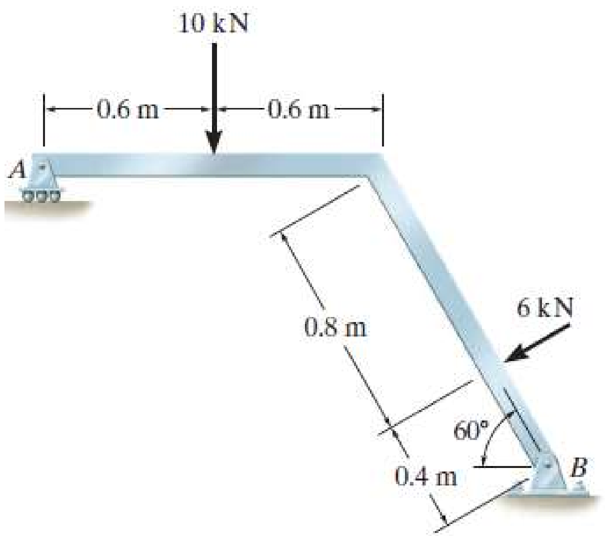
$$\overset{+}{\rightarrow} \Sigma F_x = 0; \qquad A_x - \frac{4}{5}(781.6) = 0$$

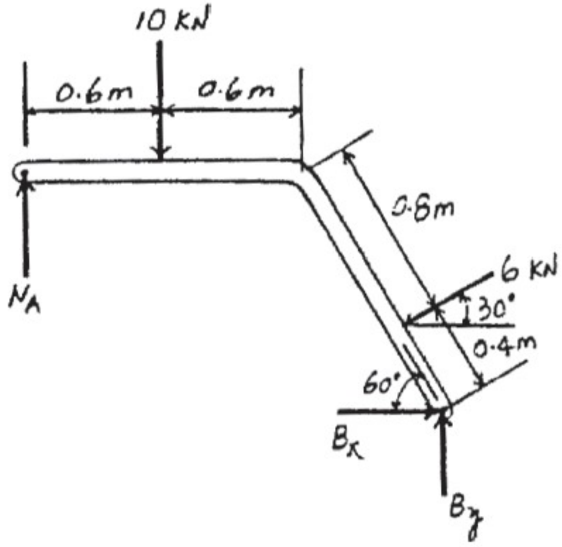
$$A_x = 625 \text{ N}$$

$$+\uparrow \Sigma F_y = 0; \qquad A_y - 800 - 350 + \frac{3}{5}(781.6) = 0$$

$$A_y = 681 \text{ N}$$

Determine the normal reaction at the roller A and horizontal and vertical components at pin B for equilibrium of the member.





$$\circlearrowleft + \Sigma M_B = 0; \quad 10(0.6 + 1.2\cos 60°) + 6\,(0.4) - N_A(1.2 + 1.2\cos 60°) = 0$$

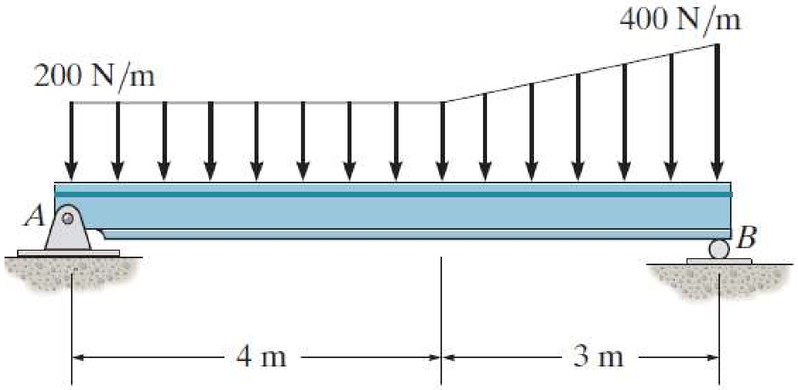
$$N_A = 8.00 \text{ kN}$$

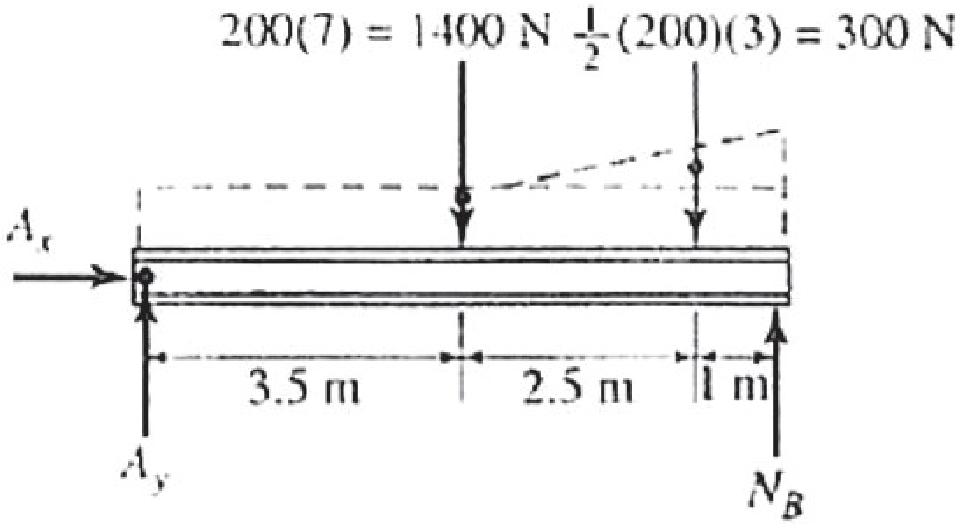
$$\overset{+}{\rightarrow} \Sigma F_x = 0; \quad B_x - 6\cos 30° = 0 \qquad B_x = 5.20 \text{ kN}$$

$$+\uparrow \Sigma F_y = 0; \quad B_y + 8.00 - 6\sin 30° - 10 = 0$$

$$B_y = 5.00 \text{ kN}$$

Determine the reactions at the supports A and B for equilibrium of the beam.





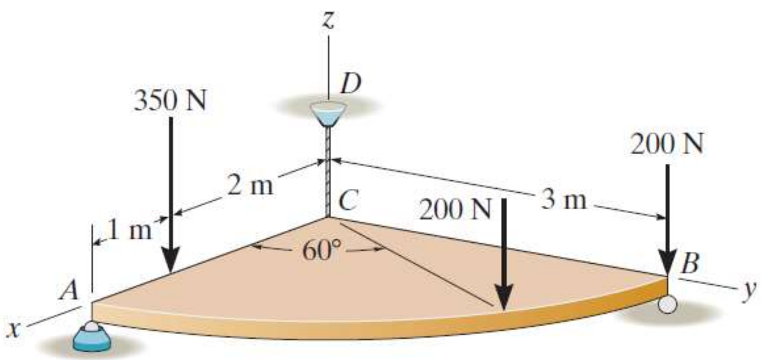
$$+\Sigma M_A = 0; \qquad N_B(7) - 1400(3.5) - 300(6) = 0$$

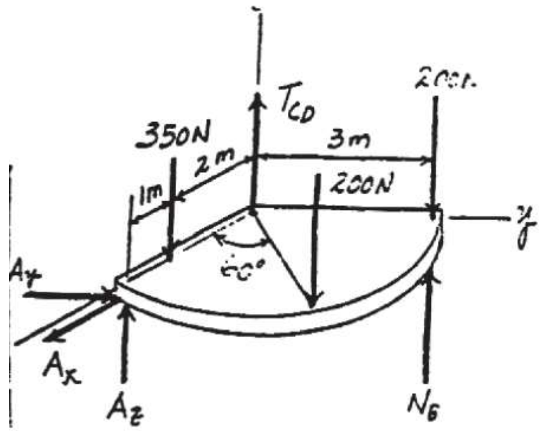
$$N_B = 957.14\text{ N} = 957\text{ N}$$

$$A_y - 1400 - 300 + 957 = 0 \qquad A_y = 743\text{ N}$$

$$\overset{+}{\rightarrow} \Sigma F_x = 0; \qquad A_x = 0$$

Determine the force components acting on the ball-and-socket at A, the reaction at the roller B and the tension on the cord CD needed for equilibrium of the quarter circular plate.





$$\Sigma M_x = 0; \quad N_B(3) - 200(3) - 200(3 \sin 60°) = 0 \qquad N_B = 373.21 \text{ N} = 373 \text{ N}$$

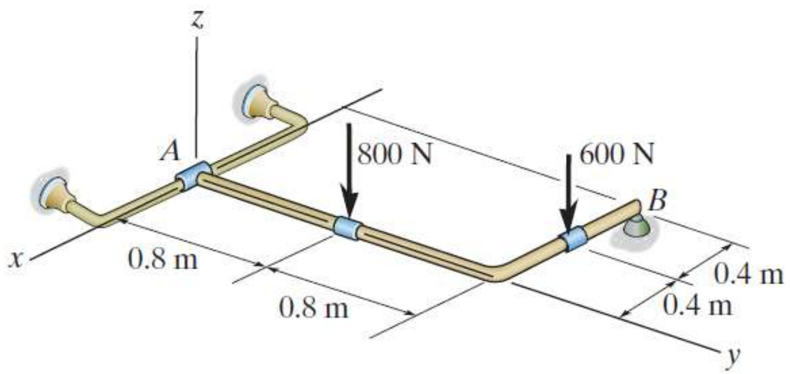
$$\Sigma M_y = 0; \quad 350(2) + 200(3 \cos 60°) - A_z(3) = 0 \quad A_z = 333.33 \text{ N} = 333 \text{ N}$$

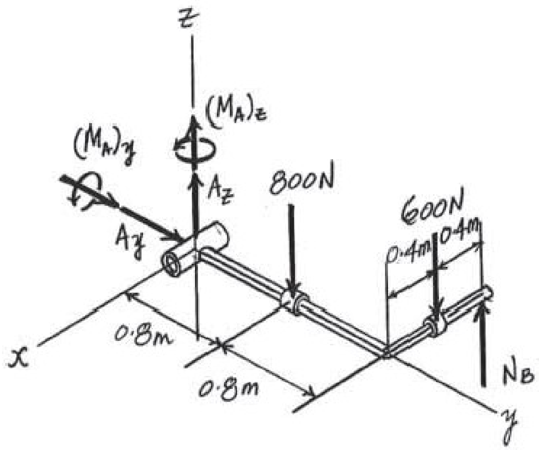
$$\Sigma F_z = 0; \quad T_{CD} + 373.21 + 333.33 - 350 - 200 - 200 = 0 \qquad T_{CD} = 43.5 \text{ N}$$

$$\Sigma F_x = 0; \quad A_x = 0$$

$$\Sigma F_y = 0; \quad A_y = 0$$

Determine the support reactions at the smooth collar A and the normal reaction at the roller support B.





$$\Sigma M_x = 0;\ N_B(0.8 + 0.8) - 800(0.8) - 600(0.8 + 0.8) = 0 \quad N_B = 1000\text{ N}$$

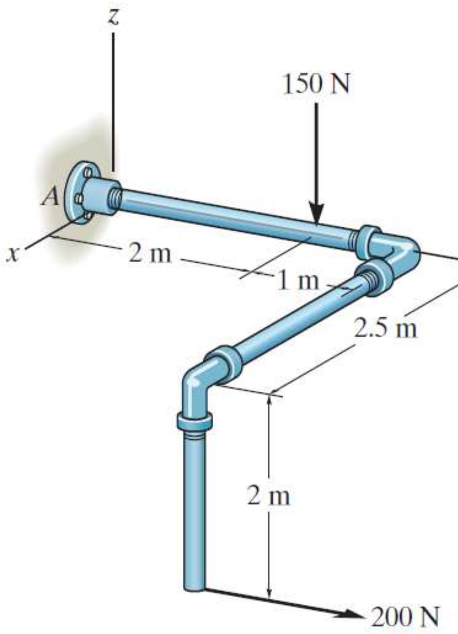
$$\Sigma M_z = 0;\quad (M_A)_z = 0$$

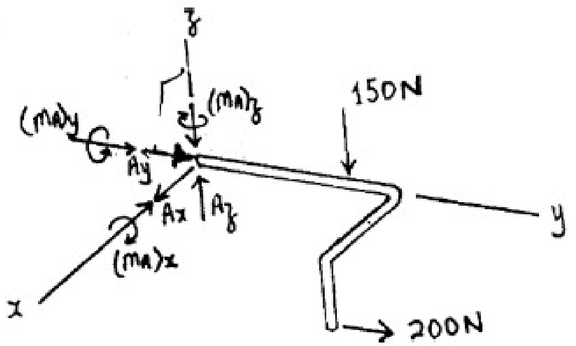
$$\Sigma F_y = 0;\ A_y = 0$$

$$\Sigma M_y = 0;\ (M_A)_y - 600(0.4) + 1000(0.8) = 0 \quad (M_A)_y = -560\text{ N}\cdot\text{m}$$

$$\Sigma F_z = 0;\ A_z + 1000 - 800 - 600 = 0 \quad A_z = 400\text{ N}$$

Determine the x, y, z components of reaction at the fixed wall A. The 150-N force is parallel to the z axis and the 200-N force is parallel to the y axis.





$$\Sigma F_x = 0; \quad A_x = 0$$

$$\Sigma F_y = 0; \quad A_y + 200 = 0 \quad A_y = -200\text{ N}$$

$$\Sigma F_z = 0; \quad A_z - 150 = 0 \quad A_z = 150\text{ N}$$

$$\Sigma M_x = 0; \ -150(2) + 200(2) - (M_A)_x = 0 \quad (M_A)_x = 100\text{ N}\cdot\text{m}$$

$$\Sigma M_y = 0; \quad (M_A)_y = 0$$

$$\Sigma M_z = 0; \ 200(2.5) - (M_A)_z = 0 \quad (M_A)_z = 500\text{ N}\cdot\text{m}$$