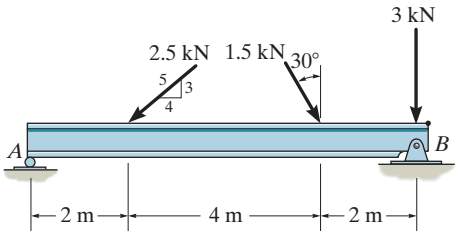
PROBLEMS

4–103. Replace the force system acting on the beam by an equivalent force and couple moment at point *A*.

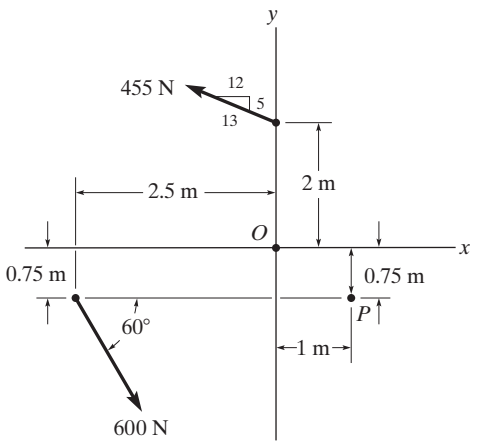
***4–104.** Replace the force system acting on the beam by an equivalent force and couple moment at point *B*.



Probs. 4–103/104

4–105. Replace the force system by an equivalent resultant force and couple moment at point *O*.

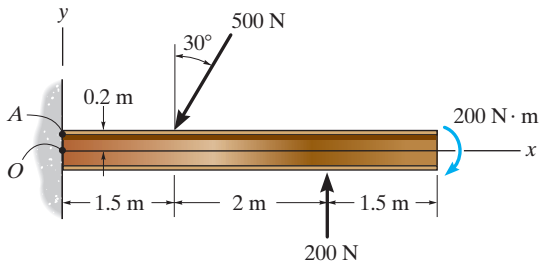
4–106. Replace the force system by an equivalent resultant force and couple moment at point *P*.



Probs. 4–105/106

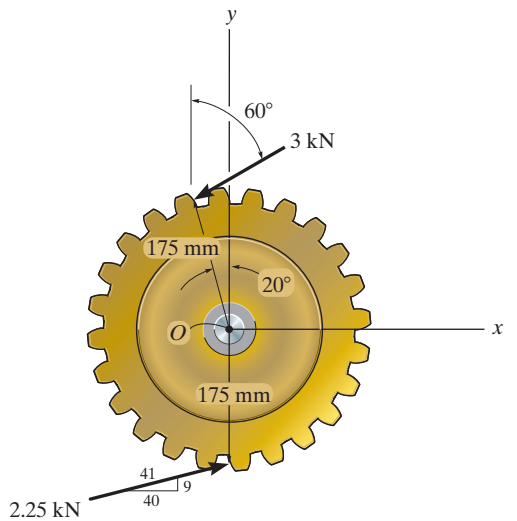
4–107. Replace the force and couple moment system acting on the beam by an equivalent resultant force and couple moment at point *A*.

***4–108.** Replace the force and couple moment system acting on the beam by an equivalent resultant force and couple moment at point *O*.



Probs. 4–107/108

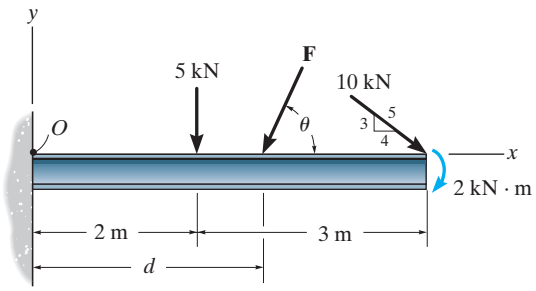
4–109. Replace the forces acting on the gear by an equivalent resultant force and couple moment acting at point *O*.



Prob. 4–109

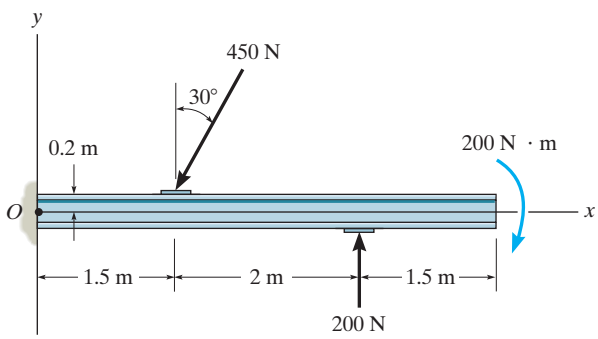
4–110. Determine the magnitude and orientation of θ of force **F** and its placement d on the beam so the loading system is equivalent to a resultant force of 15 kN acting vertically downward at point O and a clockwise couple moment of 60 kN · m.

4–111. Determine the magnitude and orientation of θ of force **F** and its placement d on the beam so the loading system is equivalent to a resultant force of 20 kN acting vertically downward at point O and a clockwise couple moment of 80 kN · m.



Probs. 4–110/111

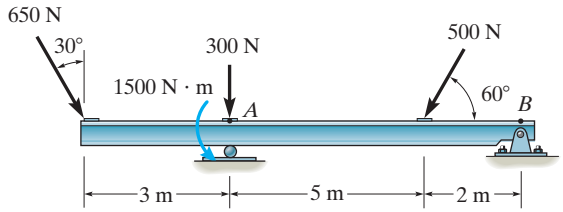
***4–112.** Replace the loading system acting on the beam by an equivalent resultant force and couple moment at point O.



Prob. 4–112

4–113. Replace the loading system acting on the post by an equivalent resultant force and couple moment at point A.

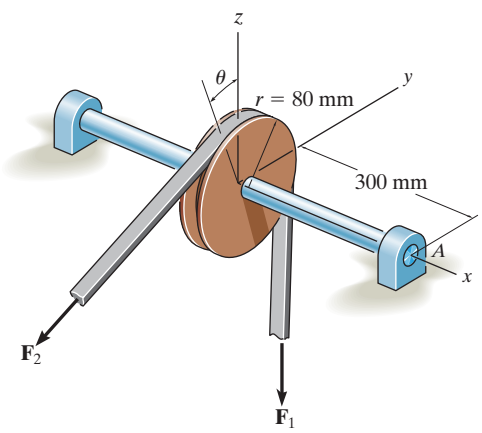
4–114. Replace the loading system acting on the post by an equivalent resultant force and couple moment at point B.



Probs. 4–113/114

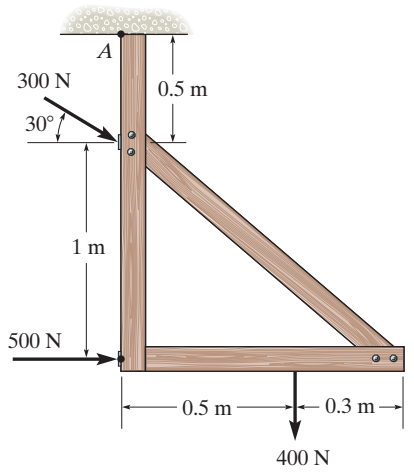
4–115. The belt passing over the pulley is subjected to forces $\mathbf{F}_1$ and $\mathbf{F}_2$, each having a magnitude of 40 N. $\mathbf{F}_1$ acts in the $-\mathbf{k}$ direction. Replace these forces by an equivalent force and couple moment at point A. Express the result in Cartesian vector form. Set $\theta = 0°$ so that $\mathbf{F}_2$ acts in the $-\mathbf{j}$ direction.

***4–116.** The belt passing over the pulley is subjected to two forces $\mathbf{F}_1$ and $\mathbf{F}_2$, each having a magnitude of 40 N. $\mathbf{F}_1$ acts in the $-\mathbf{k}$ direction. Replace these forces by an equivalent force and couple moment at point A. Express the result in Cartesian vector form. Take $\theta = 45°$.



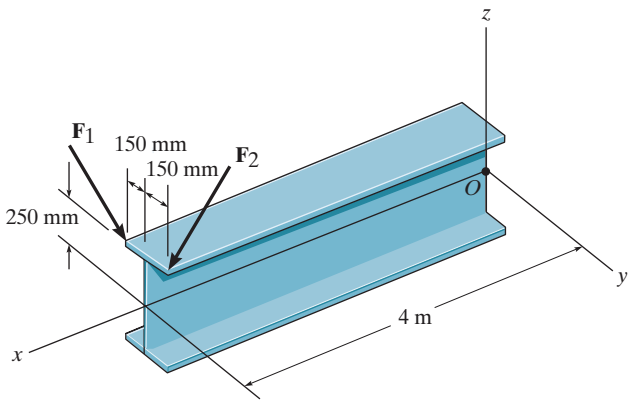
Probs. 4–115/116

4–117. Replace the force system acting on the frame by an equivalent resultant force and couple moment acting at point A.



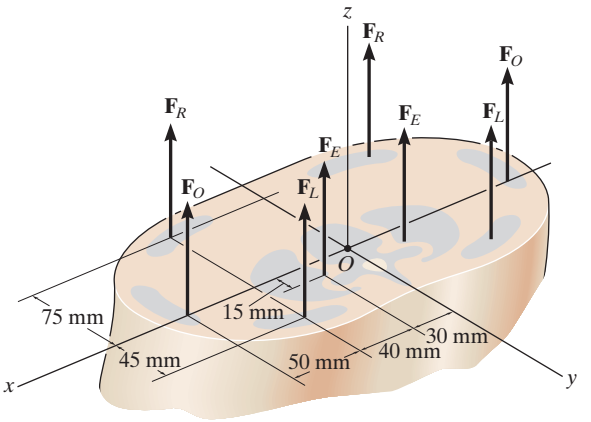
Prob. 4–117

4–118. The forces $\mathbf{F}_1 = \{-4\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}\}$ kN and $\mathbf{F}_2 = \{3\mathbf{i} - 4\mathbf{j} - 2\mathbf{k}\}$ kN act on the end of the beam. Replace these forces by an equivalent force and couple moment acting at point O.



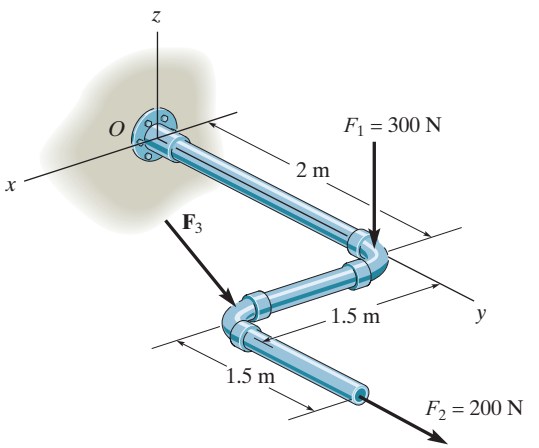
Prob. 4–118

4–119. A biomechanical model of the lumbar region of the human trunk is shown. The forces acting on the four muscle groups consist of $F_R = 35$ N for the rectus, $F_O = 45$ N for the oblique, $F_L = 23$ N for the lumbar latissimus dorsi, and $F_E = 32$ N for the erector spinae. These loadings are symmetric with respect to the y–z plane. Replace this system of parallel forces by an equivalent force and couple moment acting at the spine, point O. Express the results in Cartesian vector form.



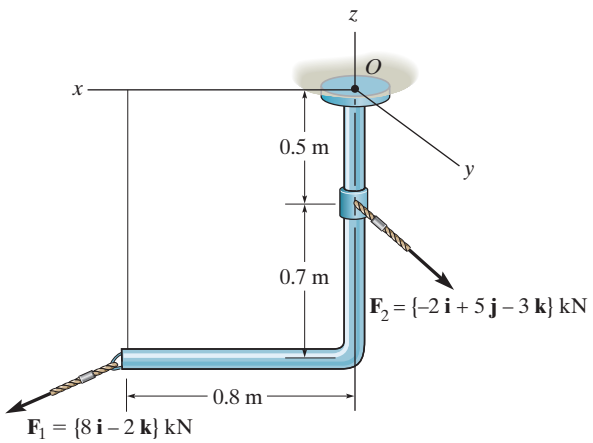
Prob. 4–119

***4–120.** Replace the force system by an equivalent resultant force and couple moment at point O. Take $\mathbf{F}_3 = \{-200\mathbf{i} + 500\mathbf{j} - 300\mathbf{k}\}$ N.



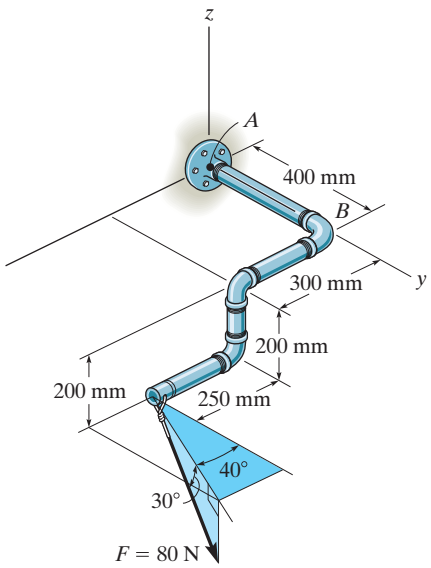
Prob. 4–120

4–121. Replace the loading by an equivalent resultant force and couple moment at point O.



Prob. 4–121

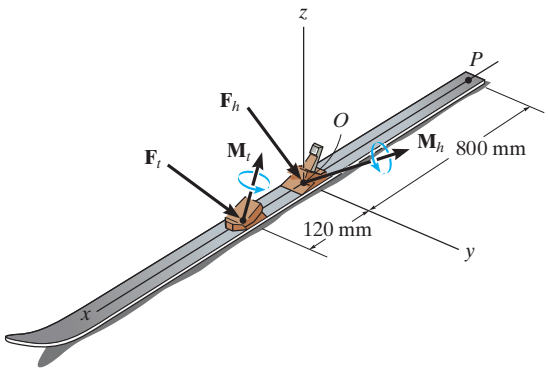
4–122. Replace the force of $F = 80$ N acting on the pipe assembly by an equivalent resultant force and couple moment at point A.



Prob. 4–122

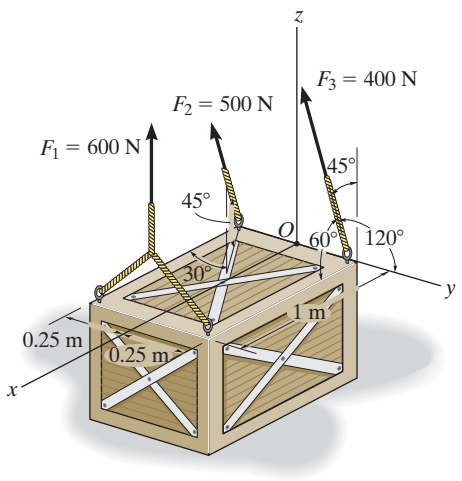
4–123. The forces and couple moments exerted on the toe and heel plates of a snow ski are $\mathbf{F}_t = \{-50\mathbf{i} + 80\mathbf{j} - 158\mathbf{k}\}$ N, $\mathbf{M}_t = \{-6\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}\}$ N·m, and $\mathbf{F}_h = \{-20\mathbf{i} + 60\mathbf{j} - 250\mathbf{k}\}$ N, $\mathbf{M}_h = \{-20\mathbf{i} + 8\mathbf{j} + 3\mathbf{k}\}$ N·m, respectively. Replace this system by an equivalent force and couple moment acting at point O. Express the results in Cartesian vector form.

***4–124.** The forces and couple moments exerted on the toe and heel plates of a snow ski are $\mathbf{F}_t = \{-50\mathbf{i} + 80\mathbf{j} - 158\mathbf{k}\}$ N, $\mathbf{M}_t = \{-6\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}\}$ N·m, and $\mathbf{F}_h = \{-20\mathbf{i} + 60\mathbf{j} - 250\mathbf{k}\}$ N, $\mathbf{M}_h = \{-20\mathbf{i} + 8\mathbf{j} + 3\mathbf{k}\}$ N·m, respectively. Replace this system by an equivalent force and couple moment acting at point P. Express the results in Cartesian vector form.



Probs. 4–123/124

4–125. The crate is on the ground and is to be hoisted using the three slings shown. Replace the system of forces acting on the slings by an equivalent resultant force and couple moment at point O. The force $\mathbf{F}_1$ is vertical.



Prob. 4–125

4