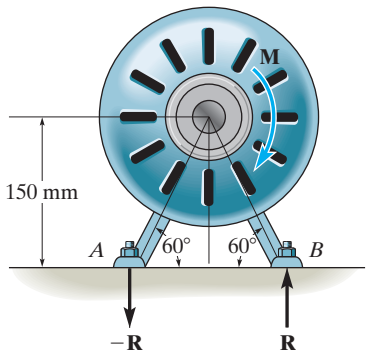
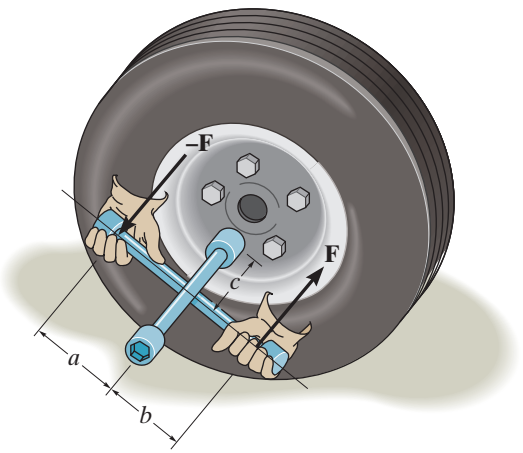
# PROBLEMS

**4–73.** A clockwise couple $M = 5\ \text{N}\cdot\text{m}$ is resisted by the shaft of the electric motor. Determine the magnitude of the reactive forces $-\mathbf{R}$ and $\mathbf{R}$ which act at supports $A$ and $B$ so that the resultant of the two couples is zero.




**Prob. 4–73**

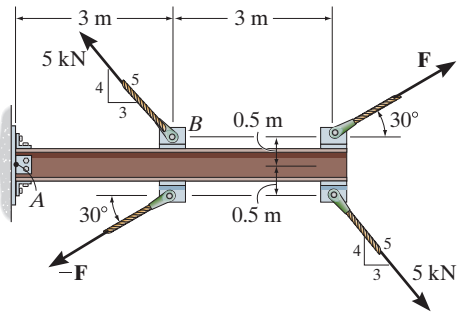
**4–74.** The crossbar wrench is used to remove a lug nut from the automobile wheel. The mechanic applies a couple to the wrench such that his hands are a constant distance apart. Is it necessary that $a = b$ in order to produce the most effective turning of the nut? Explain. Also, what is the effect of changing the shaft dimension $c$ in this regard? The forces act in the vertical plane.




**Prob. 4–74**

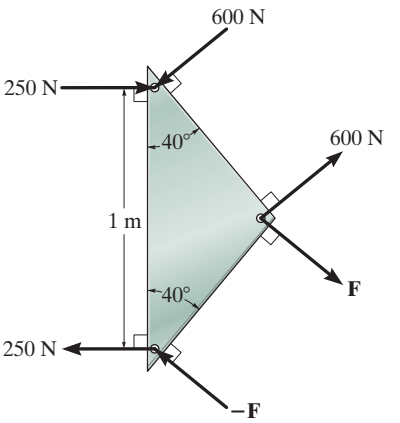
**4–75.** Two couples act on the cantilever beam. If $F = 6$ kN, determine the resultant couple moment.

***4–76.** Determine the required magnitude of force $\mathbf{F}$, if the resultant couple moment on the beam is to be zero..



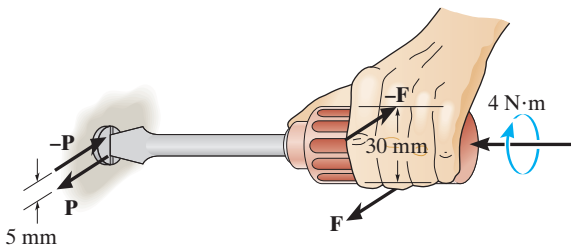

**Probs. 4–75/76**

**4–77.** Determine the magnitude of the forces $\mathbf{F}$ and $-\mathbf{F}$, so that the resultant couple moment is $400\ \text{N}\cdot\text{m}$ clockwise.



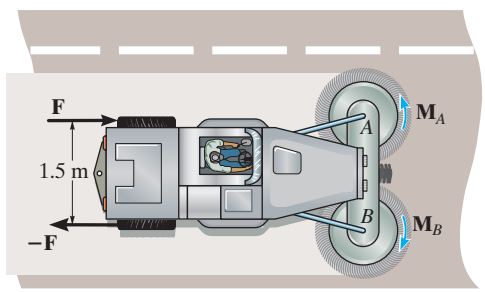

**Prob. 4–77**

**4–78.** A twist of 4 N · m is applied to the handle of the screwdriver. Resolve this couple moment into a pair of couple forces **F** exerted on the handle and **P** exerted on the blade.



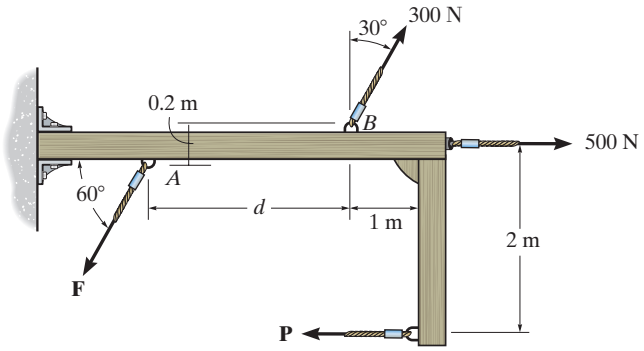

**Prob. 4–78**

**4–79.** The road exerts a torque of $M_A = 400\ \text{N} \cdot \text{m}$ and $M_B = 200\ \text{N} \cdot \text{m}$ on the brushes of the road sweeper. Determine the magnitude of the couple forces that are developed by the road on the rear wheels of the sweeper, so that the resultant couple moment on the sweeper is zero. What is the magnitude of these forces if the brush at $B$ is turned off?




**Prob. 4–79**

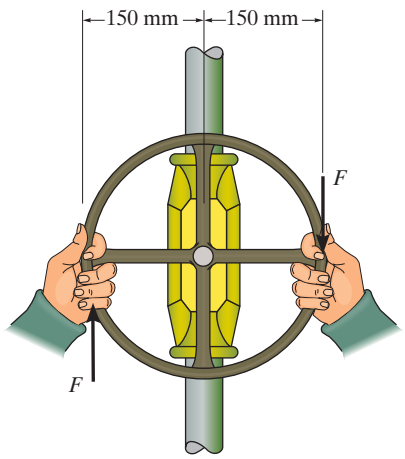
***4–80.** Two couples act on the beam. If the resultant couple is to be zero, determine the magnitudes of **P** and **F**, and the distance $d$ between $A$ and $B$.




**Prob. 4–80**

**4–81.** The man tries to open the valve by applying the couple forces of $F = 75\ \text{N}$ to the wheel. Determine the couple moment produced.

**4–82.** If the valve can be opened with a couple moment of 25 N · m, determine the required magnitude of each couple force which must be applied to the wheel.

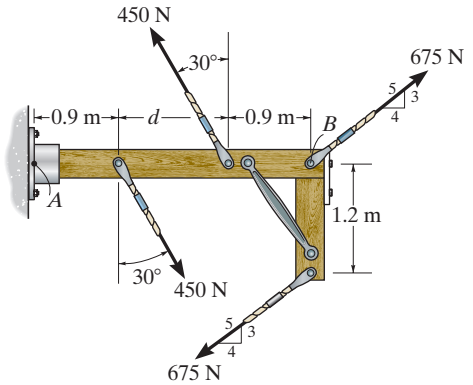



**Probs. 4–81/82**

**4–83.** Two couples act on the frame. If the resultant couple moment is to be zero, determine the distance $d$ between the 450-N couple forces.

***4–84.** Two couples act on the frame. If $d = 1.2$ m, determine the resultant couple moment by (a) summing the moments of the two couples and (b) resolving each force into $x$ and $y$ components and then summing the moments about $A$ of all the force components.

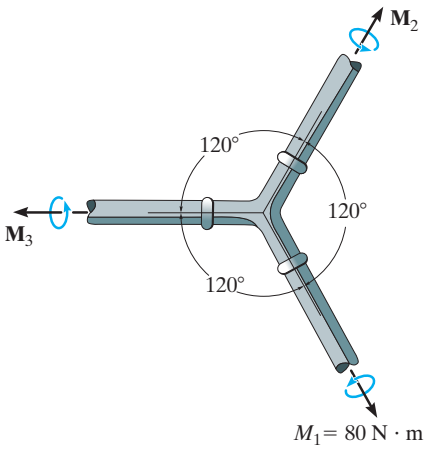
**4–85.** Two couples act on the frame. If $d = 1.8$ m, determine the resultant couple moment by (a) summing the moments of the two couples and (b) resolving each force into $x$ and $y$ components and then summing the moments about $B$ of all the force components.




**Probs. 4–83/84/85**

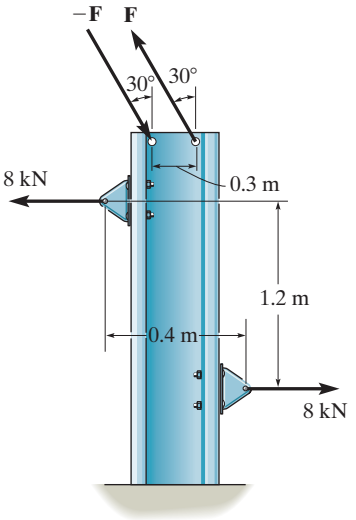
**4–86.** Three couple moments act on the pipe assembly. Determine the magnitude of the resultant couple moment if $M_2 = 50$ N · m and $M_3 = 35$ N · m.

**4–87.** Three couple moments act on the pipe assembly. Determine the magnitudes of $\mathbf{M}_2$ and $\mathbf{M}_3$ so that the resultant couple moment is zero.




**Probs. 4–86/87**

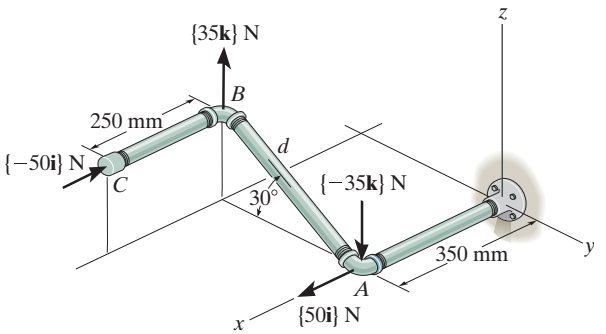
***4–88.** Determine the magnitude of **F** so that the resultant couple moment is 12 kN · m, counterclockwise. Where on the beam does the resultant couple moment act?




**Prob. 4–88**

**4–89.** Determine the resultant couple moment of the two couples that act on the pipe assembly. The distance from $A$ to $B$ is $d = 400$ mm. Express the result as a Cartesian vector.

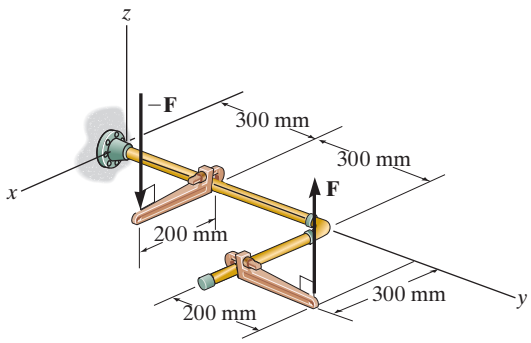
**4–90.** Determine the distance $d$ between $A$ and $B$ so that the resultant couple moment has a magnitude of $M_R = 20$ N · m.




**Probs. 4–89/90**

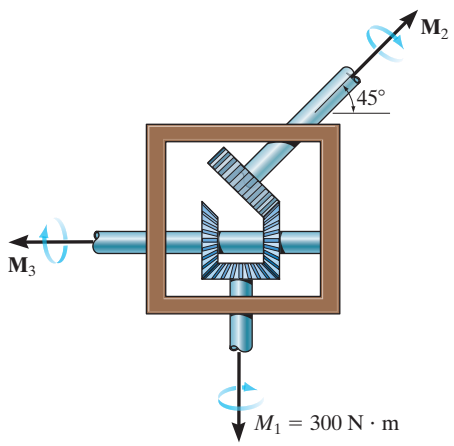
**4–91.** If $F = 80$ N, determine the magnitude and coordinate direction angles of the couple moment. The pipe assembly lies in the $x$–$y$ plane.

***4–92.** If the magnitude of the couple moment acting on the pipe assembly is 50 N · m, determine the magnitude of the couple forces applied to each wrench. The pipe assembly lies in the $x$–$y$ plane.




**Probs. 4–91/92**

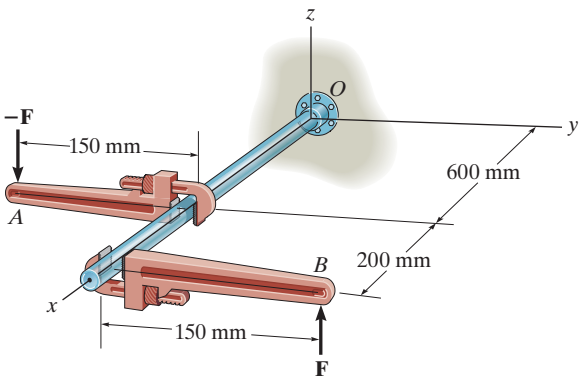
**4–93.** Determine the required magnitude of the couple moments $\mathbf{M}_2$ and $\mathbf{M}_3$ so that the resultant couple moment is zero.




**Prob. 4–93**

**4–94.** Express the moment of the couple acting on the pipe as a Cartesian vector. What is the magnitude of this couple moment? Take $F = 125$ N.

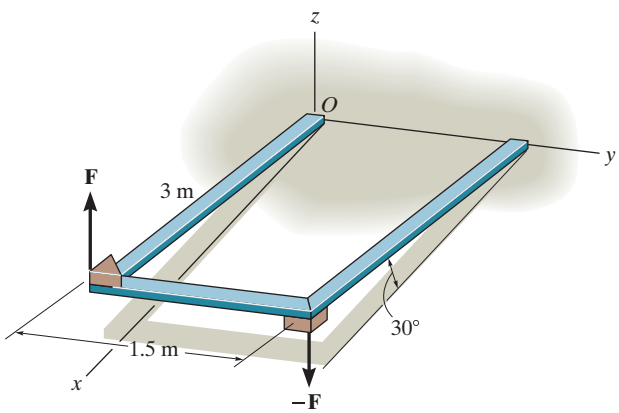
**4–95.** If the couple moment acting on the pipe has a magnitude of 300 N · m, determine the magnitude of the forces applied to the wrenches.




**Probs. 4–94/95**

***4–96.** Express the moment of the couple acting on the frame as a Cartesian vector. The forces are applied perpendicular to the frame. What is the magnitude of the couple moment? Take $F = 50$ N.

**4–97.** If the component of the couple moment along the $x$ axis is $\mathbf{M}_x = \{-20\mathbf{i}\}$ N · m, determine the magnitude $F$ of the couple forces.




**Probs. 4–96/97**