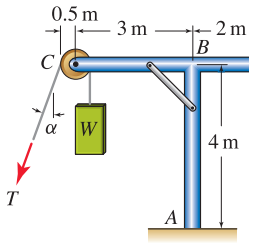
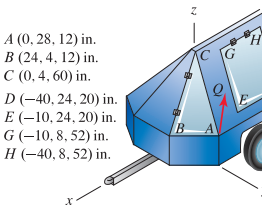
The load carrying capacity of the frame of Prob. 4.11 can be increased by placing a counterweight Q at point D as shown. The resultant moment about point A due to the cable forces and Q is not to exceed 20 kN·m.

(a) Determine the largest value of counterweight Q. (*Hint:* Let $W = 0$ and determine Q so that $M_A = 20$ kN·m.)

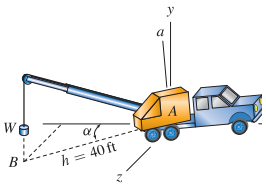
(b) With the value of Q determined in Part (a), determine the largest weight W that may be supported and the corresponding value of α.



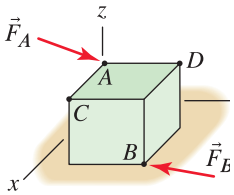
In the trailer of Prob. 4.37, if $F = 15$ lb, determine the direction in which it should be applied so that its moment about edge GH of the rectangular door is as large as possible, and determine the value of this moment.



If the poorly leveled crane of Prob. 4.41 can have any position α, where $0 \leq \alpha \leq 135°$, determine the largest moment of the weight $W = 5000$ lb about line a and the position α that produces this moment. Assume $h = 40$ ft for any position α (this requires the operator to slightly change the boom's height and/or length as the crane rotates about line a).



Consider an object with forces $\vec{F}_A$ and $\vec{F}_B$ applied. The first column of the following table lists resultant moments at various points due to both of these forces. For each statement select True or False.



	If $\vec{F}_A$ and $\vec{F}_B$ are not a couple	If $\vec{F}_A$ and $\vec{F}_B$ are a couple
$\vec{M}_C = \vec{r}_{CA} \times \vec{F}_A + \vec{r}_{CB} \times \vec{F}_B$	T or F?	T or F?
$\vec{M}_C = \vec{r}_{AB} \times \vec{F}_B$	T or F?	T or F?
$\vec{M}_C = \vec{r}_{BA} \times \vec{F}_A$	T or F?	T or F?
$\vec{M}_A = \vec{r}_{AB} \times \vec{F}_B$	T or F?	T or F?
$\vec{M}_D = \vec{r}_{CA} \times \vec{F}_A + \vec{r}_{CB} \times \vec{F}_B$	T or F?	T or F?

Rather than the traditional horizontal and vertical stabilizers, some aircraft such as the Bonanza 35 single-engine airplane (pictured) and the F-117 Stealth fighter feature a V tail. Points A and B are located at $A(112, -7, 0)$ mm and $B(62, -93, 0)$ mm, and direction a has direction angles $\theta_x = 150°$, $\theta_y = 60°$, and $\theta_z = 90°$. If the forces are $\vec{F}_1 = (40\,\hat{\imath} - 100\,\hat{\jmath} + 280\,\hat{k})$ N and $\vec{F}_2 = (50\,\hat{\jmath} + 120\,\hat{k})$ N, determine the resultant moment of $\vec{F}_1$ and $\vec{F}_2$ about line a.