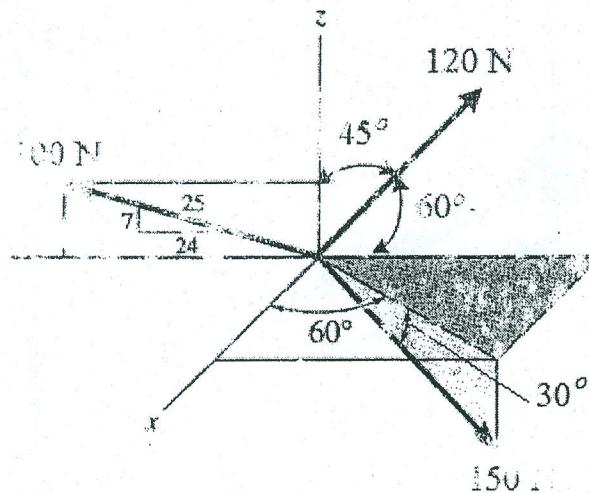




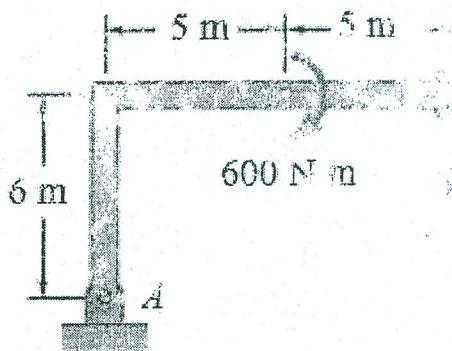
Exam Guidelines: This Exam contains 6 questions in 2 pages. Start every question in a new page.

(1) [9 pt.] Determine the magnitude and direction angles of a force \mathbf{F} to be added to the system for equilibrium. The 120 N force lies in front of the yz plane.

(2) [7 pt.] A 600 N.m couple applied on the bent rod AB as shown in figure. Determine the reactions at the pin at A and the roller at B when $a = 30^\circ$.

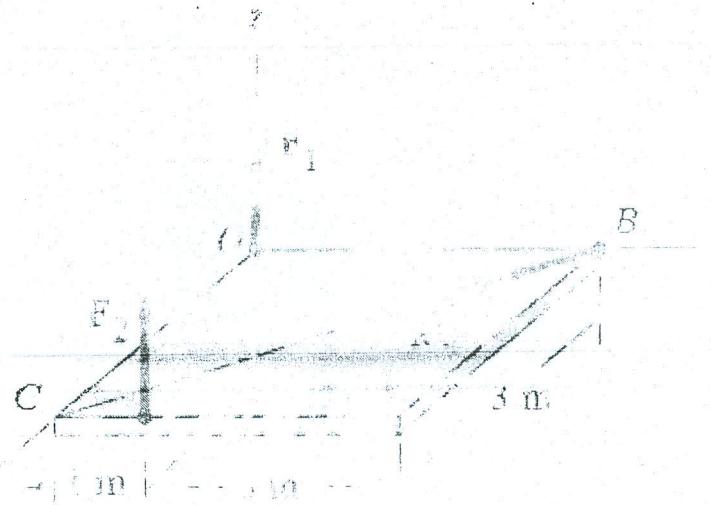


Prob. (1)



Prob. (2)

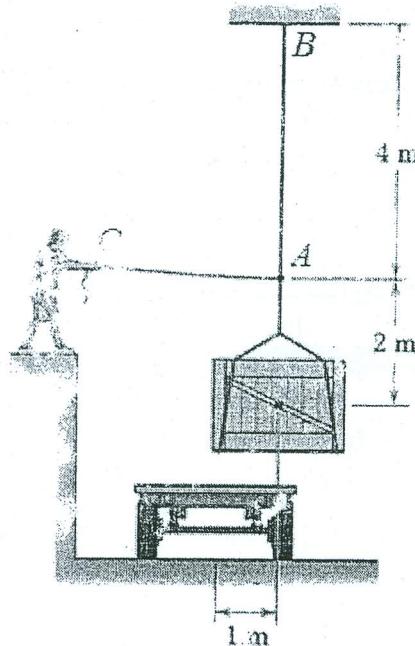
(3) [12 pt.] The forces $F_1 = 80 \text{ N}$, $F_2 = 120 \text{ N}$ and a couple $M = 150 \text{ N.m}$ are applied as shown on a sheet metal. Replace the force system shown by an equivalent force-couple system acting at the point O . Then reduce them to an equivalent single force of wrench and determine the point where the single force or axis of the wrench intersects the xz plane.



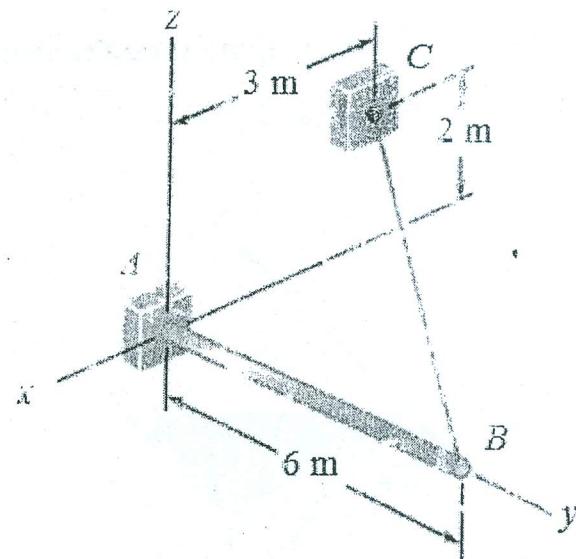
Prob. (3)

(4) [7 pt.] What horizontal force P must a worker exert on the rope AC to position the 500 N crate directly over the trailer. Also, determine the tension in the rope AB .

(5) [9 pt.] The 6 m boom AB is has a fixed support at A . If the tension in the cable BC applied at B is 700 N, determine the reactions at the fixed support at A .

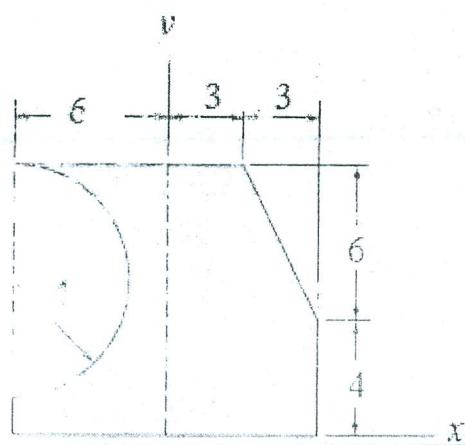


Prob. (4)



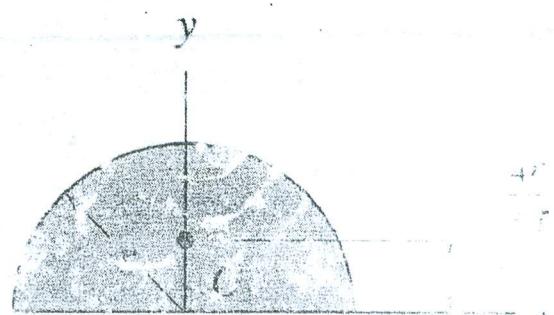
Prob. (5)

(6) [10 pt.] Determine the location of the centroid of the shaded area shown in figure. Also, determine the volume of the surface of revolution generated by revolving the shaded area about x axis by an angle equals 130° .



Dimensions in m

Prob. (6)



Centroid of semicircular lunes