| Date: 17 / 1 / 2013 | Preparatory year | | Mansoura University |
| Time: 2 hours | First Semester 2012/2013 | | Faculty of Engineering |
| Full mark: 90 marks | Engineering Mechanics I | | Math. and Phys. Science Dept. |

Exam Guidelines: This Exam contains **7** questions in **2** pages, start every question in a new page.

(1) [10 pt.] Determine the magnitude of the force P and its direction angle θ so that the three forces shown are equivalent to the single force $\mathbf{R} = 85\mathbf{i} + 20\mathbf{j}$ kN.

(2) [15 pt.] Determine the tension devloped in the cables AB, AC, and AD to maintain equilibrium.
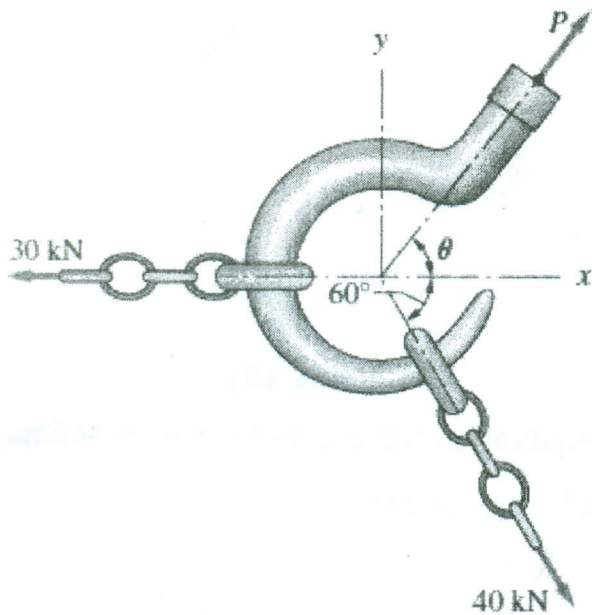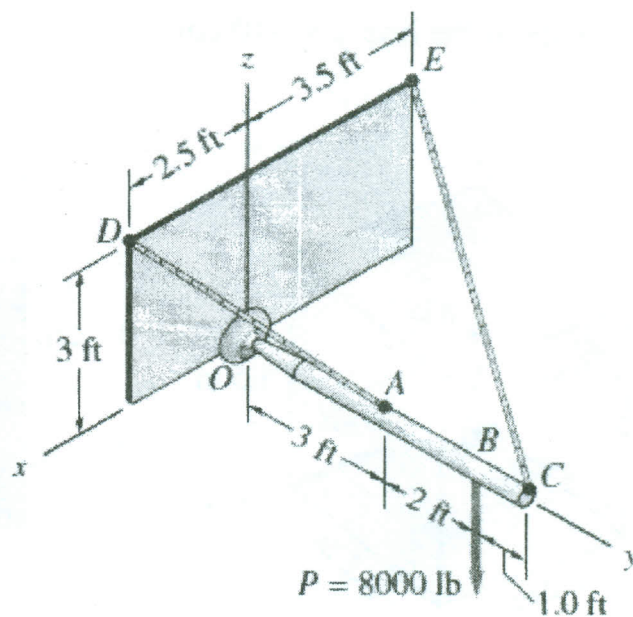

Prob. (1)
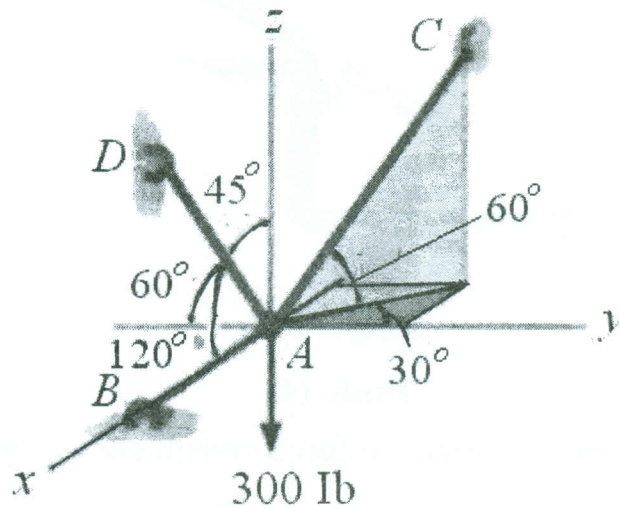
Prob. (2)

(3) [15 pt.] The horizontal boom OC, which is supported by a ball-and-socket joint and two cables, carries the vertical force $P = 8000$ Ib. Calculate the tensions in the cables, T_{AD} and T_{CE}, and the components of the force exerted on the boom by the joint at O. the weight of the boom is negligible.
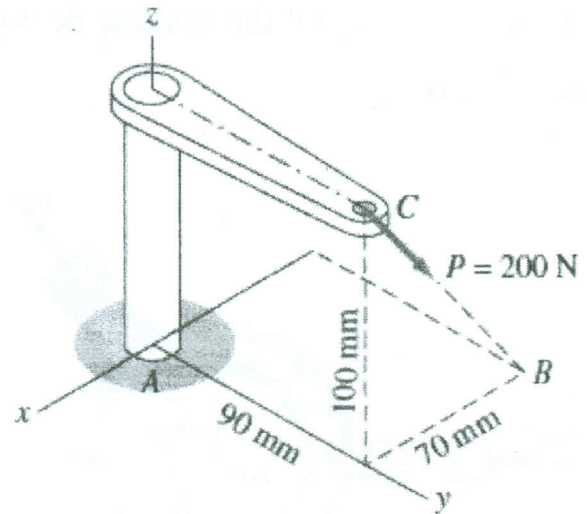

Prob. (3)

(4) [10 pt.] The homogeneous 40 kg bar *ABC* is held in position by a horizontal rope attached to end *C*. Neglecting friction, determine the tension in the rope.

(5) [10 pt.] Compute the moment of the force **P** about point *A*. Also compute the moment of **P** about *y*-axis and determine the shortest distance between them.
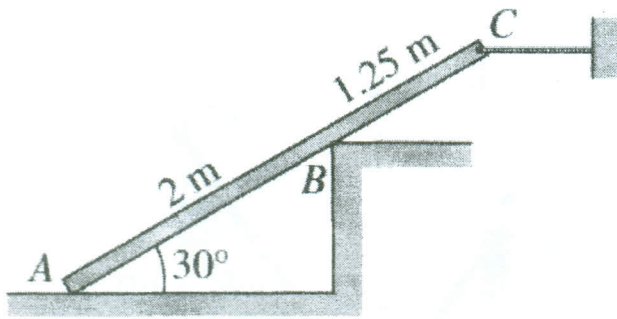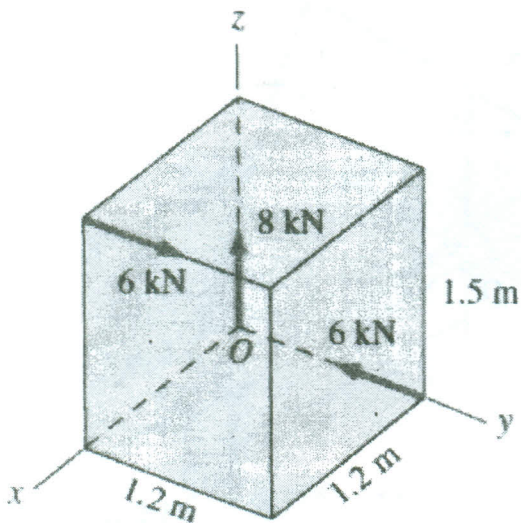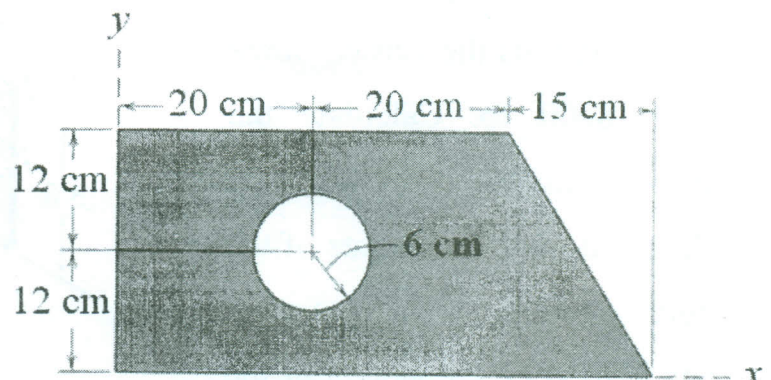
Prob. (4)   **Prob. (5)**

(6) [15 pt.] Replace the force system shown by an equivalent force-couple system acting at the point *O*. Also, determine the equivalent wrench, and find the coordinates of the point where the axis of the wrench crosses the *xy*-plane.

(7) [15 pt.] Determine the location of the centroid of the shaded area shown in Fig. Also, determine the volume of revolution generated by revolving the shaded area a complete revolution about the line $y = -10$ cm.

Prob. (6)   **Prob. (7)**

With all best wishes
Dr.\ Waleed El-Beshbeeshy and Dr.\ Mohamed Soror