1. A homogeneous block having a mass m rests on the top surface o
(25 pt) the cylinder, as shown in Fig. 1. Using the "Concept of potential energy" and neglecting the frictional effect, determine the present position of the block is at equilibrium or not, and then discuss its stability conditions.

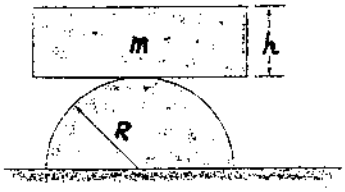
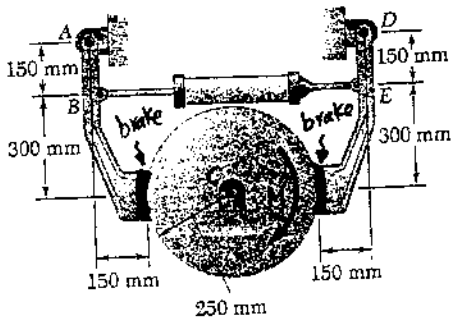


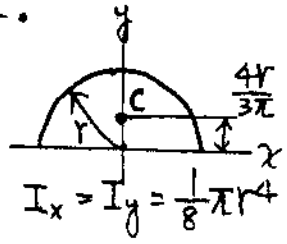
Fig. 1

2. The hydraulic cylinder shown in Fig. 2, exerts a force 3 kN
(25 pt) directed to the right on point B and to the left on point E. If the coefficient of static friction $\mu_s = 0.40$ and the coefficient of dynamic friction $\mu_K = 0.30$ are used between the drum and the brake surface, then determine the magnitude of the couple $\vec{M}$ required to rotate the drum clockwise at a constant speed.



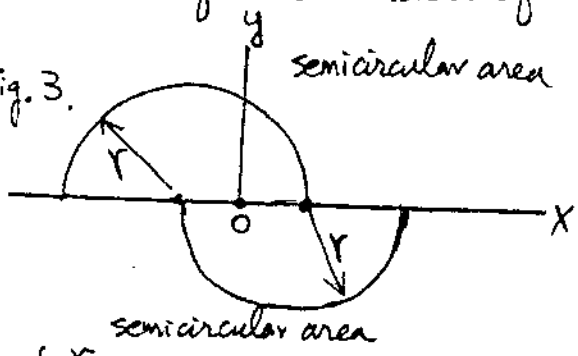
(背面仍有題目,請繼續作答)

3. For the area as shown in Fig. 3, using the Mohr's circle to (25 pt) determine the orientation of the principal axes at the origin and the corresponding principal values of the moments of inertia.

Note: ① 

$I_x = I_y = \frac{1}{8}\pi r^4$

Semicircular area

Fig. 3. 

② Express your results in terms of r.

4. The bracket ABC can be supported in the following different ways (25 pt) as shown in Fig. 4. All connections consist of smooth pins, rollers, or short links. For each case, determine whether (a) the bracket is complelely, partially, or improperly constrained, (b) the reactions are **statically determinate** or indeterminate, (c) the equilibrium of the bracket is maintained in the position shown. Also, wherever possible, compute the reactions in terms of P.

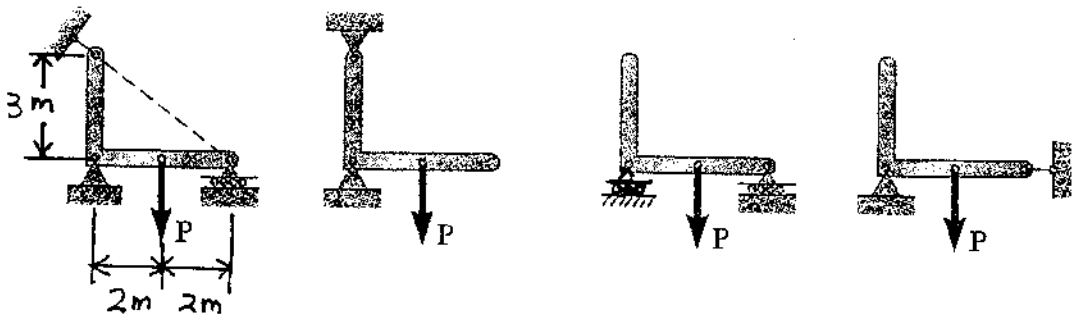


Fig. 4 (1) (2) (3) (4)