**Assignment 3: Engineering Mechanics (NMEC101) (Session 2025-26)**

Instruction: Figure numbers correspond to the problem numbers.

1. Determine the moment of inertia of the shaded area shown with respect to the x-axis.

2. (a) Determine by direct integration the product of inertia of the given area with respect to the x-and y- axes. (b) Use Mohr's circle to determine the orientation of the principal axes at the origin and the corresponding values of the moments of inertia. (c) Using Mohr's circle, determine the moments of inertia and the product of inertia with respect to new axes obtained by rotating the x-and y-axes about O through 45° counterclockwise, and through 30° clockwise.

3. For the area indicated, determine the orientation of the principal axes at the origin (centroid) and the corresponding values of the moments of inertia.

4. The mechanism shown is acted upon by the force P. Derive an expression for the magnitude of the force Q required for equilibrium.

5. A block of weight W is hung from member AB as shown. Neglecting the weight of AB and knowing that the spring is unstretched when θ = 20°, determine the value of θ corresponding to equilibrium when 6.6 N. W = 6.6 N. State whether the equilibrium is stable, unstable, or neutral.

6. Spring AB of constant 2 kN/m is attached to two identical drums as shown. Knowing that the spring is unstretched when θ = 0 and that m = 20 kg, determine the values of θ less than 180° corresponding to equilibrium. State in each case whether the equilibrium is stable, unstable, or neutral.

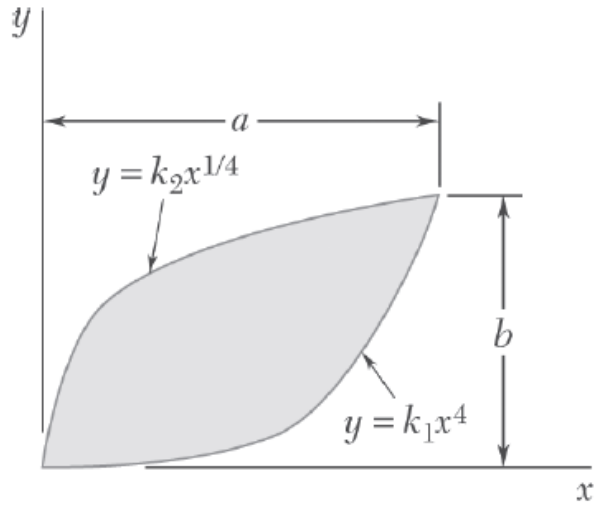


**Fig. 1**

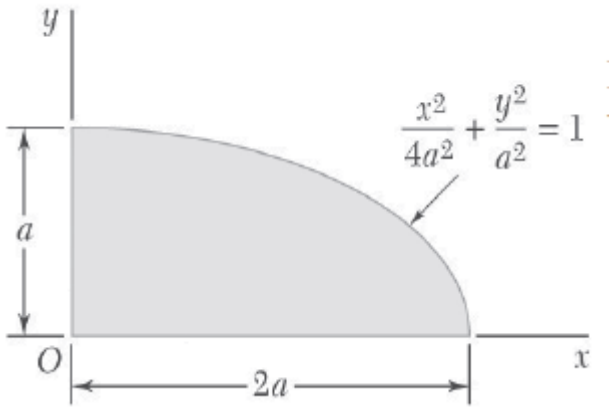


**Fig. 2**

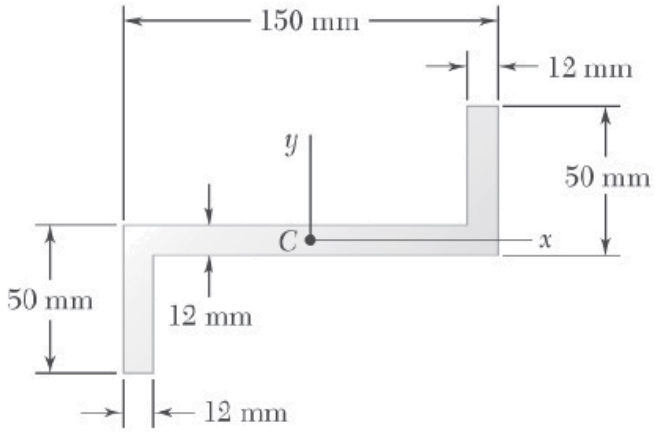


**Fig. 3**

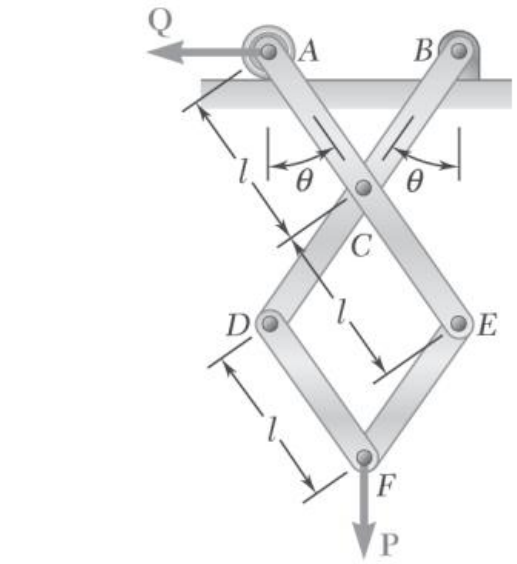


**Fig. 4**

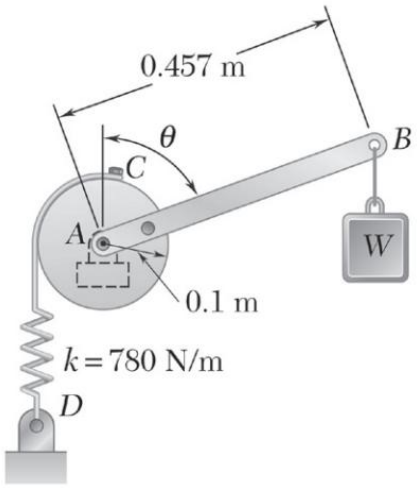


**Fig. 5**

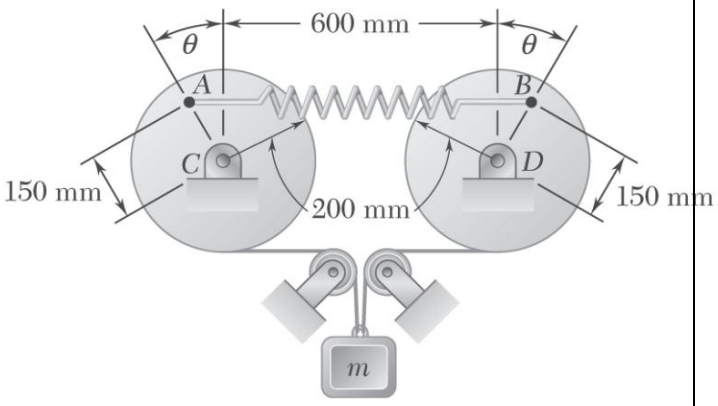


**Fig. 6**