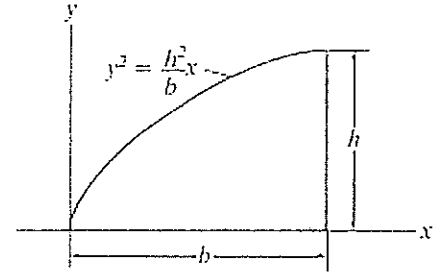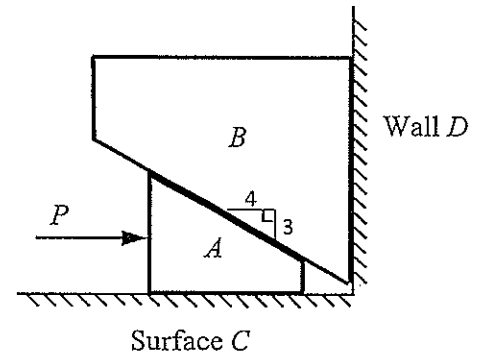※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (25%) For the shaded area shown, determine (1) its moment of inertia of about the x axis, and (2) its product of inertia with respect to the x and y axes.


2. (25%) The block B has a weight W. The coefficients of static friction between wedge A and block B, and between A and surface C, are $\mu_s = 1/3$. The wall D is smooth. Neglect the weight of the wedge. Determine the smallest force P needed to lift the block.

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

3. On the slider crank system as shown in the right, for kinematic analysis consider OB at constant speed of 1 rad/sec counterclockwise. At the instant when $\theta = 60°$ and $\beta = 18°$ (cos θ = 0.50, sin θ = 0.87, cos β = 0.95, and sin β = 0.31), Calculate
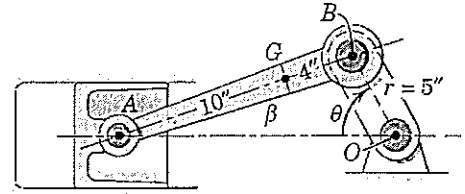
    (1) the angular velocity of the connecting rod AB and the translational velocity of the piston A, (6%) and

    (2) the angular acceleration of AB and the acceleration of the piston A. (6%)

4. On the slider crank system as shown above for dynamic analysis, let the mass center of the crank OB be at its midpoint, AB be at point G, and piston be at point A.　Consider link OB, BA, and piston each has mass m_1, m_2, and m_3, and mass moment of inertia I_1, I_2, and I_3.　For a sinusoidal force F(t) applied at the piston in horizontal direction,

(1) define the inertial coordinates and draw the free body diagram in gravitation field (vertical, downward) of all the rigid bodies by representing all forces in X-Y components, (3%) and

(2) write the equation of motion of all the rigid bodies: the crank OB, the connecting rod AB, and piston, (9%) and specify all the unknowns (8%)

5.　A circular rigid body of mass m, radius R and radius of gyration k is released from stationary in an incline plane of incline angle θ and coefficient of friction μ.　Determine the normal reaction force, friction force, linear and angular accelerations of the rigid body when it is in
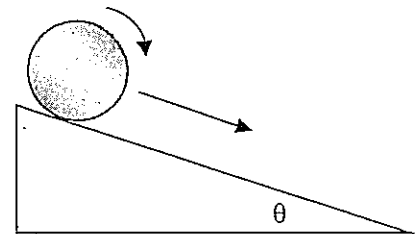
    (1)　pure rolling motion, (9%)　and

    (2)　rolling with slipping motion. (9%)