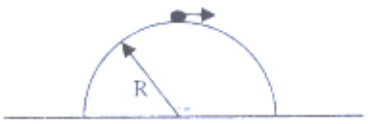
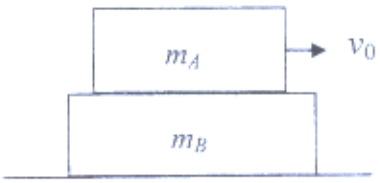
1. (20%)
   (a) Derive an equation for the trajectory of a particle moving with initial velocity v_0 at an angle θ above the horizontal in a uniform gravitational field.
   (b) For the case of a trajectory over a flat surface, find the optimal initial angle θ that leads to the maximum range.

2. (15%) A particle initially at rest starts to slide down from the top of a hemispherical mound of ice as shown. Show that the particle leaves the ice at a point whose height is 2R/3 if the ice is frictionless.

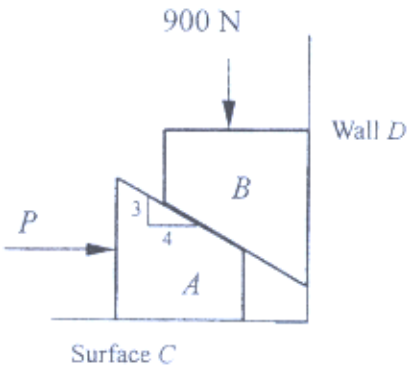


3. (15%) Block A can slide relative to block B, which can slide on a perfectly smooth horizontal plane as shown. If block A is given an initial velocity v_0, find the final velocities of the two blocks and the distance that A slides relative to B. Assume that the coefficient of sliding friction between A and B is μ and A always stays on B.

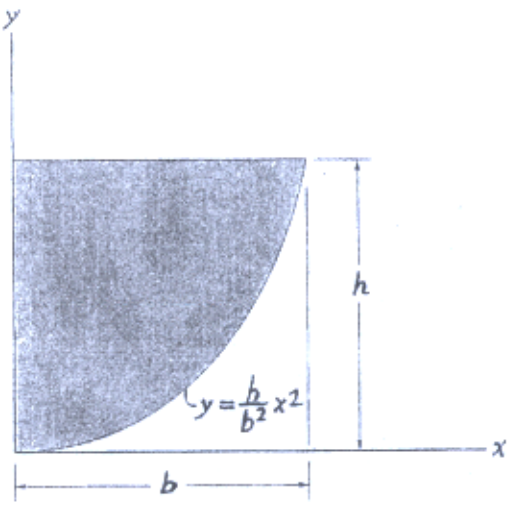


(背面仍有題目,請繼續作答)

4. (20%) The coefficients of static friction between wedges A and B, and between A and surface C, are $\mu_s = 1/3$. The wall D is smooth. Neglect the weight of each wedge. Determine the smallest force P needed to lift the 900-N load.



5. (15%) Determine the moment of inertia of the shaded area (a) about the x axis, (b) about the y axis.



6. (15%) Determine the distance d for placement of the load **P** for equilibrium of the smooth bar in the position θ as shown. Neglect the weight of the bar.