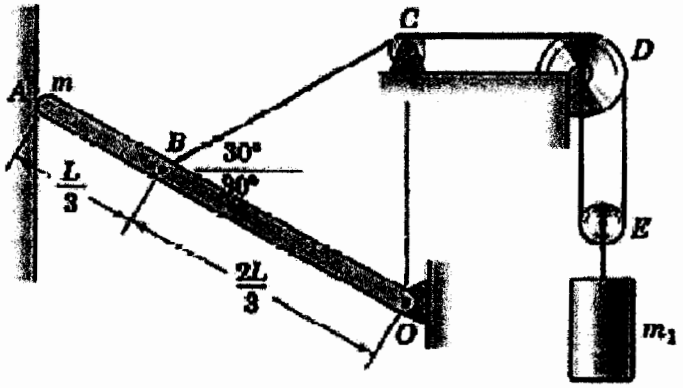
系所組別：生物醫學工程學系甲組

考試科目：工程力學 考試日期：0222，節次：1

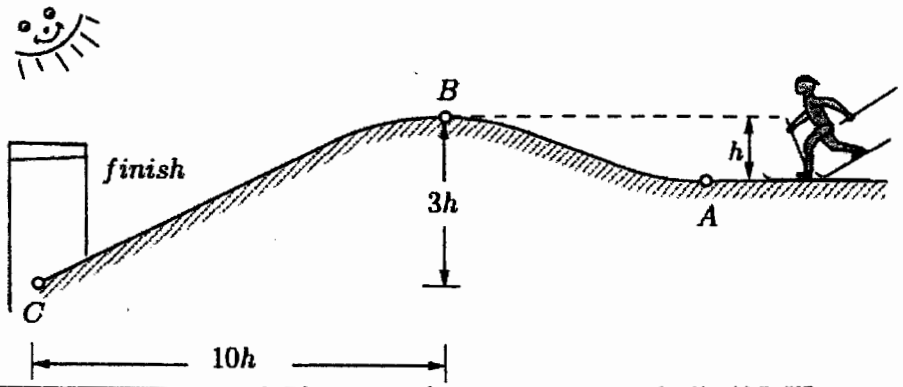
※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Explain the following terms:
   (a) Statics and Dynamics. (3%)
   (b) Theorems of Pappus and Guldinus. (4%)
   (c) 1st moment of an area and 2nd moment of an area. (4%)
   (d) Perfectly-elastic, partially-elastic and perfectly-inelastic (or plastic) collisions (you may take the two-body collision as an example). (5%)

2. **Derive a general expression for the normal force N_A** exerted by the smooth vertical wall on the uniform slender bar of mass m and length L. The mass of the cylinder is m_1, and all bearings are ideal. **Determine the value of m_1 which makes (a) N_A=mg/2 and (b) N_A=0.** (Notice: free body diagrams must be shown.) (20%)



3. The skier Michael Schumacher (mass m) has the velocity $v_A = v_0$ at point A of the cross country course (see the figure below). Although he tries hard not to lose velocity skiing uphill, he reaches point B with only the velocity $v_B = 2v_0/5$. Skiing downhill between point B and the finish C he again gains speed and reaches C with $v_C = 4v_0$. Between B and C assume that a constant friction force acts due to the soft snow in this region; the drag force from the air on the skier can be neglected. (a) **Calculate the work done by the skier on the path from A to B** (here the friction force is negligible). (b) **Determine the coefficient of kinetic friction μ_k between B and C.** (17%)



(背面仍有題目,請繼續作答)

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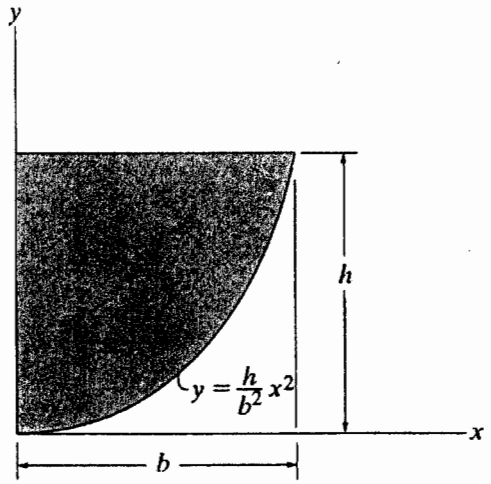
4. Determine the I_{max}, I_{min} and **principal axes of the area (see the figure below) in terms of rotating angle** θ_p. (Assume $h>b$) (25%)



5. The Formula 1 driver Rubens Barrichello drives a car of weight $W = mg$ to slip from a hemi-sphere hill (radius r) without friction downwards (as shown in the figure). The motion starts at the highest point with an initial velocity v_0. **Determine at what location in terms of angle φ will the car lift-off from the hill**? (22%)