

本試題是否可以使用計算機： 可使用， 不可使用（請命題老師勾選）

1. (25%) A bird of mass m , flying horizontally at speed v_0 perpendicular to a stick, lands on the end of the stick and holds on to it (As shown in Figure 1). The stick with mass M and length L is lying on a frozen pond with negligible friction. Find the angular velocity of the bird and stick as they move together. (Answer in terms of m , M , L , and v_0 . It is known that the moment of inertia of the stick about its center is $ML^2/12$)

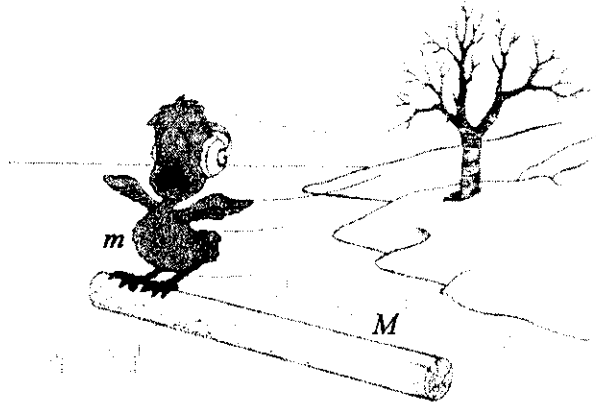


Figure 1

2. (25%) The uniform rod in Figure 2 (length 80cm, mass 20kg) is smoothly pinned to a 50kg cart at point A . Force P , applied to the cart with the system initially at rest, causes the cart to translate with the acceleration $3\mathbf{i}\text{ m/s}^2$. Find the initial angular acceleration of the rod.

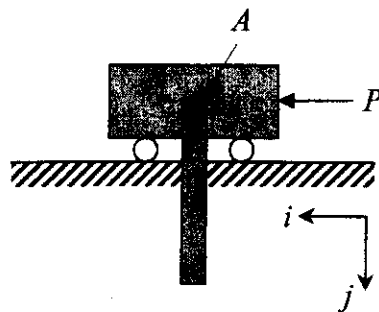
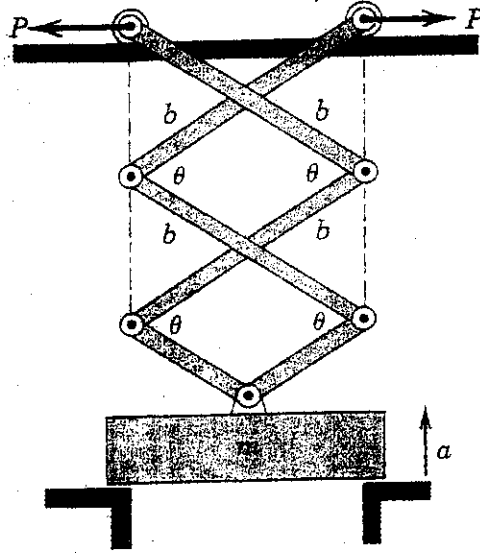


Figure 2

(背面仍有題目,請繼續作答)

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3. (25%) The load of mass m is given an upward acceleration a from its supported rest position by the application of the force P . Neglect the mass of the links and determine the initial acceleration a by using the principle of virtual work or the work-energy method.



4. (25%) A fire truck is moving backwards (in the positive y direction) at a constant speed of 5 ft/s . The ladder of the fire truck rotates around the z axis with an angular velocity of $\omega_1 = 0.15 \text{ rad/s}$, which is increasing at 0.2 rad/s^2 . At the same instant it is rotating upwards at $\omega_2 = 0.6 \text{ rad/s}$, which is increasing at 0.4 rad/s^2 . At this instant, a fireman at the midpoint B of the ladder is climbing up on the ladder at a constant speed of 3 ft/s . Determine the velocity and acceleration of the fireman. (You must use vector operations, in accordance with the coordinate system shown in the figure, throughout your calculation.)

