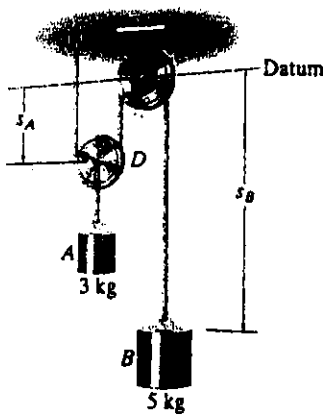
※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

(1)

Blocks A and B shown in below have a mass of 3 kg and 5 kg, respectively. If the system is released from rest, determine the velocities of blocks A and B in 6 s. Neglect the mass of the pulleys and cord. (25%)

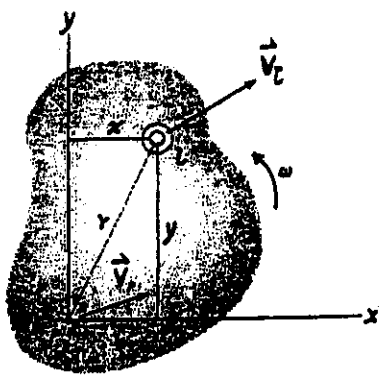


(2)

Consider a rigid body moves in X-Y plane. Please show that its kinetic energy can be expressed as

$$T = \frac{1}{2}mv_G^2 + \frac{1}{2}I_G\omega^2$$

Where m is the mass of the rigid body, v_G is the velocity of the center of mass, and I_G is the moment of inertia with respect to center of mass (G).



(Notice: (a) Firstly, please derive the kinetic energy with respect to Point P. Point P does not coincide with the mass center G for the body.
(b) Secondly, if point P coincides with the mass center G for the body, please derive the above equation.) (25%)

(背面仍有題目,請繼續作答)

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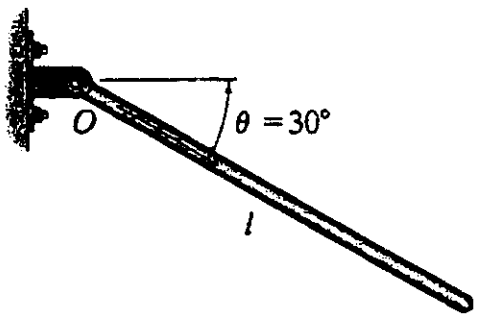
(3)

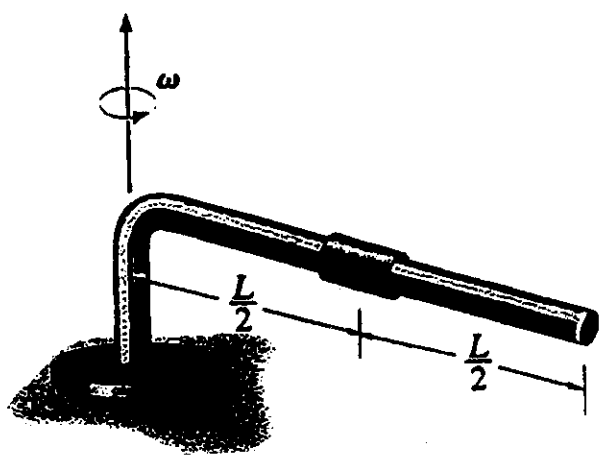
The bar has a mass m and length l. If it is released from rest from the position $\theta = 30°$, determine its angular acceleration and the horizontal and vertical components of reaction at the pin O.



(Notice: You need to consider the moment of inertia of the rod)
(25%)

(4)

The rod has a length L and mass m. A smooth collar having a negligible size and one-fourth the mass of the rod is placed on the rod at its midpoint. If the rod is freely rotating at ω about its end and the collar is released, determine the rod's angular velocity just before the collar flies off the rod. Also, what is the speed of the collar as it leaves the rod?



(Notice: You need to consider the moment of inertia of the rod)
(25%)