(1) (15%) A block having a mass of 2 kg is given an initial velocity of $v_0 = 1$ m/s when it is at the top surface of the smooth cylinder shown in Fig. 1. If the block travels along a path of 0.5-m radius, determine the angle $\theta = \theta_{max}$ at which it begins to leave the cylinder's surface.

(2) (15%) The sphere of mass m falls and strikes the triangular block with a vertical velocity v. If the block rests on a smooth surface and has a mass $3m$, determine its velocity just after the collision. The coefficient of restitution is e.

(3) (20%) The block B of the quick-return mechanism is confined to move within the slot in member CD. If AB is rotating at a constant rate of $\omega_{AB} = 3$ rad/s, determine the angular velocity and angular acceleration of member CD at the instant shown.

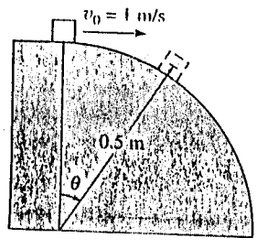


Figure 1

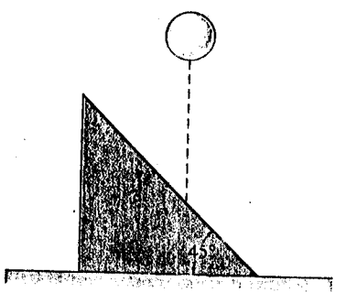


Figure 2

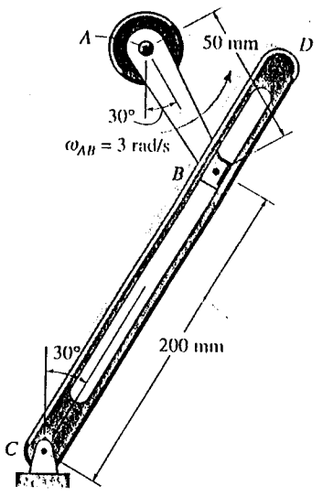
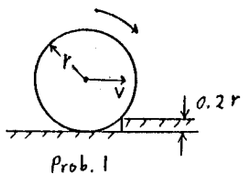


Figure 3

(背面仍有題目,請繼續作答)

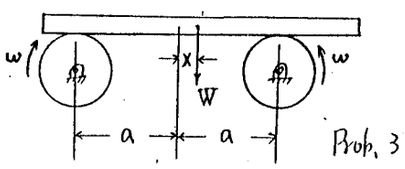
1. The disk has a mass m, radius r and rolls without slipping. If it strikes a rough step having a height 0.2r as shown, determine the smallest velocity v the disk can have and not rebound off the step when it strikes it. (15%)



Prob. 1

2. State and prove the Euler's theorem regarding the rotation of a rigid-body about a fixed point. (15%)

3. A uniform board of length L and weight W as shown is supported on two wheels which rotate in opposite directions at a constant angular speed ω. If the coefficient of kinetic friction between the board and the wheels is μ, determine the frequency of vibration of the board if its center of mass is displaced slightly, a distance x from the midpoint between the wheels, and released. (20%)



Prob. 3