

每題各20分, 總共100分.

- As shown in Fig.1, a 4000 kg car is traveling along a road defined by polar coordinates $r = 400 (1 + \cos \theta)$ m. If the car maintains a constant speed of 20 m/s, determine the radial and transverse components of the friction force which must be exerted by the road to the car in order to maintain the motion at $\theta = 30^\circ$.

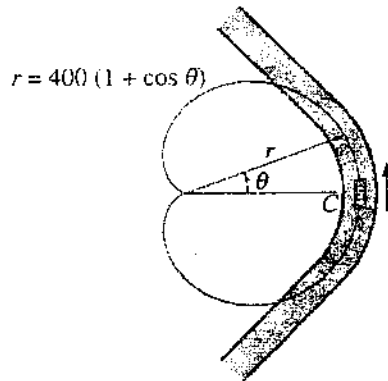


Fig.1

- As shown in Fig.2, a half section of a uniform cylinder of mass m is at rest when a force P is applied. Assuming the section rolls without sliding, determine (a) its angular acceleration, and (b) the minimum value of μ_s between the cylinder and the ground.

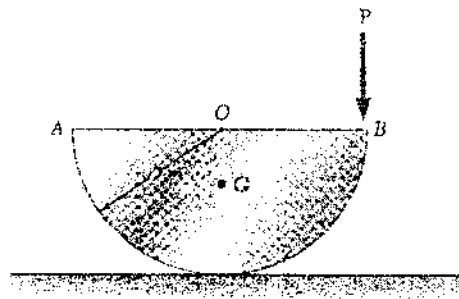


Fig.2

(背面仍有題目, 請繼續作答)

3. As shown in Fig.3, a rod AB slides on a smooth surface at a speed of 10 m/s and hits a disk D moving at a speed 5 m/s. What is the velocities of point A and B right after the impact for a coefficient of restitution of $\epsilon = 0.8$? The rod weights 30 N and the disk weights 8 N.

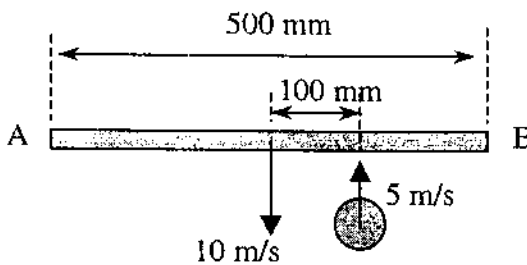


Fig.3

4. As shown in Fig.4, the two pin-connected bar each have a weight of 10 lb/ft. If a moment of $M = 60$ lb-ft is applied to the bar AB, determine the initial vertical reaction at C and the vertical and horizontal components of reaction at B. Neglect the size of the roller C. The bars are initially at rest.

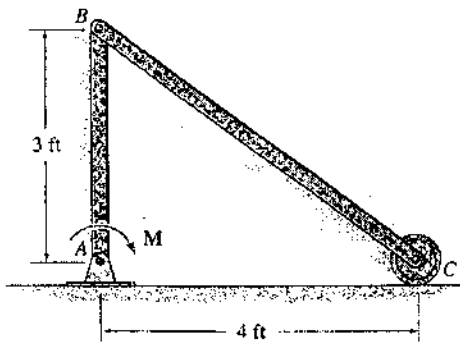


Fig.4

5. Explain the relationship between a conservative force, the potential energy of the force, and the gradient of the potential energy. Show that the work done by the conservative force is path-independent.