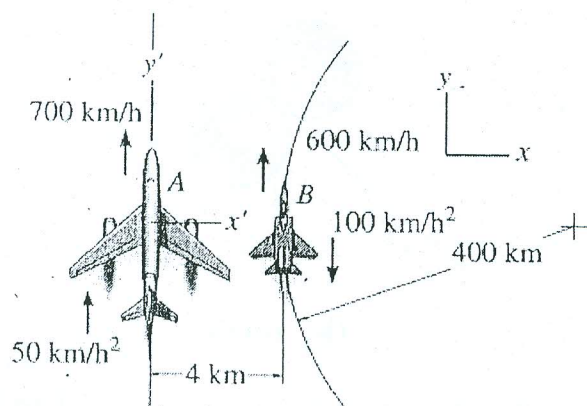
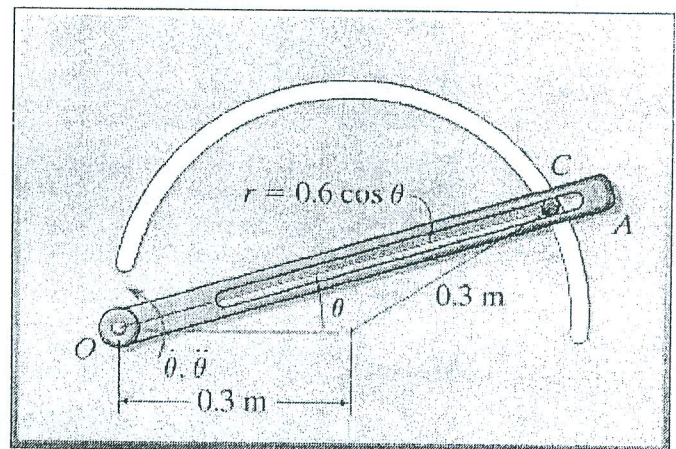


**Exam Guidelines:** This Exam contains 6 questions in 2 pages. Start every question in a new page.

- (1) [8 pt.] Plane  $A$  in figure is flying along a straight-line path, whereas plane  $B$  is flying along a circular path having a radius of curvature of  $\rho_B = 400$  km. Determine the velocity and acceleration of  $B$  as measured by the pilot of  $A$ .
- (2) [8 pt.] Due to the constrained, the 0.5 kg cylinder  $C$  travels along the path described by  $r = 0.6 \cos \theta$  m. If the arm  $OA$  rotates counterclockwise with an angular velocity of  $\dot{\theta} = 2$  rad/s and an angular acceleration of  $\ddot{\theta} = 0.8$  rad/s<sup>2</sup> at the instant  $\theta = 30^\circ$ . Determine the force exerted by the arm on the cylinder at this instant. The cylinder is in contact with only one edge of the smooth slot, and the motion is in the vertical plane.

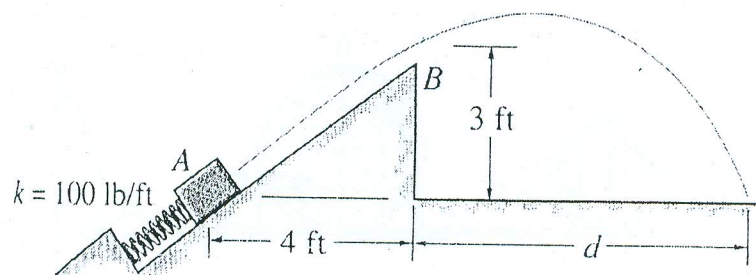


Prob. (1)



Prob. (2)

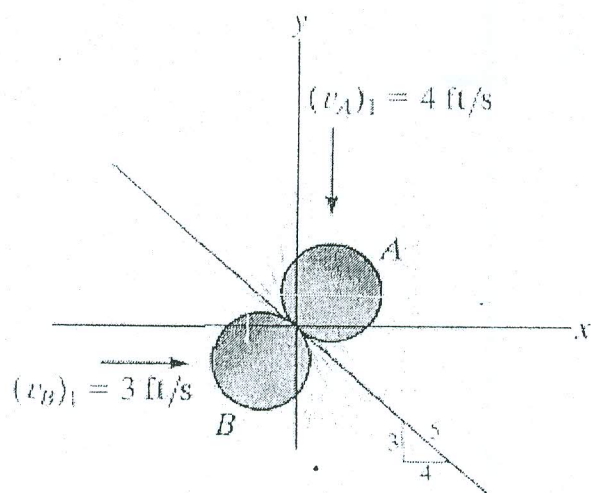
- (3) [9 pt.] The 10-lb block is pressed against the spring so as to compress it 1 ft when it is at  $A$ . If the coefficient of kinetic friction between block and the plane  $\mu_k = 0.4$ , determine the distance  $d$ , measured from the wall, to where the block strikes the ground. Neglect the size of the block.



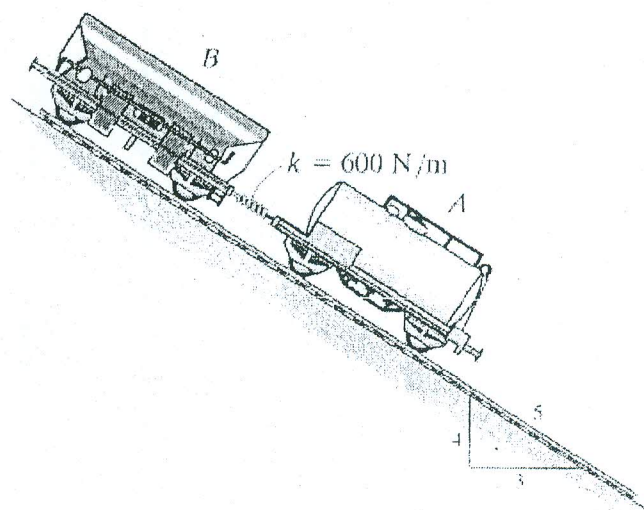
Prob. (3)



(4) [9 pt.] Two smooth disks  $A$  and  $B$ , having a weight of 2 lb, collide with the velocities shown in figure. If the coefficient of restitution for the disks is  $e = 0.5$ , determine the speed of each disk just after collision.

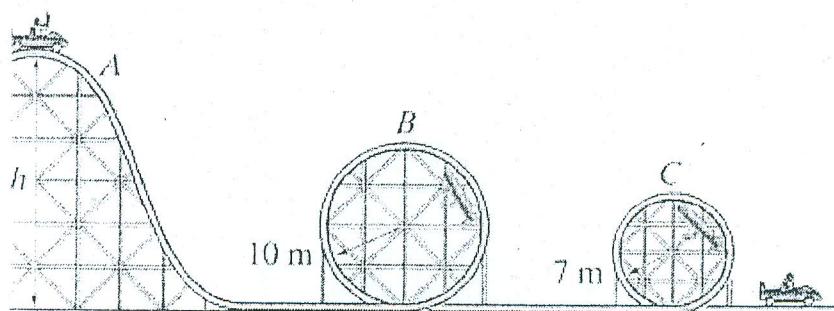


Prob. (4)



Prob. (5)

(6) [8 pt.] The roller-coaster car has a mass of 800 kg, including its passenger. If it is released from rest at the top of the hill  $A$ , determine the minimum height  $h$  of the hill so that the car travels around both inside loops without leaving the track. Neglect friction, the mass of the wheels, and the size of the car. What is the normal reaction on the car when the car is at  $B$  and at  $C$ ?



Prob. (6)