Computer Problems

12.C1 Block B of weight 18 lb is initially at rest as shown on the uper surface of a 45-lb wedge A which is supported by a horizontal surface. A 4-lb block C is connected to block B by a cord, which passes over a pulley of negligible mass. Using computational software and denoting by μ the coefficient of friction at all surfaces, calculate the initial acceleration of the wedge and the initial acceleration of block B relative to the wedge for values of $\mu \geq 0$. Use 0.01 iincrements for μ until the wedge does not move and then use 0.1 increments until no motion occurs.

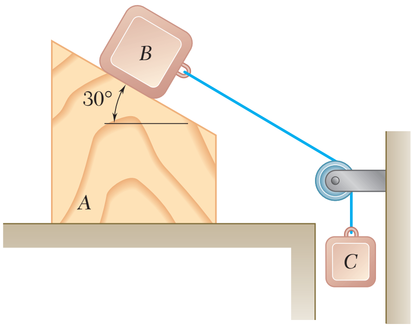

Fig. P4.C1

12.C2 A small 0.50-kg block is at rest at the top of a cylindrical surface. The block is given an initial velocity $\mathbf{v}_0$ to the right of magnitude 3 m/s, which causes it to slide on the cylindrical surface. Using computational software calculate and plot the values of θ at which the block leaves the surface for values of μ_k, the coefficient of kinetic friction between the block and the surface, from 0 to 0.4 usiing 0.05 increments.

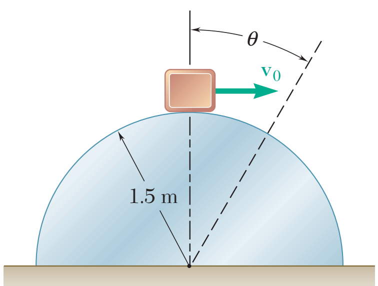

Fig. P4.C2

12.C3 A block of mass m is attached to a spring of constant k. The block is released from rest when the spring is in a horizontal and undeformed position. Knowing that $r_0 = 4$ ft, use computational software to determine (*a*) for $k/m = 15\ s^{-2}$, $20s^{-2}$, and $25\ s^{-2}$, the length of the spring and the magnitude and direction of the velocity of the block as the block passes directly under the point of suspension of the spring, (*b*) the value of k/m for which that velocity is horizontal.

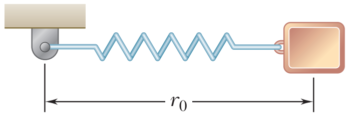

Fig. P4.C3

12.C4 An airplane has a weight of 60,000 lb and its engines develop a constant thrust of 12,500 lb during take-off. The drag **D** exerted on the airplane has a magnitude $D = 0.060v^2$, where D is expressed in lb and v is the speed in ft/s. The airplane starts from rest at the end of the runway and becomes airborne at a speed of 250 ft/s. Determine and plot the position and speed of the airplane as functions of time and the speed as a function of position as the airplane moves down the runway.

12.C5 Two wires AC and BC are tied at point C to a small sphere which revolves at a constant speed v in the horizontal circle shown. Calculate and plot the tensions in the wires as functions of v. Determine the range of values of v for which both wires reman taut.

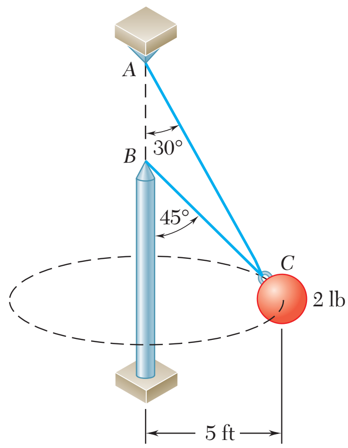

Fig. P4.C5

12.C6 A 10-lb bag is gently pushed off the top of a wall at point A and swings in a vertical plane at the end of a rope of length $l = 5$ ft. Calculate and plot the speed of the bag and the magnitude of the tension in the rope as functions of the angle θ from 0 to 90°.

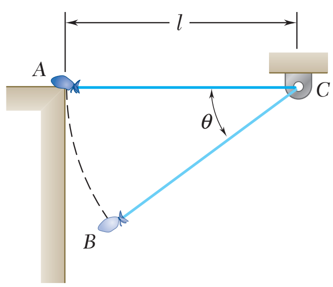

Fig. P4.C6

12.C7 The two-dimensional motion of particle β is defined by the relations $r = t^3 - 2t^2$ and $\theta = t^3 - 4t$, where r is expressed in mm, t in seconds, and θ in radians. Knowing that the particle has a mass of 0.25 kg and moves in a horizontal plane, calculate and plot the radial and transverse components and the magnitude of the force actiing on the particle as functions of t from 0 to 1.5 s.

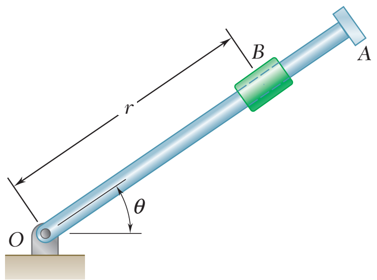

Fig. P4.C7