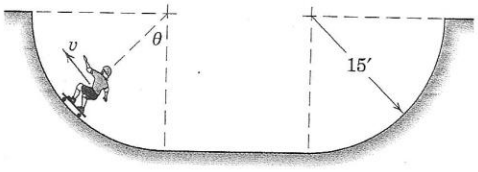
HW 4

3/63 As the skateboarder negotiates the surface shown, his mass-center speeds at $\theta = 0^+$, 45°, and 90° are 28 ft/sec, 20 ft/sec, and 0, respectively. Determine the normal force between the surface and the skateboard wheels if the combined weight of the person and the skateboard is 150 lb and his center of mass is 30 in. from the surface.

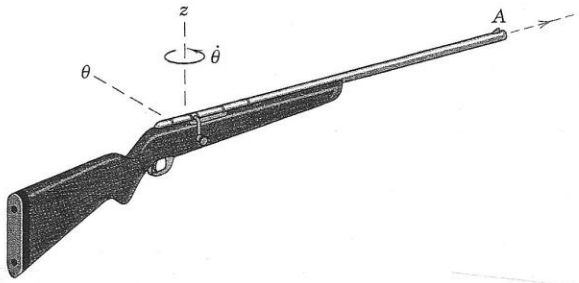
Ans. $N_0 = 442$ lb, $N_{45°} = 255$ lb, $N_{90°} = 0$



Problem 3/63

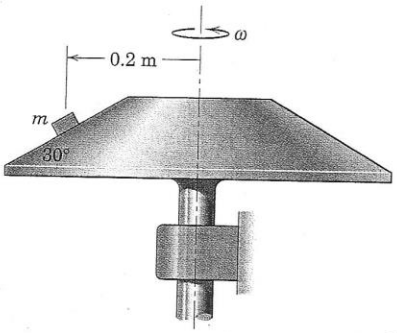
3/65 The barrel of a rifle is rotating in a horizontal plane about the vertical z-axis at the constant angular rate $\dot{\theta} = 0.5$ rad/s when a 60-g bullet is fired. If the velocity of the bullet relative to the barrel is 600 m/s just before it reaches the muzzle A, determine the resultant horizontal side thrust P exerted by the barrel on the bullet just before it emerges from A. On which side of the barrel does P act?

Ans. $P = 36$ N, right-hand side



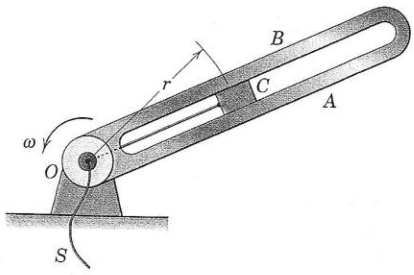
Problem 3/65

3/78 The small object of mass m is placed on the rotating conical surface at the radius shown. If the coefficient of static friction between the object and the rotating surface is 0.8, calculate the maximum angular velocity ω of the cone about the vertical axis for which the object will not slip. Assume very gradual angular-velocity changes.



Problem 3/78

3/86 The slotted arm revolves in the horizontal plane about the fixed vertical axis through point O. The 3-lb slider C is drawn toward O at the constant rate of 2 in./sec by pulling the cord S. At the instant for which $r = 9$ in., the arm has a counterclockwise angular velocity $\omega = 6$ rad/sec and is slowing down at the rate of 2 rad/sec^2. For this instant, determine the tension T in the cord and the magnitude N of the force exerted on the slider by the sides of the smooth radial slot. Indicate which side, A or B, of the slot contacts the slider.



Problem 3/86