1. Consider the motion of the propeller of an airplane making a turn. For simplicity, we shall suppose that the center O of the propeller describes a horizontal circle C with constant speed V; let b be the radius and A the center of C. Fig. P1 shows the position of the propeller when the line from the center to the tip B makes an angle θ with the vertical and the length of $\overline{OB}$ is ℓ. Find

   (1) the velocity,   (8%)
   (2) the absolute speed,   (5%)
   (3) the acceleration   (12%)
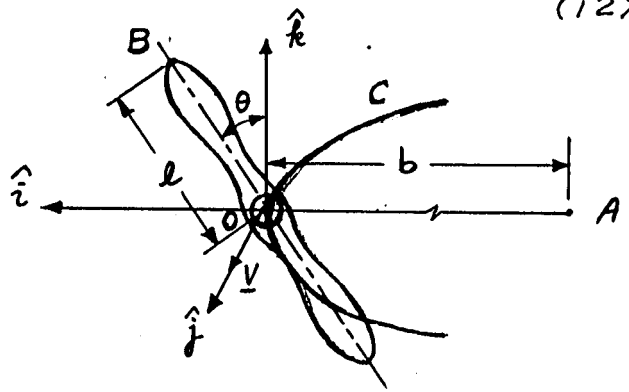   of the tip of the propeller.

Fig. P1

2. A particle P of mass m is suspended from a massless linear spring with spring constant K and undeformed length L, as shown in Fig. P2. Use the indicated generalized coordinates q_1 and q_2 to find the following:

   (1) The kinetic energy T,   (5%)
   (2) The generalized forces Q_1 and Q_2,   (5%)
   (3) The potential energy V,   (5%)
   (4) The equations of motion.   (10%)
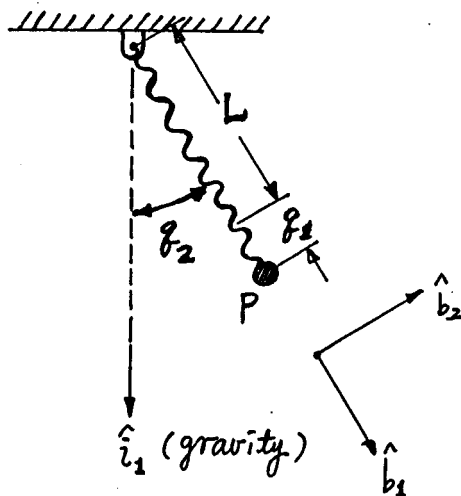

Fig. P2

（接下頁）

3. A right circular cone which is shown in Fig. P3, weighting 20 N is spinning like a top about a fixed point O at a speed $\dot{\phi}$ of 15,000 rad/sec. What are two possible precession speeds for $\theta = 30°$? (20%)
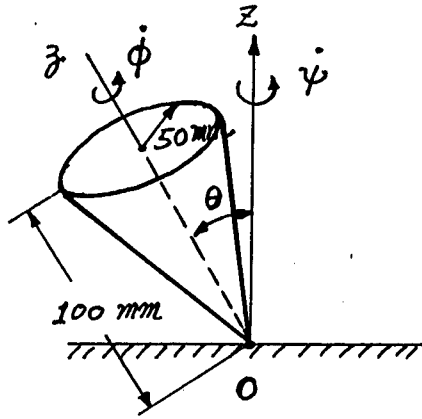

Fig. P3

4. The weight W = 200 lb hangs on a pulley A free to rotate in frictionless bearing as shown in Fig. P4. The coefficient of friction between the facing of brake B and the pulley is 0.25. What minimum force P is needed to prevent rotation ? (30%)
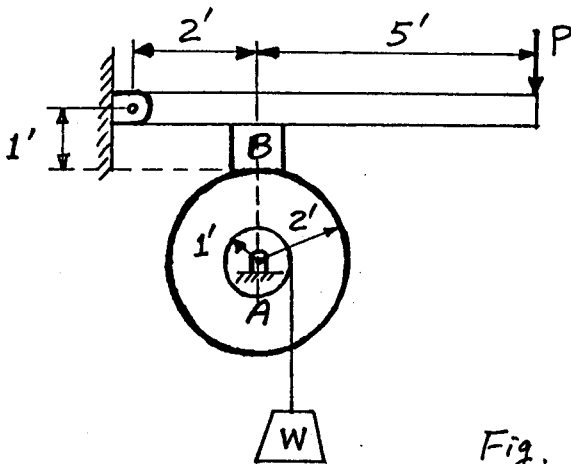

Fig. P4