

# Problems

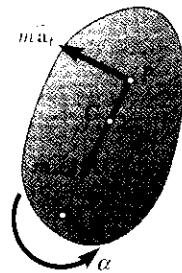


Fig. P16.70

16.70 Show that the couple  $\bar{I}\alpha$  of Fig. 16.15 can be eliminated by attaching the vectors  $m\bar{a}_r$  and  $m\bar{a}_t$  at a point  $P$  called the *center of percussion*, located on line  $OG$  at a distance  $GP = \bar{k}^2/\bar{r}$  from the mass center of the body.

16.71 A uniform slender rod of length  $L = 900$  mm and mass  $m = 1$  kg hangs freely from a hinge at  $A$ . If a force  $\mathbf{P}$  of magnitude 3.5 N is applied at  $B$  horizontally to the left ( $h = L$ ), determine (a) the angular acceleration of the rod, (b) the components of the reaction at  $A$ .

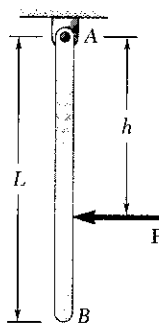


Fig. P16.71

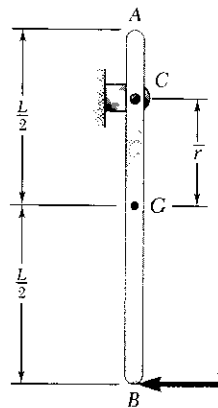


Fig. P16.72

16.72 A uniform slender rod of length  $L = 36$  in. and weight  $W = 10$  lb hangs freely from a hinge at  $C$ . A horizontal force  $\mathbf{P}$  of magnitude 15 lb is applied at end  $B$ . Knowing that  $\bar{r} = 9$  in., determine (a) the angular acceleration of the rod, (b) the components of the reaction at  $C$ .

16.73 In Prob. 16.71, determine (a) the distance  $h$  for which the horizontal component of the reaction at  $A$  is zero, (b) the corresponding angular acceleration of the rod.

16.74 In Prob. 16.72, determine (a) the distance  $\bar{r}$  for which the horizontal component of the reaction at  $C$  is zero, (b) the corresponding angular acceleration of the rod.

16.75 A uniform slender rod  $AB$  of length  $L$  and mass  $m$  is pivoted at end  $A$  and released from a horizontal position. The angular velocity of the rod as it passes through the vertical position is known to be  $\omega = \sqrt{3g/L}$ . (a) Express the tension in the rod at a distance  $z$  from end  $B$  in terms of  $z$ ,  $m$ ,  $g$ , and  $L$  for the vertical position. (b) Knowing that the weight of the rod is 10 N, determine the maximum tension in the rod for the vertical position.

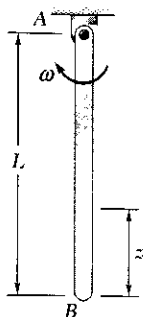


Fig. P16.75

16.76 A large flywheel is mounted on a horizontal shaft and rotates at a constant rate of 1200 rpm. Experimental data indicate that the total force exerted by the flywheel on the shaft varies from 12 kip upward to 18 kip downward. Determine (a) the weight of the flywheel, (b) the distance from the center of the shaft to the mass center of the flywheel.