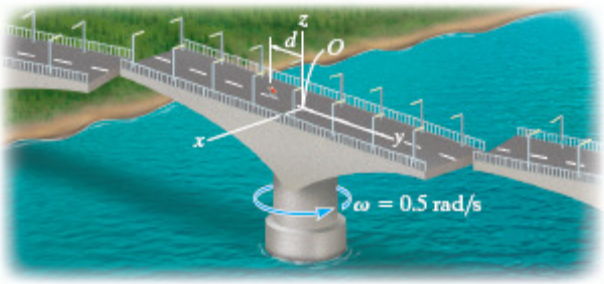
Exercise 7

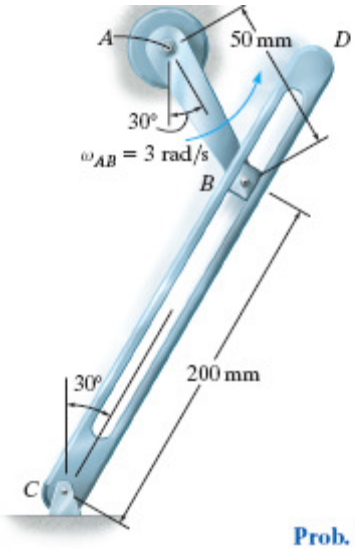
Relative motion with rotating axis

1. [Prob. 16-136] While the swing bridge is closing with a constant rotation of *0.5 rad/sec*, a man runs along the roadway such that when $d = 4\ m$ he is running outward from the centre at *2 m/s* with an acceleration of $0.8\ m/s^2$, both measured relative to the roadway. Determine his velocity and acceleration at this instant.

2. [Prob. 16-150] The block *B* of the mechanism shown is confined to move within the slot in member *CD*. If *AB* is rotating at a constant rate of $\omega_{AB} = 3\text{rad/s}$, determine the angular velocity and angular acceleration of member *CD* at the instant shown.



Prob. 16–136

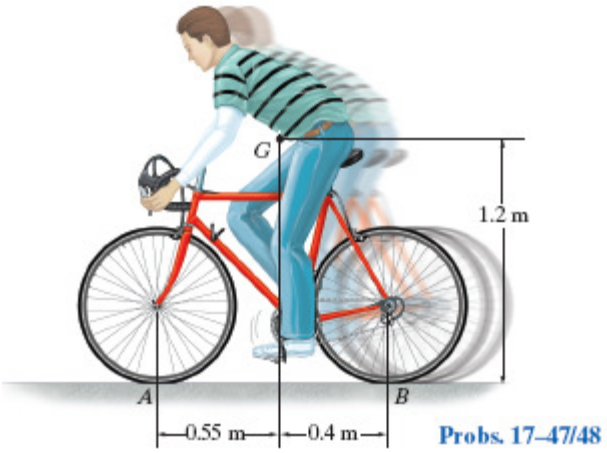


Prob. 16–150

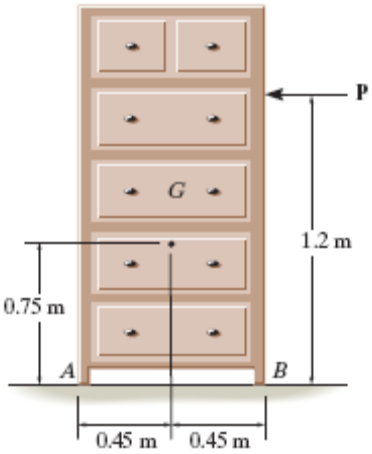
Planar Kinetics: Translation

3. [Prob. 17-47] The bicycle and rider have a combined mass of *80kg* with centre of mass located at point G. Given that the coefficient of kinetic friction of the rear tire with the ground is $\mu_k = 0.8$. You may neglect the mass of the wheels.
   (a) Determine the normal reactions at the tyres *A* and *B*
   (b) Determine the deceleration of the rider when the rear wheel locks for braking
   (c) Determine the normal reaction at the rear wheel when the bicycle is travelling at constant velocity and the brakes are not applied

4. [Prob. 17-50] A force *P* is applied horizontally on the wardrobe of mass *40kg*. Given that the coefficients of friction at points *A* and *B* are $\mu_s = 0.3$ and $\mu_k = 0.2$. Determine the maximum possible horizontal force *P* which does not cause the dresser to tip over.



Probs. 17–47/48

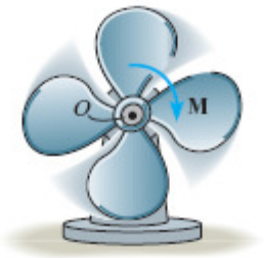


Probs. 17–49/50

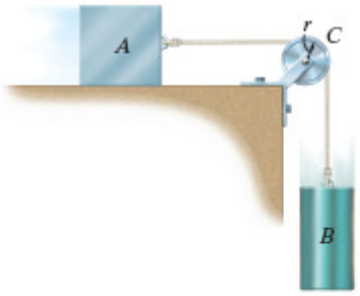
Planar Kinetics: Rotation

5. [Prob. 17-55] The *2kg* fan blade has a moment of inertia $I_O = 0.18\,kg\,m^2$ about an axis passing through its centre *O*. If it is subjected to a moment of $M = 3\left(1 - e^{-0.2t}\right)\text{Nm}$, where *t* is in seconds, determine its angular velocity when *t = 4 sec*, having started from rest.

6. [Prob. 17-85] Block A has a mass *m* and rests on a rough surface having coefficient of kinetic friction μ_k. Block B has mass *2m*. The pulley may be approximated as a thin disk of radius *r* and mass *0.25m*. The mass of the cable may be neglected. Determine the acceleration of block *A* if block *B* is released.



Prob. 17–55

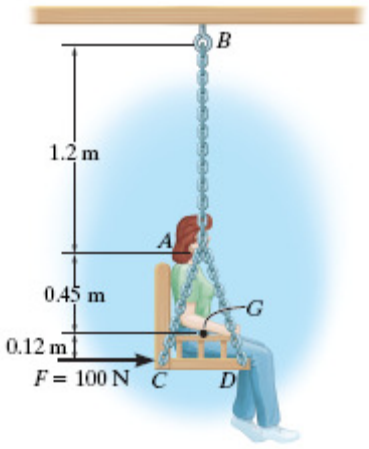


Prob. 17–85

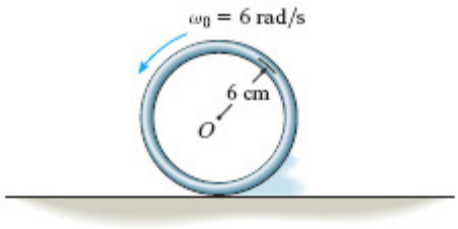
Planar Kinetics: General Plane Motion

7. [Prob. 17-106] The combined mass of the woman and the swing is 100kg and the radius of gyration about the centre of mass G is $k_G = 0.75$ m. A man pushes the swing with a horizontal force F = 100 N. Assuming that the chain segment CAD remains rigid during the motion and the swing is originally at rest, determine the following
   (a) the initial angular acceleration
   (b) the tension in each of the ***two*** supporting chains AB

8. [Prob. 17-108] A 1 kg hoop has an initial angular velocity of 6rad/sec. The kinetic coefficient of friction between the hoop and the surface is $\mu_k = 0.3$. Determine the distance the hoop has travelled before it stops slipping.



Prob. 17–106



Prob. 17–108