9.65 **CP CALC** A disk of radius 25.0 cm is free to turn about an axle perpendicular to it through its center. It has very thin but strong string wrapped around its rim, and the string is attached to a ball that is pulled tangentially away from the rim of the disk (Fig. P9.65). The pull increases in magnitude and produces an acceleration of the ball that obeys the equation \( a(t) = At \), where \( t \) is in seconds and \( A \) is a constant. The cylinder starts from rest, and at the end of the third second, the ball’s acceleration is 1.80 m/s\(^2\). (a) Find \( A \). (b) Express the angular acceleration of the disk as a function of time. (c) How much time after the disk has begun to turn does it reach an angular speed of 15.0 rad/s? (d) Through what angle has the disk turned just as it reaches 15.0 rad/s? (Hint: See Section 2.6.)

Figure P9.65

9.83 The pulley in Fig. P9.83 has radius \( R \) and a moment of inertia \( I \). The rope does not slip over the pulley, and the pulley spins on a frictionless axle. The coefficient of kinetic friction between block \( A \) and the tabletop is \( \mu_k \). The system is released from rest, and block \( B \) descends. Block \( A \) has mass \( m_A \) and block \( B \) has mass \( m_B \). Use energy methods to calculate the speed of block \( B \) as a function of the distance \( d \) that it has descended.

Figure P9.83
10.57  A 50.0-kg grindstone is a solid disk 0.520 m in diameter. You press an ax down on the rim with a normal force of 160 N (Fig. P10.57). The coefficient of kinetic friction between the blade and the stone is 0.60, and there is a constant friction torque of 6.50 N·m between the axle of the stone and its bearings. (a) How much force must be applied tangentially at the end of a crank handle 0.500 m long to bring the stone from rest to 120 rev/min in 9.00 s? (b) After the grindstone attains an angular speed of 120 rev/min, what tangential force at the end of the handle is needed to maintain a constant angular speed of 120 rev/min? (c) How much time does it take the grindstone to come from 120 rev/min to rest if it is acted on by the axle friction alone?

Figure P10.57

10.87  A uniform solid cylinder with mass $M$ and radius $2R$ rests on a horizontal tabletop. A string is attached by a yoke to a frictionless axle through the center of the cylinder so that the cylinder can rotate about the axle. The string runs over a disk-shaped pulley with mass $M$ and radius $R$ that is mounted on a frictionless axle through its center. A block of mass $M$ is suspended from the free end of the string (Fig. P10.87). The string doesn’t slip over the pulley surface, and the cylinder rolls without slipping on the tabletop. Find the magnitude of the acceleration of the block after the system is released from rest.

Figure P10.87