

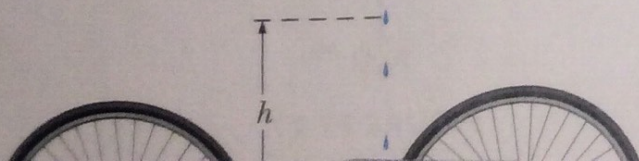
11. Is it possible for a car to move in a circular path in such a way that it has a tangential acceleration but no centripetal acceleration?
12. A satellite in orbit is not truly traveling through a vacuum—it's moving through very thin air. Does the resulting air friction cause the satellite to slow down?
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2. A wheel has a radius of 4.1 m. How far (path length) does a point on the circumference travel if the wheel is rotated through angles of  $30^\circ$ , 30 rad, and 30 rev, respectively?
3. The tires on a new compact car have a diameter of 2.0 ft and are warranted for 60 000 miles. (a) Determine the angle (in radians) through which one of these tires will rotate during the warranty period. (b) How many revolutions of the tire are equivalent to your answer in part (a)?
4. **ecp** A potter's wheel moves uniformly from rest to an angular speed of 1.00 rev/s in 30.0 s. (a) Find its angular acceleration in radians per second per second. (b) Would doubling the angular acceleration during the given period have doubled final angular speed?

## SECTION 7.2 ROTATIONAL MOTION UNDER CONSTANT ANGULAR ACCELERATION

## SECTION 7.3 RELATIONS BETWEEN ANGULAR AND LINEAR QUANTITIES

- A dentist's drill starts from rest. After 3.20 s of constant angular acceleration, it turns at a rate of  $2.51 \times 10^4$  rev/min. (a) Find the drill's angular acceleration. (b) Determine the angle (in radians) through which the drill rotates during this period.
- A centrifuge in a medical laboratory rotates at an angular speed of 3 600 rev/min. When switched off, it rotates through 50.0 revolutions before coming to rest. Find the constant angular acceleration of the centrifuge.
- eCP** A machine part rotates at an angular speed of 0.06 rad/s; its speed is then increased to 2.2 rad/s at an angular acceleration of  $0.70 \text{ rad/s}^2$ . (a) Find the angle through which the part rotates before reaching this final speed. (b) In general, if both the initial and final angular speed are doubled at the same angular acceleration, by what factor is the angular displacement changed? Why? *Hint:* Look at the form of Equation 7.9.
- eCP** A bicycle is turned upside down while its owner repairs a flat tire. A friend spins the other wheel and observes that drops of water fly off tangentially. She measures the heights reached by drops moving vertically (Fig. P7.8). A drop that breaks loose from the tire on one turn rises vertically 54.0 cm above the tangent point. A drop that breaks loose on the next turn rises 51.0 cm above the tangent point. The radius of the wheel is 0.381 m. (a) Why does the first drop rise higher than the second drop? (b) Neglecting air friction and using only the observed heights and the radius of the wheel, find the wheel's angular acceleration (assuming it to be constant).



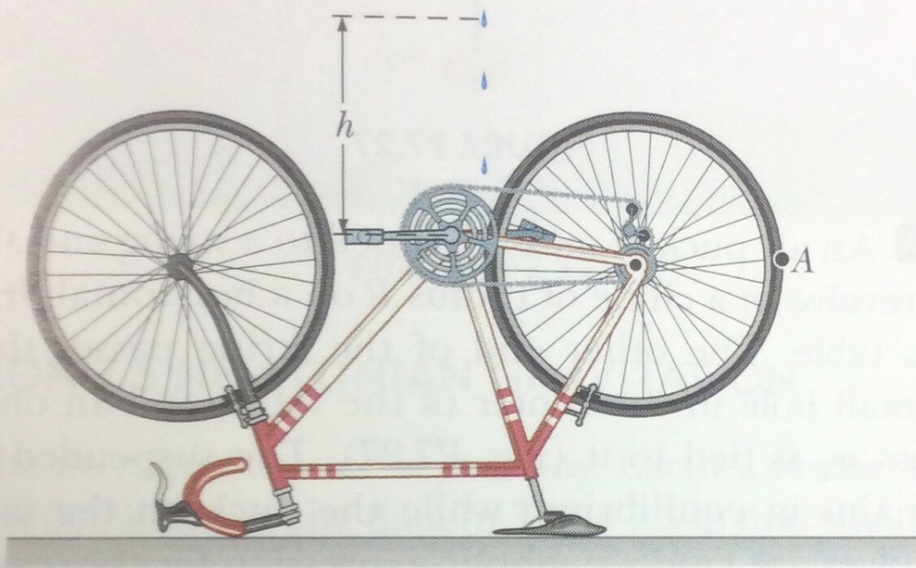
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## SECTION 7.4 CENT

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P7.8). A drop that breaks loose from the tire on one turn rises vertically 54.0 cm above the tangent point. A drop that breaks loose on the next turn rises 51.0 cm above the tangent point. The radius of the wheel is 0.381 m. (a) Why does the first drop rise higher than the second drop? (b) Neglecting air friction and using only the observed heights and the radius of the wheel, find the wheel's angular acceleration (assuming it to be constant).



**FIGURE P7.8** Problems 8 and 69.

9. The diameters of the main rotor and tail rotor of a single-engine helicopter are 7.60 m and 1.02 m, respectively. The respective rotational speeds are 450 rev/min and 4138 rev/min. Calculate the speeds of the tips of both rotors. Compare these speeds with the speed of sound, 343 m/s.
10. The tub of a washer goes into its spin-dry cycle, starting from rest and reaching an angular speed of 5.0 rev/s in 8.0 s. At this point, the person doing the laundry opens the lid, and a safety switch turns off the washer. The tub slows to rest in 12.0 s. Through how many revolutions

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does the tub turn during the entire 20-s interval? Assume constant angular acceleration while it is starting and stopping.

11. A car initially traveling at 29.0 m/s undergoes a constant negative acceleration of magnitude  $1.75 \text{ m/s}^2$  after its brakes are applied. (a) How many revolutions does each tire make before the car comes to a stop, assuming the car does not skid and the tires have radii of 0.330 m? (b) What is the angular speed of the wheels when the car has traveled half the total distance?
12. A 45.0-cm diameter disk rotates with a constant angular acceleration of  $2.50 \text{ rad/s}^2$ . It starts from rest at  $t = 0$ , and a line drawn from the center of the disk to a point  $P$  on the rim of the disk makes an angle of  $57.3^\circ$  with the positive  $x$ -axis at this time. At  $t = 2.30 \text{ s}$ , find (a) the angular speed of the wheel, (b) the linear velocity and tangential acceleration of  $P$ , and (c) the position of  $P$  (in degrees, with respect to the positive  $x$ -axis).
13. A rotating wheel requires 3.00 s to rotate 37.0 revolutions. Its angular velocity at the end of the 3.00-s interval is  $98.0 \text{ rad/s}$ . What is the constant angular acceleration of