Angular Kinematics problems from 8.1

Tangential Relationships: $s = \theta r, \ v = \omega r, \ a = \alpha r$

1. A 0.0760 m <u>diameter</u> (76 mm) skateboard wheel rolls through 137 rotations. What linear distance did it travel? (32.7 m)
2. What is the angular acceleration of a 0.630 m <u>diameter</u> bicycle wheel if it is accelerating linearly at 8.20 m/s/s? (26.0 rad/s/s)
3. A 0.0660 m diameter skateboard wheel travels 12.0 m. How many rotations does it go through? (57.9 rotations)
4. A 0.650 m <u>diameter</u> wheel accelerates at 1.54 rad/s/s. What is the tangential acceleration of the edge? (0.5005 m/s/s)
5. A wheel goes through 143 rotations when it rolls linearly 14.2 m. What is the radius of the wheel? (0.0158 m)

Tangential Relationships with unit conversions: **1 rev or rot = 2π radians, 1 minute = 60 seconds**

6. What is the linear velocity 0.120 m from the center of a grinding disk spinning at 1450 RPM? (18.2 m/s)
7. What is the angular velocity of a 0.920 m radius aircraft tire in <u>rotations/second</u> when it is has a linear velocity of 48.0 m/s? (8.30 rot/s)
8. A merry go round spins at 0.590 rotations/second. What is the tangential velocity 1.80 m from the center? (6.67 m/s)
9. A 0.940 m diameter wheel has a tangential velocity at its edge of 25.0 m/s. What is its angular velocity in RPM? (508 RPM)
10. A hard drive spins at 7200 RPM. What distance from the center has a tangential velocity of 12.0 m/s? (0.0159 m)

Simple Rotational kinematics: $v = u + at, \ s = (u+v)t/2, \ v^2 = u^2 + 2as, \ s = ut + \frac{1}{2}at^2$

11. A drill going 98.0 rad/s decelerates at -1.20 rad/s/s for 15.0 s. What is the final angular velocity in rad/s? (80.0 rad/s)
12. A drill speeds up from rest to 156 rad/s in 5.70 s. Through what angle in radians does it go? (445 rad)
13. A drill goes through 132 radians in 8.80 s slowing to rest. What was its initial angular velocity in rad/s? (30.0 rad/s)
14. A drill speeds up from 11.0 rad/s to 35.0 rad/s in 184 radians. What is its angular acceleration? (3.00 rad/s/s)
15. A drill goes through 526 radians accelerating at 2.58 rad/s/s from rest. What is its final angular velocity in rad/s? (52.1 rad/s)

Rotational Kinematics with unit conversions:

16. A motor speeds up from 1350. RPM with an angular acceleration of 2.90 rad/s/s for 19.0 seconds. Through what angle in radians does it rotate? (3210 rad)
17. A car tire initially rotating at 37.0 rotations per second slows down through 148 rotations in 5.20 seconds. What is its final angular velocity in rotations per second? (19.9 rot/s)
18. A drill speeds up from 680. RPM to 1540 RPM with an acceleration of 1.80 rad/s/s. How many rotations does it go through? (926 rotations)
19. A skateboard wheel speeds up from 5.30 rotations/sec to 12.0 rotations/s in 9.00 seconds. What is the angular acceleration in rad/s/s? (4.68 rad/s/s)
20. A turntable accelerates at 0.835 rad/s/s from rest to 33.3 RPM. What is its angular displacement in radians? (7.28 rad)

Rotational Kinematics with tangential relationships:

21. A car with 0.340 m radius tires going 19.2 m/s decelerates at 1.20 m/s/s for 2.30 s. What is the final angular velocity of the tires? (48.4 rad/s)
22. A car with 0.840 m diameter wheels accelerates from rest with an acceleration of 6.40 m/s/s for 3.50 seconds. Through what angle in radians do the wheels go? (93.3 radians)
23. A 0.110 m radius ball going 5.80 m/s rolls to a stop in 9.70 seconds. What was the angular acceleration of the ball in rad/s/s? (-5.44 rad/s/s)
24. A 0.360 m radius car tire goes from 12.5 rad/s to 36.8 rad/s with a linear acceleration of 3.90 m/s/s. What linear distance does the car travel? (19.9 m)
25. A 0.125 m radius grinding wheel speeds up from 142 rad/s to 259 rad/s in 13.0 s. Through what distance does a point in the edge of the wheel travel in this time? (326 m)