Rotational Kinematics: *It’s Enough to Make Your Head Spin!*

1. A wheel rotates 3.00 times. What is its angular displacement?
2. If a 30.0 cm radius wheel rotates through 3.0 radians how far has it rolled?
3. What is the angular displacement of the minute hand on a clock during a 30.0-minute interval.
4. Three hours pass by. What is the angular displacement of the Hour hand on the clock during this interval?
5. A carnival ride rotates through 4.0 radians of angular displacement. If the ride has a diameter of 4.0 meters, what is the path length that the passengers have moved in this time?
6. A merry-go-round rotates 10 complete revolutions. What path length has the passenger moved through if they are seated 2.0 meters from the ride’s center?
7. Through how many radians has a 40.0 cm radius wheel rotated through if it has traveled 10.0 meters?
8. A motor runs at 1200 rpm. What is the angular speed of the motor?
9. A wheel is observed to rotate 5 complete revolutions in 25 seconds. What is its angular speed?
10. What is the angular speed of the minute hand of any clock?
11. What is the **tangential velocity** of a point at the equator of the earth? (radius of earth = 6.37 x 106 meters)
12. What is the **angular velocity** of a point at the equator of the earth? (radius of earth = 6.37 x 106 meters)
13. An automobile wheel rotates at 5.0x102 rpm.
    1. If the wheel has a diameter of 1.0 meter, what is the velocity (m/s) of the automobile?
    2. If the wheel is underinflated, its diameter is only 0.90 meters and rotates at the same speed. What velocity will the car have?
14. In order to travel at 20.0 m/s what angular speed must your tires have if your tires have a 0.80 m radius?
15. A cyclist traveling at 5.0 m/s uniformly accelerates up to 10.0 m/s in 2.0 seconds. Each tire of the bike has a 35 cm radius, and a small pebble is caught in the tread of one of them. What is the angular acceleration of the pebble during those two seconds?
16. A flywheel speeds up uniformly from rest to 900.0 rpm in 2.0 minutes.
    1. Find the **angular** acceleration.
    2. Find the **tangential** acceleration of the rim if the flywheel has a 0.50 m radius.
17. A CD player spins at 8590 rpm. If it starts from rest and has an acceleration of 450 rad/s2, how long does it take to reach full speed?
18. A turntable is initially rotating at 0.40rad/s. The turn table then undergoes an angular acceleration of 0.085rad/s2 for 4.0s. Through what angle does the table rotate in this time?
19. A turntable is initially rotating at 0.40rad/s. The turn table then undergoes an angular acceleration of 0.085rad/s2 for 4.0s. Through what distance does a point 12.0cm from the center of the table travel in this time?
20. A car accelerates around a circular track. The track has a radius of 25.0m. The car starts at rest and accelerates to 20.0m/s in 8.00s.

a. Find the cars angular acceleration.

b. Find the cars tangential acceleration.

c. Find the cars centripetal acceleration at t=8.00s.

Answers:

1. 1080o or 18.8 rads
2. 0.90m
3. π radians, 3.14radians
4. 1.57 radians
5. 8.0 m
6. 130 m
7. 25.0 radians
8. 126 rad/s
9. 1.3 rad/s
10. 0.0017 rad/s
11. 4.64 x 102 m/s
12. 7.27 x 10-5 rad/s
13. a. 26 m/s b. 24 m/s
14. 25 rad/s
15. 7.14 rad/s2
16. a. 0.79 rad/s2 b. 0.39 m/s2
17. 2.0 s
18. 2.3rad
19. 0.27m
20. a. 0.10rad/s2 b. 2.5m/s2 c.16m/s2