Rotational Kinematics Worksheet 1

1. The radius of the Earth is 6371km and it completes one rotation every 24 hours.
   1. What is the ∆θ in degrees and radians that the earth moves in 1 hour?
   2. What is the Earth’s angular velocity (ω) in degrees/hour?
   3. What tangential velocity (m/s) does an object have at the equator?
2. A traditional watch has three hands: an hour hand, a minute hand, and a second hand. Determine the angular velocity (ω) in degrees per second for each hand.
3. A 0.5-meter diameter bicycle wheel is rotating at 60 rpm.
   1. What is its initial angular speed in radians per second?
   2. What is the tangential velocity in m/s of a point on the rim of the wheel?
   3. If the bicycle wheel accelerates at a rate of 1rad/sec2, what is the new tangential velocity of a point on the rim of the wheel after thirty seconds?
4. Imagine a Ferris wheel that is rotating at the rate of 45 degrees each second.
   1. What is the Ferris wheel’s period of rotation in seconds?
   2. What is the angular velocity in rotations per minute (rpm)?
   3. What is the angular velocity in radians per second?
   4. If the tangential velocity of one of the cars is 7.85 m/s, how far (in meters) is it located from the center (axis of rotation)?
5. The second hand of a watch rotates at a constant angular velocity (ω) of 0.105 radians/sec.’
   1. What is the angular displacement (∆θ) in radians and degrees after 90 seconds?
   2. How many rotations did the second hand undergo?
6. Wheel of Misfortune. In a popular game show, contestants give the wheel a spin and try to win money and prizes! The wheel is given a rotational velocity and this rotation slows down over time and the wheel eventually stops. One contestant gives the wheel an initial angular velocity (ωi) of 1 revolution every two seconds. Because of friction, the wheel eventually comes to rest (ωf = 0 radians/sec) in 6 seconds.
   1. Because the wheel’s angular velocity is changing, we must have an angular acceleration. Calculate, α, the angular acceleration in radians/s2.
   2. Why is the angular acceleration you found in part (a) a negative value? What does the negative sign physically mean for the wheel?
   3. How many radians (Δθ or θf – θi) did the wheel “sweep” out as it was slowing down to a stop?
   4. Convert this Δθ you found in the previous answer from radians to rotations.
   5. The wheel stop rotating in 6 seconds. So at t = 3 seconds, it is still rotating. Calculate the ω in radians per second at this time.