Rotational Motion Worksheet

1. A girl sits on a merry-go-round at a distance of 1.5 m from the center. If the girl moves through an arc length of 2.5 m, through what angular displacement does she move?

2. A beetle sits at the top of a bicycle wheel with a diameter of 0.75 m. Assuming the wheel turns counterclockwise, what is the angular displacement of the beetle before it is squashed under that wheel? What arc length does the beetle travel through before it is squashed?

3. A car tire rotates counterclockwise 3.5 times during a time interval of 0.75 s. What is the angular speed of the tire?

4. A girl ties a toy airplane to the end of a string and swings it around her head. What is the plane's angular speed if the plane moves through an angular displacement of 3.3 rad during 1.5 s?

5. A figure skater begins spinning counterclockwise at an angular speed of 4.0π rad/s. During a 3.0 s interval, she slowly pulls her arms inward and finally spins at 8.00π rad/s. What is her average angular acceleration during this time interval?

6. What angular acceleration is necessary to increase the angular speed of a fan blade from 8.5 rad/s to 15.4 rad/s in 5.2 s?

7. A diver performing a double somersault spins at an angular speed of 4.00π rad/s precisely 0.50 s after leaving the platform. Assuming the diver begins with zero initial angular speed and accelerates at a constant rate, what is the diver's angular acceleration during the double somersault?

8. A fish swimming behind an oil tanker gets caught in a whirlpool created by the ship's propellers. The fish has an angular speed of 1.0 rad/s. If the water in the whirlpool accelerates at a constant rate of 3.0 rad/s^2, what will the fish's instantaneous angular speed be 4.5 s later?

9. A remote-controlled car's wheel accelerates at 22.4 rad/s^2. If the wheel begins with an angular speed of 10.8 rad/s, what is the wheel's angular speed after exactly 3 full turns?

10. How long does the wheel in #9 take to make the three turns?

11. A bicyclist rides along a circular track. If the bicyclist travels around exactly half the track in 10.0 s, what is his average angular speed?

12. Find the angular acceleration of a spinning amusement-park ride that initially travels at 0.50 rad/s then accelerates to 0.60 rad/s during a 0.50 s time interval.

13. What is the instantaneous angular speed of a spinning amusement-park ride that accelerates from 0.50 rad/s at a constant angular acceleration of 0.20 rad/s^2 for 1.0 s?