Rotational motion

Physics 211
Syracuse University, Physics 211 Spring 2015
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April 20, 2016

Announcements

- Homework due Friday
- Office hours today 1:30-4 (that's as long as I can extend them, sorry)
- Bring grade appeals to me in person at office hours, or put them in my mailbox with the form
- Last homework is posted
- Practice exam for Exam 3 will be posted Friday

Rotational motion problems

All these problems can be approached in the same way:

- Write down an "extended free-body diagram" (force diagram with locations of forces labelled) for each object
- Write down $\vec{F} = m\vec{a}$ and $\tau = I\alpha$ separately for each object, creating a large system of equations
- Think about the constraints that you have: do the accelerations relate to each other?
- Solve the system

How do the gears on a bike work?

For a given angular velocity of the rear tire:

- If the rear sprocket is smaller, then the rear tire turns faster
- If the rear sprocket is smaller, then a greater force is required on the pedals
- The angular velocities of the pedals and the rear wheel are *not* equal

Sample problem 1

A mass m is hung from a spool with moment of inertia I. The radius of the spool where the string connects is r. What is the acceleration of the hanging mass?

Sample problem 2

A pulley of mass m_1 (and moment of inertia $\lambda m_1 r^2$ – let's leave its shape as an unknown for now!) has masses m_2 and m_3 hanging on either side of it.

What are the accelerations of the objects? **Note:** The two tensions now are not necessarily equal!