

DAY 13

Homework Assignment (see syllabus for homework collection information)

1. From http://whatis.techtarget.com/definition/0,,sid9_gci211759,00.html:

Format of the CD-ROM is the same as for audio CDs: a standard CD is 120 mm (4.75 inches) in diameter and 1.2 mm (0.05 inches) thick and is composed of a polycarbonate plastic substrate (underlayer - this is the main body of the disc), one or more thin reflective metal (usually aluminum) layers, and a lacquer coating.

Constant Linear Velocity (CLV) is the principle by which data is read from a CD-ROM. This principle states that the read head must interact with the data track at a constant rate, whether it is accessing data from the inner or outermost portions of the disc. This is affected by varying the rotation speed of the disc, from 500 rpm at the center, to 200 rpm at the outside. In a music CD, data is read sequentially, so rotation speed is not an issue. The CD-ROM, on the other hand, must read in random patterns, which necessitates constantly shifting rotation speeds. Pauses in the read function are audible, and some of the faster drives can be quite noisy because of it.

Calculate what the CLV is in mm/s for a CD-ROM with the specifications given here. If data is written all the way to the outer edge of the CD-ROM, how far in does the data extend? If the CD-ROM is to be able to read data from the inner edge of the disk, and then from the outer edge, with no more than a 2 second delay, what angular acceleration must be generated by the CD-ROM drive? How many times will the CD-ROM revolve in that 2 seconds?

2. Finish Day 12 Example #3.
3. A cord is wrapped around a pulley that measures 10 cm in diameter and has mass 2 kg. The other end of the cord is tied to a 1 kg mass. Find the acceleration of the mass.
4. Consider an old-fashioned water well.

A bucket is lowered into the water and then cranked up by means of a bucket, rope, and drum. The bucket weighs 6 lbs. The drum is a cylinder 3 ft long, consisting of 2" thick oak planks nailed onto two 2" thick oak disks that are 16 inches in diameter. The water lies 25 feet below the bucket.

If the bucket is allowed to drop into the well, unspooling the rope as it goes, how long will it take to reach the water?



5. A kid turns his bike upside down and spins the tire at 2 revolutions per second. The spoked wheel measures 26 inches in diameter and weighs 5 lbs. The kid presses a piece of metal against the rubber tire to bring it to a halt. About how long will it take to bring the wheel to a halt if the kid presses with a force of 10 lb?

6. The USS Constitution's largest anchor weighed 5443 lbs. The capstan was a drum that measured roughly 4 ft in diameter. Twelve poles, each about 12 feet long, could be stuck into the capstan. Sailors pushed on the poles, winding the anchor rope around the capstan and raising the anchor. Assume half the torque generated is lost to friction and slippage. How much force must be applied to each pole to raise the anchor? How many sailors do you think would have to man each pole?



<http://www.ussconstitution.navy.mil/capstan.html>
<http://www.tallshiprose.org/info/tour/quicktour/capstan.html>

7. A merry-go-round (a piece of playground equipment for those not familiar with them) consists of a disk 10 ft in diameter that weighs 250 lbs. The disk turns on a low-friction bearing.



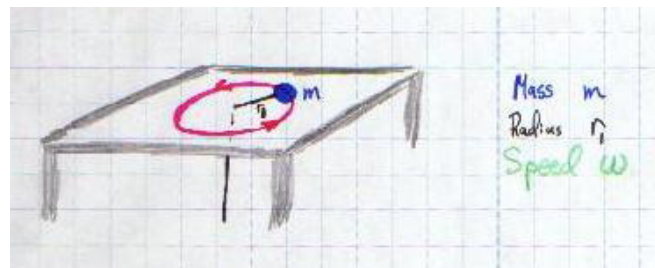
<http://animationfactory.fortunecity.com/>



<http://shop.store.yahoo.com/educationworks/allsteelmerg.html>

A kid who weighs 100 lbs sits on the edge of the merry-go-round. The merry-go-round is turning at 1 rev every 3 seconds. If the kid moves to the center of the merry-go-round, how fast will the merry-go-round be turning?

8. A mass m is whirling in circle of radius r_1 on the end of a string as shown. The angular speed of the mass is ω . The mass slides on the table with little friction. The string passes through a hole in the table. The string is pulled down through the hole, shortening the radius to r_2 . How much work is done? Give your answer in terms of m , r_1 , r_2 and ω .



9. **PHY 231 ONLY**

The triangular plate shown has a thickness of 0.5 cm and a density of 7 g/cm^3 . What is the moment of inertia of this plate if it is rotated about an axle running vertically up its right side?

