**Do 5 out of the 6 problems. You will be graded on your _COMMUNICATION_** of physics understanding

#1 I drop into a smooth half pipe with a radius of 15 m. I have a bathroom scale between my feet and my skateboard. If I have a mass of 100 kg, what force will the scale indicate when I am riding through the bottom of the half pipe on my way to the other edge? Clearly explain your reasoning. *You need two lenses to solve this. Did you get both of them? Now just for fun… would you like to solve this with less than 4 lines of math? Try not putting in any numbers until the final substitution step. You'll find most of the values cancel and you should be able to solve this problem in a very short time if you know where you're going.*

15 m
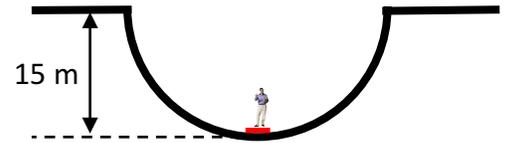
#2 I have two identical uniform disks, but one got run over by a steamroller and is flattened to twice its original radius. I weld identical axels through the middle of them and wind them up on the same length of string. I let them fall. As the disks fall and unroll, which string has the larger tension, or are they same? why? Please explain your reasoning thoroughly. You can solve this with a variety of different lenses. Can you do it by more than one method? Given a disc of radius R, mass m, and axle of radius, r, can you find the expression for the acceleration of the wheel and the tension in the string?
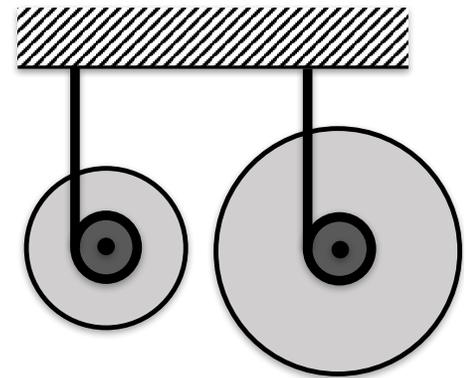
#3 A satellite is in a circular orbit around a planet, and then it is moved to a higher orbit, three times as far from the planet's center: $R \Rightarrow 3R_o$ *Clearly Explain Both Answers Below.*

a) By what factor did the gravitational attraction to the planet change: $F \Rightarrow \_\_\_F_o$

b) By what factor did the satellite's speed change: $v \Rightarrow \_\_\_v_o$

Identify lenses. Does your answer make sense?

#4 The system at right is composed of three masses, and lightweight, low friction string; but a coefficient of 0.4 exists between the 2 kg mass and the underlying surface. Find the acceleration or the speed after the system moves 1m, but you don't have to find both. Can you solve this method by different methods? Can you find the tension in the two strings... just for fun and practice?
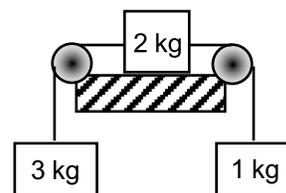
#5 A playground carousel is a 100 kg uniform flat disk (r = 2 m), freely rotating at $\omega = 1/s$. I am at rest and also have a mass of 100 kg. I step onto the disk and hang onto handles on the edge.

a) Estimate the new rotational velocity of the carousel with me on it.
b) Then I struggle my way to the center of the carousel and stand straight and tall in the middle. Estimate the new rotational velocity of the carousel with me on it.
c) Describe any changes to the kinetic energy of the rotating system during the above process.
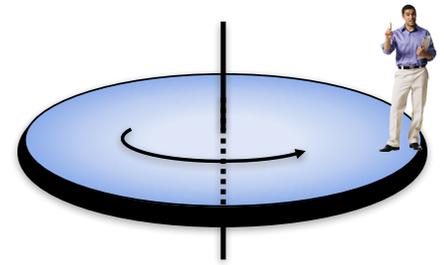
What does it mean to be "freely rotating"? Can work be done on a system if there is no outside forces?

#6 A uniform plank ***has a mass of 20 kg***, is 10 m long, and is supporting a 10 kg hanging mass as shown. The supporting structures (A and B) are bolted onto the plank and are located 1 m and 2 m from the right edge where the 10 kg mass is fixed. Find the forces (*and include direction*) that each support supplies. Make sure you recognize that the plank has mass. Additionally, consider in your brain, what should be the direction of the forces provided by A and B.

$F_A =$ _____(state force and direction)

$F_B =$ _____ (state force and direction)

Name _____