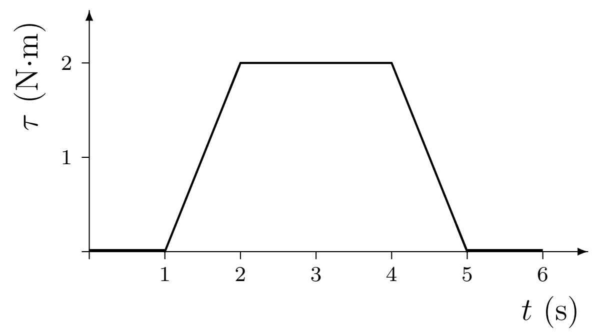
Practice 2; Phys 185 Name ________________

1. (0 points) You decide to spin up a merry-go-round platform from rest by bringing it into contact with a rotating motorcycle wheel. You find that the torque applied by the motorcycle varies in time according to the following graph. The platform is a disk ($I = \frac{1}{2}MR^2$), with radius 1.35 m and mass 118 kg. Assume the platform rotates without friction in its central shaft. Find the angular velocity of the platform after the motorcycle wheel ceases contact.

Note: This is the angular analogue of something you know how to do with *linear* momentum, force, velocity etc. Recall that all we did with force-time curves and change of momentum was just another way of expressing what is in $\sum \vec{F} = \frac{d}{dt}\vec{p}$. The angular analogue of that equation is $\sum \tau = \frac{d}{dt}L$, with L the *angular* momentum. So if you follow the same reasoning with angular quantities, you will get what you want.



2. (0 points) You have two identical-looking cylinders, with the same mass m and radius r. Cylinder 1 has a moment of inertia $I_1 = mr^2$, while cylinder 2 has $I_2 = kmr^2$, with k an unknown constant. You let them go from rest from the exact same height on an inclined plane, and let them roll without slipping. When they reach the bottom of the incline, you measure their center-of-mass speeds, finding $v_1 = 0.94\,v_2$. What is k?

3. (0 points) For the following, look up any astronomical data you need.

(a) About where is the axis of rotation of our solar system located? Is this exact, or an approximation? Explain.

(b) Calculate the moments of inertia of the Sun, Earth, and Jupiter around this axis. Be explicit about what approximations you are using to get the moment of inertia for each.

(c) Calculate the angular momentum of the Sun, Earth, and Jupiter. (The Sun's period of rotation around its own axis is 24.5 days.) Add all these angular momenta together to get a total, and state what percentage of this total is associated with each.

4. (0 points) The Earth is in orbit around the sun, and you can calculate its speed v_E at any moment. A comet with mass $m = 0.001m_E$ and speed v but going in the exact opposite direction approaches the Earth.

(a) Say the comet collides head-on with the Earth. Assume no significant material gets ejected into space. What must v be to produce a 1% change in the speed of the Earth?

(b) Say the comet misses the Earth entirely, but interacts with Earth's gravity so that it gets a "slingshot" so that it ends up going straight back in the direction it came from. If there is, again, a 1% reduction in the speed of the Earth, what must the initial and final speeds of the comet be?