

Name \_\_\_\_\_

U5: Homework Questions #1

*Rotational Kinematics and Moment of Inertia*

1. A bar on a hinge starts from rest and rotates with an angular acceleration  $\alpha = (14 + 5t)$  rad/s<sup>2</sup>, where  $t$  is in seconds. Determine the angle in radians through which the bar turns in the first 4.09 s.

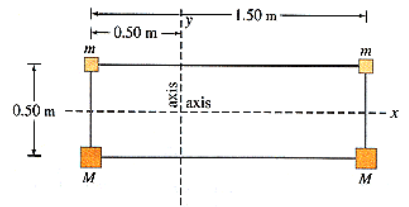
rad

2. A centrifuge in a medical laboratory rotates at an angular speed of 3450 rev/min. When switched off, it rotates 48.0 times before coming to rest. Find the constant angular acceleration of the centrifuge.

rad/s<sup>2</sup>

3. A rotating wheel requires 3.03 s to rotate through 37.0 revolutions. Its angular speed at the end of the 3.03 s interval is 97.9 rad/s. What is the constant angular acceleration of the wheel?

rad/s<sup>2</sup>



4. In the figure to the right:  $m = 1.8$  kg and  $M = 3.3$  kg.

(a) Calculate the moment of inertia of the array of point objects shown above about the vertical axis.

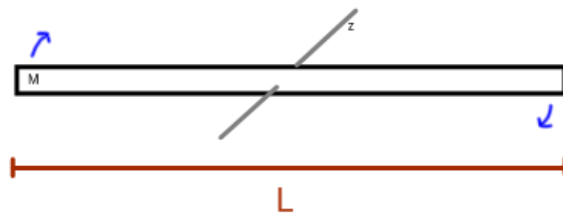
kg·m<sup>2</sup>

(b) Calculate the moment of inertia of the array of point objects shown above about the horizontal axis.

kg·m<sup>2</sup>

5. A rigid rod of length  $L$  and mass  $M$  rotates about its center of mass ( $z$  axis in picture). Prove that the moment of inertia for the rod is:

$$I = (1/12)ML^2$$



6. A solid cylinder rotates about an axis that lies directly through its center. Prove that the moment of inertia of this cylinder  $I$  is equal to:

$$I = \frac{1}{2}MR^2$$

\*A Hint:

\*With the bar examples, we looked at the ratio  $dm/dr$ . Here, think about starting with a ratio of  $dm/dV$  and trying to get it back to  $dr$ .

- "V" is volume

