

Name: _____

**AP Physics 1: Rotational Motion
Moment of Inertia and Torque**

Conceptual Question:

1. Why do tightrope walkers carry a long, narrow beam?

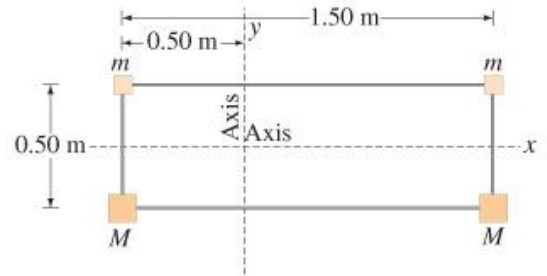
Mathematical Questions:

Moment of Inertia:

2. Calculate the moment of inertia of the array of objects shown below. Assume that $m = 1.80 \text{ kg}$ and $M = 3.1 \text{ kg}$. The objects are connected together on a rectangular piece of wire. The wire is split by a vertical and horizontal axis.

Hint: Consider the general equation for moment of inertia

- A. What is the moment of inertia in regards to the horizontal axis?
- B. What is the moment of inertia in regards to the vertical axis?
- C. Which axis makes the rectangular harder to rotate from rest?



3. A softball player swings a bat, accelerating it from rest to 3.0 rev/s in a time of 0.20 s . Approximate the bat as a 2.20 kg uniform rod of length 0.95 m . What is the torque the player applies to one end of it during the swing?

4. A centrifuge rotor rotating at 13,000 rpms is shut off and eventually brought uniformly to rest by a frictional torque of $1.20 \text{ m} \cdot \text{N}$. If the mass of the rotor is 4.80 kg and it can be approximated as a solid cylinder of radius 0.0710 m, through how many revolutions will the rotor turn before coming to rest?

5. A helicopter rotor blade can be considered a long thin rod, as shown below.
- If each of the three rotor blades is 3.75 m long and has a mass of 160 kg, calculate the moment of inertia of the three rotor blades about the axis of rotation.
 - How much torque must the motor apply to bring the blades up to a speed of 5.0 rev/s in 8.0 s?

