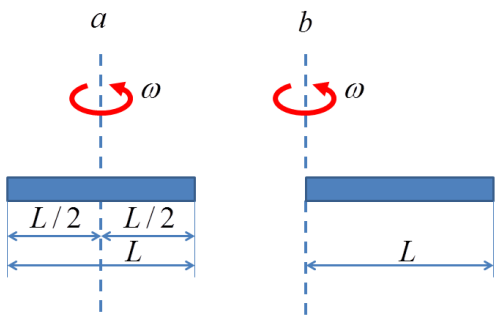
Physics 2314, Midterm III (4/4)

M1 Two identical rods are rotating with the same angular speed about axes a and b as shown below. What is the ratio of their kinetic energies K_a/K_b?

A. 1/4
B. 1/3
C. 1/2
D. 1
E. 2
F. 3
G. 4



M2 A toy airplane hangs from the ceiling at the bottom end of a string. You turn the airplane many times to wind up the string clockwise and release it. The airplane starts to spin counterclockwise, slowly at first and then faster and faster. Take counterclockwise as the positive sense and assume friction is negligible.

(a) When the string is entirely unwound, the airplane has its maximum rate of rotation. At this moment, its angular acceleration is

A. positive.
B. zero.
C. negative.

(b) The airplane continues to spin, winding the string counterclockwise as it slows down. At the moment it momentarily stops, its angular acceleration is

A. positive.
B. zero.
C. negative.

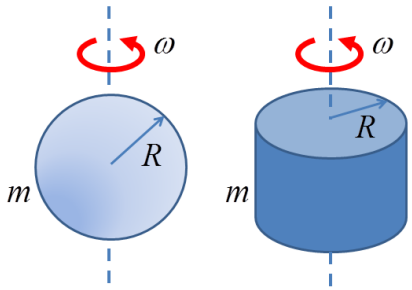
M3 A solid sphere and a solid cylinder have the same mass and radius. They are rotating with the same angular speed as shown below. Which one has the higher angular momentum?

A. The sphere.

B. The cylinder.

C. Their angular momenta are the same.

D. It is impossible to determine.



M4 An object is rotating about the z axis. Its angular position is given by the equation $\theta = (1 + t)^2$, where t is in seconds, and θ is in radians. Which of the following statements is true?

A. It is rotation with constant angular velocity.

B. It is rotation with constant angular acceleration.

C. Nether angular velocity nor angular acceleration is constant.

P1 An object is rotating with a constant angular acceleration 0.1 rad/s^2. After 10 revolutions, its angular speed increases by a factor of 2. What is the angular speed of the object at this moment?

P2 A solid sphere has a radius of 0.2 m and a mass of 1 kg. Find its moment of inertia about an axis displaced by 0.01 m with respect to the center of the sphere.

P3 A particle with mass 0.1 kg is moving in the xy plane. Its position as a function of time is given by

$$\mathbf{r} = t\mathbf{i} + t^2\mathbf{j}$$

where $\mathbf{r}$ is in meters and t is in seconds. Find the angular momentum of the particle at $t = 1$ s.

P4 A conical pendulum consists of a ball of mass 0.1 kg suspended from a string of length 0.196 m. If the angular speed of the ball is 10 rad/s, find the angular momentum of the ball about the vertical dashed line.