Question 1 (2 points)
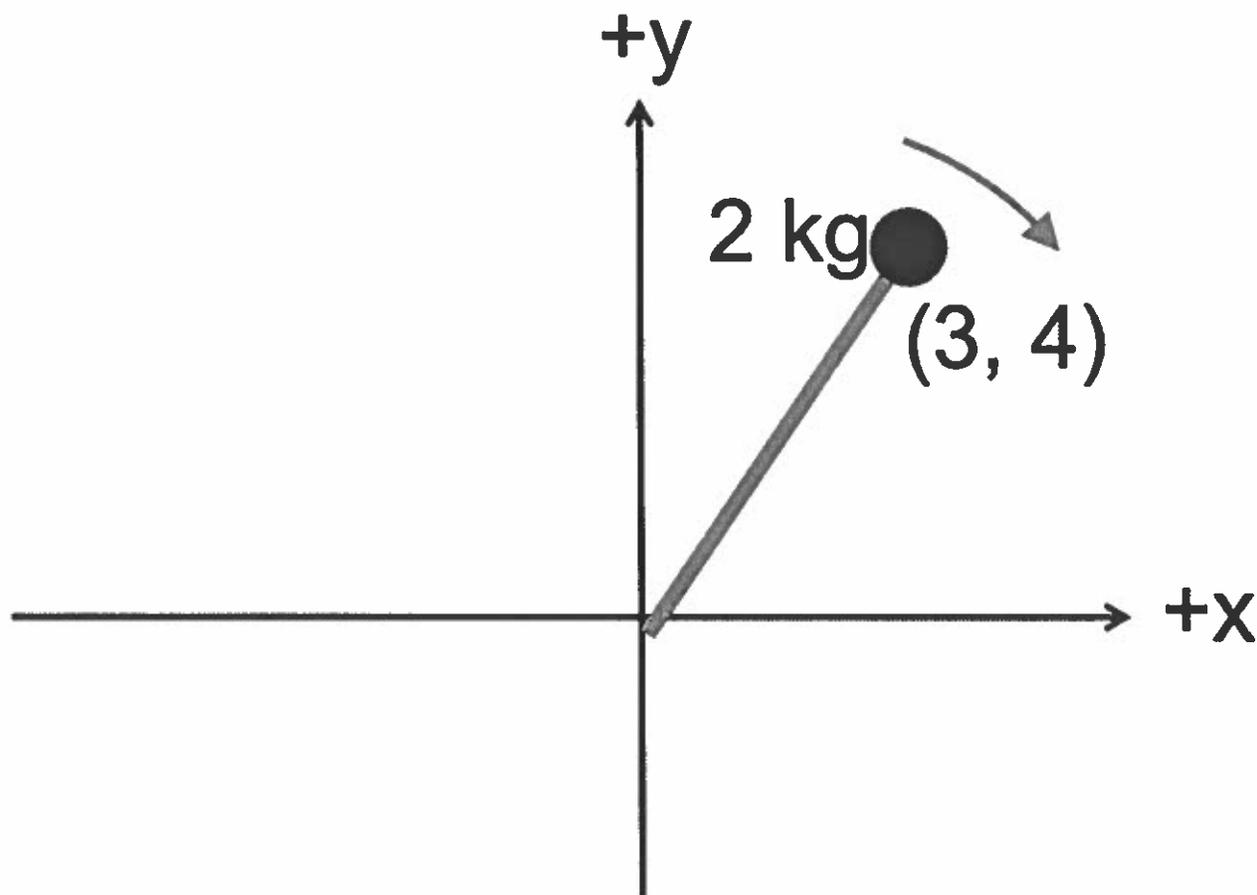
A particle of mass 2 kg is located at (3,4) m in the *xy* plane. It is made to rotate about an axis that lies along the z axis and passes through the origin, so it rotates in the xy plane as shown. What is the MOI of the 2 kg particle?

○ (18 kgm², 32 kgm²)

○ 18 kgm²

○ 32 kgm²

○ 50 kgm²

Question 2 (2 points)

Consider a uniform thin rod of length L and mass M rotated about an axis perpendicular to the rod and passing through the center. The MOI of this is $1/12\ ML^2$:

Now consider a uniform thin rod of length L and mass M rotated about an axis perpendicular to the rod and passing a point L/4 from left end. Use the parallel axis theorem to calculate the moment of inertia of the rod about this axis?
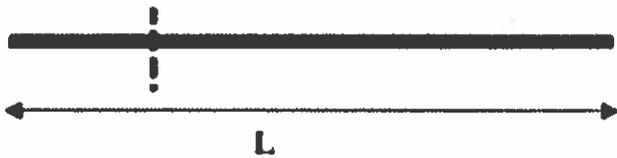
○ 1/12 ML^2

○ 7/48 ML^2

○ 1/3 ML^2

○ 1/9 ML^2

○ 3/24 ML^2

Questions to help prepare you for Part 2 of Module 11

Question 3 (2 points)

Calculus Review:

Consider the integral used to calculate impulse,

$$\vec{J} = \int \vec{F}\,dt.$$

What are the SI units of dt?

○ Meters, since we always integrate with respect to position.

○ Seconds, since dt is just a tiny bit of time.

○ Newtons, because it is an impulse integral.

○ No units— dt is just a calculus placeholder.

Question 4 (2 points)

Calculus Review:

Consider the integral used to calculate work in one dimension,

$$W = \int F \, dx.$$

What are the SI units of dx?

○ Seconds, since we always integrate with respect to time.

○ Meters, since dx is just a tiny little length

○ Joules, because it is a work integral.

○ No units— dx is just a calculus placeholder.

Question 5 (2 points)

Calculus Review:

An integral can be understood as...

○ The sum of all the very tiny elements in the integral.

○ The slopes of all the very tiny elements in the integral.

○ The change in time of all the very tiny elements in the integral.

Question 6 (2 points)

Density Review:

Say you have a 3D object with total volume V and a uniform mass density given by ρ. How would you get the mass of this object?

○ $$m = \frac{\rho}{V}$$

○ $$m = \frac{V}{\rho}$$

○ $$m = \frac{1}{\rho V}$$

○ $$m = \rho V$$

Question 7 (2 points)

Density Review:

Say you have a 2D object (like a piece of paper) with total surface area A and a uniform "areal mass density" (which is mass per area) given by σ. How would you get the mass of this object?

○ $$m = \frac{\sigma}{A}$$

○ $$m = \frac{A}{\sigma}$$

○ $$m = \sigma A$$

○ None of the above

Question 8 (2 points)

Density Review:

Say you have a 1D object (like a long rod or string) with total length L and a uniform "linear mass density" (which is mass per length) given by λ. How would you get the mass of this object?

○

$$m = \frac{\lambda}{L}$$

○

$$m = \frac{L}{\lambda}$$

○

$$m = \lambda L^2$$

○

$$m = \lambda L$$

Question 9 (2 points)

Density review, combined with calculus review:

Say you have long rod of length L, and it has some "linear mass density" (which is mass per length) given by λ.

You cut your rod into tiny little bits of length, which each has some tiny length dx.

What is the mass of one tiny piece of the rod?

○

$$\text{tiny mass} = dm = \frac{\lambda}{L}$$

○

$$\text{tiny mass} = dm = \frac{\lambda}{dx}$$

○

$$\text{tiny mass} = dm = \lambda L$$

○

$$\text{tiny mass} = dm = \lambda dx$$

Optional Study Questions

These questions are here for exam study purposes.

These are bonus points, although no score above 100% is allowed.

Question 10 (0.5 points)

Two spheres have the same radius and equal masses. One is made of solid aluminum, and the other is made from a hollow shell of iron. Which one has the bigger moment of inertia about an axis through its center?

○ The sphere made of solid aluminum.

○ The sphere made of hollow iron.

○ They both have the same moment of inertia.

Question 11 (0.5 points)

The three objects shown below all have the same mass M and radius R. Each object is rotating about its axis of symmetry (shown in blue). Rank the moments of inertia for each object.

I II III

R_2
R_1
R
R
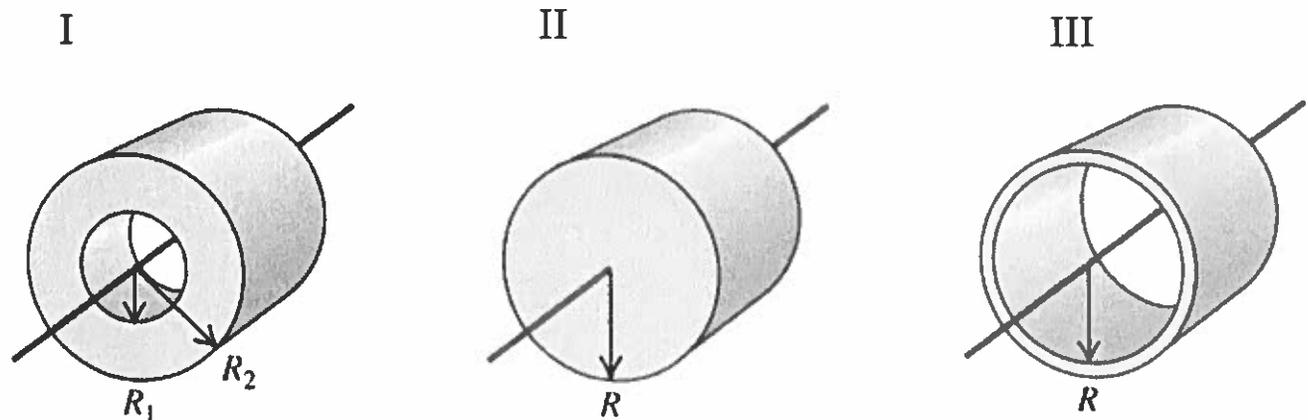
○ I > II > III

○ II > I > III

○ II > I = III

○ III > I > II

○ III > II > I

Question 12 (0.5 points)

A wheel spins with an angular velocity given by $\omega(t) = 3t^2$. The wheel starts from rest. What is the angular acceleration at t = 1s?

○ 1 rad/s^2

○ 1.5 rad/s^2

○ 3 rad/s^2

○ 6 rad/s^2

○ 9 rad/s^2

Submit Quiz   *0 of 12 questions saved*