1 Center of Mass of a Two Wires

Two identical uniform straight wires, both with length a, are in the x-y plane. One wire has one end at the origin and goes along the positive x axis. The other wire has one end at the origin and goes along the positive y axis. Find the center of mass of the two wires.

2 Center of Mass of a Cone

A uniformly solid cone has a base diameter $2a$ and height h. The base of the cone is at the origin. The cone points along the z direction. Find the center of mass of this cone.

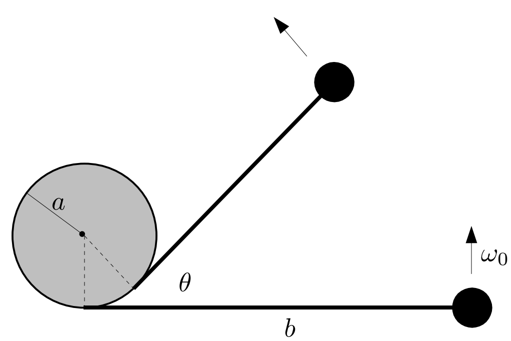
3 Center of Mass of a Circular Arc

A uniform wire subtends a circular arc with angular length θ and radius a. The wire is in the x-y plane. The arc is a portion of a circle that is centered at the origin with the y position of the center of mass being zero and the center of mass having a positive x position. Find the x component of the position of the center of mass of this wire.

4 Center of Gravity

The center of gravity of a system of particles is the point about which external gravitational force exerts no net torque. For a uniform gravitational field, show that the center of gravity is identical to the center of mass for a system of particles.

5 Wrapping a String with Bob Around a Pole



A particle of mass m at the end of a light stretch-less string wraps itself about a fixed vertical cylinder of radius a. All the motion is in the horizontal plane (no gravity). The initial angular velocity of the string is ω_0 when the distance from the particle to the point of contact of the string and cylinder is b. Two positions of the particle and string are shown above. Find the angular velocity ω and the tension, τ, after the cord has turned through an additional angle θ. Hint: Energy is conserved.

6 Rope Sliding off a Table

A massive stretch-less flexible rope of length 1.0 m slides without friction on a flat table top. The rope is initially released from rest with 30 cm of rope hanging straight down over the edge of the table. Find the time, τ, from when the rope is released, when the last part of the rope will leave the table top. 15 points extra HW credit for figuring out what's wrong with this problem and solving it correctly (As explained in class).