CLASS PROBLEMS ***CHAPTER 9***

Example 1

A wheel is rotating about an axis that is in z-direction. The angular velocity, ω, is -6.0 rad/s at t=0, increases linearly with time, and is +8.0 rad/s at t = 7.0 s. Take counterclockwise rotation as positive.

a) Is the angular acceleration during this time interval positive or negative?
b) During what time interval is the speed of the wheel increasing? Decreasing?
c) What is the angular displacement of the wheel at t = 7.0 s?

Example 2 9.5 Sec. 9.1

A child is pishing a merry-go-round (MGR). The angle through which the MGR has turned varies with time according to $\theta(t) = a\,t + b\,t^3$, a = 0.400 rad/s and b = 0.012 rad/s^3.

a) Calculate the angular velocity of the MGR as a function of time.
b) What is the initial value of the angular velocity?
c) Calculate the instantaneous value of the angular velocity ω_z at t = 5.00 s and the average angular velocity $\omega_{av\text{-}z}$ for the time interval t = 0 to t = 5.00 s. Show that $\omega_{av\text{-}z}$ is not equal to average of the instantaneous angular velocities at t = 0 and t = 5.00 s, and explain why why it is not.

Example 3 Sec. 9.2

A high speed flywheel in a motor is spinning at 500 rpm when a power failure suddenly occurs. The flywheel has a mass 40.0 kg and diameter of 75.0 cm. The power is off for 30 s and during this time off the flywheel makes 200 complete revolutions.

a) At what rate is the flywheel spinning when the power comes back on?
b) How long after the beginning of the power failure would it have taken the flywheel to stop if the power had not come back on, and how many revolutions would the wheel have made during this time?

Example 4 9.24 Sec. 9.3

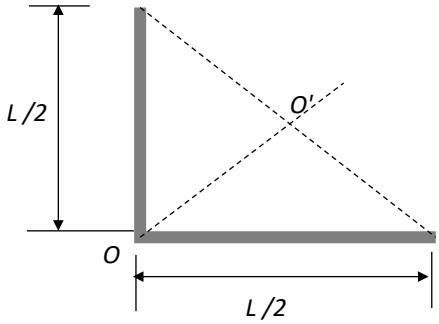
An elecrtic turntable 0.75 m in diameter is rotating about a fixed axis with an initial angular velocity of 0.25 rev/s and a constant angular acceleration of 0.90 rev/s^2.

a) Compute the angular velocity of the turntable after 0.2 s.
b) Through how many revolution has the turntable spun in this time interval?
c) What is the tangential speed of a point on the rim of the turntable at t = 0.20 s?
d) What is the magnititude of the resultant acceleration of a point on the rim at t = 0.20 s?

Example 5 9.57 Sec. 9.5

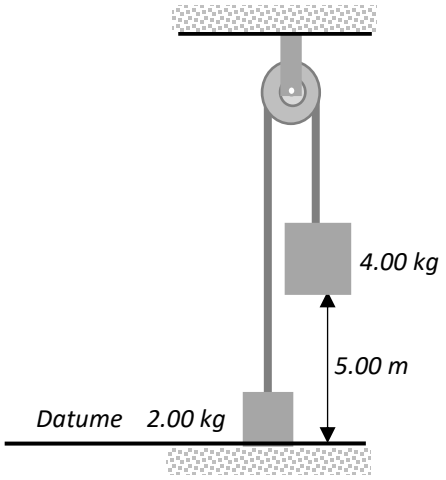
A thin uniform rod of mass M and length L is bent at its center so that the two segments are now perpendicular to each other. Find the moment of inertia about an axis perpendicular to its plane and passing through

a) the point where the two segments meet, and
b) the mid point of the line connecting its two ends.



Example 6

The pulley has a radius of 16 cm and moment of inertia 0.560 kg.m^2. The rope does not slip on the pulley rim. Use energy method to calculate the speed of the 4.00-kg block just before it stikes the floor.

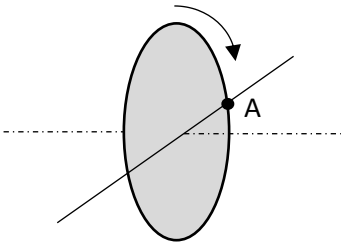


Example 7

A flywheet with a radius of 0.300 m starts from rest and accelerates with a constant angular acceleration of 0.600 rad/s^2. Compute the magnitude and direction of the acceleartion of a point A on its rim if at t = 0 pint A is located on a horizontal radius.

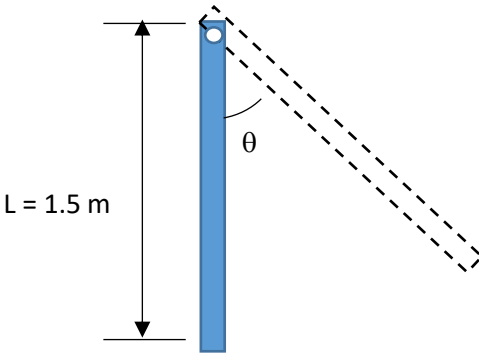
a) at the start.

b) after it has turned through 60.0^O.



Example 8

A small dart of mass 0.1 kg is launched with an initial velocity of 10 m/s . of 8 m/s . It collides with and sticks to the bottom of a long, thin rod of mass 1.0 kg and length 1.5 m. The rod is able to rotate about a frictionless hinge located at the top of the rod. Find the angle θ that corresponds with the highest point the rod and dart reach.



Example 9

Moment of Inertia for a Thin Shell about an axis passing through the center

Calculate the moment of inertia of a thin shell about an axis through iths center.
t = shell thickness