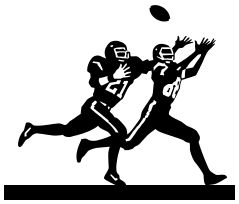
Video
w03
(6:37)

Rotational Mechanics

Name: _____

A spinning object rotates about its...



translational motion:

--

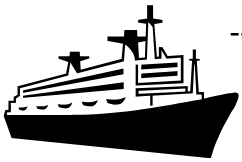
-- object is considered to be a...

rotational motion:

-- object must be considered to be an _____ _____

if the rotation is crucial to the motion

In translational motion, an object's resistance to changing its state of motion is its...



-- the greater the mass...

In rotational motion, an object's resistance to changing its state of motion is its...

-- also called rotational inertia

-- the more mass that is farther from the axis of rotation...

Moment of inertia formulas have been compiled for simple shapes, e.g.,

I =  -- a solid sphere spinning about its central axis

I =  -- a point mass M revolving at radius R

I =  -- a hollow sphere rotating about its axis

I =  -- a thin disc rotating about its axis

Video w06 (8:35)

A large moment of inertia means that if the object is…

…rotating, then it "wants quite badly" to keep rotating.

…NOT rotating, then it "wants quite badly" to keep NOT rotating.

A small moment of inertia means that if the object is…

…rotating, then it "only kinda wants" to keep rotating.

…NOT rotating, then it "only kinda wants" to keep NOT rotating.

An object's moment of inertia has NOTHING to do with the rotational speed of the object, but it has EVERYTHING to do with the object's mass and geometry (i.e., its physical configuration).

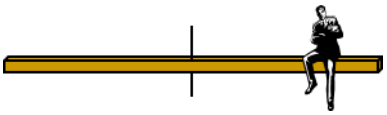
Video w09 (4:00)

Angular Momentum

If the mass of the Earth is 6.0×10^{24} kg and its mean radius is 6.4×10^{6} m, find the mag. of the angular momentum of the Earth as it spins on its axis.

Video w12 (4:39)

A 68 kg man sits 3.2 m from the axis of a spinning wooden plank of mass 95 kg and length 7.8 m. The axis goes through the center of the plank, which spins at 1.3 rad/s. Find the mag. of the angular momentum of this system.



Video w15 (5:52)

Law of Conservation of Angular Momentum

For a closed system, the angular momentum of the system is conserved.

Video w18 (4:29)

A merry-go-round of mass 115 kg and radius 2.0 m spins at 2.6 rad/s while a 65 kg student stands at the edge. Find the new angular speed after the student has moved to a distance of 0.50 m from the axis.

Video w21 (4:36)

Rotational Kinetic Energy

If the mass of the Earth is 6.0×10^{24} kg and its mean radius is 6.4×10^{6} m, find the rotational kinetic energy of the Earth as it spins on its axis.

Video w24 (4:11)

<u>torque</u>:

τ = torque (N-m)
F = applied force (N)
d = dist. between force & pivot pt. (m)

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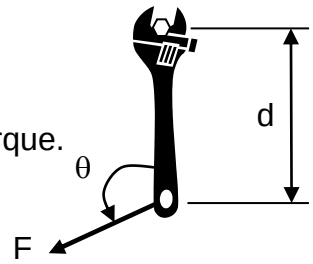
EX. A 62 N force is applied to end of wrench. Force makes a 129^{o} angle w/handle. Distance between force and bolt is 39 cm. Find mag. of the torque.

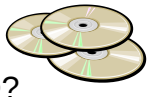


Video w27 (7:47)

Newton's 2nd Law for Rotation

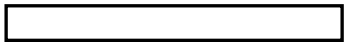
A football player applies a net torque of 0.082 N-m to a football having a moment of inertia of 5.7×10^{-4} kg-m^2. If it starts from rest, what is the angular acceleration of the ball over the time the QB takes to throw it?

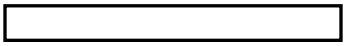
EX. A compact disc has mass 8.0 g and radius 6.0 cm. Starting from rest, the CD speeds up to 220 rpm in 1.6 s. What net torque does the disc player apply to the CD?



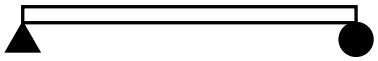
Video w30 (7:17)

Static Equilibrium 1. forces acting on object are balanced AND 2. torques acting on object are balanced



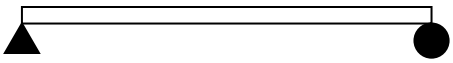


EX. A 4.0 m horiz. beam is supported at ends. Point load of 1.0×10^3 N acts ↓ 3.2 m from left end. Find support reactions. Neglect beam's mass.

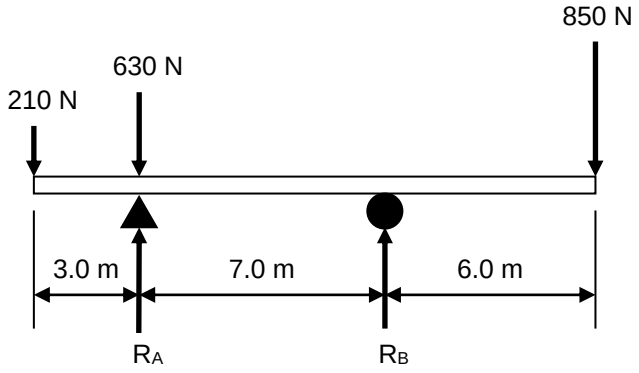


Video w33 (9:00)

A 12 m horiz. beam is supported at ends. ↓ point loads of 3.0×10^2 N, 4.0×10^2 N, and 5.0×10^2 N act 3.0 m, 5.0 m, and 7.0 m (respectively) from left. Find support reactions. Neglect beam's mass.

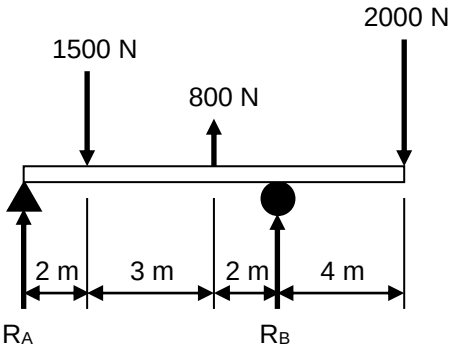


EX. Find support reactions. Neglect beam's mass.

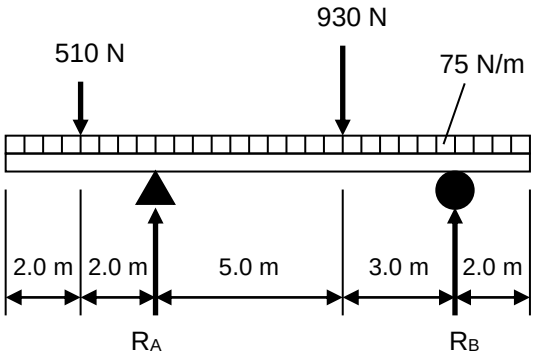


Video w36 (8:51)

Find reactions. Ignore beam's weight.



EX. A 14 m horiz. beam is supported at 4.0 m and 12.0 m from left end. Point loads of 510 N ↓ and 930 N ↓ act 2.0 m and 9.0 m (respectively) from left. Beam's weight acts as a uniformly distributed load of 75 N/m along entire beam. Find support reactions.



To deal ^{w}/distributed load…

Concentrate distributed load into a point load by taking...

This _____ N point load acts at <u>centroid</u> of the dist. load.