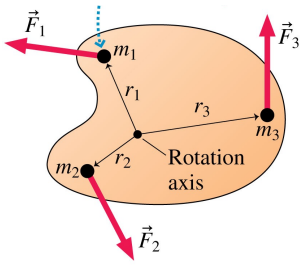
Rotational Dynamics:

In the same way that a net force produces an acceleration:

$$\sum \vec{F} = m\vec{a}$$



The net torque produces an angular acceleration:

$$\sum \vec{\tau} = I\vec{\alpha}$$

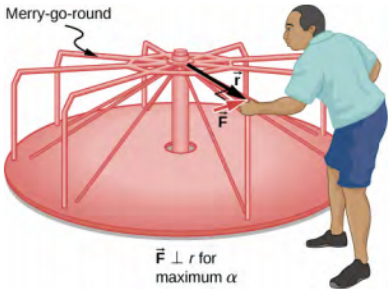
where I is the moment of inertia. It depends not just on the mass, but how the mass is distributed relative to the the axis of rotation.

Example 1: Merry-Go-Round

A person pushes a merry-go-round. He exerts a force of 250 N at the edge of the 50-kg merry-go-round, which has a radius r = 1.50 m. Consider the merry-go-round to be a uniform disk with negligible friction.

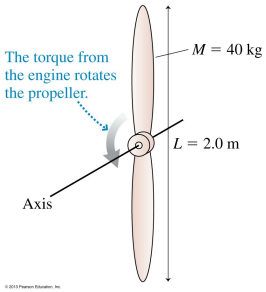
What is the angular acceleration produced by the push?

(The moment of inertia of a disk is given by 1/2 MR^2.)



Example 2:

The engine in a small airplane is specified to have a torque of 60 N·m. The engine drives a 2.0 m long, 40 kg propeller. On startup, how long does it take the propeller to reach 20.9 rad/s.



The moment of inertia is given by: $I = \frac{1}{12}ML^2$