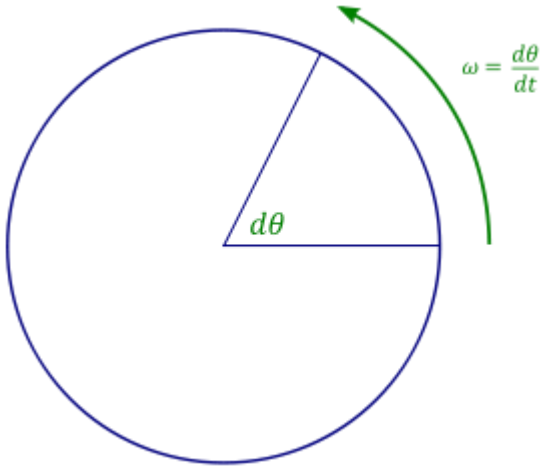
2nd Newton's Law for Rotation

Linear motion	Rotation
Coordinate: x	Angle (in radians): $\theta = l/R$
Velocity: $v = \Delta x/\Delta t$	Angular velocity: $\omega = \Delta\theta/\Delta t$
Mass: m	Moment of Inertia: $I = \sum_i m_i r_i^2$
Acceleration: $a = \Delta v/\Delta t$	Angular acceleration: $\Delta\omega/\Delta t$
Force, F	Torque, $T = F \times l$



2nd Newton's Law:

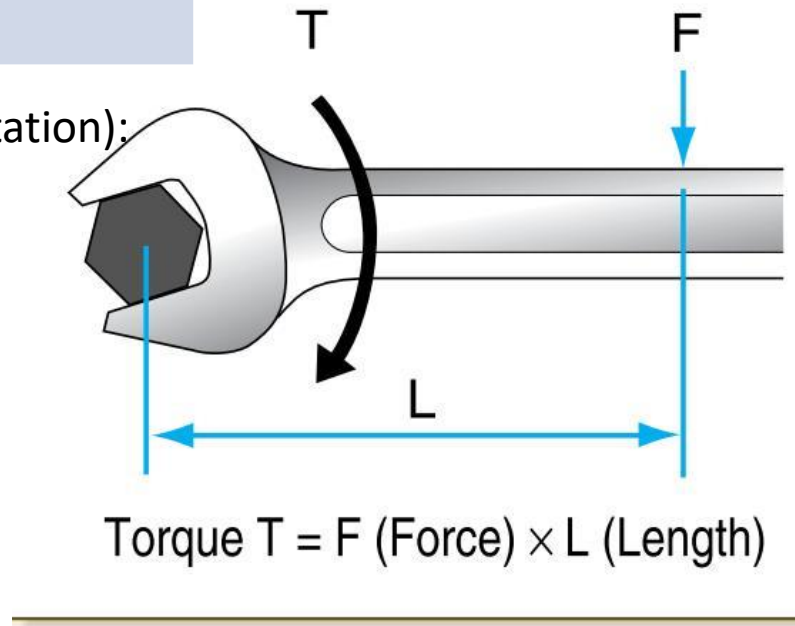
$$F = ma = \frac{\Delta(mv)}{\Delta t}$$

2nd Newton's Law (for rotation):

$$T = \frac{\Delta(I\omega)}{\Delta t}$$

$p = mv$ is Linear Momentum

$L = I\omega$ is called Angular Momentum



Homework

Problem 1

A car has mass M=2000 kg. It accelerates from 0 to 30m/s is 4 seconds. Find the torque that is applied to its wheels by the motor, during this acceleration. Assume all-wheel-drive, i.e. all 4 wheels are propelling it forward. Wheel radius is R=0.4 m.

Problem 2*

Kids on a playground are having fun with a “merry go round” platform. They first make it spin with speed 0.3 revolution per second, staying at the edge of the platform. After that, they move to the center. Suppose, they all stop at half the originbal distance form the center. How fast the platform will be moving?

Hint: You need to use the conservation of angular momentum (there is no external torque). Note that moment of inertia of the system changes when the kids move. Ignore the mass of the platform.