Introduction

"Music is a hidden practice of the soul, which does not know that it is doing mathematics."

-- Leibniz

Announcement

- The PHY138 home page now contains a link: "Test 1"
  - Everything you wanted to know about the test but were afraid to ask.

Reminder from Class 1

- For Physics, the "last minute cram" before the test will not work
  - Get a good night's sleep the night before, or
  - Go "trick or treating"
- You will do your best if you are:
  - Rested
  - Calm
  - Confident

A Loose End …

Impulse:

$F_{\text{ground on body}}\,\Delta t = \Delta p$

Work:

$F_{\text{leg on upper body}}\,\Delta s = \Delta K$

Longer Leg: Increases both Δt and Δs.

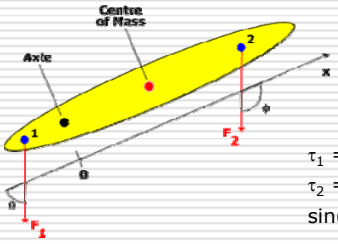
Last Time

- Power
- Basal Metabolism
- Rotational Kinematics
  - A Review
- Centre of Mass: $x_{cm} = 1/M\ \Sigma\ x_i\ \Delta m$
- Torque: $\tau = r\ F_t$
- $I = \Sigma\ m_i\ r_i^2$
- $\alpha = \tau_{net}/I \quad (a = F_{net}/m)$

Today

- Torques continued
  - Gravitational torque
  - Rotation about a fixed axis
  - Equilibrium
- Rotational Energy
- ω is a vector
- More about angular momentum

Gravitational Torque



$\tau_1 = - m_1 g x_1 \sin(\theta)$

$\tau_2 = - m_2 g x_2 \sin(\phi)$

$\sin(\phi) = \sin(\theta)$

$\tau_{tot} = - M g x_{cm} \sin(\phi)$

Atwood Machine

String: massless and does not stretch

$m_2 > m_1$

$M = 0$

$a = (m_2 - m_1)g/(m_1 + m_2)$,

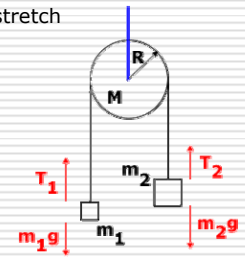
m_2 moves down

$M \neq 0$

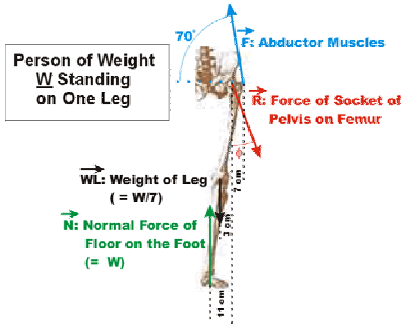
$I = c MR^2$ $\quad 0 < c < 1$

$a = (m_2 - m_1)g/(m_1 + m_2 + cM)$,

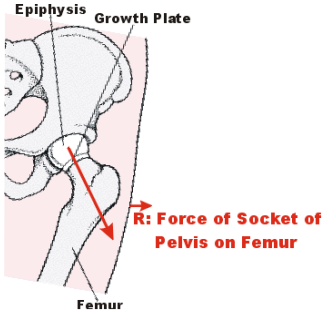
m_2 moves down



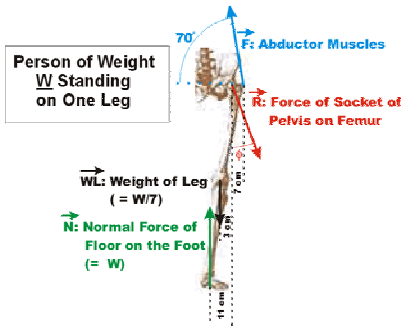
Forces on the leg



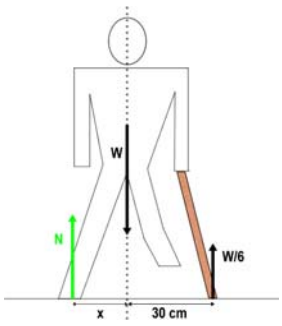
Force on Femoral Epiphysis



Forces on the leg



Cane: Opposite Side



Use of a Cane

	Force of Abductor on Trochanter	Force of Socket on Epiphysis
No Cane	1.6 W	2.4 W
Cane Same Side	1.3 W	2.0 W
Cane Opposite Side	0.6 W	1.3 W

Direction of Angular Velocity Vector