Introduction

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

-- Leibniz

Networks Down Again

• Connectivity to the Mechanics pages has been sporadic since Monday afternoon
• My email has been unavailable since Monday afternoon
• Now up sporadically

Medical Science Student Union

Info session on volunteering in the Philippines:

Friday, October 27, 3 PM, MS3171

Bake sale:

Monday, October 20, 10 – 5 PM, Sydney Smith lobby

FREE PHY 138 HELP SESSION

October 24, 3:00 – 5:00 pm, SS1072

October 26, 1:00 – 2:00 pm, SS2119

For more information, visit our website at http://utpt.sa.utoronto.ca

URGENT! Assu NEEDS YOU!

Project: Universal Minds

VOLUNTEER TUTORS NEEDED

• tutor a high school student for one hour a week
• add volunteer experience to your resume
• get a certificate of recognition from the Dean of Arts & Science
• feel good on the inside

Pick up an application form or contact us to get more information:

• Office: SS 1068
• Web site: assu.ca
• Phone: 416-978-4903
• E-mail: students.assu@utoronto.ca

Test

• Tuesday, October 31, 6:10 – 7:30 PM
• Locations:
  • Go to the PHY138 (not Mechanics) page
  • Click on Test 1
• Reminder:
  • Monday’s Class will be a test review
  • The PowerPoint will be available via the summary for today’s class
Test Aids

- Closed book
- You must bring:
  - A soft-lead pencil
  - Your student card
- You may bring:
  - A calculator without text-storage or communication capability
  - A single 8 ½ x 11 inch sheet of paper on which you have written anything that you wish
- We will supply any needed constants

Test Format

- 8 Multiple-Choice Questions
  - Worth 8 marks each
  - Full credit for the correct answer
  - No credit or penalty for blank or wrong answers
- 1 Long-Answer Question
  - 5 Parts
  - Some partial credit may be given for some parts: clearly show your work and reasoning

Studying for Tests

- Testing for your knowledge of facts: the “last minute cram” can work
- Testing for your understanding and ability to apply concepts: the “last minute cram” is proven to not work

For the PHY138 Test, get a good night’s sleep Monday night.
At some point well before the test starts, stop studying.

Doing Well on the Test

- You are likely to not be getting as many questions correct as you are used to
- Being calm and confident allows you to do your best
  - “Don’t worry, be happy,” – Bobby McFerrin
- Be sure to answer the question being asked
  - Often we see students answer a question that has not been asked!

Last Time 1/2

- Power
- Metabolism
  - Basal: “resting”
  - Thermal Equilibrium
  - Allometry: BMR = m^{2/3}
  - Expt: BMR = m^{3/4}
  - Is the circulatory system fractal?
- Rotating Rigid Body: ω and ω same for every point of the body

Last Time 2/2

- Center of Mass (CM)
  - Unconstrained: rotates about CM
  - \( x_{cm} = \frac{1}{M} \sum (m_i x_i) \)
- Torque \( \tau \)
  - \( r F_i \)
  - \( r F \sin(\phi) \)
  - \( d F \)
- Gravitational torque: treat the entire mass as being at the center of mass
Today

- Rotational Dynamics
- Moment of Inertia
- Equilibrium
- Force on the leg
- Using a cane
- Rotational Energy
- Angular Velocity Vector

\[ M = 0 \]
\[ a = \frac{(m_2 - m_1)g}{(m_1 + m_2)} \]

Figure 13.24

Forces on the leg

Person of Weight \( W \) Standing on One Leg

- \( \text{Normal Force of Floor on the Foot} (= W) \)
- \( \text{Weight of Leg} (= W/7) \)
- \( R \): Force of Socket of Pelvis on Femur
- \( \text{Abductor Muscles} \)

Force on Femoral Epiphysis

- \( \text{Epiphysis Growth Plate} \)
- \( \text{Femur} \)
- \( R \): Force of Socket of Pelvis on Femur
Cane: Opposite Side

Use of a Cane

<table>
<thead>
<tr>
<th></th>
<th>Force of Abductor on Trochanter</th>
<th>Force of Socket on Epiphysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Cane</td>
<td>1.6 W</td>
<td>2.4 W</td>
</tr>
<tr>
<td>Cane Same Side</td>
<td>1.3 W</td>
<td>2.0 W</td>
</tr>
<tr>
<td>Cane Opposite Side</td>
<td>0.6 W</td>
<td>1.3 W</td>
</tr>
</tbody>
</table>

Direction of Angular Velocity Vector