# Review problems

Physics 211
Syracuse University, Physics 211 Spring 2019
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# Announcements

Upcoming schedule:

- Tuesday, February 26 (today): office hours 3-5 PM in the Physics Clinic
- Wednesday, February 27: HW4 due in recitation. Begin work on HW5 in recitation.
- Thursday, February 28: One new small topic; mostly review/practice
- Friday, March 1: Group Exam 2. Office hours 11-1 PM in the Physics Clinic
- Sunday, March 3: Review in Stolkin Auditorium, 1-4 PM
- Monday, March 4: office hours 1-3 PM
- Tuesday, March 5: Review in class; office hours 3-5 PM
- Wednesday, March 6: Come to recitation prepared with questions; review there. Homework 5 due.
- **Thursday, March 7: Exam 2 in class.**
- Friday, March 8: **No recitation** (we'll be grading): enjoy your spring break!

# Ask a Physicist: imaginary time?

(It's not as crazy as you think!)

## Agenda for today:

I was going to introduce one new idea today – a broad concept that we'll build on later.

I thought I needed to do this now, but it turns out we have enough time later in the semester.

So, instead, we could spend the entire day doing practice problems.

I have a few in mind, but you can ask me to walk you through:

- Anything from Homework 4 that you just turned in
- Hints to problems on Homework 5
- Anything from previous recitations

# How does a centrifuge work?

How fast must the plastic tube spin so that the eraser doesn't fall?

Remember:

- Circular motion problems are no different than anything else!
- Think clearly about directions of forces on your force diagram!

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What force pushes the eraser outward?

What is the mass of the Sun?

# What is the mass of the Sun?

The intermediate result we got – that $\omega = \frac{2\pi}{\tau}$, where $\tau$ is how long it takes to go around – is useful to know.

# Hauling a sled up a hill

Suppose a sled-dog of mass $m$ wants to drag a sled up a hill at an angle $\theta$. The coefficient of static friction between the dog's paws and the ground is $\mu_s$, and the coefficient of kinetic friction between the sled's runners and the ground is $\mu_k$. (There are no other angles – the sled is about as tall as the dog.)

- What's the largest mass sled that the dog can pull?
- How much force must the rope be able to support without breaking to do this?

# The multiple pulley

Suppose I make a pulley system with multiple "winds" of the rope, and hang masses off of it as shown. Analyze this like you would Problem 3 from HW4:

- If I hang two equal masses from the two ropes, how will they accelerate?
- If I want to balance the system, what mass should I use to balance a 30 kg mass on the right?

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This machine – much like many others – exhibits a concept called **mechanical advantage**.

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Examples:

- A crowbar
- A wedge
- These pulley systems
- The gears on a bicycle
- A hydraulic lift

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On one hand, you're getting something for free: exert a force of 100 N, lift a weight of 500 N!

On the other hand, you're not: the product force $\times$ distance is always the same.

This is a hint that this quantity is special. It is: it's called *work* or *energy transfer*, and it's what we'll study after break.

# The Earth/Moon Lagrange points

Suppose you want to place a satellite somewhere along the line connecting the Earth and the Moon so that it *stays* in line – that is, so that it orbits the Earth with the same $\omega$ as the Moon.

Where are they? (We'll make the assumption that the Earth doesn't move because of the Moon's gravity – not quite right, but close enough.)