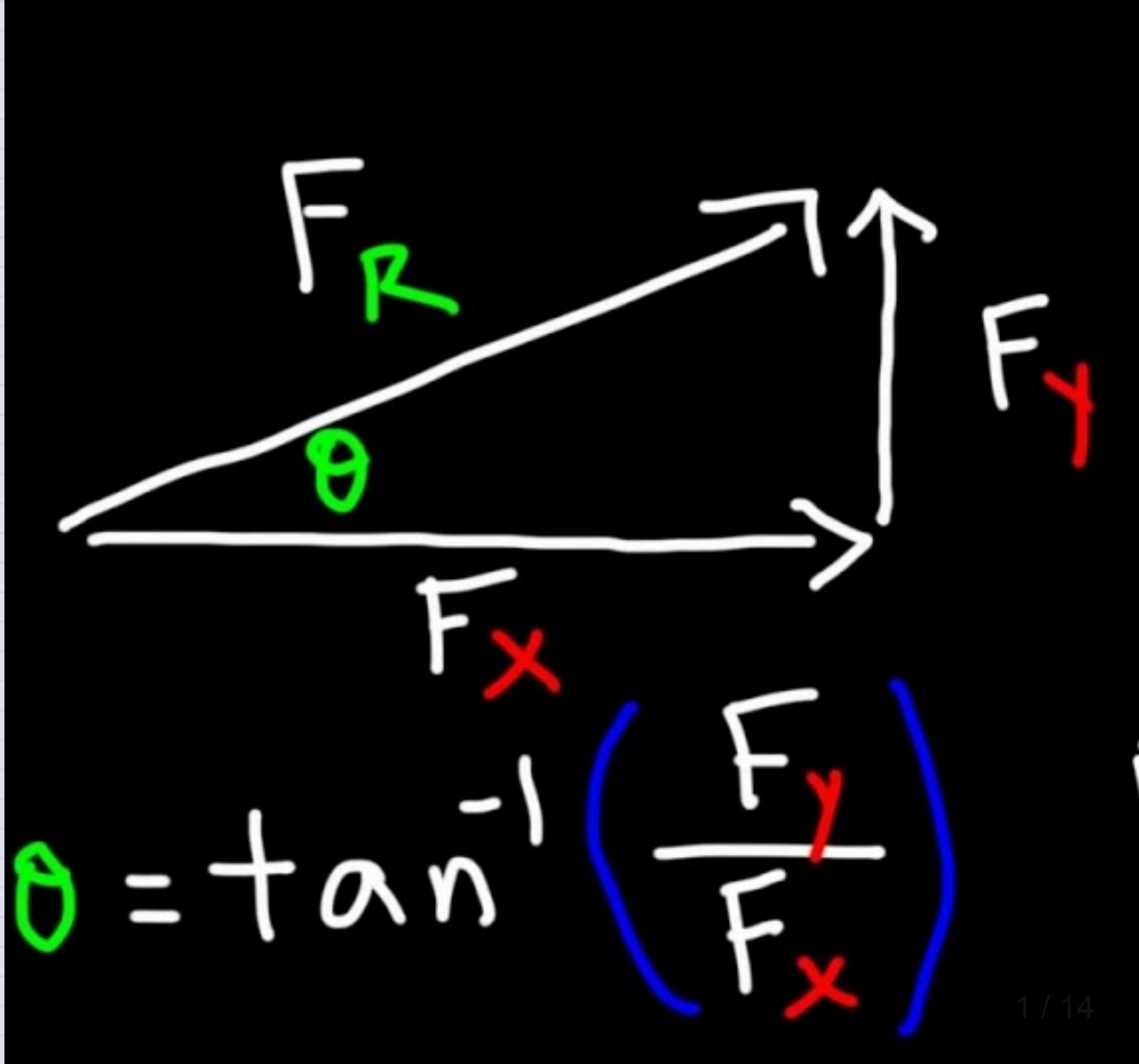
Day 04 - Mathematical Preliminaries



Announcements

- Homework 1 is due this Friday
- Homework 2 is posted now
- Help sessions start this week
  - DC today at 4pm; Friday at 3pm (1248 BPS)
- Elisha (ULA) will join us Friday; additional help hours soon
  - Complete poll for additional help hours

Seminars this week (Tuesday and Wednesday)

TUESDAY, January 21, 2025

- **High Energy Physics Theory Seminar**
  - 11:00am, FRIB 1200 lab; Speaker: **Alexei Bazavov**, MSU-CMSE/PA
  - Title: *Lattice QCD: From classical computation to quantum simulation*

WEDNESDAY, January 22, 2025

- **Astronomy Seminar**
  - 1:30 pm, 1400 BPS; Speaker: **Allyson Bieryla**, CfA | Harvard & Smithsonian
  - Title: *Exoplanets and Solar Eclipses for Research and Community Engagement*

Seminars this week (Wednesday, cont.)

- **PER Seminar**
  - 3:00 pm., BPS 1400; Speaker: **Justin Gambrell**, Assistant Professor, Department of Computational Mathematics, Science, and Engineering, Michigan State University - **MSU PA ALUMNUS**
  - Title: *Computational Thinking Assessment for Introductory Physics: Design, Implementation, and Future Directions*
- **FRIB Nuclear Science Seminar**
  - 3:30pm., FRIB 1300 Auditorium; Speaker: Calem Hoffman of Argonne National Laboratory
  - Title: The Influence of Near-Threshold States on Nuclear Observables

Goals for this week

Be able to answer the following questions.

- What are the essential physics models for single particles?
- How do we setup problems in classical mechanics?
- What mathematics do we need to get started?
- How do we solve the equations of motion?

AI Policy Update

Acceptable use cases proposed by y'all:

- All uses are OK
- Brainstorming, getting ideas, finding information
- Asking for help, clarifying concepts, elaborating on ideas
- Outlining, structuring, and editing writing
- Fixing errors, debugging code, checking solutions

AI Policy Update

Unacceptable use cases proposed by y'all:

- No use is OK
- Asking directly for answers and solutions
- Using AI to complete the entire assignment
- Using AI to write papers or reports
- Turning in work that is not your own

AI Policy Update

Ways of documenting AI use proposed by y'all:

- Summarizing the use of AI and how it helped
- Documenting the use of AI in the assignment
- Providing prompts, responses, and outcomes
- Detailed documentation including screenshots and date/time of use

AI Policy Update

Ways of collectively enforcing our policy:

- It is not possible.
- Honor system; hold old your friends accountable
- Collective policy helps us all; encourage honesty and integrity
- Report violations to Danny
- Fail the assignment if you violate the policy
- Fail the course if you violate the policy

Ranked Choice Vote on our AI Policy

- **Proposal 1: We adopt a policy that does not allow AI use at all.**
  - Violation results in a failing grade on assignment.
  - Repeated violations result in failing the course.
- **Proposal 2: We adopt a policy that allows AI use for brainstorming, help, and editing.**
  - AI cannot be used for direct answers or completion of assignments.
  - We expect documentation of AI use, but it can be informal.
  - Violations are discussed with Danny; the first violation requires a redo of the assignment, and repeated violations result in a failing grade.

Ranked Choice Vote on our AI Policy

- **Proposal 3: We adopt a policy that allows AI for use in nearly any way.**
  - We require detailed documentation of use; this means screenshots, prompts, responses, and outcomes.
  - Violations are discussed with Danny; the first violation requires a redo of the assignment, and repeated violations result in a failing grade.
- **Proposal 4: We adopt a policy that allows AI for use in any way with no documentation required.**
  - Violations of the policy are limited to sharing answers or solutions with others.

Vote here: https://forms.office.com/r/PwfNQYJ2Rm

Reminders from Day 03

- In a Newtonian world, we start from a vector description of motion
- Differential equations are mathematical models that describe the motion of particles
- We can use different methods to solve these differential equations

Clicker Question 4-1

Consider the generic position vector $\vec{R}$ for a particle in 2D space. Which of the following describes the direction of the vector in plane polar coordinates (r, ϕ)?

1. $\hat{R}$
2. $\hat{r}$
3. $\hat{\phi}$
4. Some combination of $\hat{r}$ and $\hat{\phi}$
5. I'm not sure.

Group Discussion 4-1

We found the following expression for the equation of motion of a falling ball subject to air resistance:

$$m\ddot{y} = +mg - b\dot{y} - c\dot{y}^2$$

What are the units of the constants b and c?