Phys 131 2023

Lecture 1.

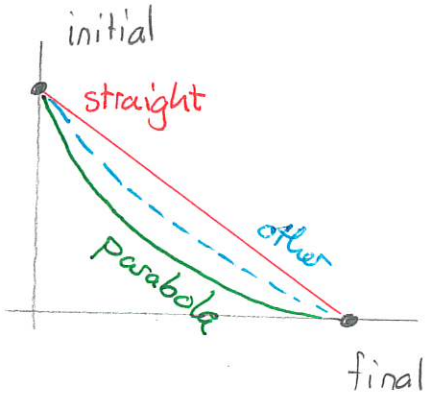
Handouts *Syllabus

* Survey - return by Thurs
* Attendance Sheet

LABS: NO LABS this week.

Physics question

Demo: Bring Brachistochrone device



Consider an object that slides along a ramp only under influence of Earth's gravity. The initial and final locations of the object are fixed. Various possible ramps exist that could connect these points. What shape should the ramp have so that the travel time from the initial to final point is shortest?

Exercise:
* Introduce yourself to neighbor
* Decide which shape you think will give shortest time.
* Why did you choose your answer? What reasoning/evidence supports your answer?
* How can you evaluate your neighbor's answers?

This is one example of a question that physics can address. In this case the question is about the motion of an object. The branch of physics that addresses questions about motion of ordinary objects is called classical mechanics / Newtonian mechanics. Phys 131 will introduce you to the core ideas of classical mechanics.

DEMO: Actual Brachistochrone.

The course will aim to:

1) introduce you to the phenomena of classical mechanics
2) show how to describe motion using standard basic physical concepts and mathematics.

More broadly the course also aims to:

1) develop your abilities to use mathematics to "tell a story" about physical situations. This mathematics will include:
   - algebra, trigonometry, geometry, vectors and calculus.
2) develop your abilities to reason about a wide range of situations starting with the same few basic principles.

Classical physics contains a small number of basic principles that can describe a wide range of situations. Examples are:

1) rolling / sliding objects
2) falling objects
3) rotating objects
4) oscillating objects
5) orbital motion
6) fluid motion, ...

Course details (for the moment)

1) syllabus - contact info
   - your email
2) course website + course materials page
3) ~~exam~~ & D2L page (described on Thursday)
4) exam dates – no conflicts please!

This week:

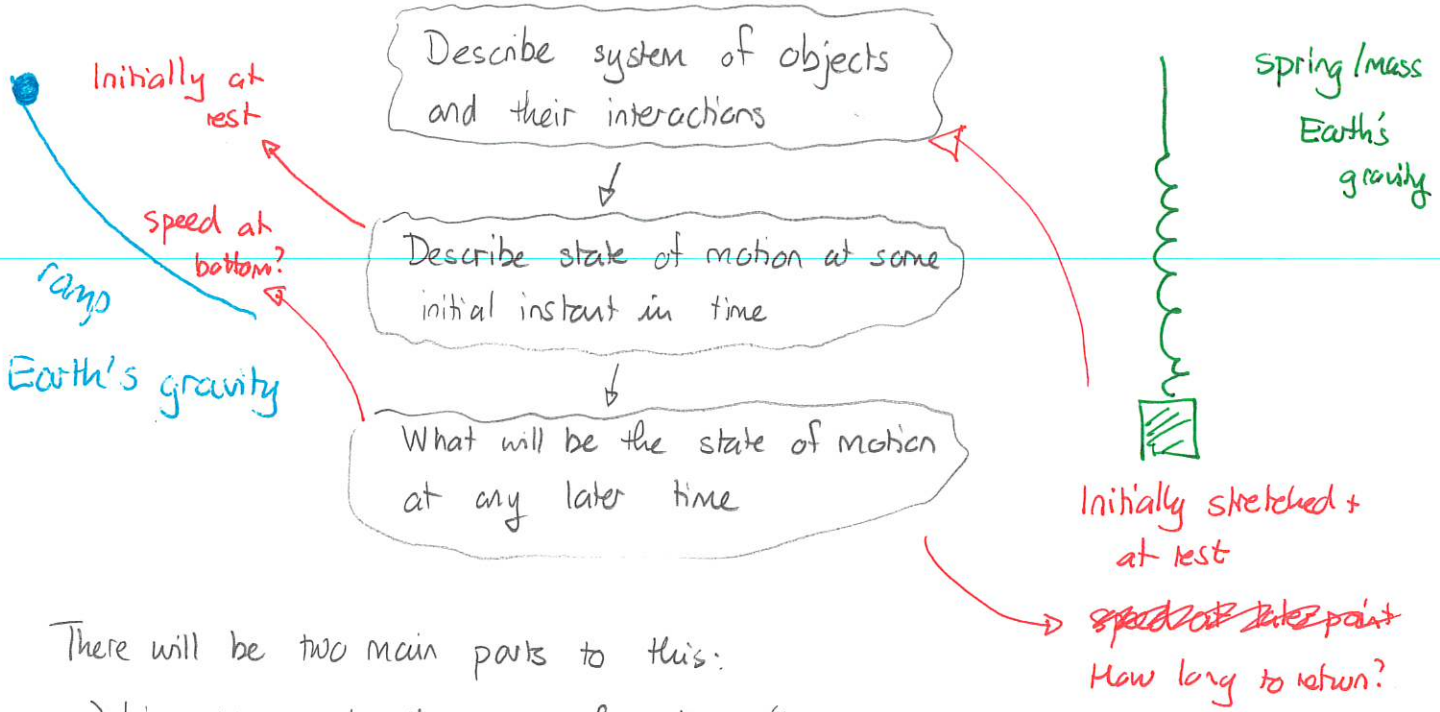
* Tuesday - diagnostic test (pre-test)
  - 30 multiple choice questions
  - will retake at end of semester (post-test) for extra credit
  - need to take pre-test to get eventual extra credit.

* ~~Wednesday~~ Thursday - regular class
  - course page shows reading

* Friday - Warm Up Exercise (reading quiz) on D2L
  - Group exercise in class - must attend!

Motion

Classical physics considers how to describe how and why objects move as they do. The basic situation is



There will be two main parts to this:

1) kinematics – describe states of motion (how motion happens – vocabulary/grammar for motion)

2) dynamics – describe <u>why</u> states of motion occur/change ("building sentences + paragraphs")

Kinematics in One Dimension: Position

Consider an object that can only move in one dimension. There are two fundamental notions that underpin all of kinematics.

1) position ⇝ describes location of objects
   ⇝ use a frame of reference calibrated in meters [m]

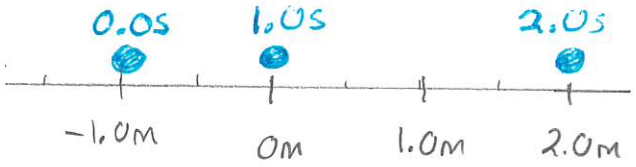
2) time ⇝ describes instants when events occur
   ⇝ measured by a standard clock in seconds [s]

The fundamental issue will be to track the location of an object at all times.

We can represent the motion via

Motion diagram

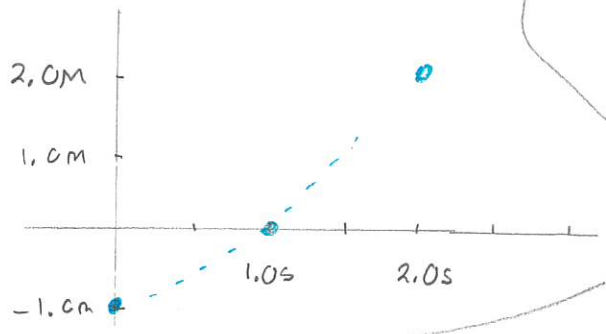
Chart position along axis



Data

time t	position x
0.0s	-1.0m
1.0s	0.0m
2.0s	2.0m

Graph of position vs. time



Function representing x vs t

$$x = \frac{1}{2}t^2 + \frac{1}{2}t - 1$$

or

$$x(t) = \frac{1}{2}t^2 + \frac{1}{2}t - 1$$

Quiz1 90% ~ 95%