

Physics 113 - Sept. 5, 2013

- Lab lecture on STATISTICS Tomorrow 3:30 → here
(Expect it to last ~1.5 hrs)
- Workshops to begin Next Week

Last
Time

Course organization + tips

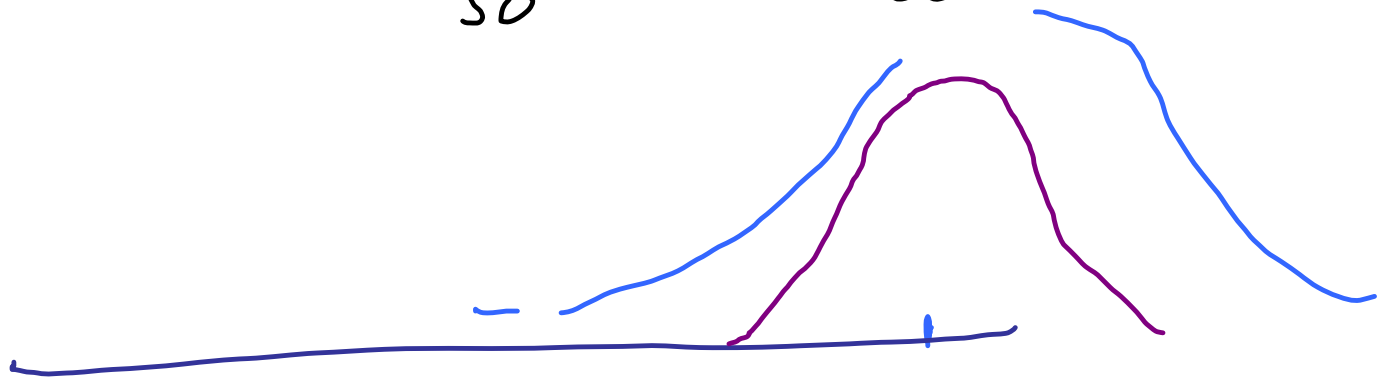
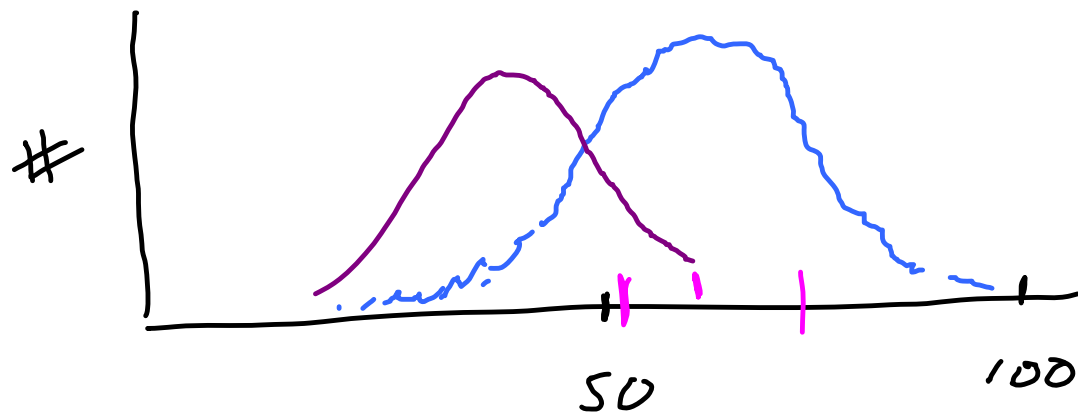
A bit about the nature of Science + physics
+ human perspective and scales

Questions ?

Will post Slides
+ Audio
on class
website

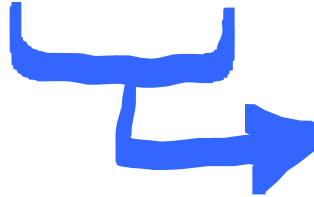
No audio for
lect 1
this time





What is Time?

1 dimensional motion



Kinematics

Kinematic variables

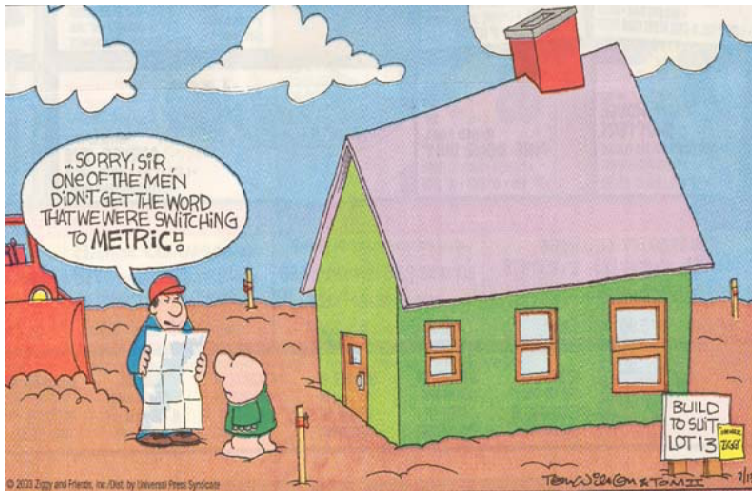
time

t seconds

position

meters

x or y or z or s



Two Teams, Two Measures Equaled One Lost Spacecraft

By ANDREW POLLACK

LOS ANGELES, Sept. 30 — Simple confusion over whether measurements were metric or not led to the loss of a \$126 million spacecraft last week as it approached Mars, the National Aeronautics and Space Administration said today.

An internal review team at NASA's Jet Propulsion Laboratory said in a preliminary conclusion that engineers at Lockheed Martin Corporation, which had built the spacecraft, specified certain measurements about the spacecraft's thrust in pounds, an English unit, but that NASA scientists thought the information was in the metric measurement of newtons.

The resulting miscalculation, undetected for months as the craft was designed, built and launched, meant the craft, the Mars Climate Orbiter, was off course by about 60 miles as it approached Mars.

"This is going to be the cautionary tale that is going to be embedded into introductions to the metric system in elementary school and high school

and college physics till the end of time," said John Pike, director of space policy at the Federation of American Scientists in Washington.

Lockheed's reaction was equally blunt.

"The reaction is disbelief," said Noel Hinnee, vice president for flight systems at Lockheed Martin Aeronautics in Denver, Colo. "It can't be something that simple that could cause this to happen."

The finding was a major embarrassment for NASA, which said it was investigating how such a basic error could have gone through a mission's checks and balances.

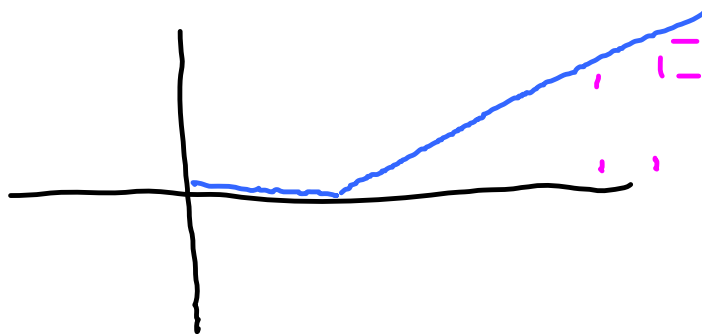
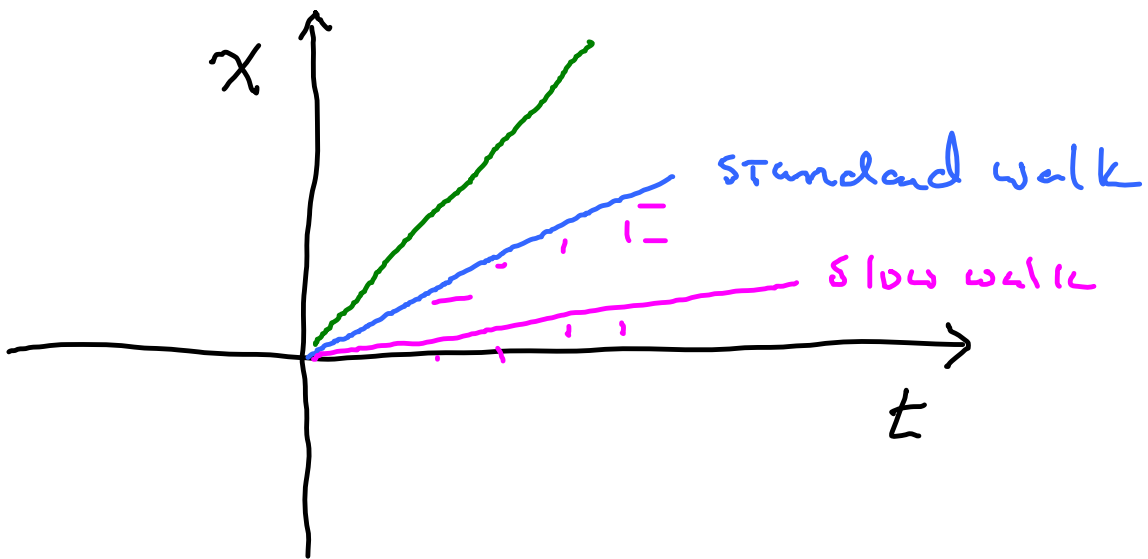
"The real issue is not that the data was wrong," said Edward C. Stone, the director of the Jet Propulsion Laboratory in Pasadena, Calif., which was in charge of the mission. "The real issue is that our process

Continued on Page A16

ON MICHAEL FERRELL'S 21st BIRTHDAY, THE lot of many appearances on this page! — ADVT.

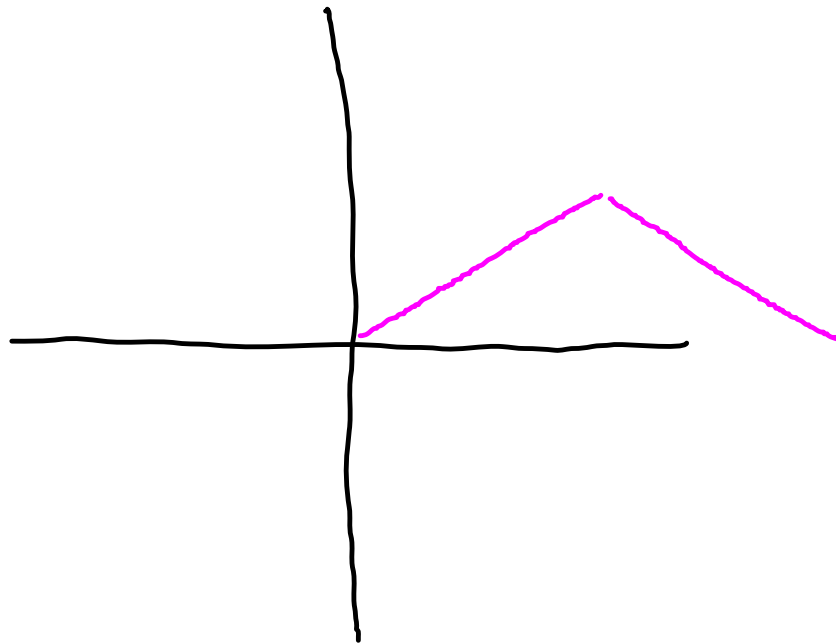


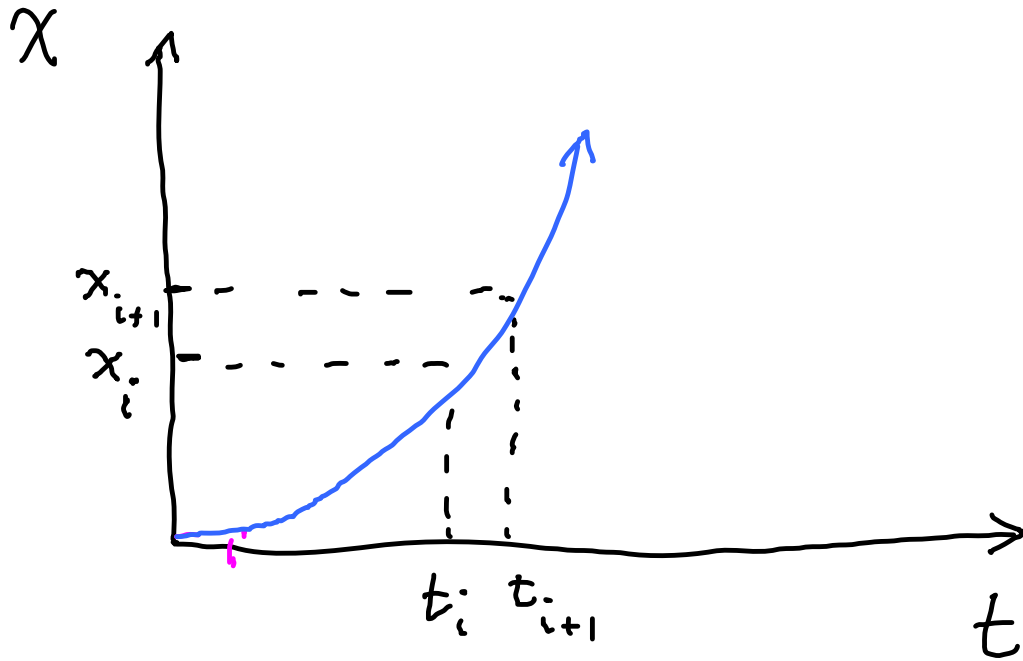
THE NEW YORK TIMES is available for delivery in most major cities. On the Web: home.delivery.nytimes.com, or telephone, toll-free 1-800-NYTIMES. ADVT.



finite change in
something

$$\text{time} \sim t_2 - t_1$$
$$\Delta t$$



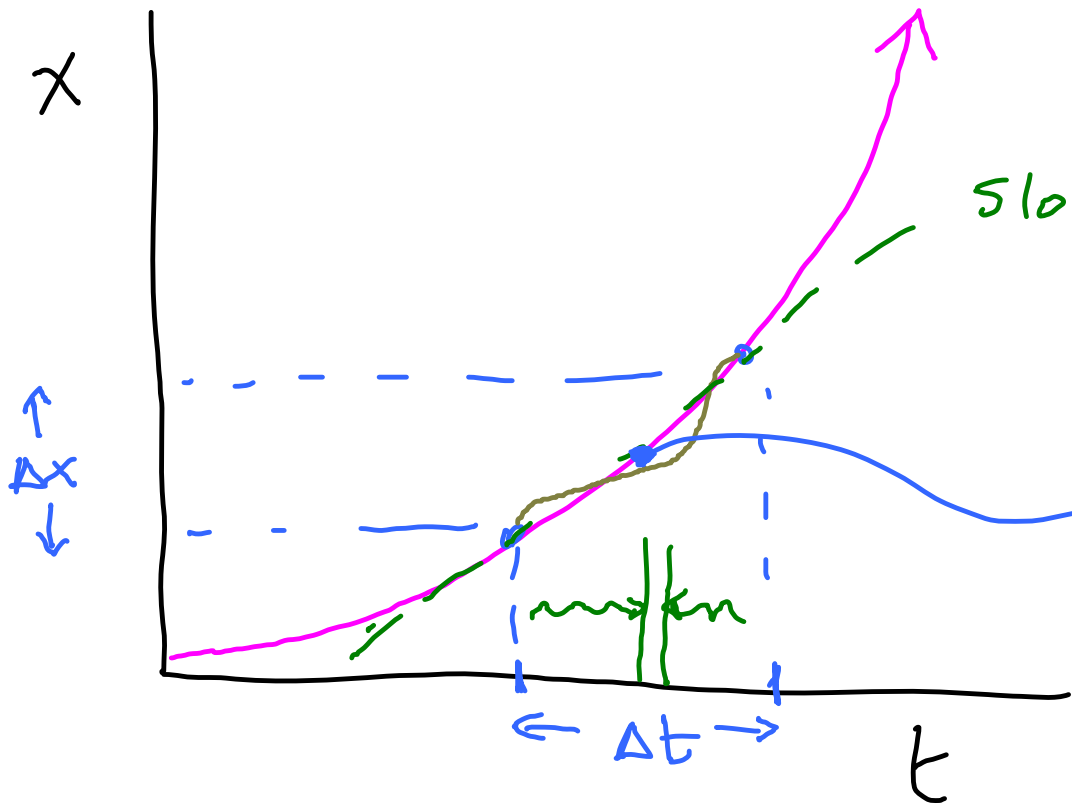


Average Speed over interval:

$$\equiv \frac{\text{displacement}}{\text{time}}$$

$$\equiv \left| \frac{x_{i+1} - x_i}{t_{i+1} - t_i} \right| = \left| \frac{\Delta x}{\Delta t} \right|$$

Average velocity $\equiv \frac{x_{i+1} - x_i}{t_{i+1} - t_i} = \frac{\Delta x}{\Delta t}$



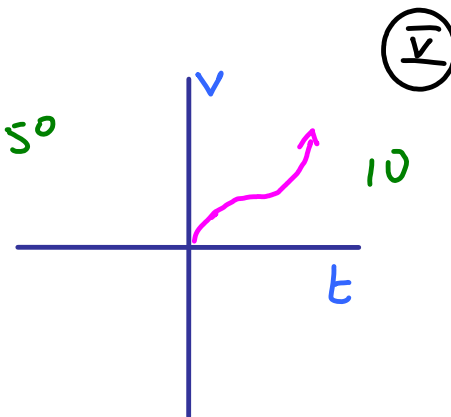
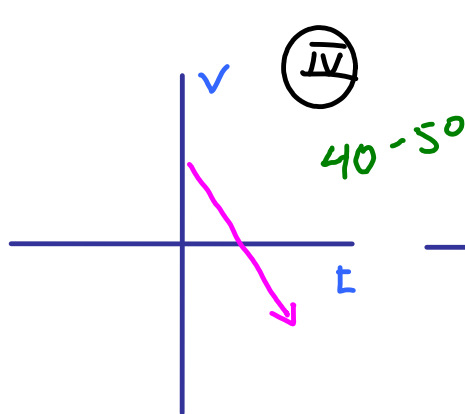
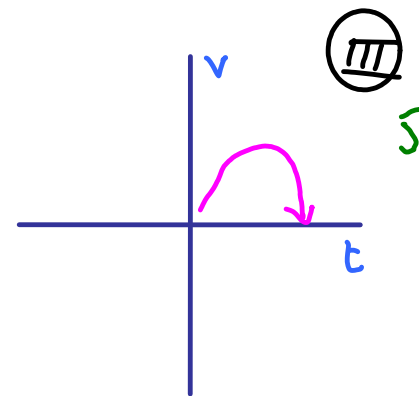
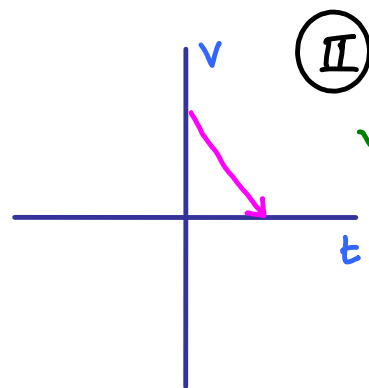
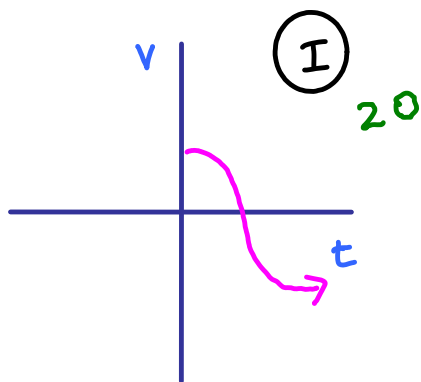
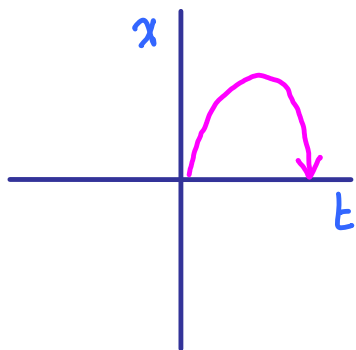
slope = $\frac{\Delta x}{\Delta t}$

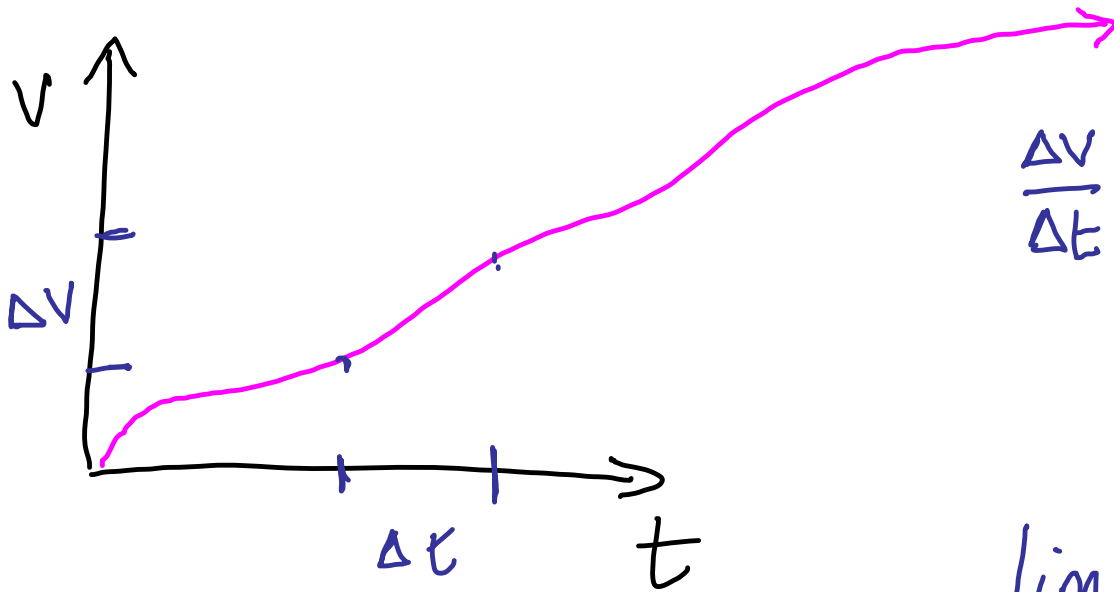
Ave speed
bet two pts

ASIK what is Speed
at this
instant
point

$$\lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$$

Given $x-t$ motion/graph, what is the most appropriate $v-t$ graph?





$$\frac{\Delta v}{\Delta t} = \text{Average acceleration}$$

INSTANTANEOUS
Acceleration

$$\lim_{\Delta t \rightarrow 0} \frac{\Delta v}{\Delta t} = \text{" "}$$

Accel. is
Slope of v-t graph $a(t)$

Velocity $\frac{\Delta x}{\Delta t} \sim \frac{m}{s}$

$a \sim \frac{(\frac{\Delta x}{\Delta t})_2 - (\frac{\Delta x}{\Delta t})_1}{\Delta t}$ units m/s^2

Kinematic Variables

		<u>MKS</u>	<u>CGS</u>	<u>English</u>
x	Position	m	cm	feet
v	velocity	m/s	cm/s	feet/s
a	acceleration	m/s ²	cm/s ²	feet/s ²
t	time	s	s	s

units are important