hi

Lecture 1

velocity and acceleration

housekeeping

Remember:

MasteringPhysics!

Facebook Group!

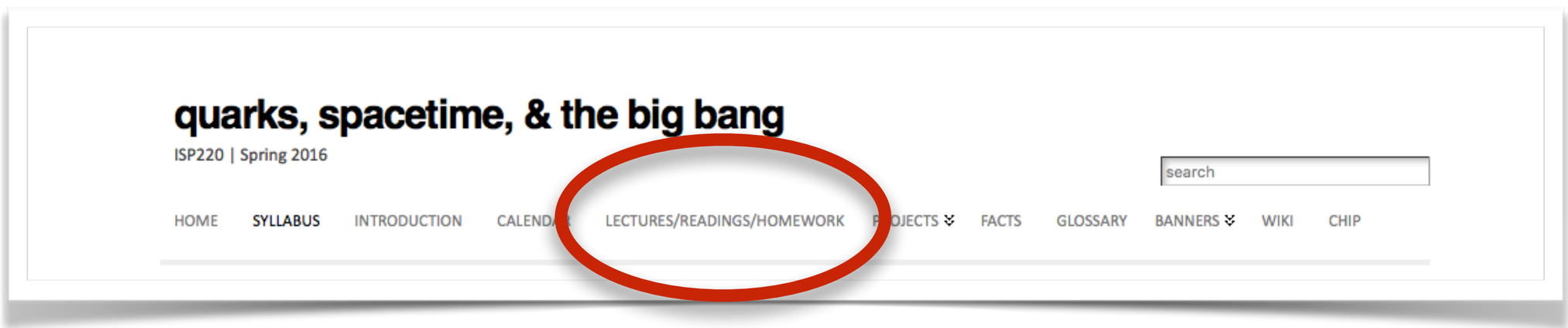
Homework will be posted Saturday!

Manuscript:

chapters 2, *Tools*, and *Motion* are up at

`http://www.chipbrock.org/details/#head1234`

Remember the readings, videos, and homework on:



motion is old

The historical physics action?

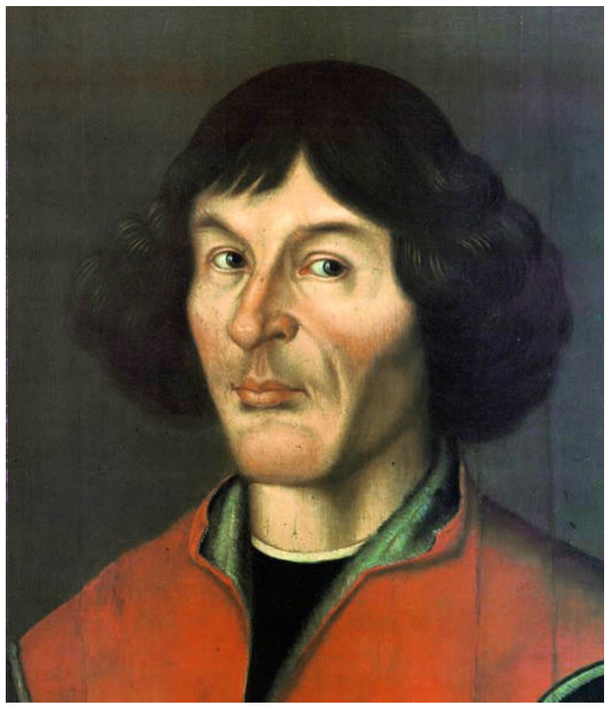
is understanding motion

Aristotle?
Physics Poison

motion is old

Planetary motion

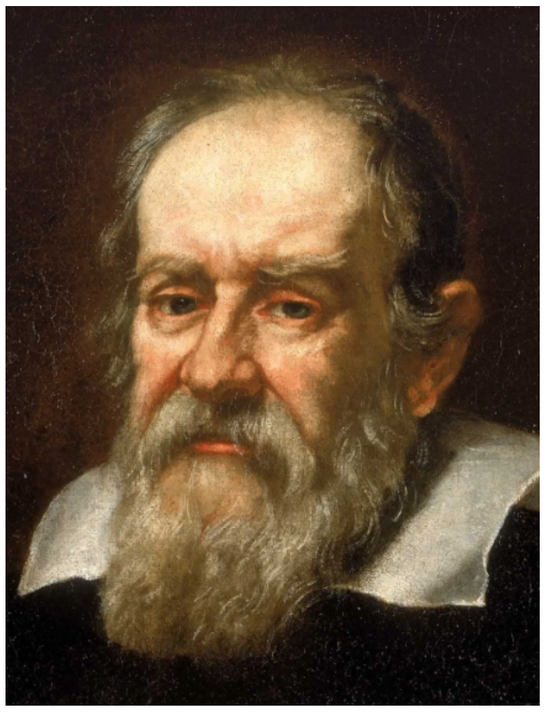
Copernicus, Brahe, Kepler, Galileo



Copernicus

Tycho

Kepler



Galileo

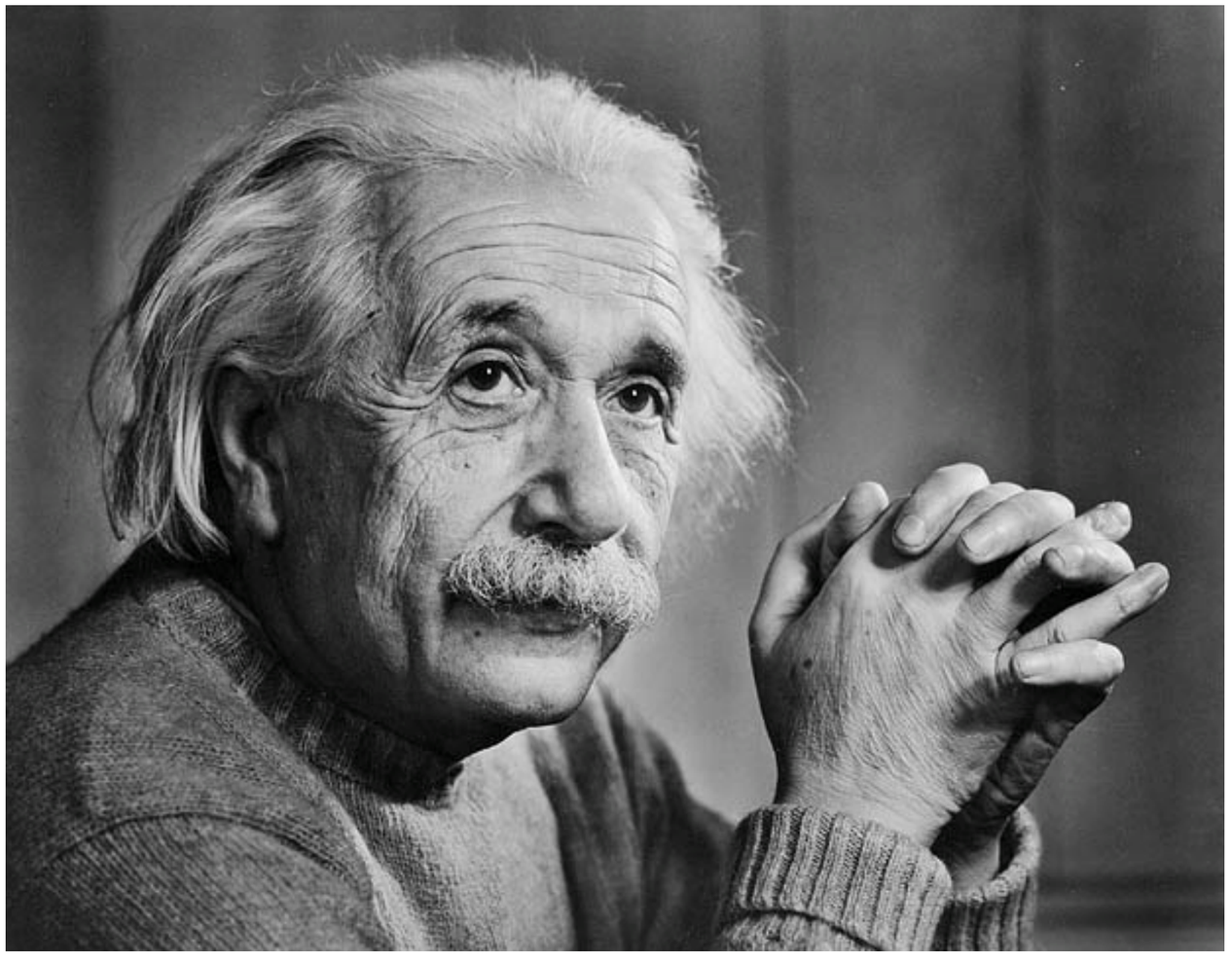
motion is old

Everything

Isaac Newton

motion became new

Everything, and then some.



Albert Einstein

these

are all matters for ISP220

motion is familiar

65 pounds?

65 degrees?

65 furlongs?

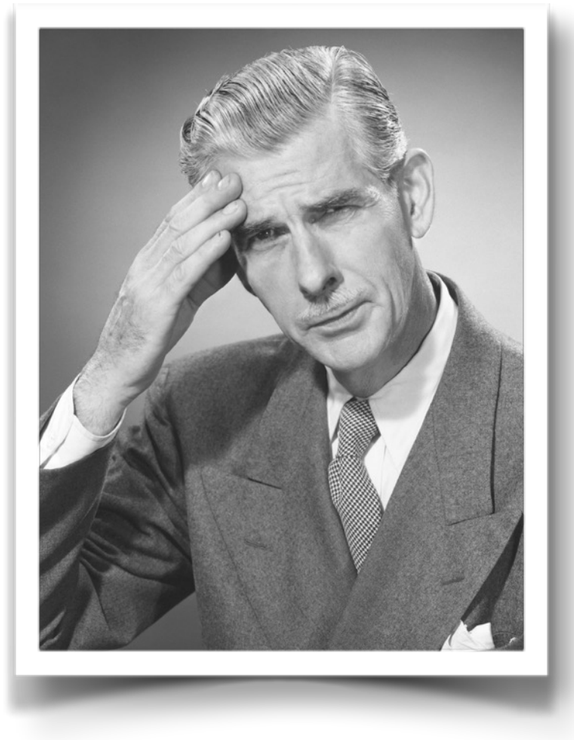
65 feet?

After all:

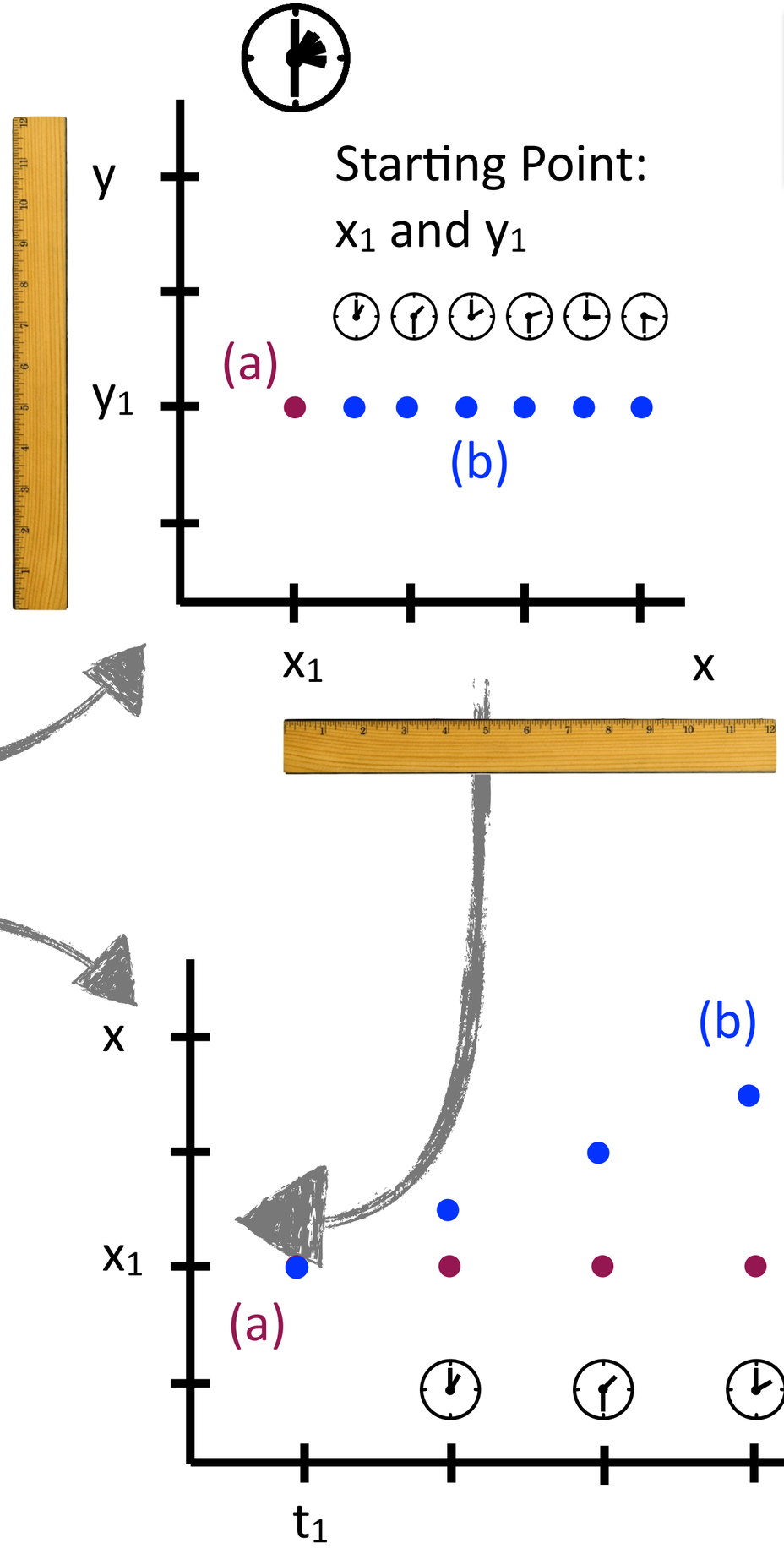
$$\text{speed} = \frac{\text{distance traveled}}{\text{time taken}}$$

sounds simple

we’ll make it complicated



constant speed represented in 2 ways



space

time

Space Diagram

(a) sitting still

Spacetime Diagram

conventional notation

"delta"

"Δ": "change-in" or "difference" = (where you **end up** – where **you started**)

we deal in

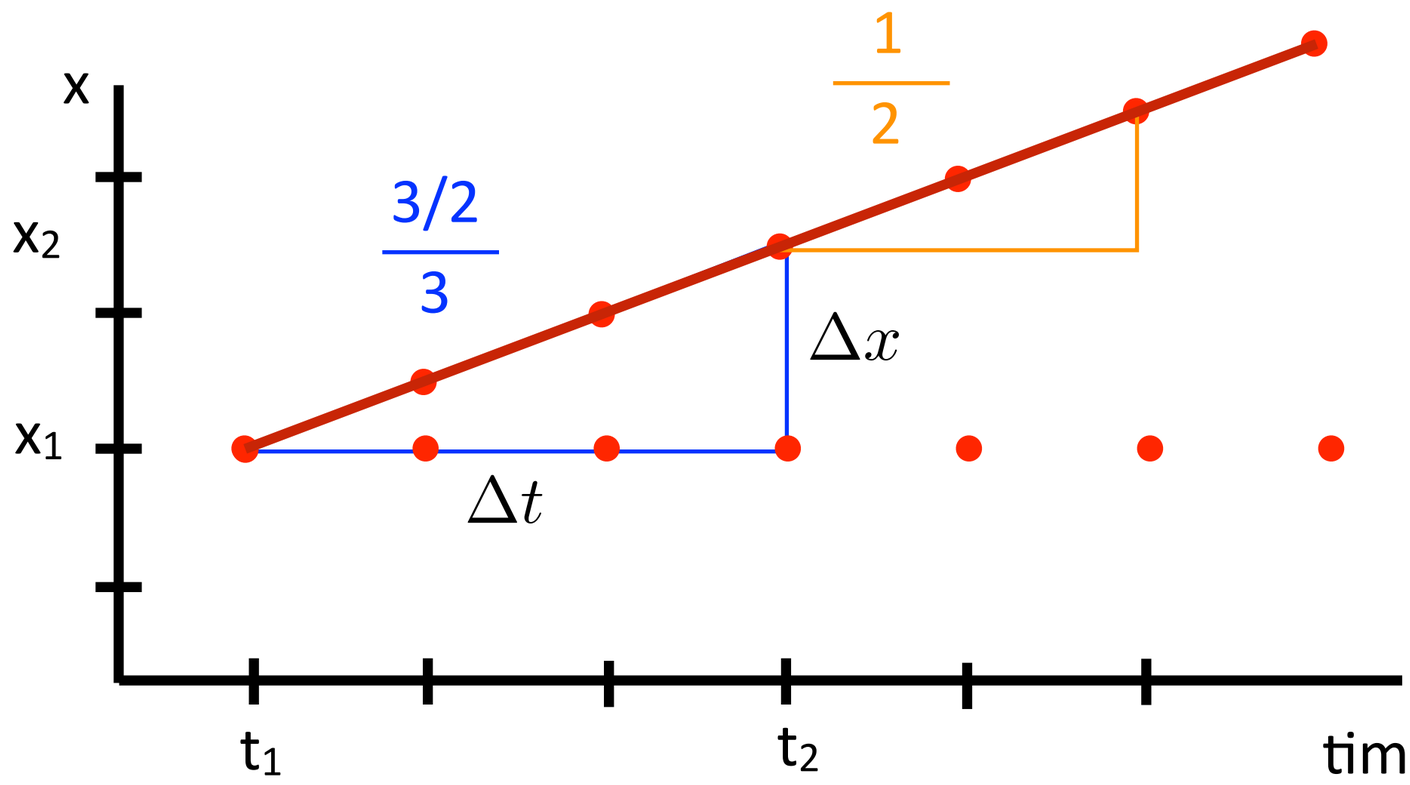
average speed.

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

Speed

Distance over time

so, we'll use functions



$$v = \text{speed} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{\Delta x}{\Delta t}$$

the slope of the x-t curve

"v" for "velocity"
(stay tuned)

Velocity is the change of distance in time:

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

conventional notation

"x_0"

little subscript 0: "where you start" or "initial position"

average $v = \text{speed} = \dfrac{x - x_0}{t - t_0}$

conventional notations

average of a quantity

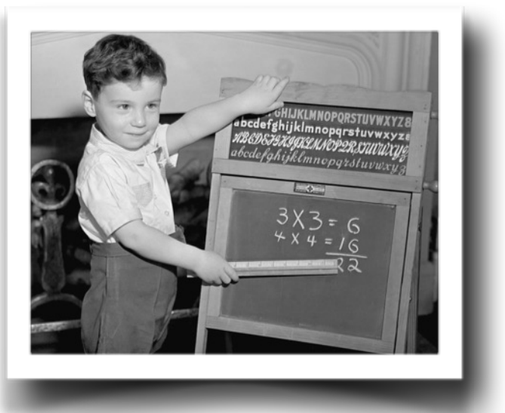
$\overline{X}$ or $< X >$

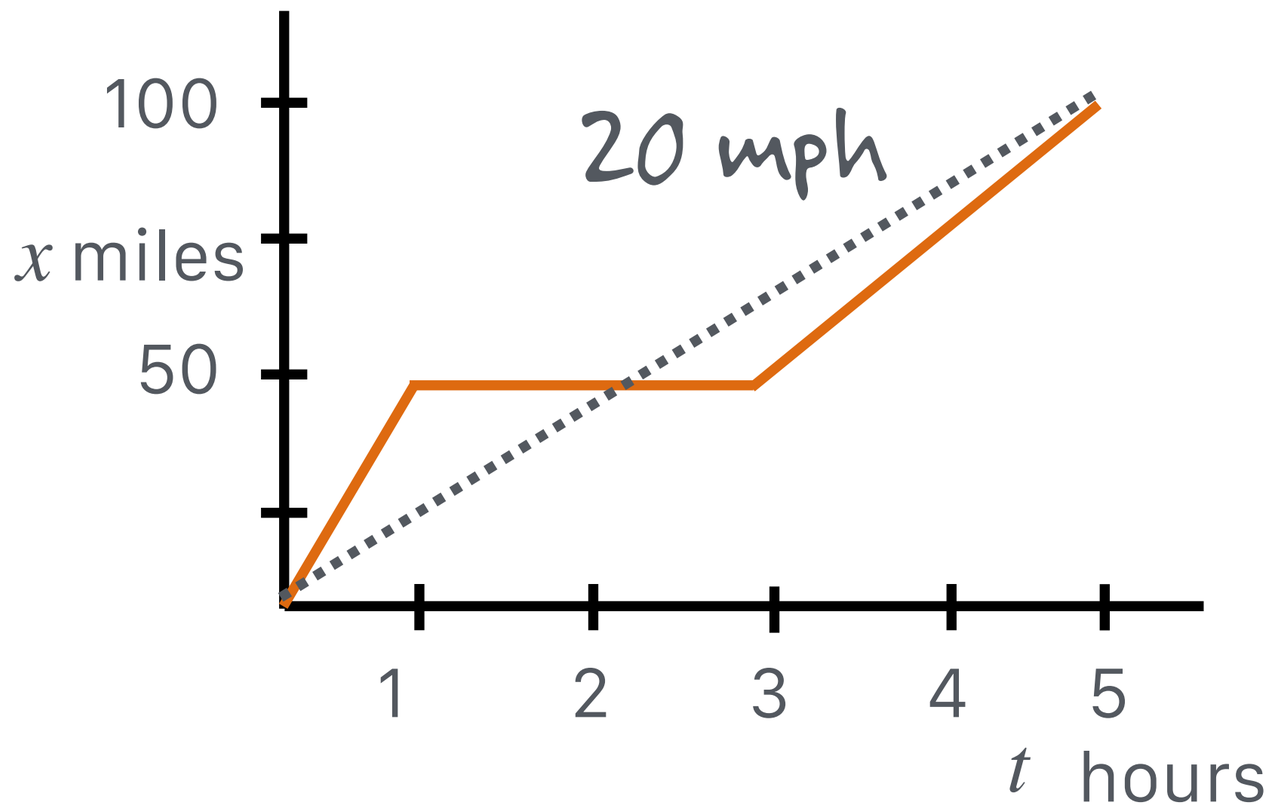
average speed

is always:

$$\bar{v} = \frac{\text{total distance traveled}}{\text{total time}}$$

what's the average velocity





average speed? careful!

normally, you think of the average of something:

Tuesday I had 90 students and if today I have 10, what would you call the average attendance for the week?

Embarrassing.

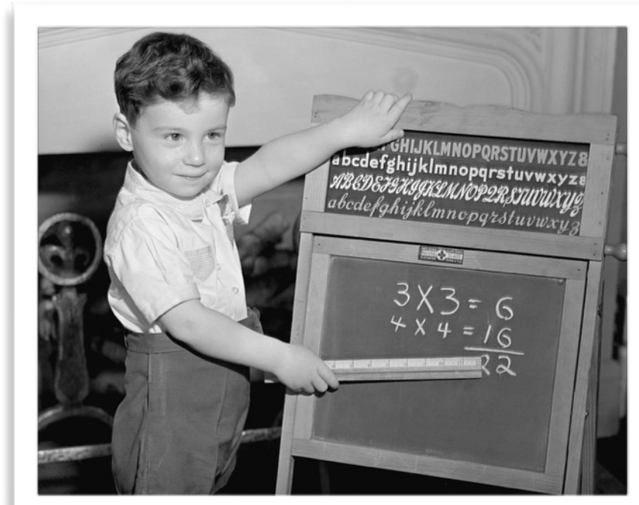
$$\text{average attendance} = \frac{\text{Tuesday's} + \text{Thursday's}}{2} = 50$$

BUT: Suppose you traveled:
20 mph for 2 hours
40 mph for 4 hours.

Is your average velocity $\frac{1}{2}(20+40) = 30$?

this is an average of averages...a easy trap

$$\bar{v} = \frac{\text{total distance traveled}}{\text{total time}} = \frac{40+160}{6} = \frac{200}{6} = 33.3$$



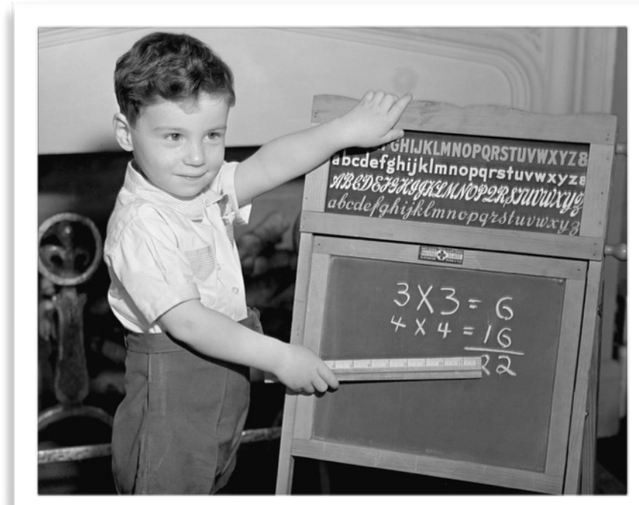
a number:

the speed of light

186,000 miles per sec

what’s this speed in:

miles/hr, meters/second



a number:

the speed of light

186,000 miles per sec

how far (in meters) does light travel in:

1 year

kinds of motion

in time:

constant speed: “uniform motion”

changing speed: “accelerated motion”

changing speed at constant rate: “uniformly accelerated motion”