

Lecture 3D

- Let's spend the rest of the course talking about interesting things 😊
- things that you probably won't see in any other course at CNU, which is just wrong, IMNSHU.

TOPIC 1

Relativity and Albert Einstein

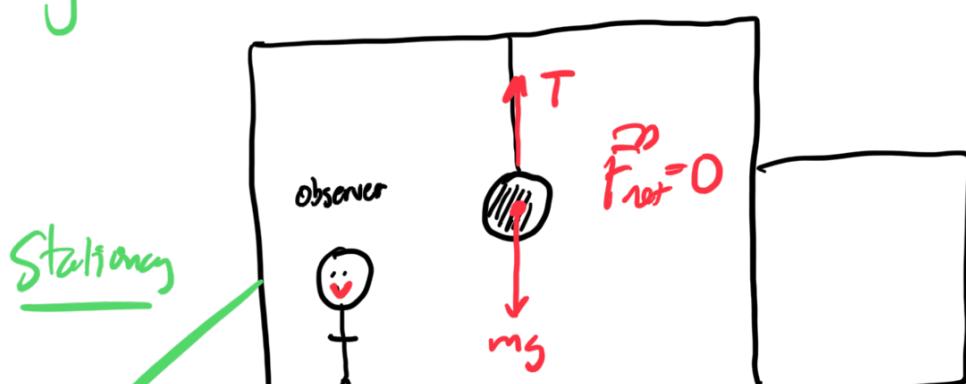
Einstein was incredibly brilliant, and had a lot of personal flaws - ~~woman~~ in his life. He

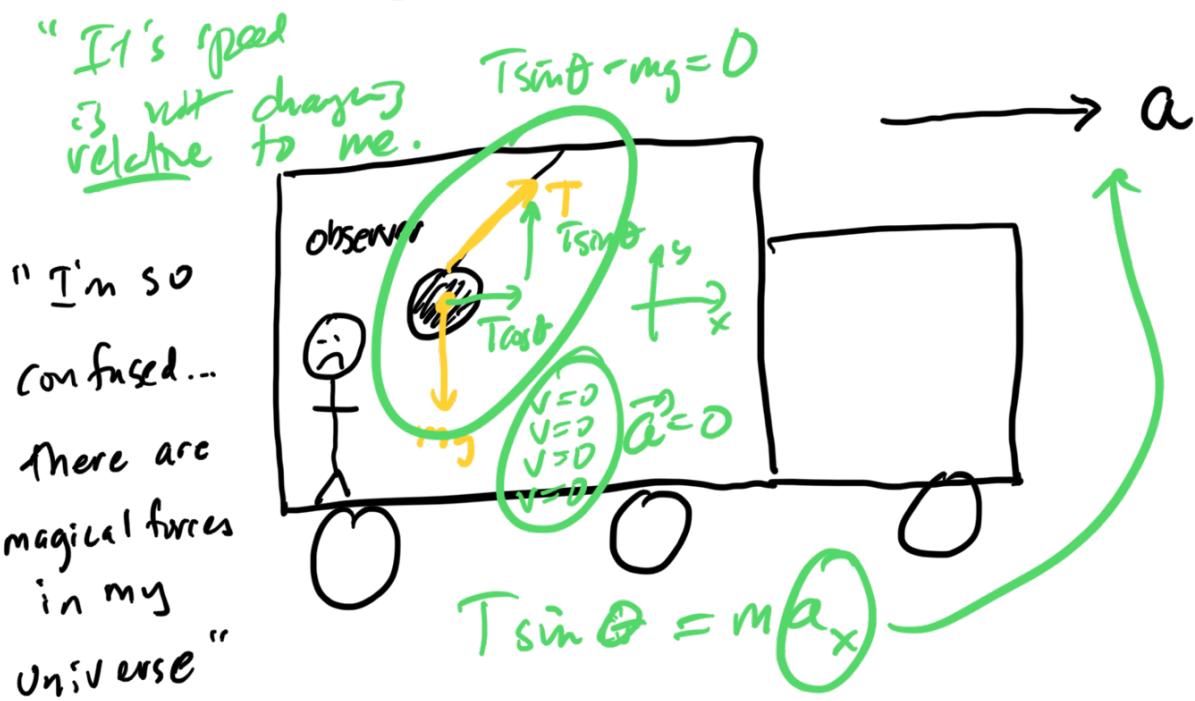
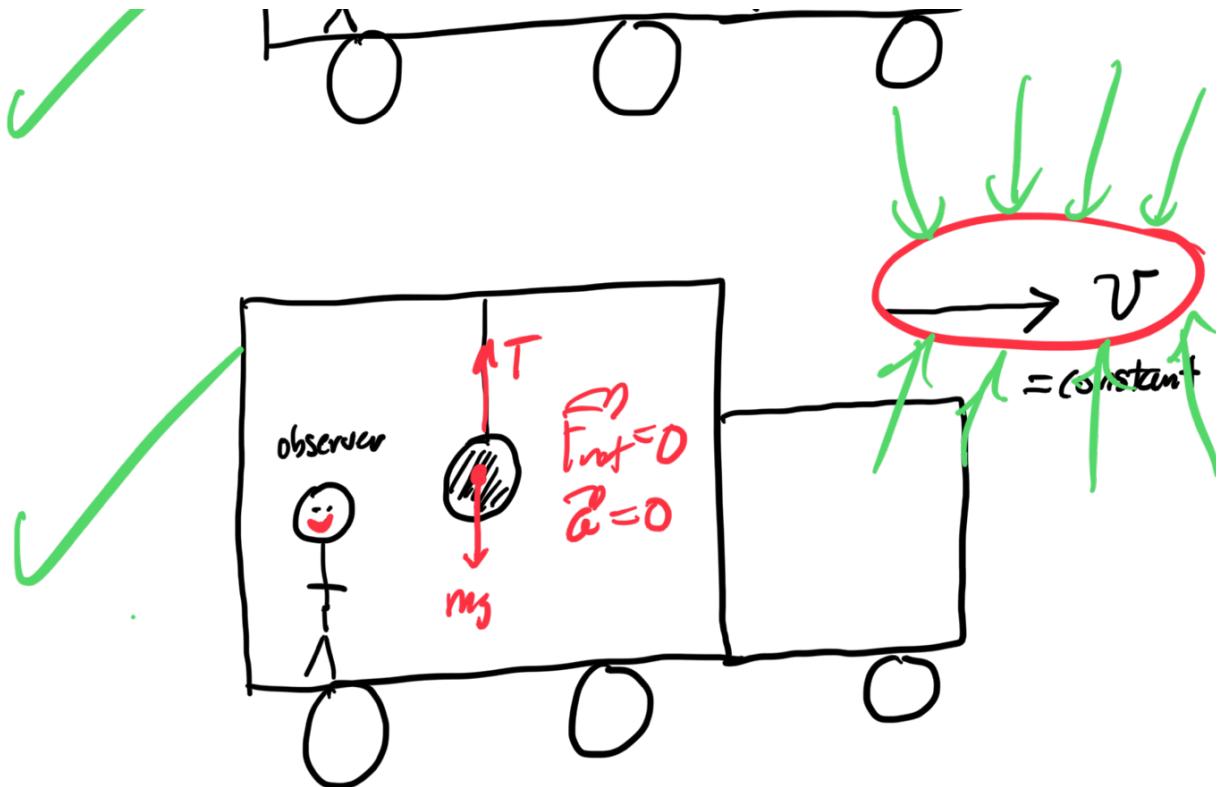
and major issues --
B a fascinating person; you should
read about him.

- ① He asked hard and probing questions.
- ② He was willing to go against the commonly accepted explanation of things.

Newton's Laws, and Accelerating
Reference Frames
gedanken experiments

$$\begin{aligned}\vec{F}_{\text{net}} &= 0 \\ &= m\vec{a} \\ \text{constant velocity}\end{aligned}$$





Conclusions:

① Newton's Laws only work in non-accelerating

reference frames.

- ② The speed of the reference frame can never appear in the equations of motion.

BIG PROBLEM !

Maxwell's

Equations → describe EM phenomena, and light!

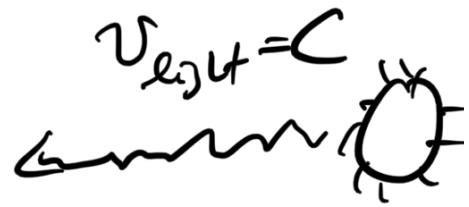
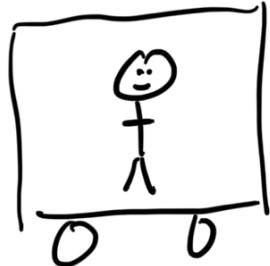
→ the speed of light appears in the equations of motion.



$$v_{\text{light}} = c$$

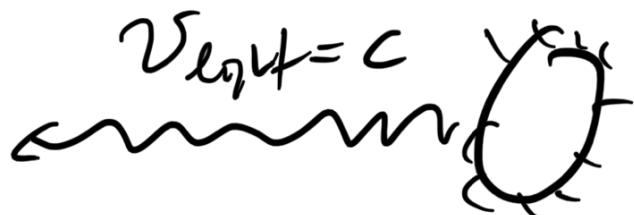
, $3 \times 10^8 \text{ m/s}$

$$(2.99 + \alpha) c$$



$$v_{\text{trunk}}$$

relative to him



$$\leftarrow v_{\text{trunk}}$$

$$v_{\text{object}}^{\text{relative to him}} = v_{\text{object}}^{\text{same}} + v_{\text{trunk}}$$

~~$$= C + v_{\text{trunk}}$$~~

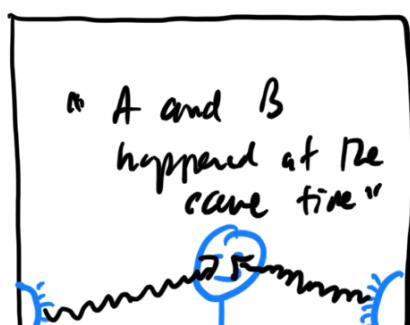
~~$$= C + v_{\text{trunk}}$$~~

$$= c$$

huh?

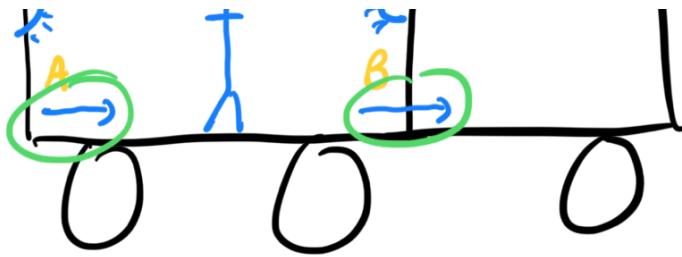
"The speed of light is the same in all reference frames."

How?



$$v = 0.8c$$





→ light A and light B flash at the same time.

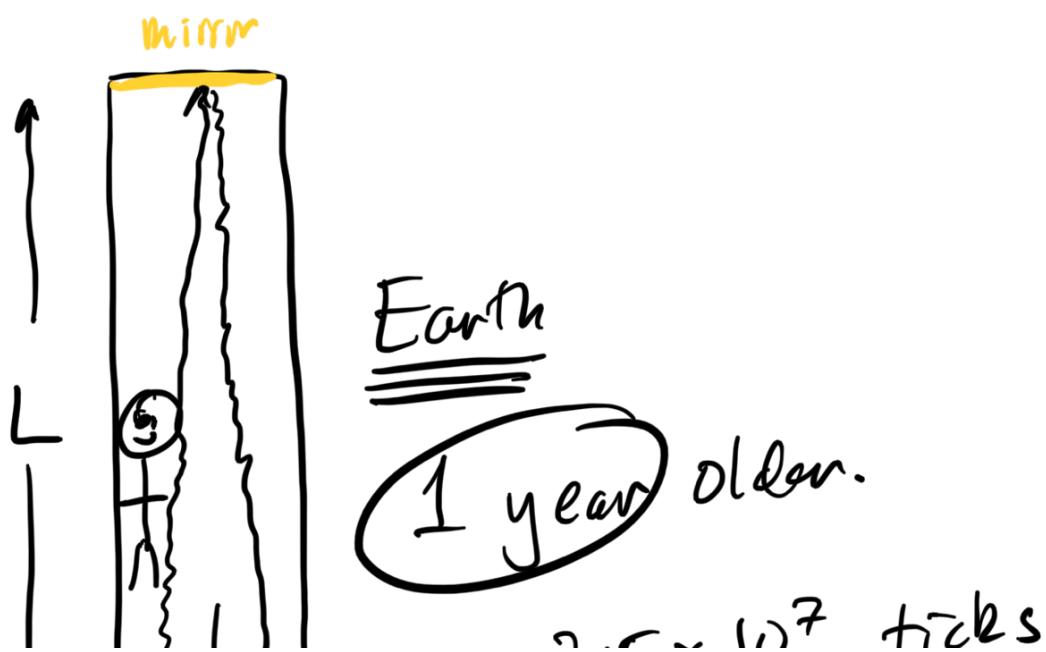
light similes
 are moving.
 $v = 0.8c$
 light from A and B do not
 reach his eyes at the same
 time.

"A and B happened at different
 times"

Principle of Simultaneity.

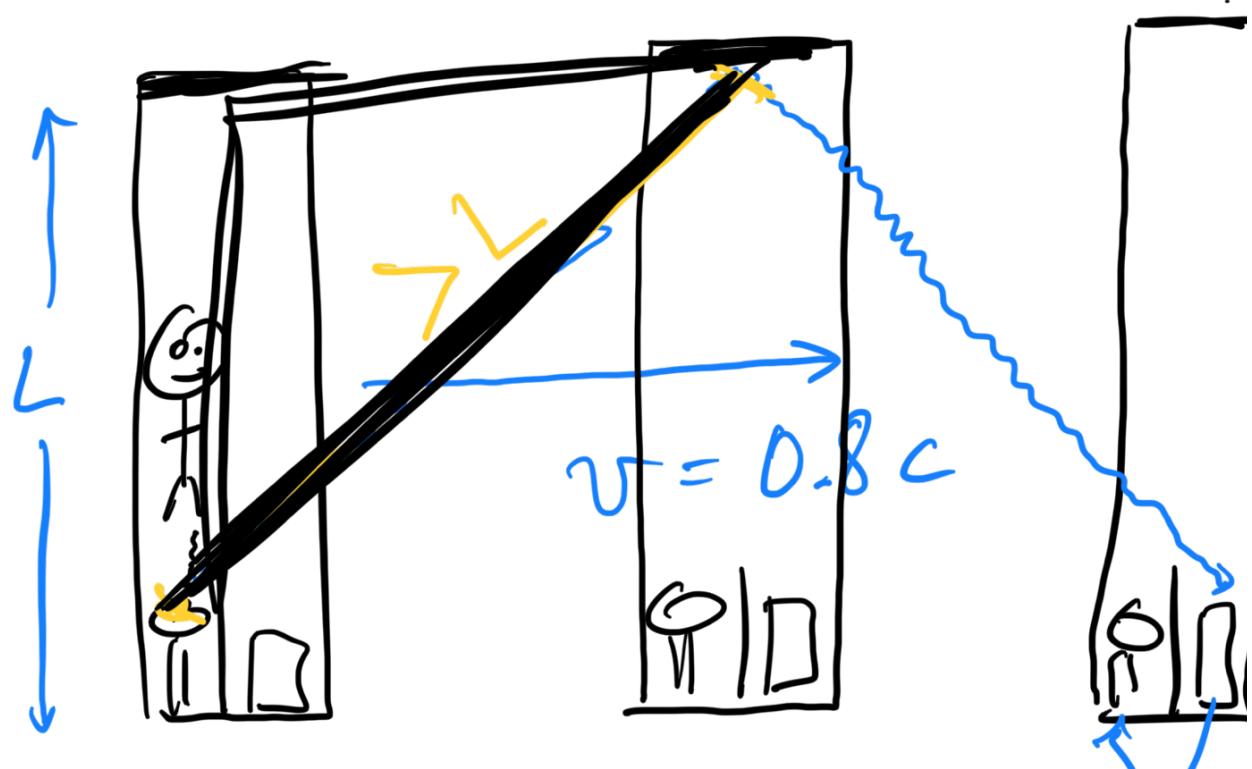
"Our perception of time
depends on whether we
are moving relative to
the event that we
are observing"

Build a Clock





design L such
that light
flashes 1 time
per second.



Moving Clock runs slow

slower ;

— tick one every 1.7 seconds.

" $\frac{1}{1.7}$ of a year." older.

"TWIN PARADOX"

Space and time are
not separate dimensions

Time Dilatation



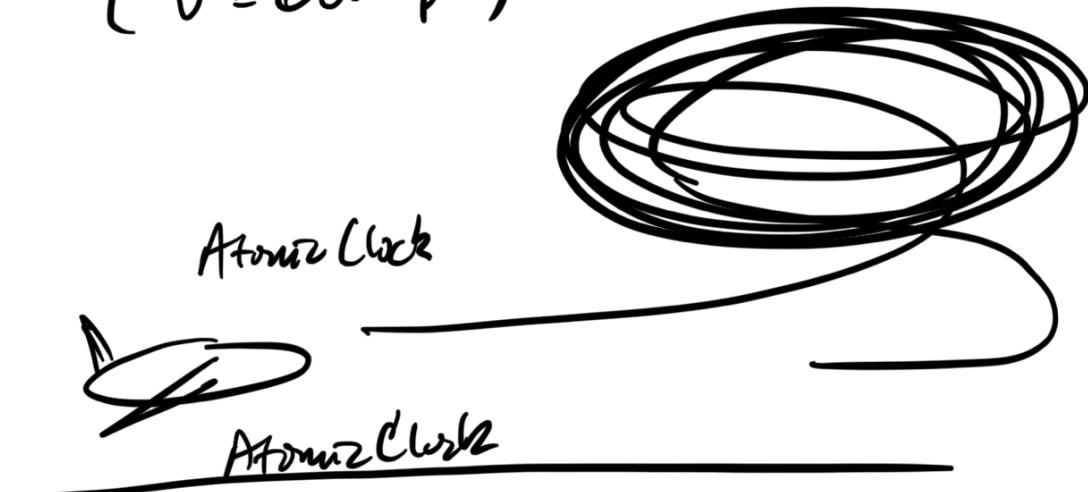
$$1 - \frac{v^2}{c^2}$$

dilation factor

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

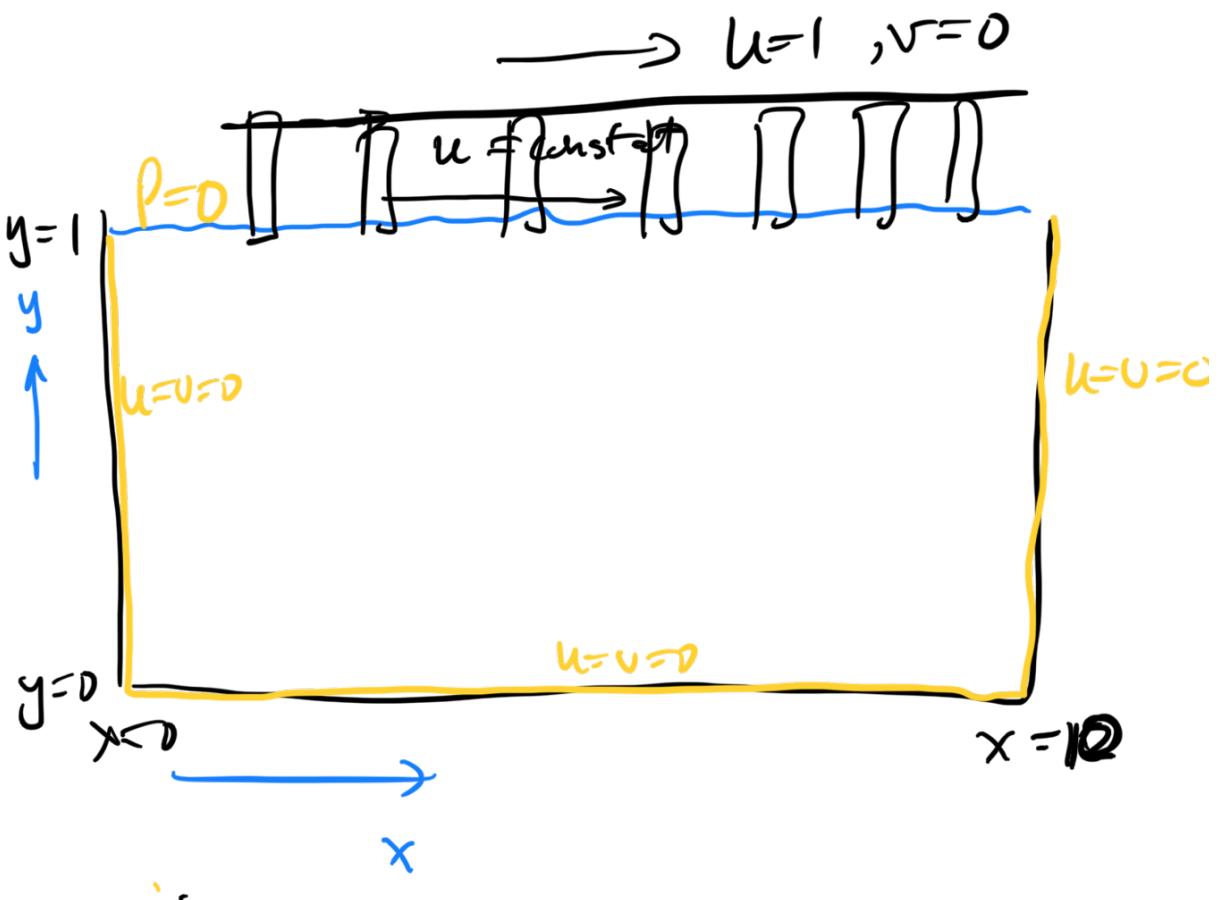
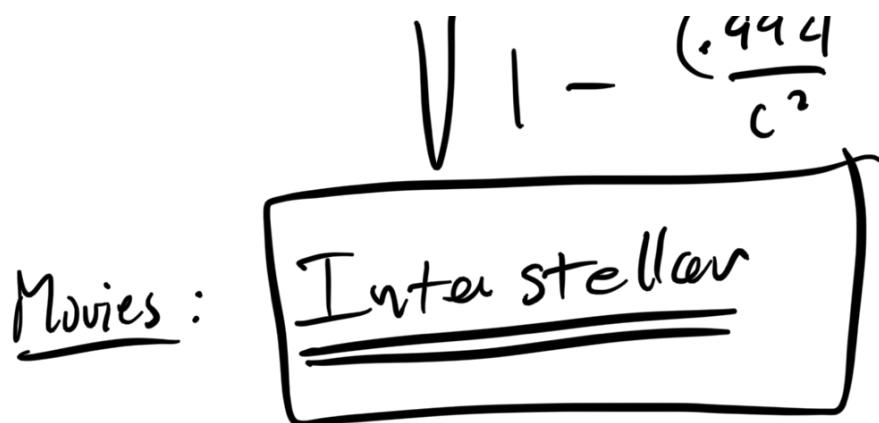
Jet Airplane
($v = 600 \text{ mph}$)

$$\gamma = 1.000000$$

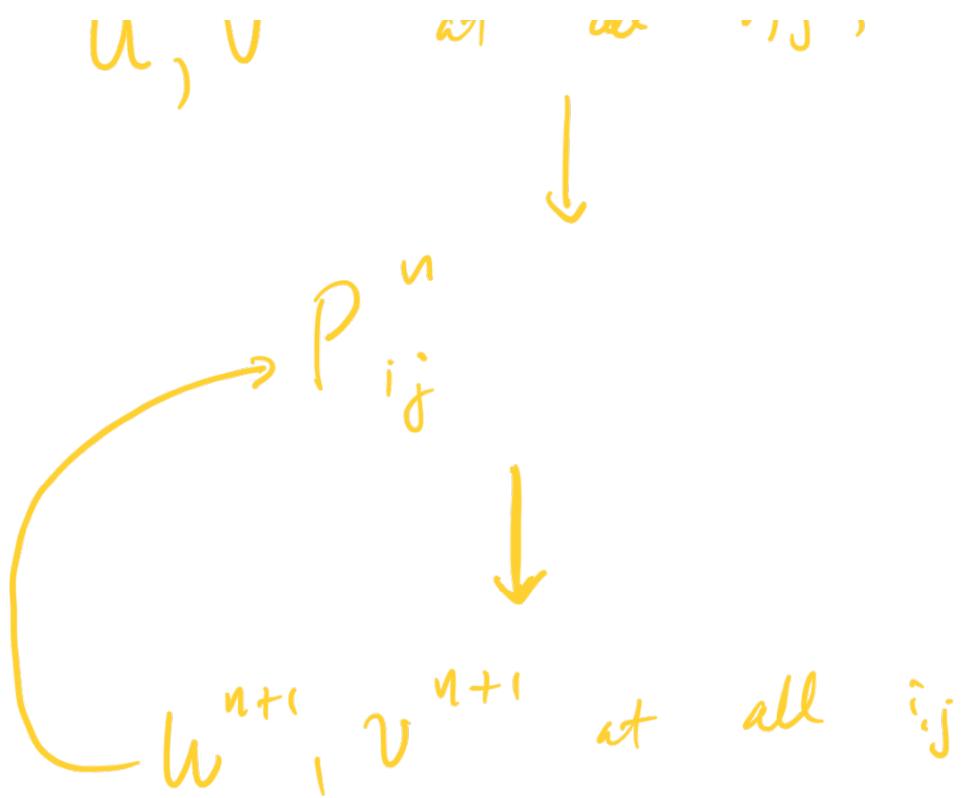


$$v = 0.99 c$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = 7.1$$



$1 + \dots + \text{all i.e. } n=0$



- ENGL 223
- Foreign Language ?
- MATH MATH 140 or MATH 12
- MATH
- AINW + Lab → CHEM 121 + Lab
- AIGM



Kinesiology - Specs of next semester.

Fall 2021

- 3 FRENCH 102
- 3 ENGL 223
- 3 CHEM 121
- 1 CHEM 121L
- 3 BIO 211
- 1 BIO 211L



Sprg 2022

- 3 FREN 200
- 3 CHEM 122
- + CHEM 122L
- 3 BIO 212
- + BIO 212 L

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ALGM

MATH 125 pre reqs for Y10 300

Foreign Language

SPAN 200

ENGL 223

FALL 2021

MATH 247

ENGL 223

CDEV 214

PHYS 303



SPRING 2022

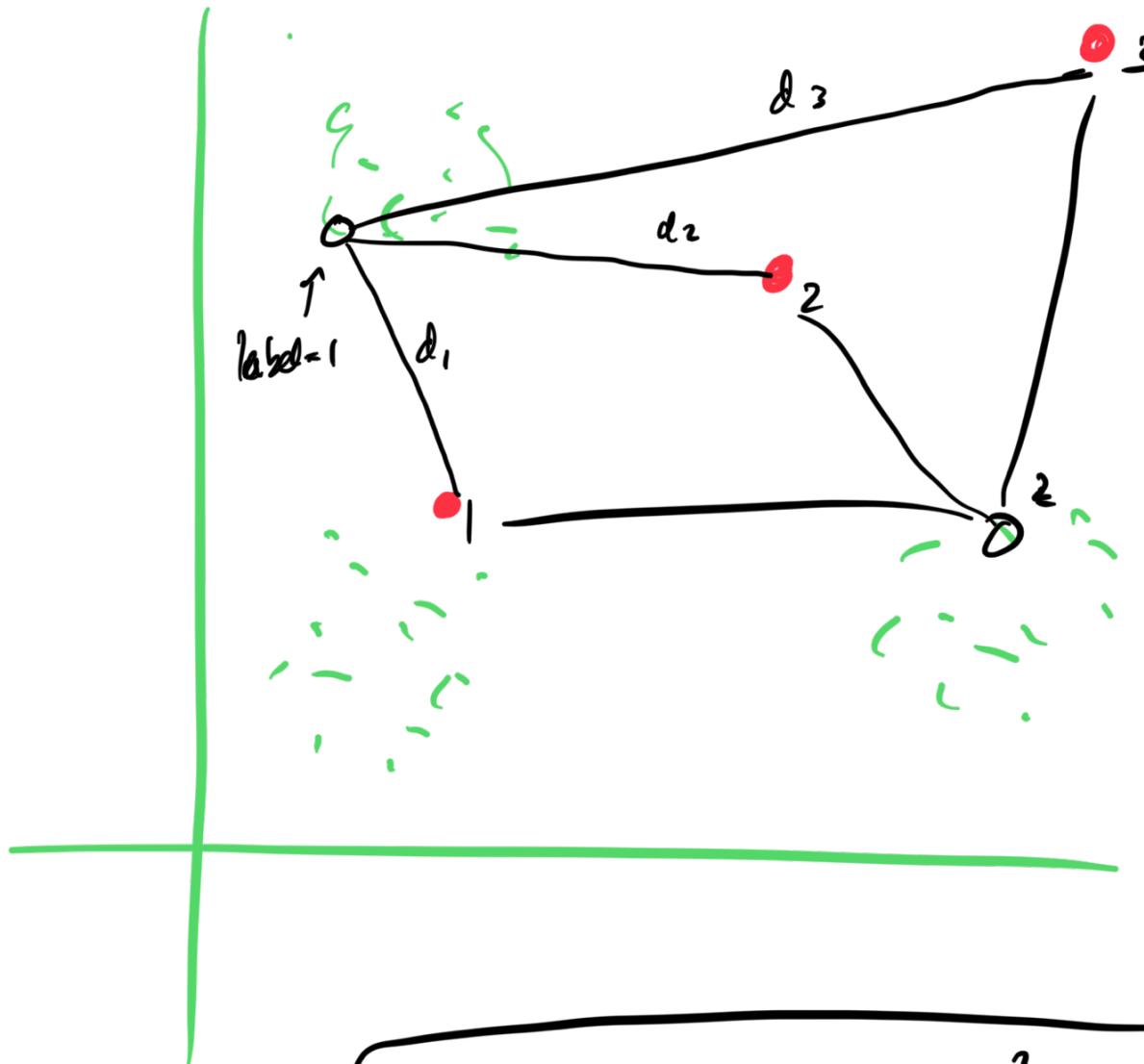
MATH 250

① SPAN 200

② CHINESE / FRENCH / GERMAN / AUSTRIAN ✓

③

PHYS 341



$$\sqrt{(x - x'_c)^2 + (y - y'_c)^2 + (z - z'_c)^2}$$

abs ← numpy array !