Welcome to MATH 107

Weekly expectations (details in syllabus)

- weekly homework assignments
  - programming component
  - written component
- lecture assessments - due by midnight before the next lecture
- exams (2 midterms + final)

Office hours: to be determined

* always available by appointment *

Office hours are good: go to them!

Upcoming deadlines

- flipgrid intros due Friday @ midnight
- lecture assessment
  - 1st due Tuesday night
  - 2nd due Sunday night
- install MATLAB ASAP!
- read the syllabus

MATH 107 HYPE!

Pretty much the coolest Freshman class ever!

{ Programming
  linear algebra

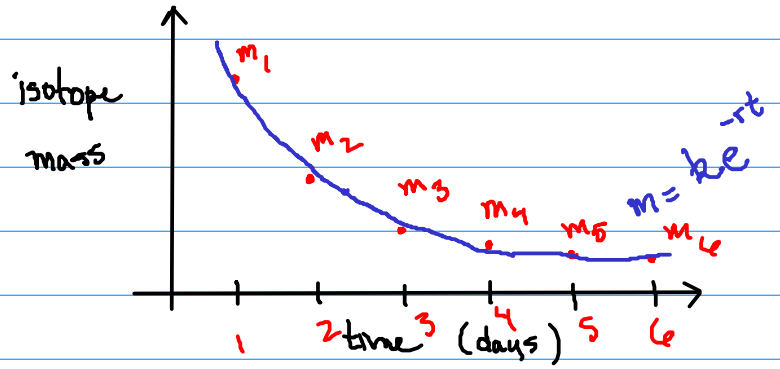
The better you are at these, the better that life is going to be!

You are getting these skills early on, relative to many other universities

You can even make waves / money with websites which use these skills (Kaggle)

Applications of computational linear algebra

- Curve fitting



Choose the curve that fits the data as close as possible!

$$\text{Error}_{\text{RMS}} = \sqrt{\left(m_1 - ke^{-r\cdot 1}\right)^2 + \left(m_2 - ke^{-r\cdot 2}\right)^2 + \ldots + \left(m_6 - ke^{-r\cdot 6}\right)^2}$$

Using computational linear algebra, choose k + r so

that Error_{RMS} is minimized.

Another application — housing prices

lot size	interior sq ft	# beds	# baths	price
2000	1500	3	2	425 000
3000	1000	2	1	375000
3120	2000	4	2	500000
1100	850	2	2	225000
2000	1800	3	3	432000

Question: what should your house cost approximately

Given lot size/interior/beds/baths, guess price

Linear regression does this ← computational linear algebra

Solve differential Equations:

Think about a pendulum

The angle changes as a function of time $\theta = \theta(t)$

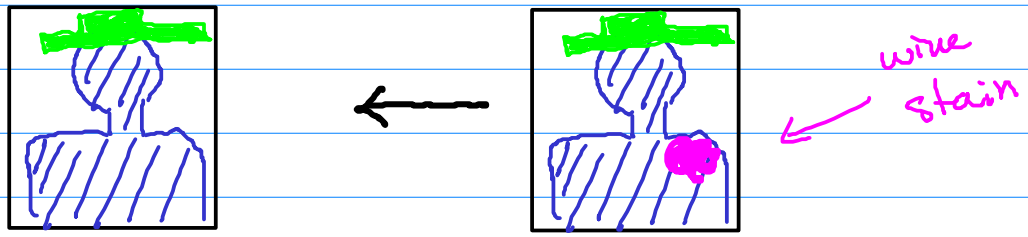
Satisfying a differential equation

$$\frac{d^2\theta}{dt^2} + p\frac{d\theta}{dt} + k^2\theta = 0$$

p: friction coefficient

k: related to length of the pendulum + mass

Image Processing



we can remove the stain with computational linear algebra.

Instagram filters ⇝ also involve digital image processing w/ computational linear algebra!

Flashback to calc 1

Newton's method.

To solve an equation $f(x)=0$

Start with a guess x_0

Update with the rule $$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

Then the x_n's converge to a solution

Ex: $e^x + x = 0$

$f(x) = e^x + x$

$f'(x) = e^x + 1$

$$x_{n+1} = x_n - \frac{e^{x_n} + x_n}{e^{x_n} + 1}$$

Do fast w/ matlab!