Week 1

Tuesday, January 19, 2021 5:04 PM

- introduction
  - name: Izak (he/him/his) pronounced Isaac
    - 2nd year math graduate student
    - from Wisconsin
    - email:
    - website (I may have a section website)
  - go through names
    - name
    - year
    - where you are currently (city)
    - a good movie, show, book, or anything you recently experienced
  - office hours
    - **Tuesday and Thursday 5pm - 6pm**
    - if you have a question or don't understand something, go to office hours (mine or another GSI)! (I prefer this to emails)
      - it is **the** most efficient way to learn something
  - math 98 (MATLAB)
    - consider taking this if you are new to coding

- discussion philosophy
  - **purpose of discussion**: help you learn course material efficiently in a smaller class size
  - types of discussion
    - problem solving - I prepare a worksheet, everyone works on it.
      - ideally students work together and **discuss**. Teaching is the best way to learn
      - in practice: complete silence, I just go through the problems. This is no difference than watching a youtube video (except worse, because people on youtube are better explainers than I am).
    - office hours - I just answer questions, I don't prepare any materials
      - this is nice, especially virtually, unfortunately, most students will not have prepared questions
    - lecture - where I just lecture material
      - this is redundant, but if requested by majority of people going to discussion, I will do this

- Fluidity
  - this discussion section will change, I will ask for feedback
  - some students may come to first (or second) section and not like how it is run, and won't return. Instead give me feedback, or see if things improve.
    - discussion will be shaky for the first few weeks
  - **I am here to help you learn, not to give you a bad grade**

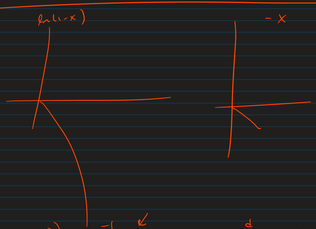
- Exercises (if time permits)

1) prove $\ln(1-x) \leq -x$ for $0 \leq x < 1$
2) suppose p^* must approximate p with relative error at most 10^{-3}. Find the largest interval in which p^* must lie for $p = 150$ and $p = 1500$

Def relative error p to p^* is

$$\left|\frac{p-p^*}{p}\right|$$

1)

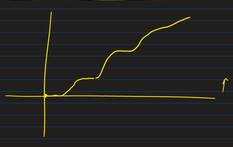


$\frac{d}{dx}(\ln(1-x)) = \frac{-1}{1-x}$ $\qquad$ $\frac{d}{dx}(-x) = -1$

$\ln(1-x) \overset{?}{\leq} -x$

$0 \overset{?}{\leq} \underbrace{-x - \ln(1-x)}_{f(x)}$ $\qquad$ want to show $f(x) \geq 0$

if $\begin{cases} f(0) = 0 \\ f'(x) \geq 0 \end{cases}$ then $f(x) \geq 0$



$f(0) = -0 - \ln(1) = 0$

$f'(x) = -1 + \frac{1}{1-x} = \frac{1-1+x}{1-x} = \frac{x}{1-x} \overset{?}{\geq} 0$ on $0 \leq x < 1$

$\boxed{\text{DESMOS}}$

numerator ≥ 0 b/c $x \geq 0$

denominator ≥ 0 b/c $x < 1$

2) find p^* s.t. $\left|\frac{p-p^*}{p}\right| \leq 10^{-3}$ for $p = 150$, $p = 1500$

$$\boxed{\begin{array}{l} \text{Prop } |x| \leq a \\ \text{if and only if} \\ -a \leq x \leq a \end{array}}$$

$$-10^{-3} \leq \frac{p-p^*}{p} \leq 10^{-3}$$

$$(-10^{-3})p \leq p - p^* \leq (10^{-3})p$$

$$(-10^{-3})p - p \leq -p^* \leq (10^{-3})p - p$$

$$(-1)((-10^{-3})p - p) \geq p^* \geq (-1)((10^{-3})p - p)$$

$$p(10^{-3}+1) \geq p^* \geq p(1-10^{-3})$$

$$[p(\underbrace{1-10^{-3}}_{.999}), (\underbrace{10^{-3}+1}_{1.001})p]$$

$p = 150$ $\qquad$ $(150$