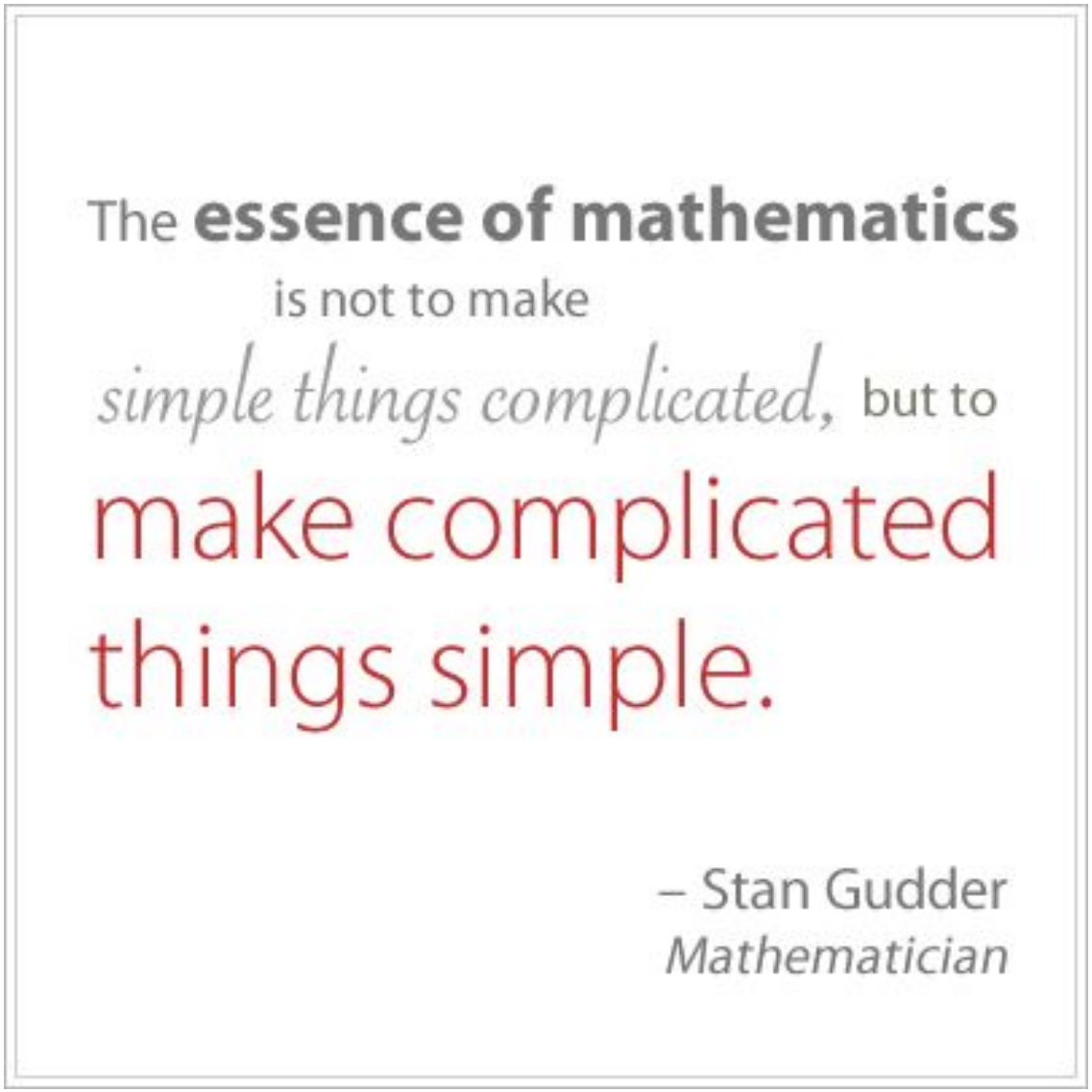
Data Exploration

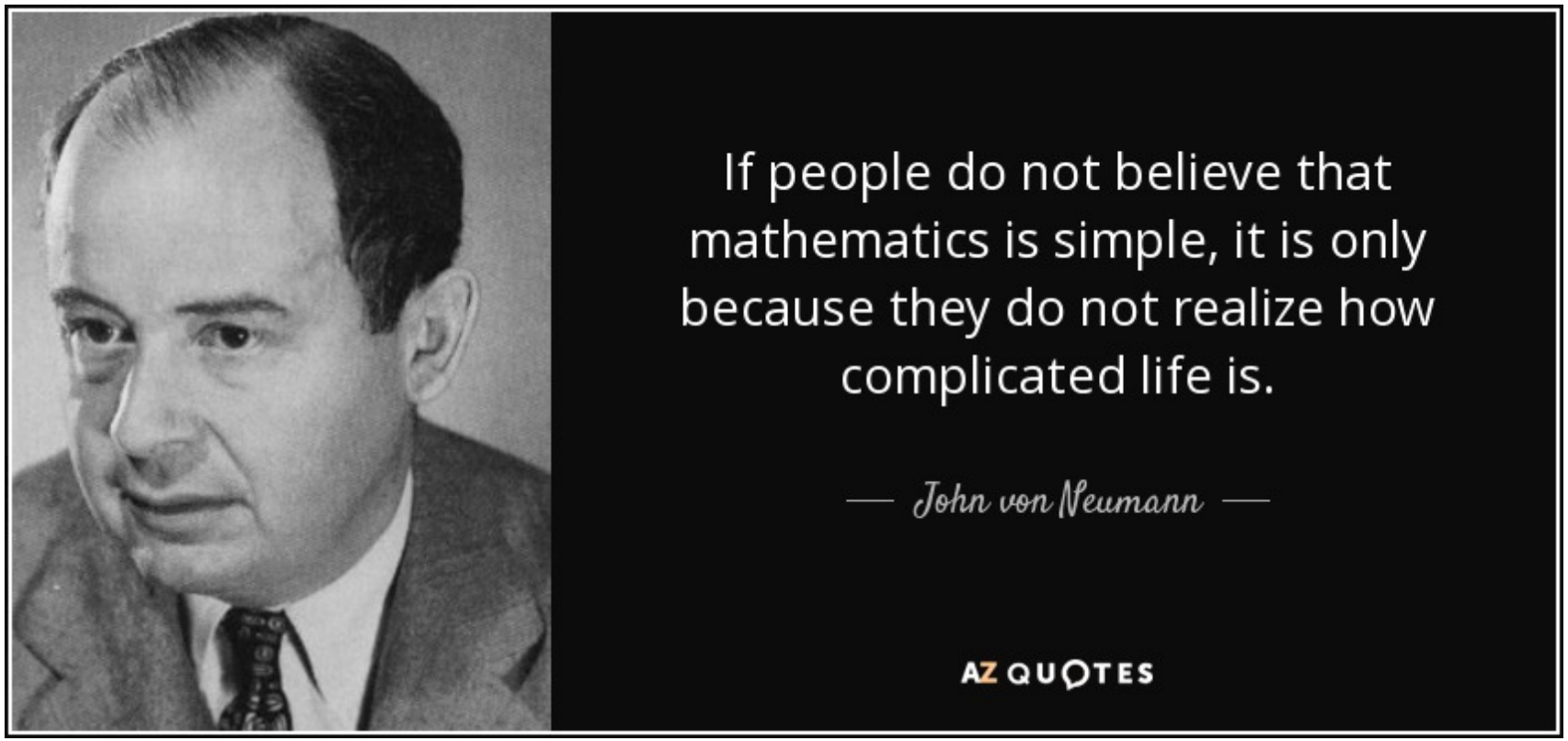
BIO401-01/598-02

2021-03-31 Wed

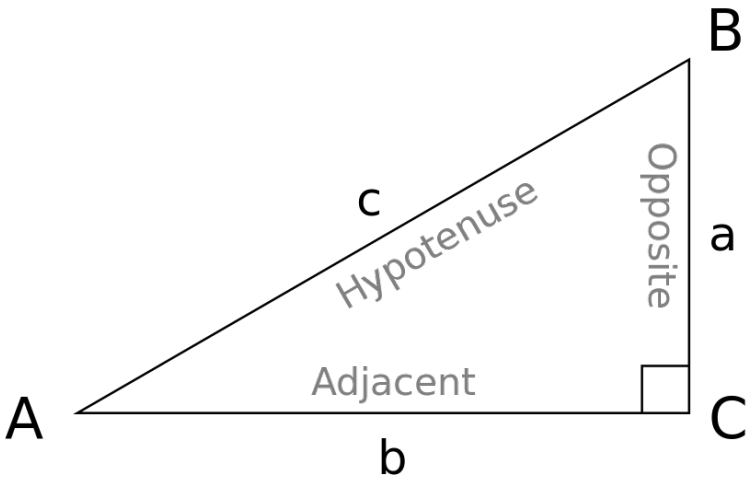
Preface


The essence of mathematics
is not to make
simple things complicated, but to
make complicated
things simple.
– Stan Gudder
Mathematician

Preface

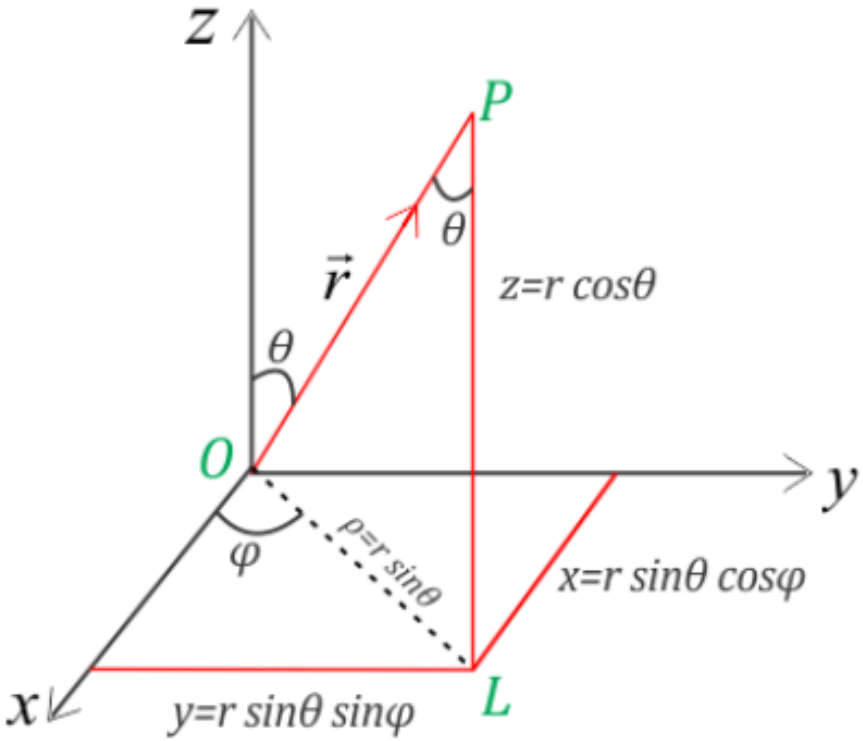

If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is.
— John von Neumann —
AZ QUOTES

REVIEW : Trigonometry



$$sin(A) = a/c$$
$$cos(A) = b/c$$

REVIEW : Spherical Geometry



Spherical law of cosines

$$cos(\gamma) = cos(\alpha)\,cos(\beta) + sin(\alpha)\,sin(\beta)\,cos(c)$$

$$cos(c) = cos(a)\,cos(b) + sin(a)\,sin(b)\,cos(\gamma)$$

Geodesic : d(X,Y) being the distance between two points on Earth

$$d(X,Y) = R\cos^{-1}\{sin(\phi_X)\,sin(\phi_Y) + cos(\phi_X)\,cos(\phi_Y)\,cos(\Delta\lambda)\}$$

where ϕ_X and ϕ_Y are latitudes for X and Y, and $\Delta\lambda$ is the longitude difference.

Example

Consider two locations in north America, A(80.554 W,25.740 N) and B(162.786 W,68.802 N), calculate their geodesic distance.

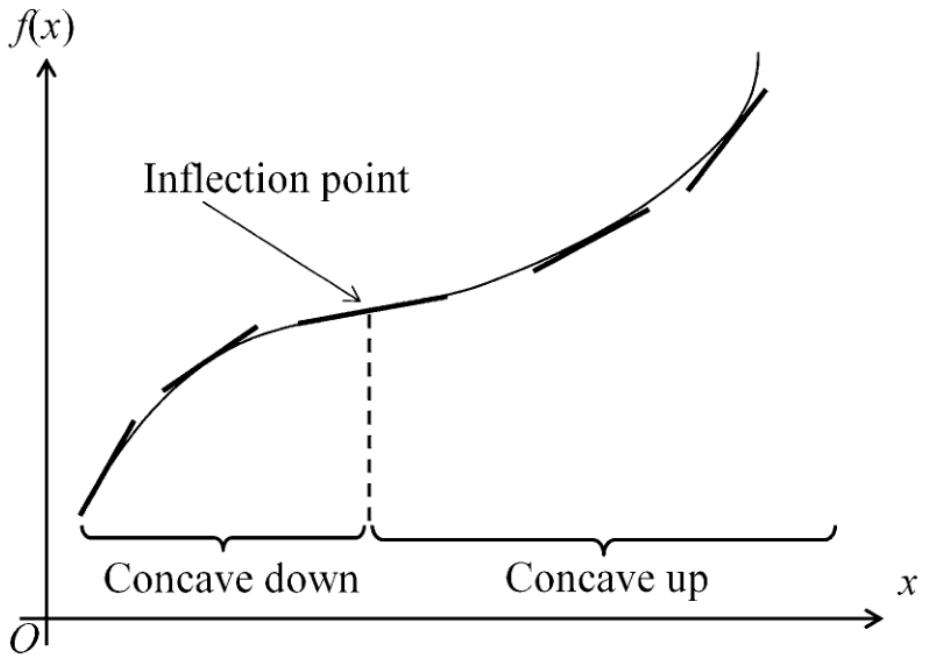
REVIEW : Derivative properties

Extrema

If $f(a)$ is local minimum or maximum for f, the $f'(a) = 0$

- Concavity

When the first derivative of a function is decreasing, then the function is concave ($f''(x) < 0$).
When the first derivative of a function is increasing, then the function is convex ($f''(x) > 0$).
Then change of concavity occurs at the inflection point, where $f''(x) = 0$



Grading

```
# total is sum of the scores for all questions except for the bonus
# bonus is a fraction, say .1 = 10%
# final score is scaled to 10*(1+bonus)

grdMerge <- function(week,raters,total,bonus){
  lstGrd <- vector(mode='list')
  for (grader in raters){
      sheetname <- paste0("grading_sheet_",grader,"_",week,".csv")
      lstGrd[[grader]] <- read.csv(sheetname,header=FALSE)
      nQ <- ncol(lstGrd[[grader]]) - 1
      colnames(lstGrd[[grader]])[1] <- "name"
      colnames(lstGrd[[grader]])[-1] <- paste0("Q",1:nQ)
      lstGrd[[grader]][,-1] <- lapply(lstGrd[[grader]][,-1],as.numeric)
      lstGrd[[grader]]$sum <- rowSums(lstGrd[[grader]][,-1],na.rm=TRUE)
      lstGrd[[grader]]$scale <- lstGrd[[grader]]$sum*(10*(1+bonus)/total)
  }
  lstGrd[[raters[1]]]$ave <- (lstGrd[[raters[1]]]$scale + lstGrd[[raters[2]]]$scale)/length(raters)
  lstGrd[[raters[2]]]$ave <- (lstGrd[[raters[1]]]$scale + lstGrd[[raters[2]]]$scale)/length(raters)
  for (grader in raters){
      sheetname <- paste0("grading_sheet_",grader,"_",week,"_merg.csv")
      lstGrd[[grader]][,1] <- formatC(lstGrd[[grader]][,1],width=18)
      lstGrd[[grader]][,-1] <- lapply(lstGrd[[grader]][,-1],formatC,format="f",digits=1,width=5)
      colnames(lstGrd[[grader]])[1] <- formatC(colnames(lstGrd[[grader]])[1],width=18)
      colnames(lstGrd[[grader]])[-1] <- formatC(colnames(lstGrd[[grader]])[-1],width=5,digits=1,format="f")
      write.table(lstGrd[[grader]],sheetname,sep=",",row.names=FALSE,quote=FALSE)
  }
}
```

HW return

- BB
- email
- slack : encryption or not

Encryption

```
$ gpg --gen-key
answer questions along and set up your password
this may take a bit of time

$ gpg --list-keys
$ gpg --export --armor --output your_name.asc your_email
```

Decryption

```
$ gpg --output decrypted_filename --decrypt encrypted_filename
```

Action

message me your option in the slack private channel by 4 pm April 1st.

1. No. I don't want marked HW
2. Yes. Please send via email
3. Yes. Please send via slack w/ encryption
4. Yes. Please send via slack w/o encryption

```
If (3), please send along the file your_name.asc
in the slack private channel by 4 pm April 1st.
```

If I did not receive any response from you by the due time, I take it as you chose option (1).

References

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