

Lecture 3

(Rough Notes)

Part 1 -- recap "matrix"

1) In previous lecture, we mentioned "matrix", which is something well-known to physics students, but maybe not to other students.

Q: What is the original meaning of the English word "matrix"? Can you tell me – you can look up the meaning anywhere!

A: pregnant animal, womb.

Please check in Wikipedia or else what the etymological origin (語源) of the word “matrix” is.

Q: Next, what is the historical origin of the matrix?

A: (I give) Read this article (you don't have to know every word inside, especially the mathematical term. That's how some people read a science paper for the first time! Of course, after first reading, if you find the paper interesting, you can read it many times in more detail!)

<https://mathsmartinthomas.wordpress.com/2017/02/26/discovering-the-theory-of-matrices-one-of-arthur-cayleys-first-papers/>

Q1: What was Cayley's profession? Why? Do you see any difference to today's universities?

Now, back to Cayley and matrix. Look at his paper (this is an exercise to see how math people wrote papers almost 200 years ago) and "underline" those words unfamiliar to you, or you want to clarify on p.1 (ignore everything after the words "I succeeded...")

<https://mathsmartinthomas.files.wordpress.com/2017/02/cayleymatrices.pdf>

Exercise: What is the meaning of $(x \ y \ z)(a \ b \ c)$ in there?

Exercise: Why did Cayley talk about transformation?

Exercise: Try to compare this with modern textbook notations.

Remark: Note that Cayley mentioned "modestly" that he considers only 3×3 matrices and continues to claim that he can do similar computations for other matrices

Q: What are real life applications of matrices?

Exercise: Read (part of)

<https://math.stackexchange.com/questions/160328/what-is-the-usefulness-of-matrices>

The most Famous Example

Google Page Rank

Every time when you search for something using Google Chrome, you are using matrix. The way they rank the pages is called Page Rank.

Please look up what "Page Rank" is in the internet.

Appendix (for vector, matrix)

This website is very easy to understand. A good read.

<https://chortle.ccsu.edu/VectorLessons/vectorIndex.html>

(Part 2) Symmetry

Q: What do you mean when you say something is symmetric?

Q: How would mathematicians define this concept?

Sauty's YouTube

https://www.ted.com/talks/marcus_du_sauty_symmetry_reality_s_riddle