

# Learning Notation: Introduction

Uppsala Pareto Seminars

03 March 2022

## Welcome

Welcome to the Learning Notation mathematics seminars! The seminars are organized by economics masters students in Pareto to discuss mathematics and economics in an informal setting.

Among others, we hope to venture topics including

- proof techniques and set theory,
- real analysis and advanced calculus,
- differential equations and linear algebra,
- probability theory,
- complex numbers and their geometry.

The motivation of the seminars is to provide a forum where we can discuss and explore mathematics without the stress and obligations of an academic class. The hope is that we can discover some of the beauty and rigor of mathematical ideas together.

*A musician wakes from a terrible nightmare. In his dream he finds himself in a society where music education has been made mandatory. ... Since musicians are known to set down their ideas in the form of sheet music, these curious black dots and lines must constitute the “language of music”. It is imperative that students become fluent in this language if they are to attain any degree of musical competence; indeed, it would be ludicrous to expect a child to sing a song or play an instrument without having a thorough grounding in music notation and theory. Playing and listening to music, let alone composing an original piece, are considered very advanced topics and are generally put off until college, and more often graduate school. ...*

*Waking up in a cold sweat, the musician realizes, gratefully, that it was all just a crazy dream. Of course! he reassures himself, “No society would ever reduce such a beautiful and meaningful art form to something so mindless and trivial; no culture could be so cruel to its children as to deprive them of such a natural, satisfying means of human expression. How absurd!”*

-Paul Lockhart, [A Mathematician's Lament](#)

The name of the project, “Learning Notation,” comes from the idea that as daunting as mathematics can seem, it's just notation. Once you understand the notation, you understand the math.

We have a [shared Overleaf project](#) where we collaborate on L<sup>A</sup>T<sub>E</sub>X notes for the seminars. We also have a [Discord server](#) for announcements and discussion and a [Google Sheet](#) for scheduling.

# How to use L<sup>A</sup>T<sub>E</sub>X

[Overleaf](#) has great resources for learning how to use L<sup>A</sup>T<sub>E</sub>X. This section also serves as a quick primer on using math notation with L<sup>A</sup>T<sub>E</sub>X. See the `.tex` file for this document on Overleaf to see the L<sup>A</sup>T<sub>E</sub>Xcode and comments.

## 1 Writing math symbols

In L<sup>A</sup>T<sub>E</sub>X we can write in-line mathematical expressions alongside our text, for example:  $\pi = 2 \int_{-1}^1 \sqrt{1-x^2} dx \simeq 3.14159$ .

### 1.1 Single-line equations

Using the `amsmath` package, we can also write single-line equations like so:

$$e^{i\pi} + 1 = 0. \tag{1}$$

If we don't want the line numbers, we can use asterisks (\*) to suppress them:

$$1 + 2 = 3.$$

### 1.2 Multi-line equations

We can also write multi-line equations.

$$\begin{aligned} f(x) = ax^n, \ n \geq 2 &\implies f'(x) = anx^{n-1} & (2) \\ &\implies f''(x) = an(n-1)x^{n-2}. & (3) \end{aligned}$$

We can reference a specific line in an equation. Here, equation (3) is the second derivative. If we don't want the line numbers, we can again suppress them.

$$\begin{aligned} ax^2 + bx + c = 0 &\implies x^2 + px + q = 0, \quad p = \frac{b}{a}, \ q = \frac{c}{a}, \ a \neq 0, \\ &\implies x^2 + px = -q \\ &\implies x^2 + px + \left(\frac{p}{2}\right)^2 = -q + \left(\frac{p}{2}\right)^2 \\ &\implies \left(x + \frac{p}{2}\right)^2 = \frac{p^2}{4} - q \\ &\implies x + \frac{p}{2} = \pm \sqrt{\frac{p^2}{4} - q} \\ &\implies x = -\frac{p}{2} \pm \sqrt{\frac{p^2}{4} - q}. \end{aligned}$$

## 2 Text formatting

In L<sup>A</sup>T<sub>E</sub>X you can format text, and also create lists:

- *Italics* (or *italics*)
- **Bold** (or **bold**)
- Underline
- `Command font`

We can create numbered lists also.

1. Learn L<sup>A</sup>T<sub>E</sub>X.
2. Write master's thesis.
3. Profit.

## 3 Tables

With L<sup>A</sup>T<sub>E</sub>X we can create tables.

	A	B
C	0.1	0.2
D	0.3	0.4

Table 1: Example Table

You can customize tables a lot.

Table 2: Social Media Use and GAD Symptoms during COVID-19				
Symptoms of Moderate or Severe Generalized Anxiety Disorder				
	(1)	(2)	(3)	(4)
<i>Use COVID-19 information from social media</i>				
Posts from news organizations or magazines only	0.070** (0.030)	0.069** (0.028)	0.025 (0.023)	0.0014 (0.035)
Posts from other users only	0.019 (0.028)	0.019 (0.027)	-0.033 (0.030)	0.065 (0.045)
Posts from both sources	0.078** (0.031)	0.084*** (0.031)	0.023 (0.031)	0.021 (0.041)
<i>Controls</i>				
Behavioural Controls	No	No	Yes	Yes
Demographic Controls	No	No	Yes	Yes
Observations	3,961	3,495	3,397	3,397
R-squared	0.010	0.039	0.243	0.095
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

## 4 Graphics

We can create graphics also,

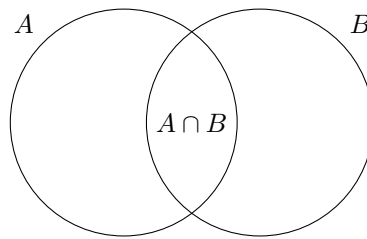


Figure 1: Venn diagram

and attach images as graphic figures.



Figure 2: Pareto logo

Document wise,  $\text{\LaTeX}$  can do pretty much anything. There's a lot to learn, but everything is just a Google search away.

## 5 Bibliography

If we use citations, we can create a bibliography. [2]

*“Simplicity is the final achievement. After one has played a vast quantity of notes and more notes, it is simplicity that emerges as the crowning reward of art.”*

- Frédéric Chopin [1]

## References

- [1] F. Chopin. Brainy quote, 1810-1849.
- [2] John Doe. Research projects for master students: an example from uppsala. *Pareto journal of Economics*, 14(3):342–351, 2022.