Learning Notation: Introduction

Uppsala Pareto Seminars

1 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.

Some topics that we may venture are:

- proof techniques and set theory

- real analysis and advanced calculus

- differential equations and linear algebra

- probability theory

- complex numbers and their geometry

- and more!

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.[1]

The name of the project, "Learning Notation," comes from the idea that as daunting as mathematics can sometimes seem, it is just notation. If you understand the notation, you understand the math.

We have a shared Overleaf project where we collaborate on LaTex notes for the seminars. We also have a Discord server for announcements and discussion and a Google Sheet for scheduling.

2 How to use LaTeX

Overleaf has great resources for learning how to use LaTeX. This section also serves as a quick primer on using math notation with LaTeX. See the `.tex` file for this document on Overleaf to see the LaTeX code and comments.

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[1]See A Mathematician's Lament.

2.1 Writing math symbols

In LaTeX we can write in-line mathematical expressions alongside our text, for example: $\pi = 2\int_{-1}^{1}\sqrt{1-x^2}\,dx \simeq 3.14159$.

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:

$$1 + 2 = 3.$$

We can also write multi-line equations.

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

Again, if we don't want the line numbers, we can suppress them:

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

2.2 Tables and graphics

With LaTeX we can create tables

	A	B
C	0.1	0.2
D	0.3	0.4

Table 1: Example Table

and graphic figures

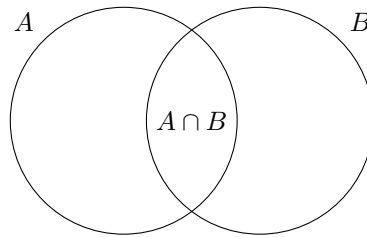Figure 1: Venn diagram

and also attach images as graphic figures.

Figure 2: Pareto logo

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