A Beginner's Guide to LaTeX for Mathematics

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1 Introduction

LaTeX is widely used for academic writing, particularly in mathematics and sciences. This guide provides an introduction to basic LaTeX features useful for mathematics students.

2 Inline vs Displayed Mathematics

Inline mathematics is included within a line of text, using dollar signs ($). For example, the code `$a^2 + b^2 = c^2$` renders as $a^2 + b^2 = c^2$ within a text.

Displayed mathematics appears on its own line. Use `\[` and `\]` for unnumbered equations, or the `equation` environment for numbered equations.

3 Basic Mathematical Operations

3.1 Fractions, Sums, and Integrals

- **Fraction:** `\frac{a}{b}` renders as $\frac{a}{b}$.
- **Summation:** `\sum_{i=1}^{n} i^2` renders as $\sum_{i=1}^{n} i^2$.
- **Integral:** `\int_{a}^{b} x^2 dx` renders as $\int_a^b x^2\,dx$.

3.2 Trigonometric and Exponential Functions

- **Sine:** `\sin(\theta)` renders as $\sin(\theta)$.
- **Cosine:** `\cos(\theta)` renders as $\cos(\theta)$.
- **Exponential:** `e^{x}` or `\exp(x)` renders as e^x or $\exp(x)$.

4 Displayed Mathematics Examples

4.1 Unnumbered Equations

```
\[
    \int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}
\]
```

This code will render as:

$$\int_{-\infty}^{\infty} e^{-x^2}\,dx = \sqrt{\pi}$$

4.2 Numbered Equations

```
\begin{equation}
    \sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}
\end{equation}
```

This code will render as:

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6} \tag{1}$$

5 A Complex Example

Euler's identity is a beautiful and profound equation in mathematics. Here's how to write it in LaTeX:

```
\begin{equation}
    e^{i\pi} + 1 = 0
\end{equation}
```

This will render as:

$$e^{i\pi} + 1 = 0 \tag{2}$$

6 Conclusion

This document is a basic introduction to LaTeX for mathematical expressions. LaTeX's capabilities extend far beyond these basics, enabling detailed typesetting for complex documents.