ABC 123 — Title

Author Name

Date/Term and Year

Welcome to my LaTeX math notes template! This is a sample for typesetting math notes.

Contents

Fact List

Chapter 1 Basics

1.1 Separate Files

Separating your chapters into separate files and `\include`-ing them in the main file makes your LaTeX code cleaner. We create a section and subsections, and these are automatically populated in the table of contents with clickable hyperlinks.

Note that the preamble was `\input`ted rather than `\include`d; you can read more about the differences here.

1.2 Some Typesetting

Environments provide certain functionality for typesetting. The syntax is as follows:

```
\begin{environment}
    Content in the environment
\end{environment}
```

Itemized lists can be created as follows:

- Some cool points
- Bullets can be customized using the `enumitem` package

Additionally, numbered lists can be used.

1. Another set of cool statements
2. Numbering can also be customized using `enumitem`

You can use ‘ and ’ for single opening and closing quotation marks (respectively), “like this” or ‘this’.

To *emphasize* certain text, use `\emph{text}`. This is similar to `\textbf{text}` (bold) and `\textit{text}` (italics), though `emph` can be customized to use any specified font.

Chapter 2 Math Typesetting

2.1 Equations

Math equations can be *inline* such as $x + 1 = 0$ using `\(expression\)`. It can also be in display style, on its own line and centered using `\[expression\]`. This yields

$$x + 1 = 0$$

The size and style of certain symbols can vary based on whether inline or display style is being used. For example, a summation would be displayed as $\sum_{i=1}^{n} a_i$ inline and

$$\sum_{i=1}^{n} a_i$$

in display mode. For limits like the summation limits, we can use `\limits` for inline math to display them as $\sum\limits_{i=1}^{n} a_i$ or use `\displaystyle` inside the inline math delimiters to get $\displaystyle\sum_{i=1}^{n} a_i$.

To number equations, use the `equation` environment.

$$x + 1 = 0 \tag{1}$$

Multiple lines of equations can be aligned with `align*` (for unnumbered equations) or `align` (for numbered equations). We use `&` to specify an "anchor" where the equations will be vertically aligned and `\\` to specify where each line ends. Additionally, `\tag{text}` can be used to align text in parentheses on the right (e.g. for justifying steps taken and citing theorems). `\tag*{text}` works the same as `\tag{text}`, though it does not have parentheses.

$$\begin{aligned}(x+1)+(x+2)+(x+3) &= x+1+x+2+x+3 && \text{(by associativity)}\\ &= x+x+x+1+2+3 && \text{(by commutativity)}\\ &= 3x+6\end{aligned}$$

2.2 Basic Symbols

Some useful math symbols/operators are as follows.

Command	Result
`\boxplus`	$\boxplus$
`\boxdot`	$\boxdot$
`\oplus`	$\oplus$
`\odot`	$\odot$
`\times`	$\times$
`\neq`	$\neq$
`\leq`	$\leq$
`\geq`	$\geq$
`\approx`	$\approx$
`\to`	$\to$
`\implies`	$\implies$
`\iff`	$\iff$
`\cup`	$\cup$
`\cap`	$\cap$
`\in`	$\in$
`\subset`	$\subset$
`\subseteq`	$\subseteq$
`\supset`	$\supset$
`\supseteq`	$\supseteq$
`\subsetneq`	$\subsetneq$
`\supsetneq`	$\supsetneq$

Command	Result
`x^2`	x^2
`\frac{p}{q}`	$\frac{p}{q}$
`x^{1 + \frac{2}{3}}`	$x^{1+\frac{2}{3}}$
`x_i`	x_i
`x_{i + 1}^{i + 2}`	x_{i+1}^{i+2}
`\set{a, b, c}`	$\{a, b, c\}$
`\abs{x}`	$\lvert x \rvert$
`\field` (custom-defined)	$\mathbb{F}$
`\reals` (custom-defined)	$\mathbb{R}$
`\complex` (custom-defined)	$\mathbb{C}$
`\vect{v}` (custom-defined)	$\mathbf{v}$
`\realmatrix{n}{k}` (custom-defined)	$\mathbf{M}_{n\times k}(\mathbb{R})$
`\realpoly{n}` (custom-defined)	$\mathbf{P}_n(\mathbb{R})$
`\spn(S)` (custom-defined)	$\operatorname{span}(S)$
`\dim(V)`	$\dim(V)$
`\kernel(T)` (custom-defined)	$\ker(T)$
`\im(T)` (custom-defined)	$\operatorname{image}(T)$
`\sum_{i = 1}^{n} a_i`	$\sum_{i=1}^{n} a_i$
`\prod_{i = 1}^{n} a_i`	$\prod_{i=1}^{n} a_i$
`\bigcup_{i = 1}^{n} S_i`	$\bigcup_{i=1}^{n} S_i$
`\bigcap_{i = 1}^{n} S_i`	$\bigcap_{i=1}^{n} S_i$

2.3 Theorem Environments

We can create theorems, definitions, axioms, and other custom-defined theorem-like environments. The syntax is

```
\begin{environment-name}{Fact Title}{cross-reference-name (optional)}
    Content
\end{environment-name}
```

We have defined `definiton`, `theorem`, `example`, `axiom`, `lemma`, and `corollary` as theorem-like environments.

Definition 2.1 — Some Object

Here, we define some object.

Lemma 2.2 — Stepping Stone

This is a lemma, which will be used later. We have defined `lemmasteppingstone` as the cross-referencing name.

`\cref{cross-referencing-name}` can be used to cite a theorem-like fact. `\Cref` does the same but capitalizes the first letter. For example, `\cref{lemmasteppingstone}` results in lemma 2.2. Note that clicking the citation text takes us back to the fact cited.

We also have `remark` and `proof` environments, which must be used without a title and cross-referencing name.

Remark: Lemma 2.2 will prove to be useful in the following theorem.

Theorem 2.3 — A Significant Result

Here is a significant result.

Proof: By lemma 2.2, the result is trivial. ■

Note the automatic placement of a QED square at the end of the proof.

> **Example 2.4**: Some important example here.
>
> Some work here.

Theorem 2.5 — Another Result of Importance

Another result.

Remark: `cref` and `Cref` can be used to cite multiple facts at once. For example, the text "theorems 2.3 and 2.5" can be produced using `\cref{theoremsigresult,theoremanother}`. Lemma 2.2 and theorem 2.5 is produced by `\Cref{lemmasteppingstone,theoremanother}`.

Each of the theorem-like facts are populated in the fact list at the beginning of this document.