Etiquette and dirty tricks in LaTeX

Jephian C.-H. Lin 林晉宏

Department of Applied Mathematics, National Sun Yat-sen University

May 21, 2019
Practice of Applied Mathematics, Kaohsiung, Taiwan

TEX

- A typesetting system create by Donald Knuth
- Comes from the Greek root $\tau\epsilon\chi$, meaning art/craft, also the stem of "technology"
- Aim to produce the finest quality of typesetting
- Current version number: 3.1415926
- History of TEX on the TeX Users Group web site
- Official manual: The TEXbook by Donald Knuth
- 大家來學 LATEX by 李果正 Edward G.J. Lee

About Knuth

By Flickr user Jacob Appelbaum, uploaded to en.wikipedia by users BeSherman, Duozmo - Flickr.com (via en.wikipedia), CC BY-SA 2.5, https://commons.wikimedia.org/w/index.php?curid=1303242

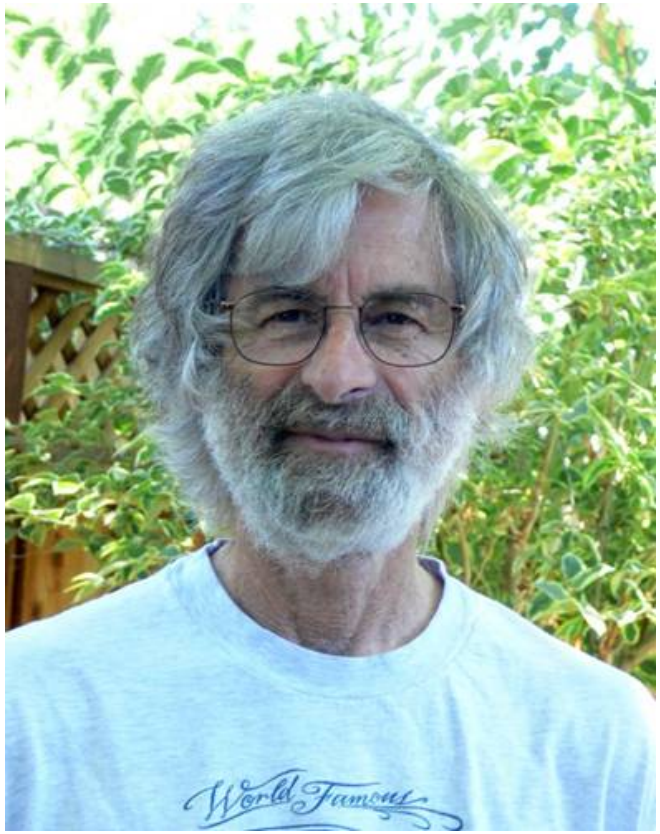
About Knuth

- Professor emeritus at Stanford University
- Computer scientist, mathematician
- Turing Award winner
- Author of *Art of Computer Programming*
- Chinese name: 高德納 (Suggested by Frances Yao)
- Pay finder fee \$2.56 for catching a typo, and \$0.32 for valuable suggestion.
- The Electronic Coach on YouTube

LaTeX

- A typesetting system based on TeX
- Originally create by Leslie Lamport, now maintained by the LaTeX project
- contains various macros of TeX
- make the writing easier
- make the code more readable
- LaTeX: A Document Preparation System by Leslie Lamport

About Lamport



From the personal website of Lamport

About Lamport

- Worked at SRI International and Microsoft Research
- Computer scientist, mathematician
- Turning Award winner

Pros and Cons

Pros:

- Easy to type mathematics formulas
- Easy to do internal references
- Easy to maintain the bibliography
- Easy to set macros
- Focus on writing
- Fast and high-quality typesetting for everyone
- Finest spacing
- Hyphenation and justification

Cons:

- Take some efforts to learn (but it is worthy, for sure!)
- No graphic preview before compiling (but why you need it?)

Pros and Cons

Pros:

- Easy to type mathematics formulas
- Easy to do internal references
- Easy to maintain the bibliography
- Easy to set macros
- Focus on writing
- Fast and high-quality typesetting for everyone
- Finest spacing
- Hyphenation and justification

Cons:

- Take some efforts to learn (but it is worthy, for sure!)
- No graphic preview before compiling (but why you need it?)

Sample file for LaTeX

```
\documentclass[a4paper]{article}
% article, report, or book
% some journal has its own class

%%% PREAMBLE %%%
\usepackage{amsmath, amssymb, amsthm}
\usepackage{tikz}

\newcommand{\rbf}[1]{\textbf{\color{red}#1}}

\begine{document}
I \rbf{love} \LaTeX{}!!!
\end{document}
```

Etiquette and Dirty Tricks in LaTeX

- Respect the original design
- Respect the style
- Dirty tricks

Etiquette

. . . the basic rule of typography is: "Every rule can be broken, as long as you are aware that you are breaking a rule."

—TikZ & PGF Manual by Till Tantau, Chapter 7

Etiquette

. . . the basic rule of typography is: "Every rule can be broken, as long as you are aware that you are breaking a rule."

—TikZ & PGF Manual by Till Tantau, Chapter 7

Respect the original design

The logo

- Type TEX (`\TeX`) and LATEX (`\LaTeX`) when possible.
- Otherwise, type TeX and LaTeX.

This displaced 'E' is a reminder that TEX is about typesetting, and it distinguishes TEX from other system names.

—TEXbook, Chapter 1

The logo

- Type TEX (`\TeX`) and LATEX (`\LaTeX`) when possible.
- Otherwise, type TeX and LaTeX.

This displaced 'E' is a reminder that TEX is about typesetting, and it distinguishes TEX from other system names.

—*TEXbook, Chapter 1*

The pronunciation

- TEX $\sim$ tech (the 'ch' is like that in Bach)
- Definitely no 's' sound at the end

It's the 'ch' sound in Scottish words like loch or German words like ach; it's a Spanish 'j' and a Russian 'kh'. When you say it correctly to your computer, the terminal may become slightly moist.

—TEXbook, Chapter 1

The pronunciation

- TEX $\sim$ tech (the 'ch' is like that in Bach)
- Definitely no 's' sound at the end

It's the 'ch' sound in Scottish words like loch or German words like ach; it's a Spanish 'j' and a Russian 'kh'. When you say it correctly to your computer, the terminal may become slightly moist.

—TEXbook, Chapter 1

EXERCISE 1.1 (TEXbook, Chapter 1)
After you have mastered the material in this book, what will you be: A TEXpert, or a TEXnician?

EXERCISE 1.1 (TEXbook, Chapter 1)
After you have mastered the material in this book, what will you be: A TEXpert, or a TEXnician?

TEXnician. There is no ‘s’ sound!

The pronunciation

How about LaTeX?

One of the hardest things about using LaTeX is deciding how to pronounce it. This is also one of the few things I'm not going to tell you about LaTeX, since pronunciation is best determined by usage, not fiat. TeX is usually pronounced teck, making lah-teck, lah-teck, and lay-teck the logical choices; but language is not always logical, so lay-tecks is also possible.

—*LaTeX: A Document Preparation System, Chapter 1*

The pronunciation

How about LaTeX?

One of the hardest things about using LaTeX is deciding how to pronounce it. This is also one of the few things I'm not going to tell you about LaTeX, since pronunciation is best determined by usage, not fiat. TeX is usually pronounced teck, making lah-teck, lah-teck, and lay-teck the logical choices; but language is not always logical, so lay-tecks is also possible.

—*LaTeX: A Document Preparation System, Chapter 1*

Focus on the writing

- TEX is a markup language.
- You mark each class, and set up the style.
- For example, use `\emph{}` rather than `\textit{}`.
- For example, use the `\begin{proof}...\end{proof}` rather than type `\textbf{Proof}\\` every time.
- Be aware of unnecessary styling. (Color, bold, italic...)
- Be aware of unnecessary space adjustment. (`\vspace{}` or `\hspace{}`...)

Line break and new paragraph

- \\ stands for a line break.
- An empty line stands for starting a new paragraph.
- For writing an article, you will almost never need to enforce a line break. (Except for creating a table, an array, or a matrix.)

obeylines

If really necessary, use the `obeylines` environment.

Name: Jephian Lin
Major: Mathematics
Known for: Shameless

```
\begin{obeylines}
Name: Jephian Lin
Major: Mathematics
Known for: Shameless
\end{obeylines}
```

Math vs text

- Math is math. For example,
  - i,j—entry (`$i,j-$entry`): terrible.
  - i,j-entry (`$i,j$-entry`): good.

- Text is text. For example,
  - $f(x) = 0$ *if* $x = 0$ (`$f(x)=0~if~x=0$`): terrible.
  - $f(x) = 0$ if $x = 0$ (`$f(x)=0$ if $x=0$`): good.

Text in displayed math

You say

$$x > 1 \text{ and } x < 3,$$

but I say

$$x < 1 \textit{ or } x > 3.$$

```
You say
\[x>1\text{ and }x<3,\]
{\it but I say
\[x<1\text{ or }x>3.\]
}
```

`\text{}` is a macro defined in the `amsmath` package. Texts in `\text{}` will adopt the surrounding style.

Letters in the math mode

- Letters in math mode are treated as variables.
- In the text mode, 'fi' or 'ff' gets together (called ligature); but in the math mode, '*fi*' or '*ff*' is separate.
  - *sinx* (`sin x`): terrible. You mean $s \times i \times n \times x$?
  - $\sin x$ (`\sin x`): good.
- Most of the functions has a corresponding control-sequence. For example, `\det`, `\ln`, `\log`, `\max`, `\min`, and so on. Otherwise, create you own operator, e.g., `\operatorname{tr}`.

$$\frac{sinx}{n} = \frac{si\not{n}x}{\not{n}} = six = 6?$$

Letters in the math mode

- Letters in math mode are treated as variables.
- In the text mode, 'fi' or 'ff' gets together (called ligature); but in the math mode, '*fi*' or '*ff*' is separate.
  - *sinx* (`sin x`): terrible. You mean $s \times i \times n \times x$?
  - $\sin x$ (`\sin x`): good.
- Most of the functions has a corresponding control-sequence. For example, `\det`, `\ln`, `\log`, `\max`, `\min`, and so on. Otherwise, create you own operator, e.g., `\operatorname{tr}`.

$$\frac{sinx}{n} = \frac{si\not{n}x}{\not{n}} = six = 6?$$

Accurate quotation marks

The quotation marks should be like ‘this’ or “this”.

Here ‘ is the key on the below `Esc`, while ’ is the key left to `Enter`

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign − ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign − ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign − ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign − ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign − ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign − ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign − ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Hyphen, en-dash, em-dash, and minus sign

- Hyphen - (-): Used in compound words.

  e.g. Chin-Hung Lin, nine-year-old boy, one-to-one function, ...
- En-dash – (--): Used in number ranges, or for combining names.

  e.g. Pages 2–5 of TEXbook, Cauchy–Schwartz inequality, Cayley–Hamilton theorem, ...
- Em-dash — (---): Used for punctuation in sentences.

  e.g. I love NSYSU—it is the best university over the world!
- Minus sign $-$ ($-$): Used in math formulas.

  e.g. $x - y$, $\mathbb{Z}_-$, $-A$, ...

Accurate spacing

- Spaces between words are different from spaces between sentences. The latter one is wider.
- Spaces after . ? ! are treated as inter-sentence spaces, unless the ending letter is upper case. (How smart?)
- Use tie (~) or the space command (\␣) to force a regular space.
- Use \@ to avoid the upper case check.

Dr. Lin	`Dr.~Lin % correct`
Dr. Lin	`Dr.\ Lin % not recommended`
Dr. Lin	`Dr. Lin % incorrect`

Electron. J. Combin.
Electron. J. Combin.
Electron. J. Combin.

```
Electron.~J. Combin. % not recommended
Electron.\ J. Combin. % correct
Electron. J. Combin. % incorrect
```

Here is NSYSU. I love it.
Here is NSYSU. I love it.
Here is NSYSU. I love it.
Here is NSYSU. I love it.

```
Here is NSYSU.~I love it. % incorrect
Here is NSYSU.\ I love it. % incorrect
Here is NSYSU.  I love it. % incorrect
Here is NSYSU\@.  I love it. % correct
```

How to compile?

- The default output of `latex` command is a DVI file. Previously, people generate the DVI file and then convert it to a PDF file.
- Nowaday, it is more often to use `pdflatex` to generate a PDF file.
- The first round of compiling records the numbers for each label to a `*.aux` file.
- The second round fills in these numbers for internal references and citations.
- If you use BibTeX, which is awesome, you need to do `bibtex *.aux` before the second round.

Good attitude

Try to resolve every warning message.

Try your best to care about every single details.

Be an awesome TEXnician!

Good attitude

Try to resolve every warning message.
Try your best to care about every single details.
Be an awesome TEXnician!

Good attitude

Try to resolve every warning message.
Try your best to care about every single details.
Be an awesome TEXnician!

Respect the style

Follow journal's style guideline

Carefully read at least one journal's Author Guidelines. Also, read the guidelines for the journal your are going to submit your paper to.

Some journal will do typesetting for you, while most of electronic journals ask you to typeset your own paper.

Follow journal's style guideline

Carefully read at least one journal's Author Guidelines. Also, read the guidelines for the journal your are going to submit your paper to.

Some journal will do typesetting for you, while most of electronic journals ask you to typeset your own paper.

Some conventions

Use the default environments. E.g., `theorem`, `proof`, ...

Use `\emph{}` when defining a new term.

Some conventions

Use the default environments. E.g., `theorem`, `proof`, ...

Use `\emph{}` when defining a new term.

Complete each sentence

Example:
Let f be a linear transformation. The *nullspace* of f is

$$\{x \in \mathbb{R}^n : f(x) = 0\},$$

and the *range* of f is

$$\{f(x) : x \in \mathbb{R}^n\}.$$

Remember to put correct punctuation marks.

Complete each sentence

Example:
Let f be a linear transformation. The *nullspace* of f is

$$\{x \in \mathbb{R}^n : f(x) = 0\},$$

and the *range* of f is

$$\{f(x) : x \in \mathbb{R}^n\}.$$

Remember to put correct punctuation marks.

Wrong example:
The equation implies $x = 1$; Which is positive.

Correct example:
The equation implies $x = 1$, which is positive.

Wrong example:
The equation implies $x = 1$; Which is positive.

Correct example:
The equation implies $x = 1$, which is positive.

Example (not recommended):
Compute

$$x^2 - 1 = 0 \implies (x+1)(x-1) = 0 \implies x = \pm 1.$$

Recommended example:
Since $x^2 - 1 = 0$, which can be factored as $(x+1)(x-1) = 0$, this leads to the conclusion that $x = \pm 1$.

Example (not recommended):
Compute

$$x^2 - 1 = 0 \implies (x+1)(x-1) = 0 \implies x = \pm 1.$$

Recommended example:
Since $x^2 - 1 = 0$, which can be factored as $(x+1)(x-1) = 0$, this leads to the conclusion that $x = \pm 1$.

Internal references and external citations

Always use the internal reference feature. Never type the number by yourself.

Theorem 1
If $x = 1$, *then* $x + 1 = 2$.

```
\begin{theorem}
\label{thm:CH}
If $x=1$, ...
\end{theorem}
```

Theorem 1 is very important.

```
Theorem~\ref{thm:CH} ...
```

Using BibTeX for bibliography is recommended. (This keep the style in the references consistent.)

Internal references and external citations

Always use the internal reference feature. Never type the number by yourself.

Theorem 1
If $x = 1$, *then* $x + 1 = 2$.

```
\begin{theorem}
\label{thm:CH}
If $x=1$, ...
\end{theorem}
```

Theorem 1 is very important.

```
Theorem~\ref{thm:CH} ...
```

Using BibTeX for bibliography is recommended. (This keep the style in the references consistent.)

Figures

Use vector graphics whenever possible.

You may use the *TikZ* package, the Ipe extensible drawing editor, or the Adobe Illustrator, and so on, to do so.

Figures

Use vector graphics whenever possible.

You may use the *TikZ* package, the Ipe extensible drawing editor, or the Adobe Illustrator, and so on, to do so.

- Put all figures in the `figure` environment.
- Put proper captions.
- Label all figures.

Example:

```
\begin{figure}
\begin{center}
\includegraphics[scale=0.5]{nsysulogo}
\end{center}

\caption{The logo of National Sun Yat-sen University}
\label{fig:nsysulogo}
\end{figure}
```

Macros

Defining a macro avoids introducing unexpected typos. It is also easier to change the style later.

Example:
$\tr(A^\trans A) = \tr(AA^\trans)$

```
\newcommand{\tr}{\operatorname{tr}}
\newcommand{\trans}{^\top}

$\tr(A\trans A) = \tr(AA\trans)$
```

Keep improving

Avoid unnecessary styling. Known the functions of each packages, and remove unnecessary packages.

There is no universal rules, but learn to deliver the information in an efficient way. Learn to appreciate or give comments to people's work and keep improving.

Keep improving

Avoid unnecessary styling. Known the functions of each packages, and remove unnecessary packages.

There is no universal rules, but learn to deliver the information in an efficient way. Learn to appreciate or give comments to people's work and keep improving.

Dirty tricks

Strut

Matrix without strut:

$$\left[\begin{array}{c|c} A & B \\ \hline B^\top & C \end{array}\right]$$

Matrix with strut:

$$\left[\begin{array}{c|c} A & B \\ \hline \topstrut B^\top & C \end{array}\right]$$

```
\newcommand\topstrut{\rule{0pt}{1.2em}}

\[\left[\begin{array}{c|c}
A & B \\
\hline
\topstrut B\trans & C
\end{array}\right]\]
```

PS This is not dirty at all. In fact, this is also suggested by the TEXbook.

How to type this?

$$\left[\begin{array}{c|cc} 0 & 1 & 1 \\ \hline 1 & \multicolumn{2}{c}{\floating{A}} \\ 1 & & \end{array}\right]$$

```
\newcommand{\floating}[1]
{\smash{\raisebox{.5\normalbaselineskip}{#1}}}

\[\left[\begin{array}{c|cc}
0 & 1 & 1 \\
\hline
 1 & & \\
 1 & \multicolumn{2}{c}{\floating{$A$}}
\end{array}\right]\]
```

How to type this?

$$\left[\begin{array}{c|cc} 0 & 1 & 1 \\ \hline 1 & \multicolumn{2}{c}{\floating{A}} \\ 1 & & \end{array}\right]$$

```
\newcommand{\floating}[1]
{\smash{\raisebox{.5\normalbaselineskip}{#1}}}

\[\left[\begin{array}{c|cc}
0 & 1 & 1 \\
\hline
 1 & & \\
 1 & \multicolumn{2}{c}{\floating{$A$}}
\end{array}\right]\]
```

How to type this?

$$
\begin{aligned}
& x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}
$$

```
\[\begin{aligned}
&\mathrel{\phantom{=}}x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}\]
```

How to type this?

$$
\begin{aligned}
& x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}
$$

```
\[\begin{aligned}
&\mathrel{\phantom{=}}x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}\]
```

Wrong spacing after the equal signs

$$
\begin{aligned}
& x^3 + x^2 + x + 1 \\
=& x^2(x+1) + (x+1) \\
=& (x+1)(x^2+1)
\end{aligned}
$$

```
\[\begin{aligned}
&x^3 + x^2 + x + 1 \\
=& x^2(x+1) + (x+1) \\
=& (x+1)(x^2+1)
\end{aligned}\]
```

Not aligned

$$
\begin{aligned}
&x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}
$$

```
\[\begin{aligned}
&\phantom{=}x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}\]
```

Correctly aligned

$$\begin{aligned}
&x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}$$

```
\[\begin{aligned}
&\mathrel{\phantom{=}}x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}\]
```

Correctly aligned

$$\begin{aligned}
&x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}$$

```
\[\begin{aligned}
&\mathrel{\phantom{=}}x^3 + x^2 + x + 1 \\
&= x^2(x+1) + (x+1) \\
&= (x+1)(x^2+1)
\end{aligned}\]
```

Enjoy! Thanks!