

For Beginners!

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Some materials sourced from Eric Krause and Ron Bannon



## About Lipi:

- Science Engagement Engineer
- Postdoc at NERSC
- Cornell BA 2015
- U. Chicago PhD 2021
- from Oregon
- SULI Alum
- Have worked at SLAC, Fermi lab, Argonne, and now Berkeley Lab!



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# LATEX

## Math mode

For inline math, use  $\backslash(\dots\backslash)$  or  $\$...\$$ . For displayed math, use  $\backslash[...\backslash]$  or  $\backslashbegin{equation}$ .

|                          |                            |                        |                          |
|--------------------------|----------------------------|------------------------|--------------------------|
| Superscript <sup>x</sup> | $\wedge\{x\}$              | Subscript <sub>x</sub> | $\_ \{x\}$               |
| $\frac{x}{y}$            | $\backslashfrac\{x\}\{y\}$ | $\sum_{k=1}^n$         | $\backslashsum_{k=1}^n$  |
| $\sqrt[n]{x}$            | $\backslashsqrt[n]\{x\}$   | $\prod_{k=1}^n$        | $\backslashprod_{k=1}^n$ |

## Math-mode symbols

|            |                     |           |                    |           |                   |                   |                            |
|------------|---------------------|-----------|--------------------|-----------|-------------------|-------------------|----------------------------|
| $\leq$     | $\backslashleq$     | $\geq$    | $\backslashgeq$    | $\neq$    | $\backslashneq$   | $\approx$         | $\backslashapprox$         |
| $\times$   | $\backslashtimes$   | $\div$    | $\backslashdiv$    | $\pm$     | $\backslashpm$    | $\cdot$           | $\backslashcdot$           |
| $\circ$    | $\backslashcirc$    | $\circ$   | $\backslashcirc$   | $\prime$  | $\backslashprime$ | $\dots$           | $\backslashcdots$          |
| $\infty$   | $\backslashinfty$   | $\neg$    | $\backslashneg$    | $\wedge$  | $\backslashwedge$ | $\vee$            | $\backslashvee$            |
| $\supset$  | $\backslashsupset$  | $\forall$ | $\backslashforall$ | $\in$     | $\backslashin$    | $\rightarrow$     | $\backslashrightarrow$     |
| $\subset$  | $\backslashsubset$  | $\exists$ | $\backslashexists$ | $\notin$  | $\backslashnotin$ | $\Rightarrow$     | $\backslashRightarrow$     |
| $\cup$     | $\backslashcup$     | $\cap$    | $\backslashcap$    | $ $       | $\backslashmid$   | $\Leftrightarrow$ | $\backslashLeftrightarrow$ |
| $\dot{a}$  | $\backslashdot a$   | $\hat{a}$ | $\backslashhat a$  | $\bar{a}$ | $\backslashbar a$ | $\tilde{a}$       | $\backslashtilde a$        |
| $\alpha$   | $\backslashalpha$   | $\beta$   | $\backslashbeta$   | $\gamma$  | $\backslashgamma$ | $\delta$          | $\backslashdelta$          |
| $\epsilon$ | $\backslashepsilon$ | $\zeta$   | $\backslashzeta$   | $\eta$    | $\backslasheta$   | $\varepsilon$     | $\backslashvarepsilon$     |
| $\theta$   | $\backslashtheta$   | $\iota$   | $\backslashiota$   | $\kappa$  | $\backslashkappa$ | $\vartheta$       | $\backslashvartheta$       |
| $\lambda$  | $\backslashlambda$  | $\mu$     | $\backslashmu$     | $\nu$     | $\backslashnu$    | $\xi$             | $\backslashxi$             |
| $\pi$      | $\backslashpi$      | $\rho$    | $\backslashrho$    | $\sigma$  | $\backslashsigma$ | $\tau$            | $\backslashtau$            |
| $\upsilon$ | $\backslashupsilon$ | $\phi$    | $\backslashphi$    | $\chi$    | $\backslashchi$   | $\psi$            | $\backslashpsi$            |
| $\omega$   | $\backslashomega$   | $\Gamma$  | $\backslashGamma$  | $\Delta$  | $\backslashDelta$ | $\Theta$          | $\backslashTheta$          |
| $\Lambda$  | $\backslashLambda$  | $\Xi$     | $\backslashXi$     | $\Pi$     | $\backslashPi$    | $\Sigma$          | $\backslashSigma$          |
| $\Upsilon$ | $\backslashUpsilon$ | $\Phi$    | $\backslashPhi$    | $\Psi$    | $\backslashPsi$   | $\Omega$          | $\backslashOmega$          |

- Pronounced “lay-tech” or “la-tech”(does not rhyme with “paychecks”!)
- Document preparation tool:
  - Quick Formatting (and re-formatting)
  - Easy equations and symbols typesetting
  - Sophisticated figure management and tables creation
- Advantages:
  - FREE!
  - Used in most academic and professional settings
  - Creative freedom

<https://wch.github.io/latexsheet/>

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

All distributions:



<https://www.latex-project.org/get/#tex-distributions>

Recommended:



Have a university email address? Use it!



# Resources!

## The Not So Short Introduction to $\text{\LaTeX}$ 2 $\epsilon$

*Or  $\text{\LaTeX}$  2 $\epsilon$  in 139 minutes*

by Tobias Oetiker  
Hubert Partl, Irene Hyna and Elisabeth Schlegl

Version 6.3, March 26, 2018

<https://tobi.oetiker.ch/lshort/lshort.pdf>

Exercises available here!

<http://m11.mathography.org/>

Some other useful websites!

<https://wch.github.io/latexsheet/>

<https://www.tablesgenerator.com/>

<https://www.latex-tutorial.com/tutorials/>

# A First Look at L<sup>A</sup>T<sub>E</sub>X

```
1 \documentclass[a4paper]{article}
2 \usepackage{amsmath}
3 \title{My First \LaTeX}
4 \author{Lipi Gupta}
5 \date{\today}
6
7 \begin{document}
8 \maketitle
9
10 % This is a comment!
11 \section{Introduction}
12 Hello, there! This is my paper.
13
14
15 \end{document}
```



My First L<sup>A</sup>T<sub>E</sub>X

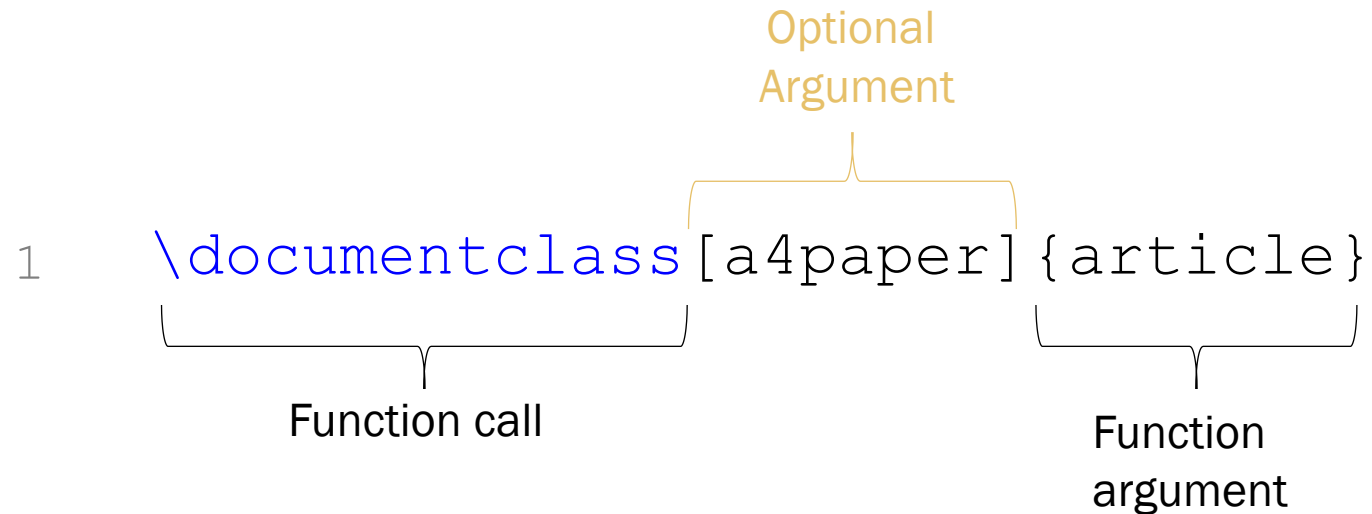
Lipi Gupta

July 31, 2014

## 1 Introduction

Hello, there! This is my paper.

# Deciphering the “code”

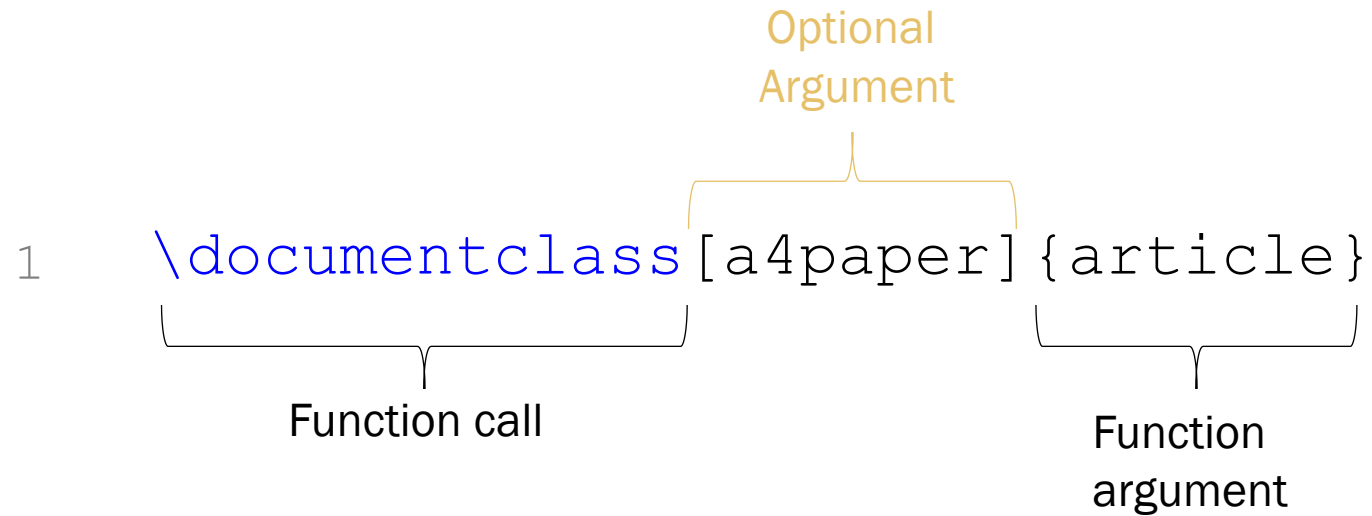


Familiar with python?

```
import latex as lx
lx.documentclass(article, paper_type = a4paper)
```

\* this is a made-up line of code to make LaTeX seem familiar!

# Deciphering the “code”



Some functions **with** arguments:

```
\textit{some words}
```

```
\section{some words}
```

```
\frac{x}{y}
```

Some functions **without** arguments:

```
\today                      \Sum
```

```
                            \alpha
```

```
\chi                              \neq
```



# Using L<sup>A</sup>T<sub>E</sub>X

| Symbol  | Description                           | In order to use the actual symbol... |
|---------|---------------------------------------|--------------------------------------|
| \       | Escape character, function call       | <code>\textbackslash</code>          |
| { }     | Argument, group or separate functions | <code>\{ \}</code>                   |
| %       | Comment                               | <code>\%</code>                      |
| \$      | Enter/leave math mode                 | <code>\\$</code>                     |
| &       | Alignment of columns                  | <code>\&amp;</code>                  |
| $\_ \^$ | Superscript/subscript in math mode    | <code>\_ \textasciicircum</code>     |
| ~       | Insert unbreakable space              | <code>\textasciitilde</code>         |

# What are environments?

```
1 \documentclass[a4paper]{article}
2
3 \title{My First \LaTeX}
4 \author{Lipi Gupta}
5 \date{\today}
6
7 \begin{document}
8 My Grocery list:
9 \begin{enumerate}
10     \item apples
11     \item coffee
12     \item milk
13 \end{enumerate}
14
15 \end{document}
```

My Grocery list:

1. apples
2. coffee
3. milk

# List Environments

```
1 \documentclass[a4paper]{article}
2
3 \title{My First \LaTeX}
4 \author{Lipi Gupta}
5 \date{\today}
6
7 \begin{document}
8 My Grocery list:
9 \begin{enumerate}
10 \item apples
11 \item coffee
12 \begin{enumerate}
13 \item hazelnut flavor
14 \item donut shop
15 \end{enumerate}
16 \item milk
17 \end{enumerate}
18 \end{document}
```

My Grocery list:

1. apples
2. coffee
  - (a) hazelnut flavor
  - (b) donut shop
3. milk

# List Environments

```
1 \documentclass[a4paper]{article}
2
3 \title{My First \LaTeX}
4 \author{Lipi Gupta}
5 \date{\today}
6
7 \begin{document}
8 My Grocery list:
9 \begin{itemize}
10     \item apples
11     \item coffee
12         \begin{enumerate}
13             \item hazelnut flavor
14             \item donut shop
15         \end{enumerate}
16     \item milk
17 \end{itemize}
18 \end{document}
```

## My Grocery list:

- apples
- coffee
  - 1. hazelnut flavor
  - 2. donut shop
- milk

# Math Mode!

```
1 \begin{document}
2
3 \paragraph{Quadratic equations!}
4 Most quadratic polynomials look like:
5
6 \begin{equation}
7     P(x) = a x^2 + b x + c.
8     \label{eq:quadratic}
9 \end{equation}
10
11 The quadratic formula tells us the
12 roots of for Eq. \ref{eq:quadratic}:
13 \begin{equation}
14     x = \frac{-b \pm \sqrt{b^2 -
15 4ac}}{2a}
16 \end{equation}
17
18
19 \end{document}
```

**Quadratic equations!** Most quadratic polynomials look like:

$$P(x) = ax^2 + bx + c. \quad (1)$$

The quadratic formula tells us the roots of for Eq. 1:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (2)$$

# Math Mode!

```
1 \begin{document}
2
3 \paragraph{Quadratic equations!}
4 Most quadratic polynomials look
5 like:
6
7 \begin{equation}
8     P(x) = a x^2 + b x + c.
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10 \end{equation}
11
12 The quadratic formula tells us the
13 roots of for Eq. \ref{eq:quadratic}:
14 \begin{equation}
15     x = \frac{-b \pm \sqrt{b^2 -
16 4ac}}{2a}
17 \end{equation}
18 where  $b^2 - 4ac$  is the
19 discriminant.
20
21 \end{document}
```

**Quadratic equations!** Most quadratic polynomials look like:

$$P(x) = ax^2 + bx + c. \quad (1)$$

The quadratic formula tells us the roots of for Eq. 1:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \quad (2)$$

where  $b^2 - 4ac$  is the discriminant.



# Some fancier stuff....

```
14 ▾ \begin{document}
15
16 ▾ \begin{equation}
17     e^{i\pi} = \cos(\pi) + i \sin(\pi) = -1
18 \end{equation}
19
20 ▾ \begin{equation*}
21     \sum_{n=0}^{\infty} \frac{x^n}{n!} = e^x
22 \end{equation*}
23
24 ▾ \begin{align}
25     S &= \begin{bmatrix}
26         x \\
27         p_x \\
28         y \\
29         p_y
30     \end{bmatrix}.
31 \end{align}
32
33 ▾ \begin{align}
34     2(q_1 + ab^2 q_2)xy &= 0 \\
35     q_2 &= \frac{-q_1}{ab^2}.
36 \end{align}
37
38 \end{document}
```

$$e^{i\pi} = \cos(\pi) + i \sin(\pi) = -1 \quad (1)$$

$$\sum_{n=0}^{\infty} \frac{x^n}{n!} = e^x$$

$$S = \begin{bmatrix} x \\ p_x \\ y \\ p_y \end{bmatrix}. \quad (2)$$

$$2(q_1 + ab^2 q_2)xy = 0 \quad (3)$$

$$q_2 = \frac{-q_1}{ab^2}. \quad (4)$$

# Tables!

<https://www.latex-tutorial.com/tutorials/tables/>

```
1 \begin{document}
2
3 \begin{table}[]
4 \centering
5 \begin{tabular}{cc}
6 Parameter & Value \\
7 \hline
8 a & 500 \textrm{n} \\
9 b & 100 \textrm{s} \\
10 \end{tabular}
11 \end{table}
12 \end{document}
```

Instructions about where the table should be placed\*\*

How many columns and how are those elements justified within the column?  
ccclll  
(6 columns, first 3 are centered, last three are left-justified)

Line break

\*\* see section 2.13 Floating Bodies in Oetiker et. al.

# Tables!

<https://www.latex-tutorial.com/tutorials/tables/>

```
1 \begin{document}
2
3 \begin{table}[]
4 \caption{This is my first table!}
5 \begin{tabular}{cc}
6 Parameter & Value \\
7 \hline
8 a & 500 \text{m} \\
9 b & 100 \text{s} \\
10 \end{tabular}
11 \label{tab:first}
12 \end{table}
13
14 Please refer to table \ref{tab:first}
15
16
17
18 \end{document}
```

Table 1: This is my first table!

| Parameter | Value |
|-----------|-------|
| a         | 500 m |
| b         | 100 s |

Please refer to Table 1.

<https://www.tablesgenerator.com/>

# Figures!

```
1 \usepackage{graphicx}
2 \begin{figure}[h!]
3
4     \centering
5     \includegraphics[width = 0.7\textwidth]{/figures/mypicture.jpg}
6     \caption{The full lattice solution resulting in an identity transform matrix,
7 where  $a_1 = 2$  and  $b_1 = 3$ .}
8     \label{fig:lattice_solution_2_3}
9
10 \end{figure}
```

Reminder: the file name should be a path to the image. Think about how to keep this organized!

`\listoffigures` and `\listoftables`

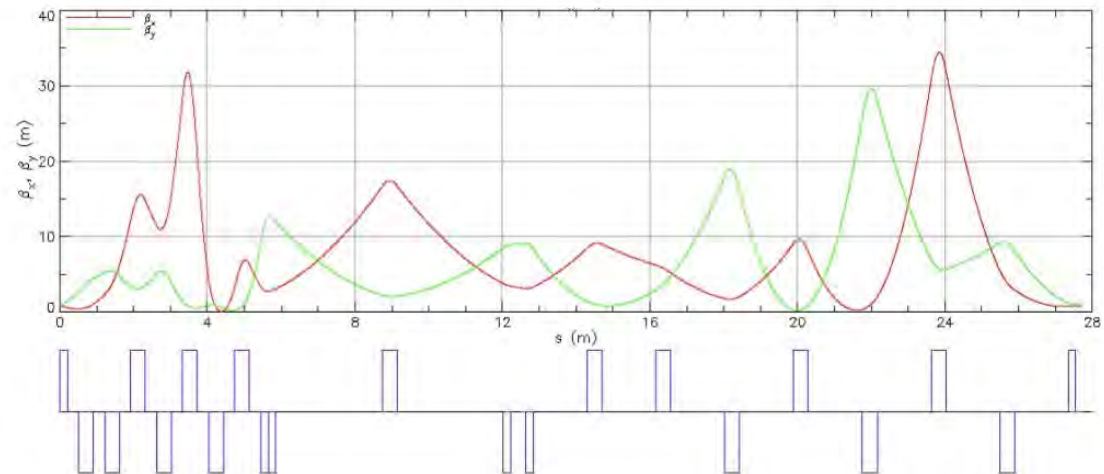


FIG. 3: The full lattice solution resulting in an identity transform matrix, where  $a_1 = 2$  and  $b_1 = 3$ .

# Figures!

```
1 \usepackage{graphicx}
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8     \label{fig:lattice_solution_2_3}
9
10 \end{figure}
```

Reminder: the file name should be a path to the image. Think about how to keep this organized!

`\listoffigures` and `\listoftables`

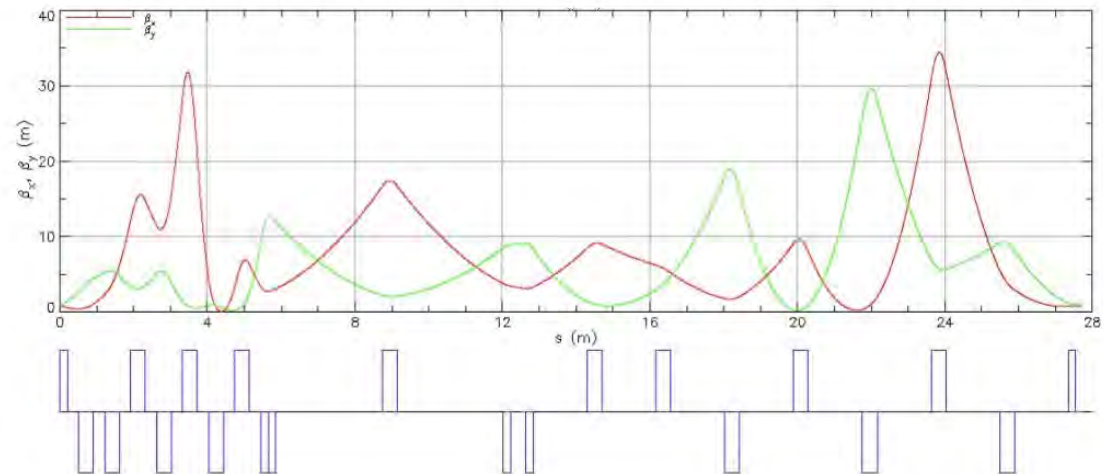


FIG. 3: The full lattice solution resulting in an identity transform matrix, where  $a_1 = 2$  and  $b_1 = 3$ .

# Some random things

- Additional spaces between words are ignored.
- Manually add spaces by escaping a space ‘\ ’
- Line break: (no indent) two backslashes ‘\\’
- Paragraph break (indent) two newlines (‘Enter’ twice)