# Day 02: Intro to LaTeX


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LaTeX101

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# Course Recap

- **Adapted from** – https://www.learnlatex.org/.
  - Day 1 – `learnlatex.org` lessons 1-6 (**Done!**)
  - Day 2 – `learnlatex.org` lessons 7-12.
  - Day 3 – Specific templates (resume, presentations).
- **Slides Available** – https://github.com/mdelrosa/latex-101.
  - Template based on Clara Pavillet's Oxford Template
- **Slack back channel**
  - UC Davis Slack channel

# Outline

# Figures

Including images, resizing, positioning

The graphicx package provides the \includegraphics command.

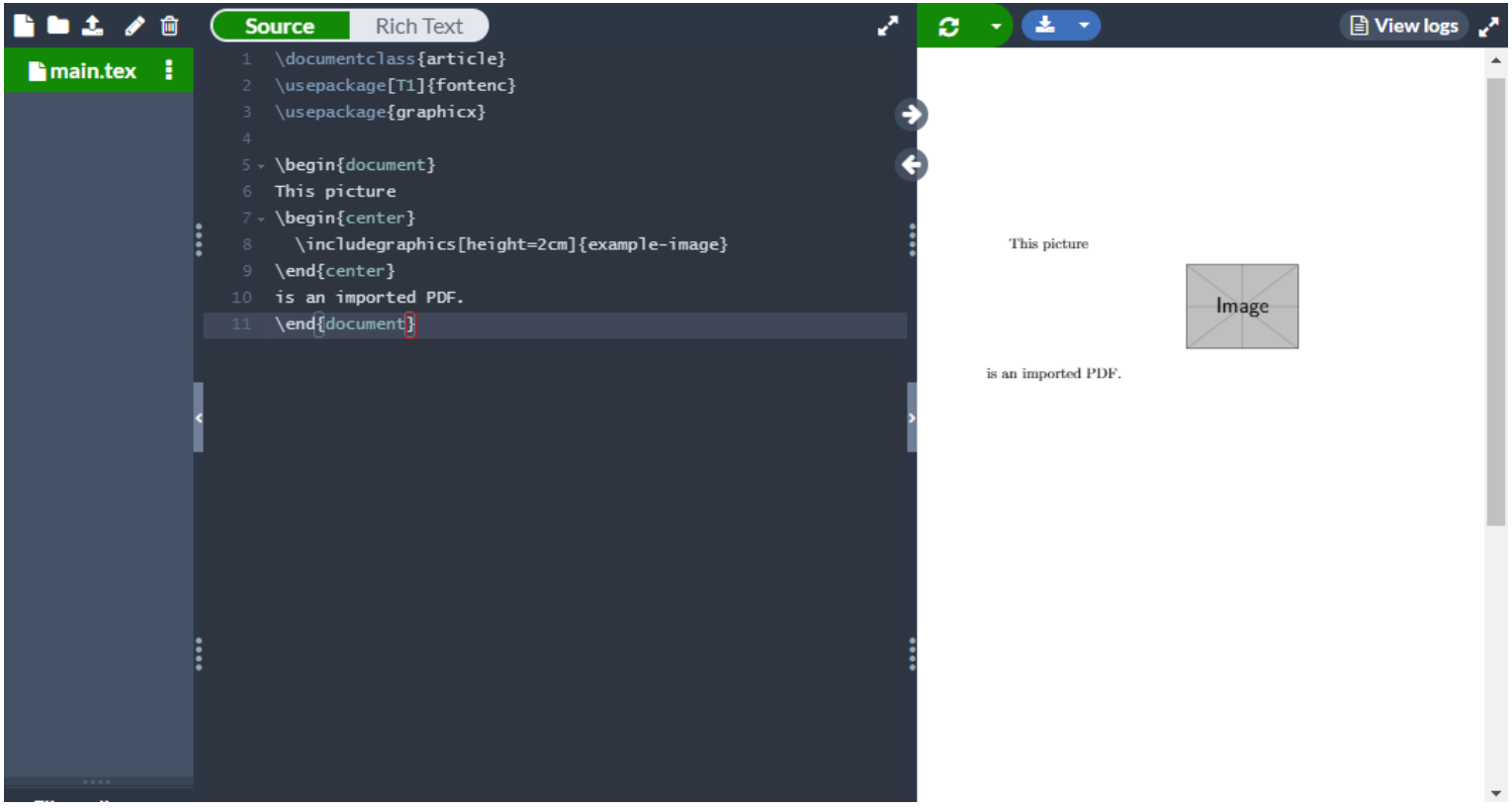



Figure 1: example-image is provided by default in most LaTeXdistributions.

# Scaling Images



- `\includegraphics` takes optional arguments for scaling
- Common commands: `\textheight`, `\textwidth`

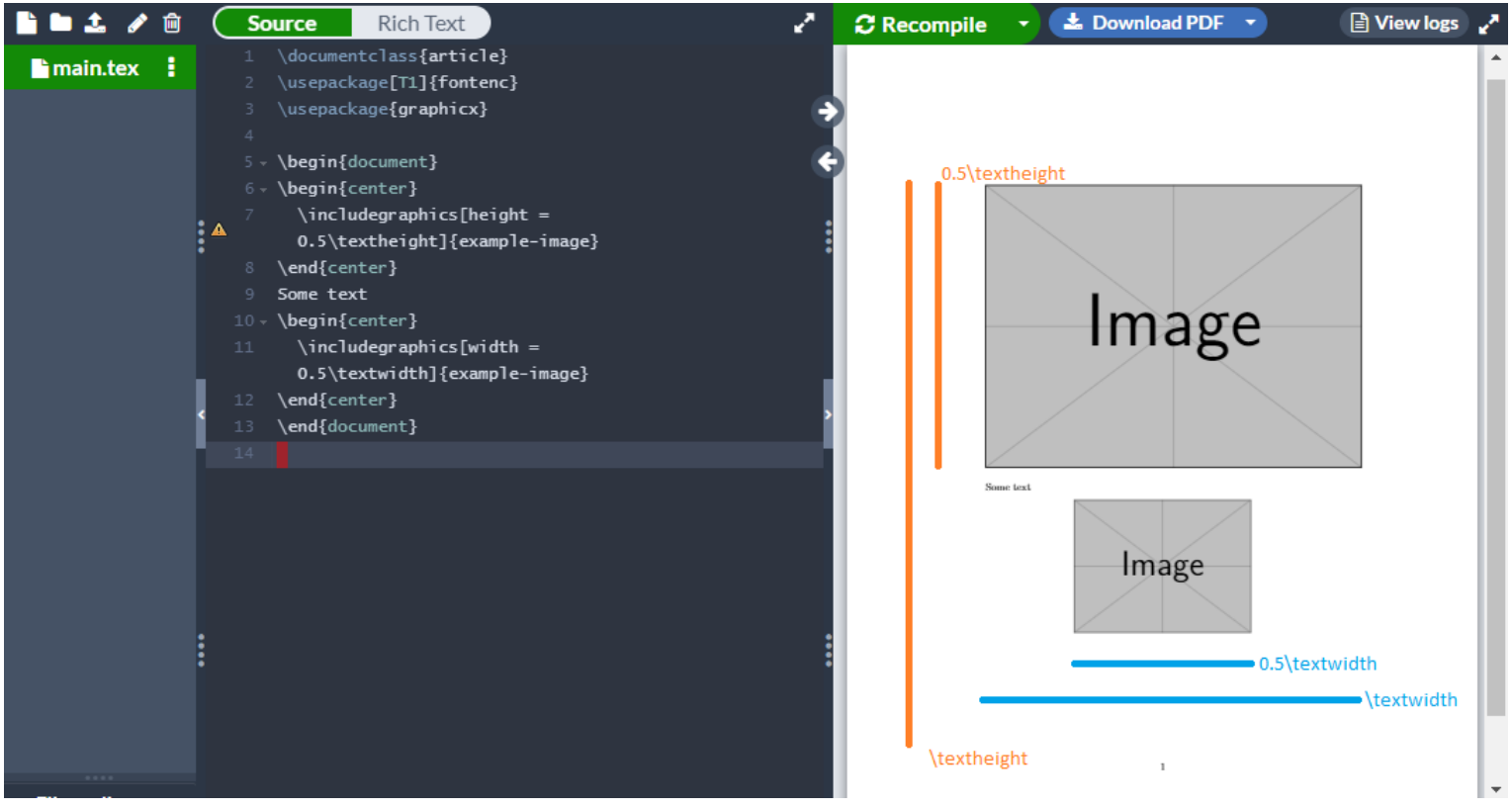



Figure 2: Optional arguments to change `width` and `height` of graphics.

`\includegraphics` takes optional arguments for clipping and rotating

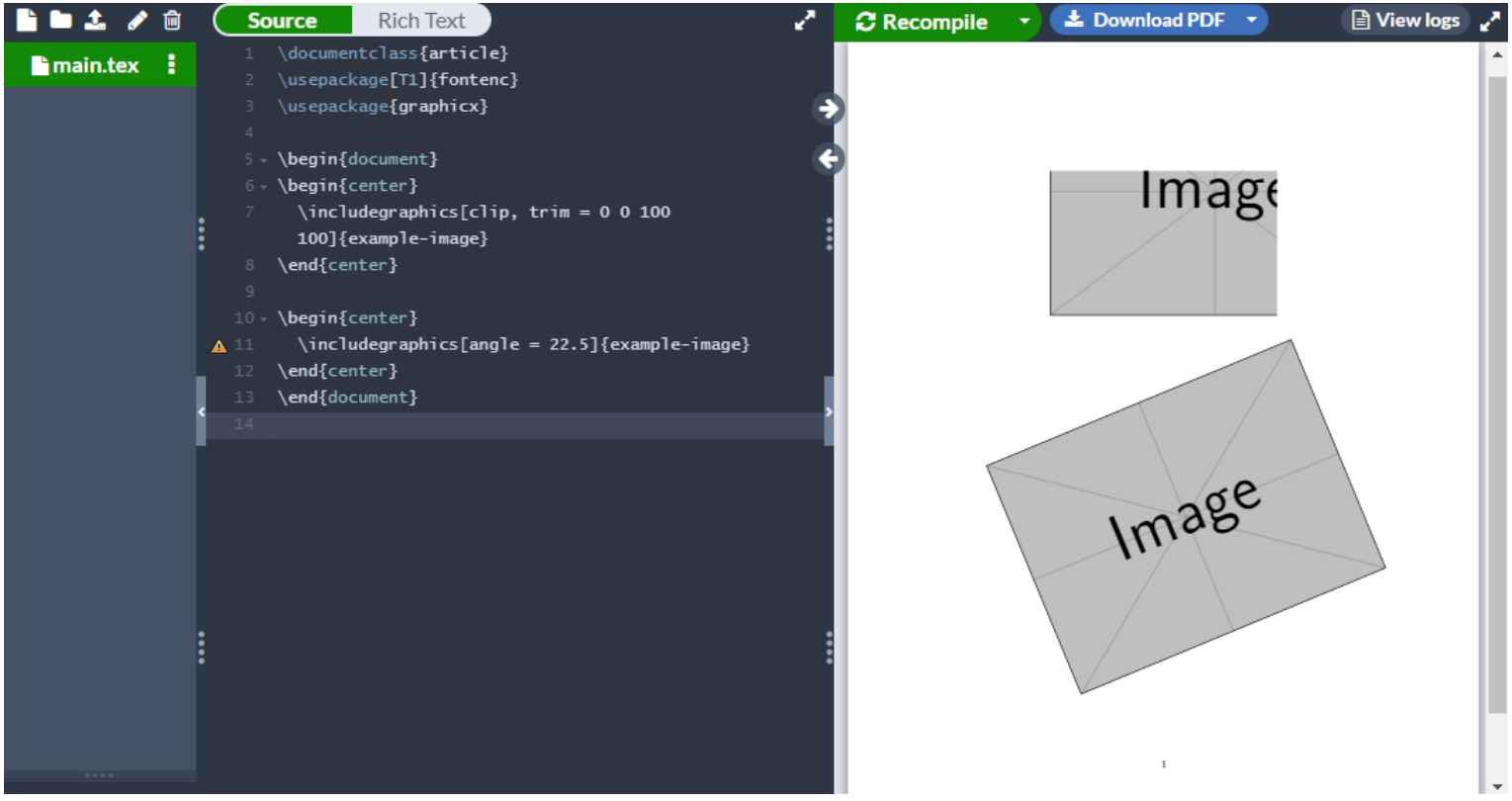



Figure 3: Optional arguments `clip`, `trim`, and `angle`.

Including images can lead to large gaps in text.

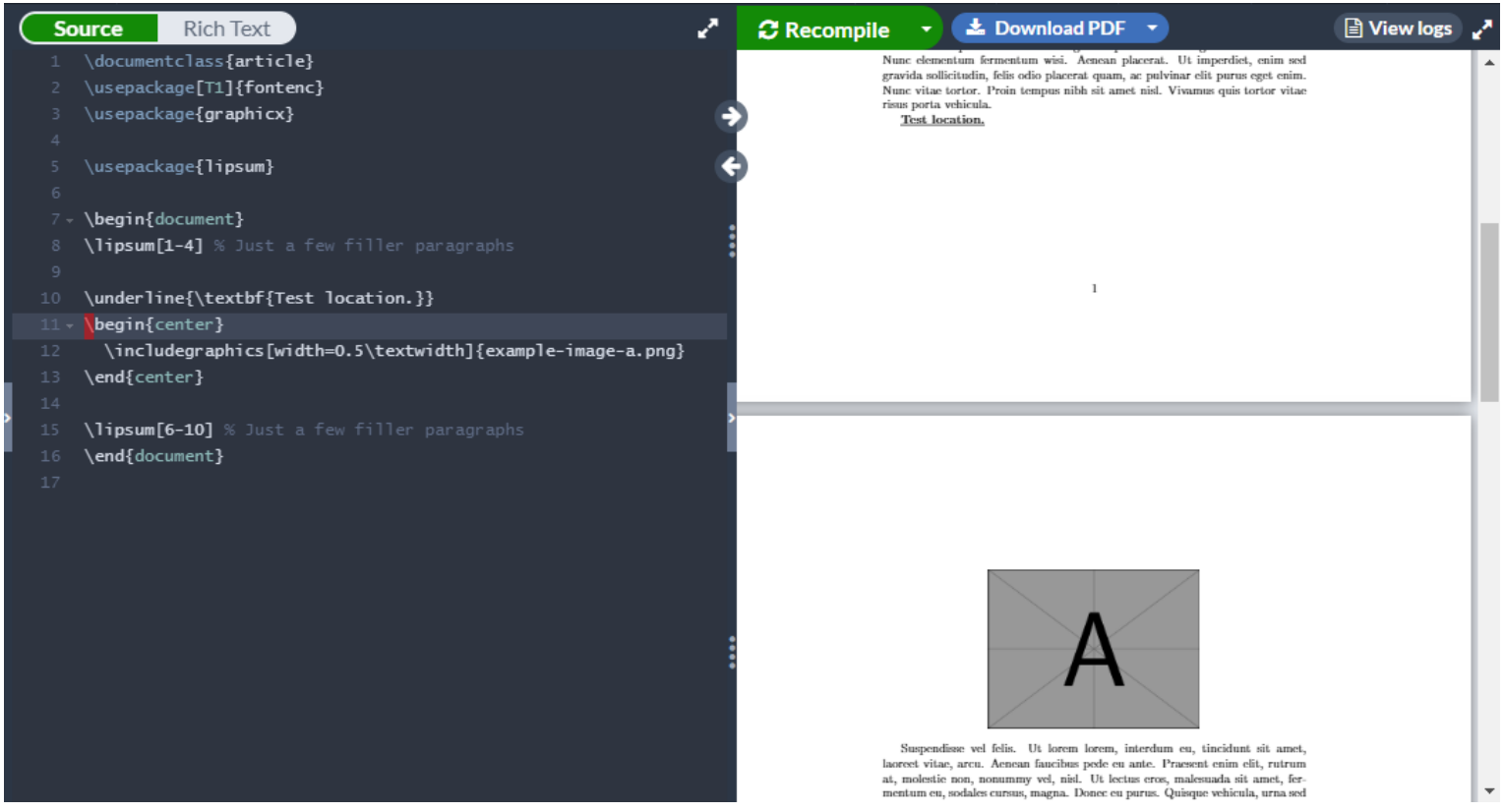



Figure 4: `\includegraphics` causing a gap on Page 1

.

Floats - an image environment (e.g., `figure`) that dynamically adjusts its position.


Figure 5: `figure` environment causes text to wrap properly

.

Optional arguments `[h]`ere, `[t]`op, `[b]`ottom, `[p]`age control float placement.


Figure 6: `figure` with `[hb]` optional argument placed on bottom of page

# Tables

Building tables, aligning and merging cells

The array package provides commands for tables.

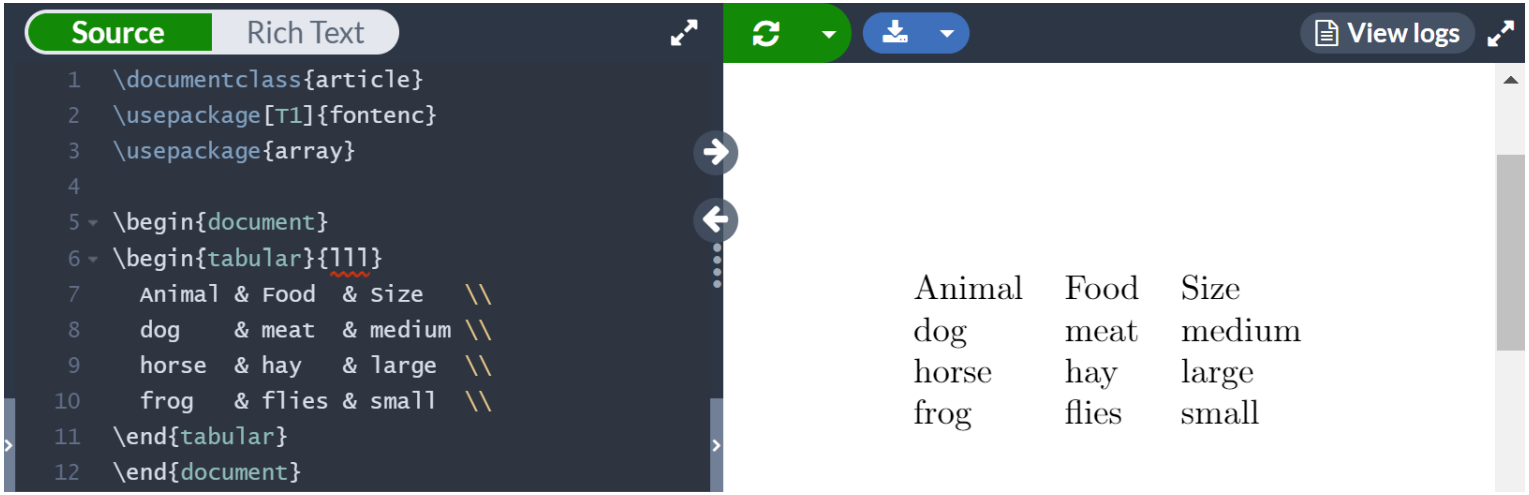



Figure 7: A tabular environment provided by array packages.

# Aligning Columns

Argument to `tabular` changes alignment – `{l}`eft, `{c}`enter, `{r}`ight.

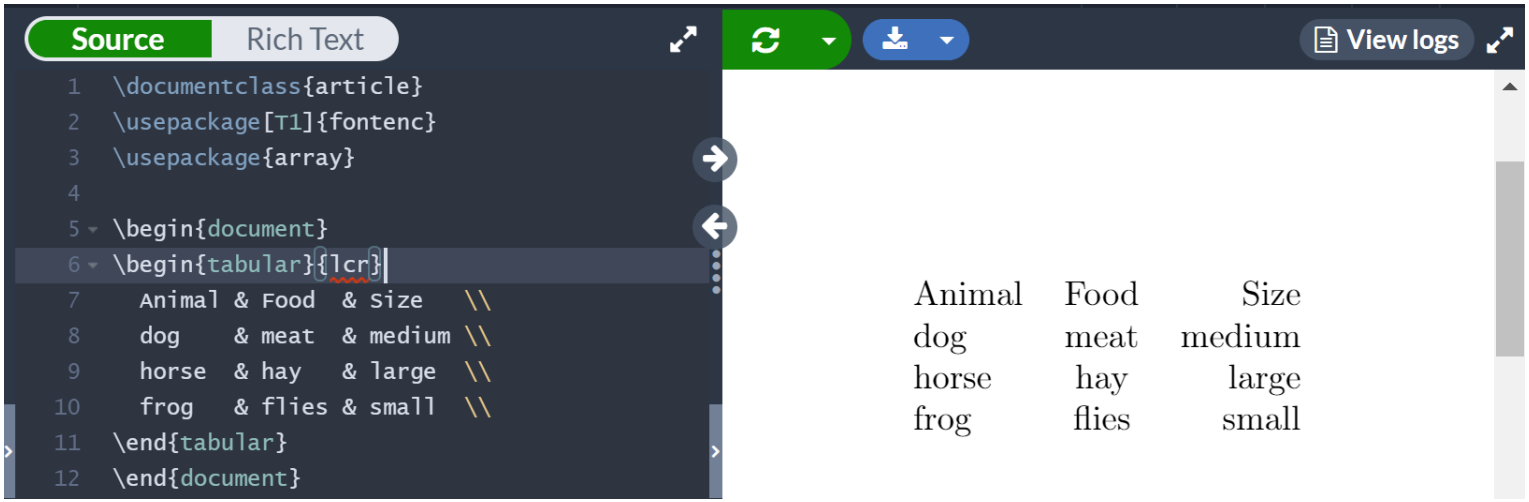



Figure 8: Same table with left, center, and right (`{lcr}`) column alignments.

# Paragraph Columns

(`{lcr}`) columns will typeset into single row, even if they are wider than the page.

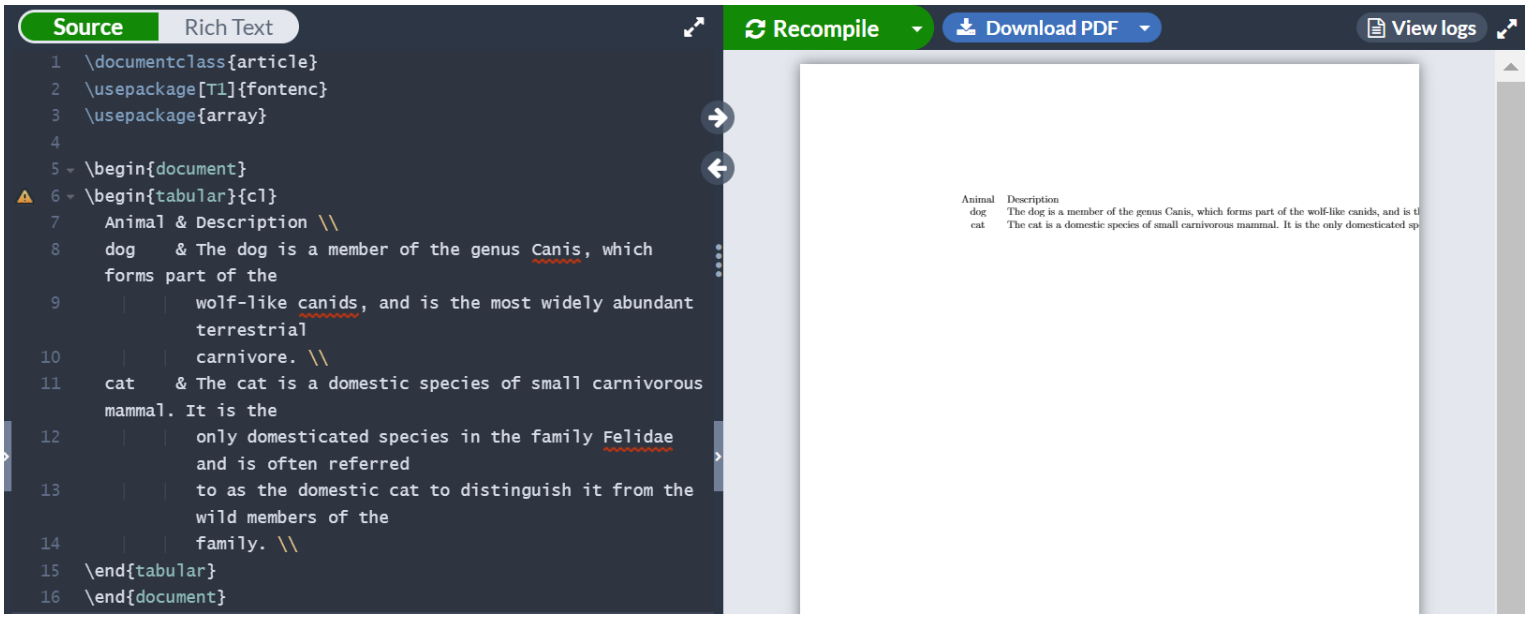



Figure 9: A runaway `l` column.

# Paragraph Columns

(`{p}`) columns are forced to a given width.

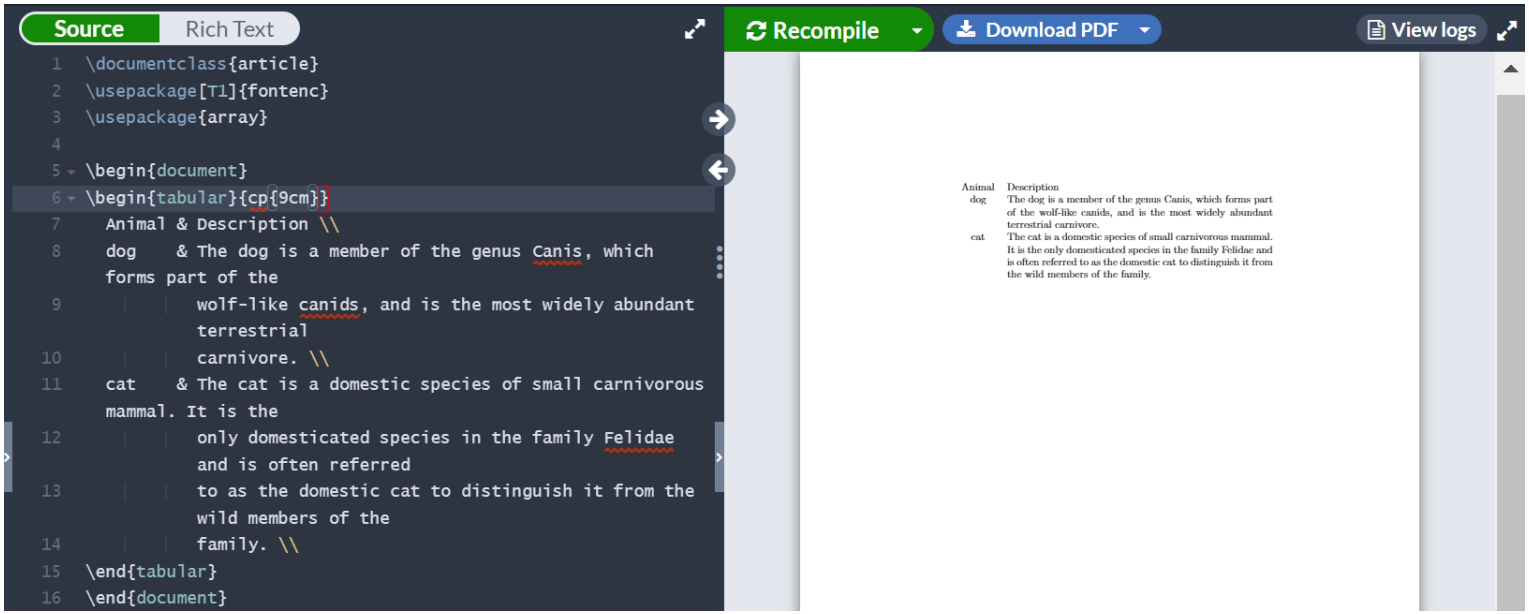
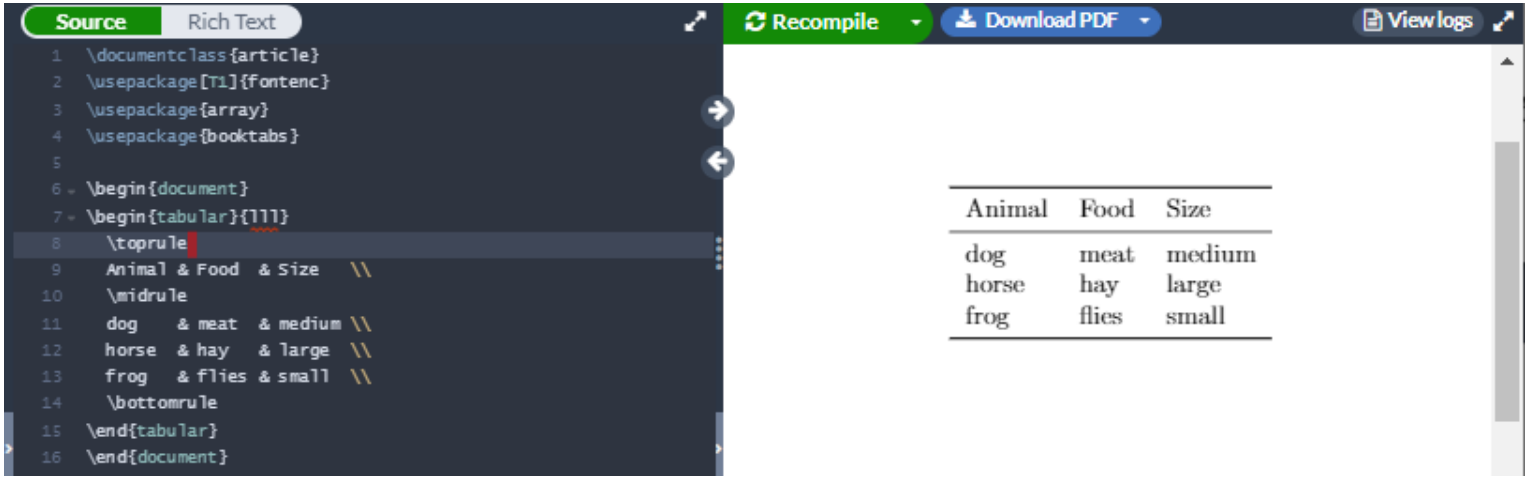



Figure 10: Same text in a `p` column with wrapped text.

# Adding rules

Rules (lines) are enabled with the `booktabs` package.



# Adding rules

`\cmidrule` spans a subset of columns.

Source | Rich Text

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{array}
\usepackage{booktabs}

\begin{document}
\begin{tabular}{lll}
  \toprule
  Animal & Food  & Size   \\
  \midrule
  dog    & meat  & medium \\
  \cmidrule{1-2}
  horse  & hay   & large  \\
  \cmidrule{1-1}
  \cmidrule{3-3}
  frog   & flies & small  \\
  \bottomrule
\end{tabular}
\end{document}
```

Recompile | Download PDF | View logs

| Animal | Food | Size |
|---|---|---|
| dog | meat | medium |
| horse | hay | large |
| frog | flies | small |

# Adding line space



`\addlinespace` useful for more subtle separation.

Source | Rich Text

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{array}
\usepackage{booktabs}

\begin{document}
\begin{tabular}{cp{9cm}}
  \toprule
  Animal & Description \\
  \midrule
  dog    & The dog is a member of the genus Canis, which
forms part of the
           wolf-like canids, and is the most widely abundant
           terrestrial
           carnivore. \\
  \addlinespace
  cat    & The cat is a domestic species of small carnivorous
mammal. It is the
           only domesticated species in the family Felidae
           and is often referred
           to as the domestic cat to distinguish it from the
           wild members of the
           family. \\
  \bottomrule
\end{tabular}
\end{document}
```

Recompile | Download PDF | View logs

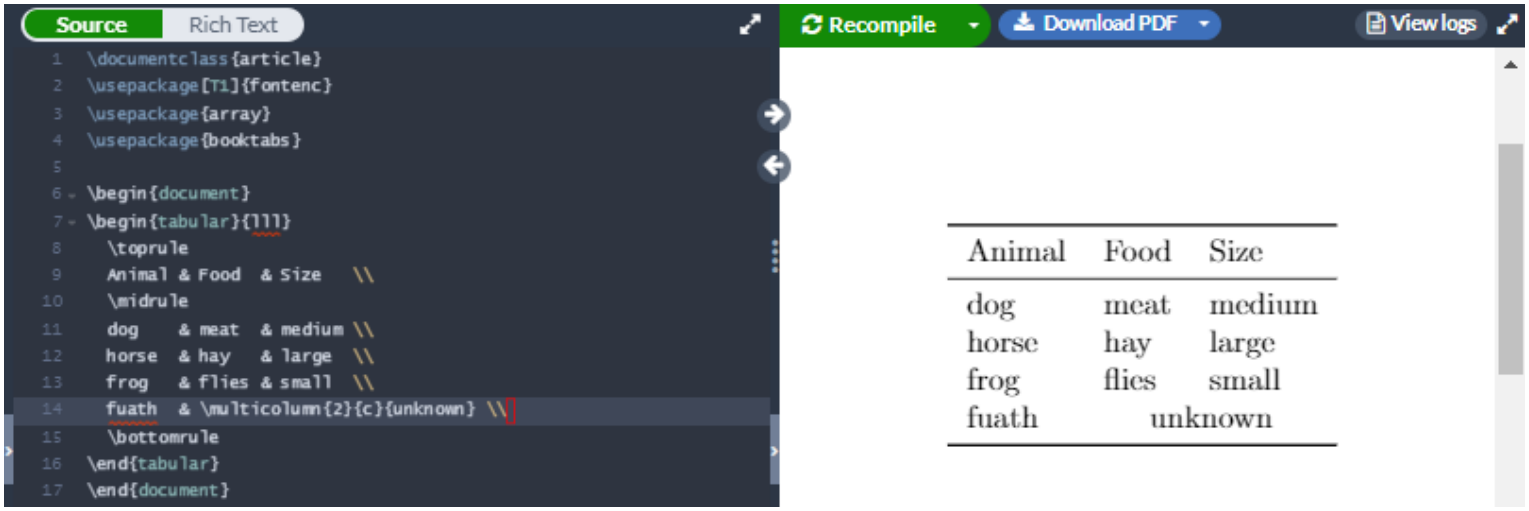
| Animal | Description |
|---|---|
| dog | The dog is a member of the genus Canis, which forms part of the wolf-like canids, and is the most widely abundant terrestrial carnivore. |
| cat | The cat is a domestic species of small carnivorous mammal. It is the only domesticated species in the family Felidae and is often referred to as the domestic cat to distinguish it from the wild members of the family. |

# Merging cells



`\multicolumn` creates cells spanning multiple columns. Arguments include:

1. Number of columns cell spans
2. Alignment of cell
3. Contents of cell



# Merging cells vertically



`multirow` package exists, but you can just use blank cells!

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{array}
\usepackage{booktabs}

\begin{document}
\begin{tabular}{lll}
  \toprule
  Group     & Animal & Size   \\
  \midrule
  herbivore & horse  & large  \\
            & deer   & medium \\
            & rabbit & small  \\
  \addlinespace
  carnivore & dog    & medium \\
            & cat    & small  \\
            & lion   & large  \\
  \addlinespace
  omnivore  & crow   & small  \\
            & bear   & large  \\
            & pig    & medium \\
  \bottomrule
\end{tabular}
\end{document}
```

| Group | Animal | Size |
|---|---|---|
| herbivore | horse | large |
| | deer | medium |
| | rabbit | small |
| carnivore | dog | medium |
| | cat | small |
| | lion | large |
| omnivore | crow | small |
| | bear | large |
| | pig | medium |

Useful utility for table creation:
`https://www.tablesgenerator.com/`.

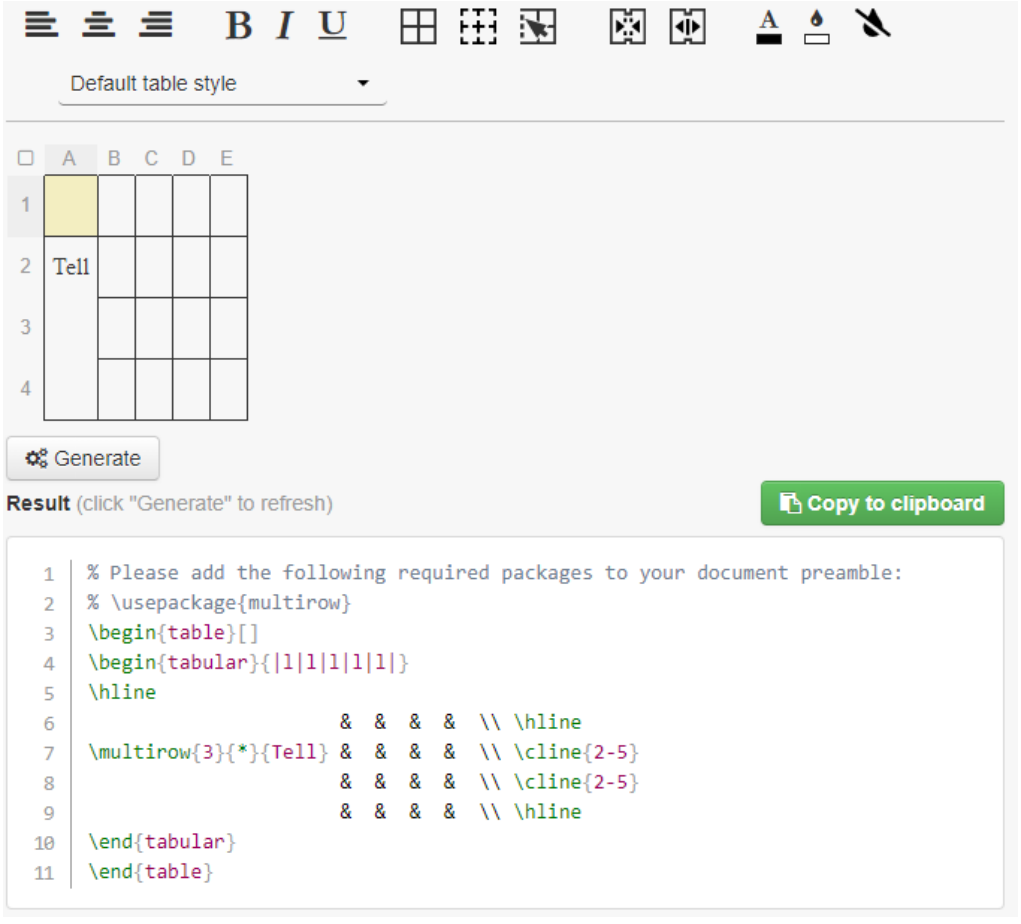



Figure 11: Generate code for table based on WYSIWYG editor.

# Cross Referencing

Smart references for figures, tables, sections, etc.

- `\label` commands assign ID to the most recent numbered element.
- `\ref` commands display number corresponding to label with same ID.

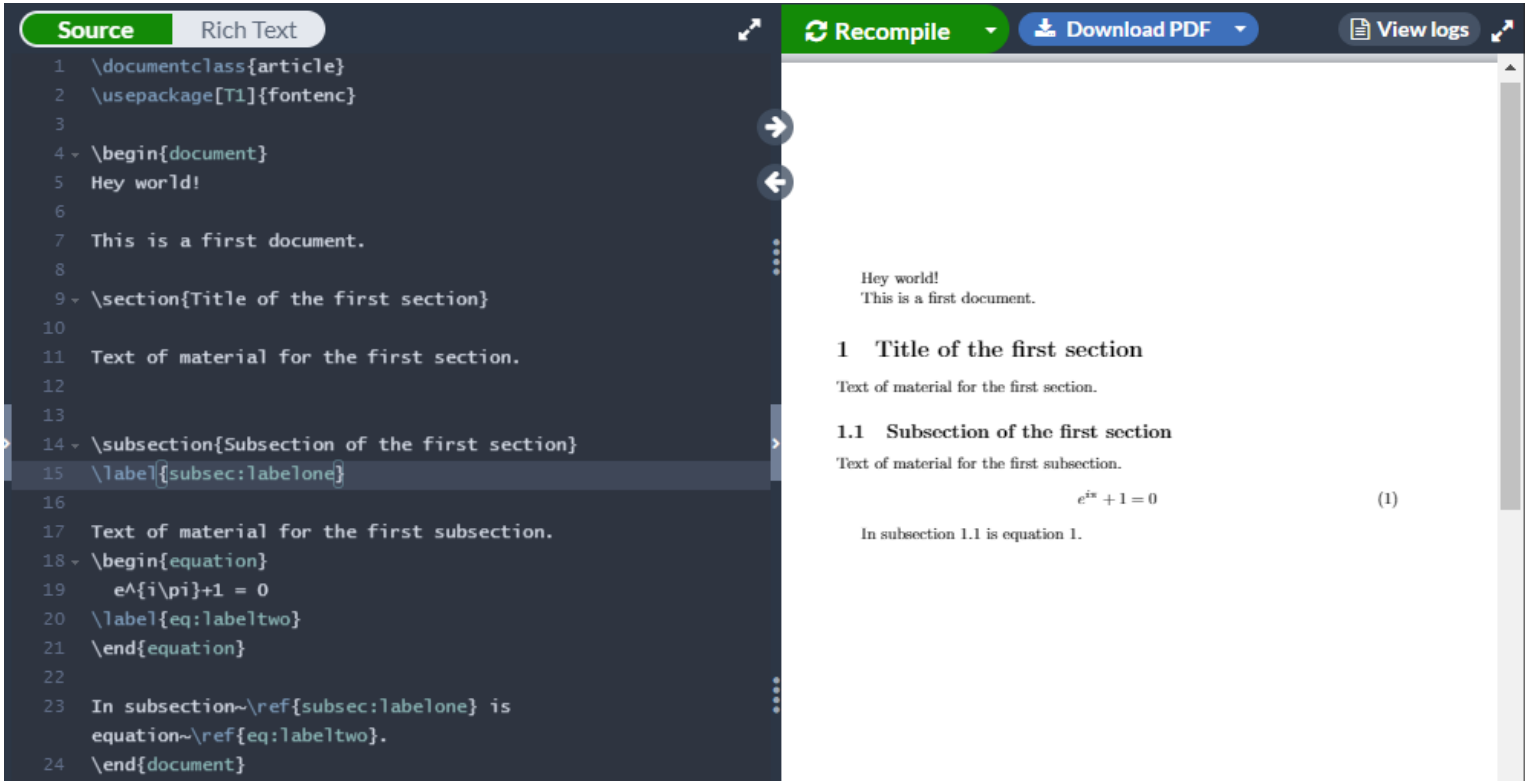



Figure 12: `\label` and `ref` commands used to number `section` and `equation` environments.

`\label` and `\ref` accept any text as arguments.

Good to name labels after corresponding elements, for example:

- `\label{eq:...}` for equations
- `\label{sec:...}` for sections
- `\label{tab:...}` for tables

# Mathematics

## Inline vs. display equations

# Inline vs. Display Equations

LaTeX's biggest feature: *math mode*. Two categories of math mode equations:

1. **Inline**: Does not break paragraph. Denoted by $\$ \ldots \$$ or $\backslash( \ldots \backslash)$.
2. **Display**: Breaks paragraph, centers equation. Denoted by $\backslash[ \ldots \backslash]$, `equation` environment, or `align` environment.

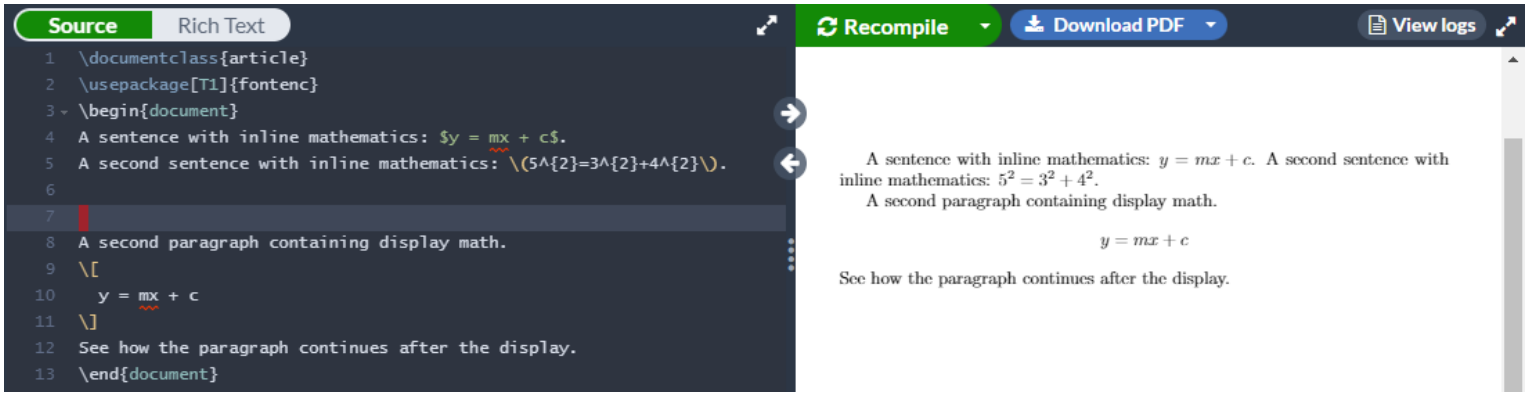



Figure 13: Examples of inline vs. display math mo.

# Inline vs. Display Equations

Customary to write *all* math symbols in math mode. For example,

- 2 and $-2$ (using inline math mode)
- 2 and -2 (without inline math mode)

Be careful about plaintext copied from other files that include:

- $ (interpreted as math mode delimiter!)
- _ (subscript symbol)

Common mathematical constructs:

- Subscripts (_) and superscripts (∧). Pay attention to curly braces ({})!
- Specialist symbols (`\sin`, `\log`, `\theta`, so many more!)

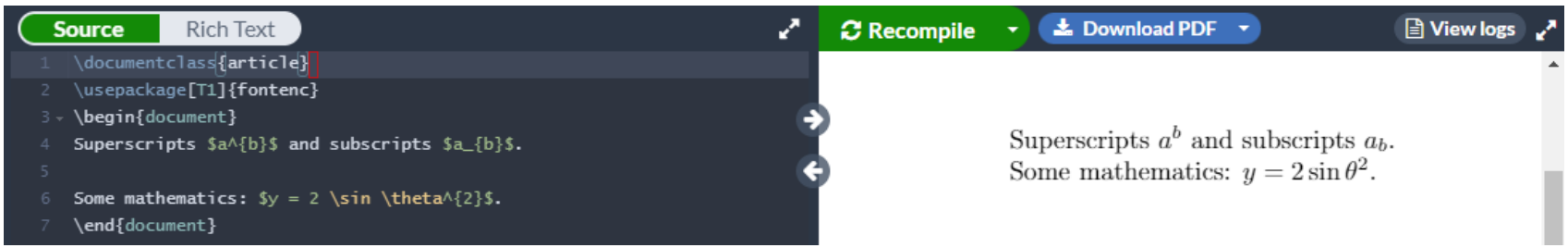



Figure 14: Examples of mathematical symbols.

Display math environments are treated as part of a paragraph. Cannot end a paragraph (i.e., no newline within display environment).


Figure 15: Error arising from blank line in display math environment.

Whitespace delimited by specific control characters (e.g., `\,`).


Figure 16: Whitespace in math environment requires control characters!

# `equation` Environment

Numbered `equation` environments enable cross-referencing.


Figure 17: Same math in `equation` environment

To suppress numbers, add asterisk (*)

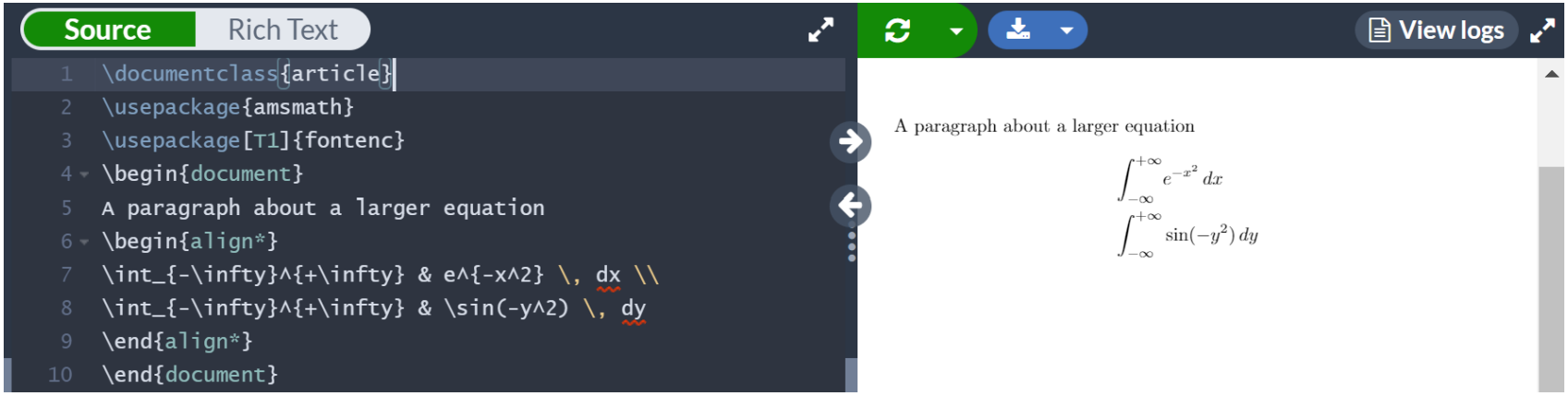



Figure 18: `align` environment with number suppressed.

# `align` Environment

`align` environments also enable cross-referencing plus control of line alignment.

- \\: Force a newline
- & : Location to align between two lines

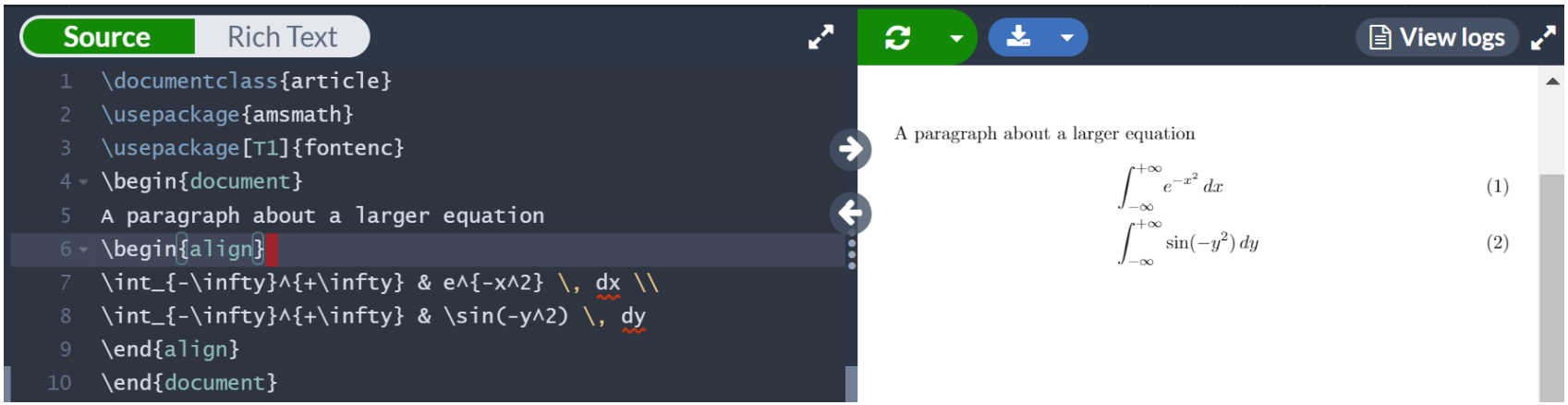



Figure 19: Two lines in `align` environment

To suppress number in `align` or `equation`, add an asterisk (i.e., `align*`, `equation*`)

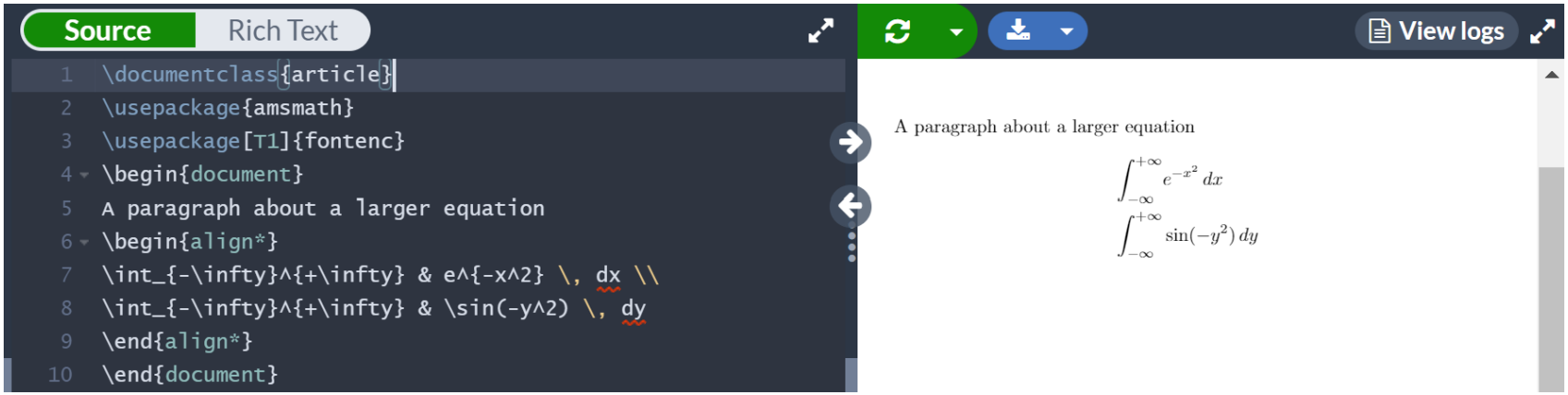



Figure 20: `align` without number.

`amsmath` provides three matrix environments:

1. `matrix` – Matrix with no brackets
2. `pmatrix` – Matrix with parentheses
3. `bmatrix` – Matrix with square brackets

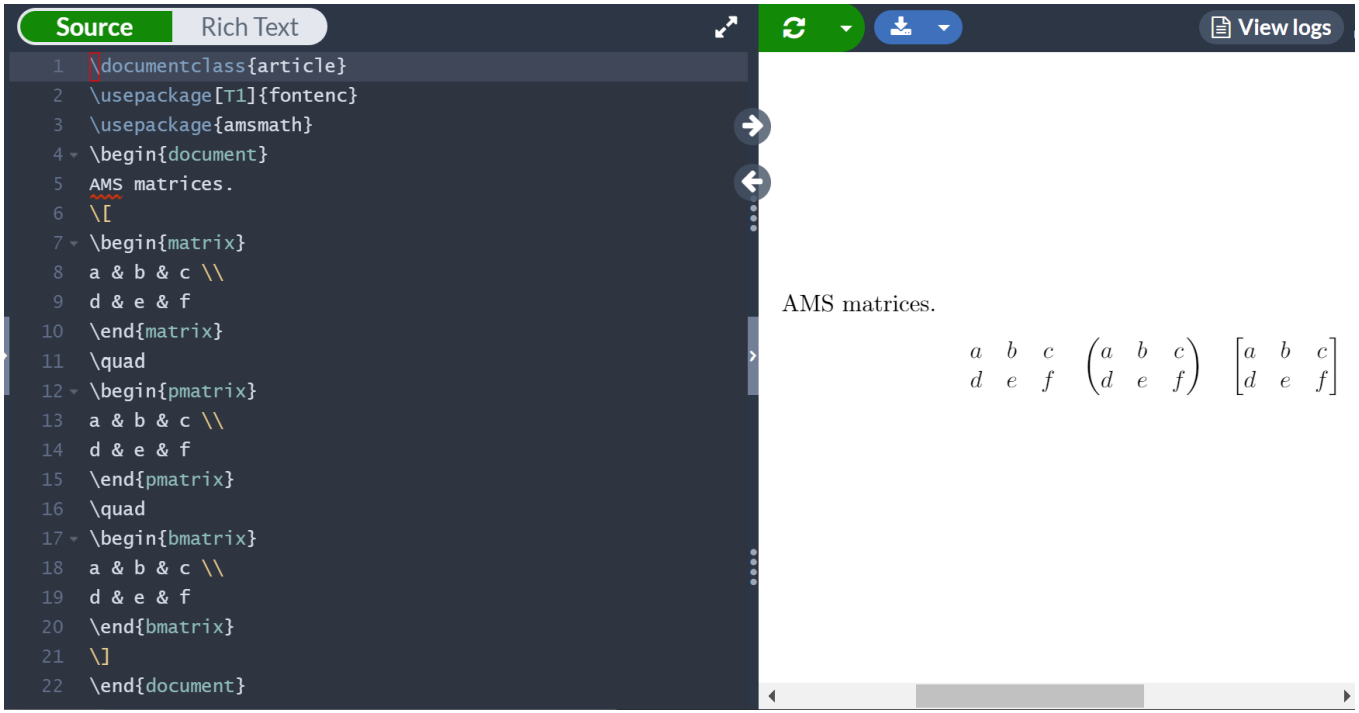



Figure 21: Different matrices with different delimiters.

Math fonts can convey specific meaning. Available math fonts are:

| **Name** | **Command** | **Example** |
|---|---|---|
| Roman | `\mathrm` | $\mathrm{R}$ |
| Italic | `\mathit` | $\mathit{R}$ |
| Boldface | `\mathbf` | $\mathbf{R}$ |
| Sans serif | `\mathsf` | $\mathsf{R}$ |
| Monospaced/typewriter | `\mathtt` | $\mathtt{R}$ |
| Double-struck/blackboard bold | `\mathbb` | $\mathbb{R}$ |

To use plain font in a math environment:

- `\text` to match outer font.
- `\mathrm` roman font (regardless of outer font).


Figure 22: Plain font in math environment.

So many math symbols! If you're lost, detexify (`http://detexify.kirelabs.org/classify.html`) can help.

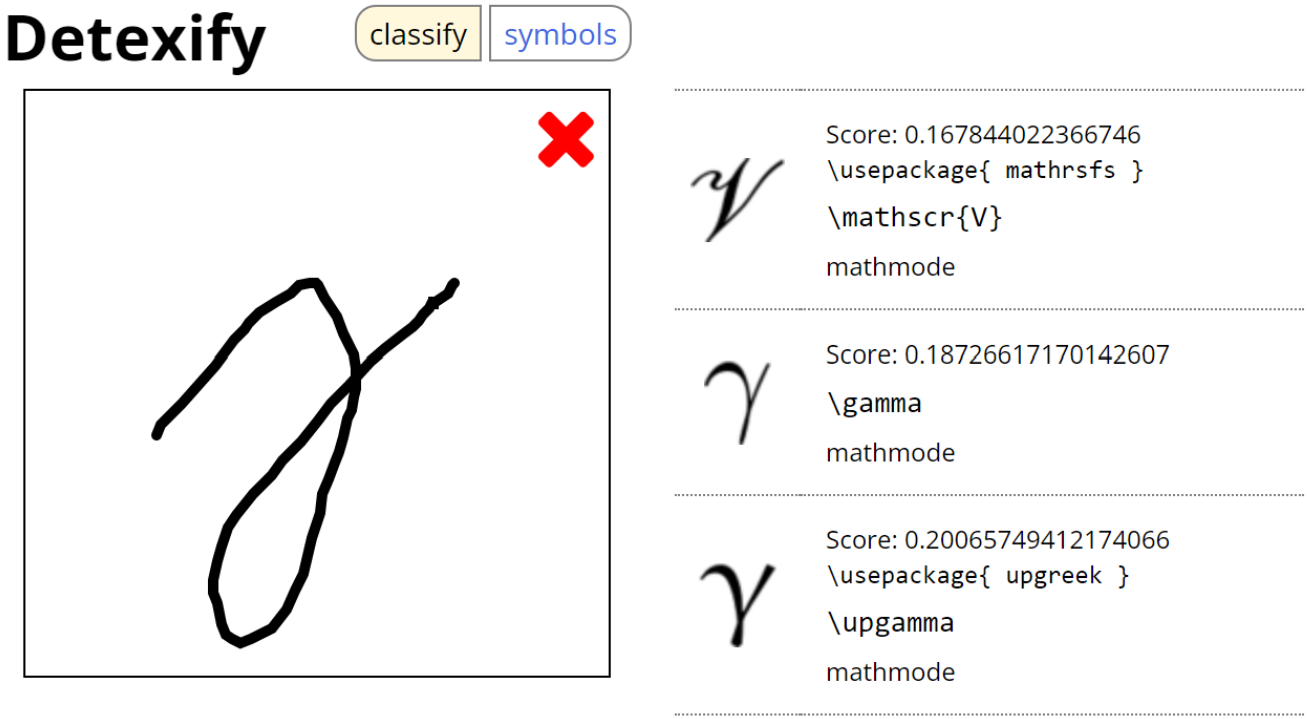



Figure 23: Returned matches for a hand-drawn gamma ($\gamma$) symbol.

# Fonts + Spacing

Paragraph spacing, newlines, explicit spacing/formatting

Behavior for new paragraphs:

- Default: indents, no blank line between paragraphs
- `parskip`: no indents, blank line between paragraphs


Figure 24: New paragraph behavior using `parskip`.

- For default text, newlines between paragraphs should be automatically added by including ‘blank lines’
- In certain environments, need \\ to force newlines
  - End of `table` rows
  - Inside of `center` environments
  - Inside of `verse` environments (poetry)

# Explicit Whitespace

For more fine-tuned whitespace:

- `\,` – thin space (text mode)
- `\.`, `\:`, `\;` – different sized spaces (math mode)
- `\hspace`, `\vspace` – explicit horizontal, vertical space

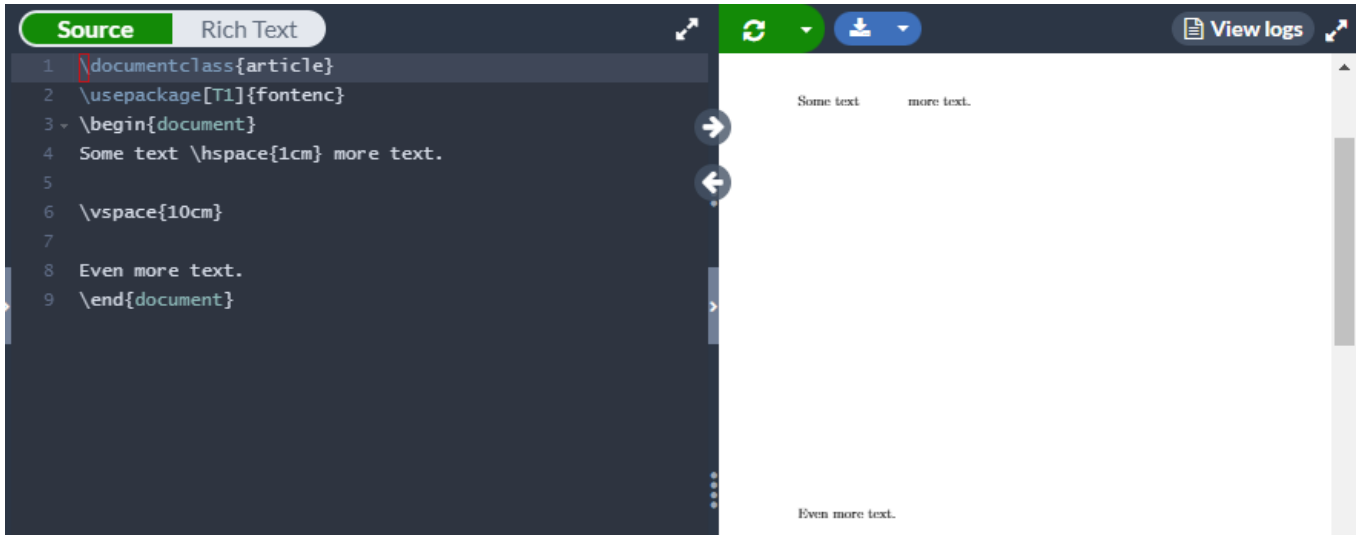



Figure 25: Examples of `\hspace`, `\vspace`.

For short pieces of text, the following formatting commands are available:

| Name | Command | Example |
|---|---|---|
| Roman | `\textrm` | Format |
| Italic | `\textit` | *Format* |
| Boldface | `\textbf` | **Format** |
| Sans serif | `\textsf` | Format |
| Monospaced | `\texttt` | `Format` |
| Small caps | `\textsc` | FORMAT |

- Group = anything in curly braces ({}). Use with large blocks of text.
- `\itshape` and `\bfseries` used to make groups italic and bold face, respectively.

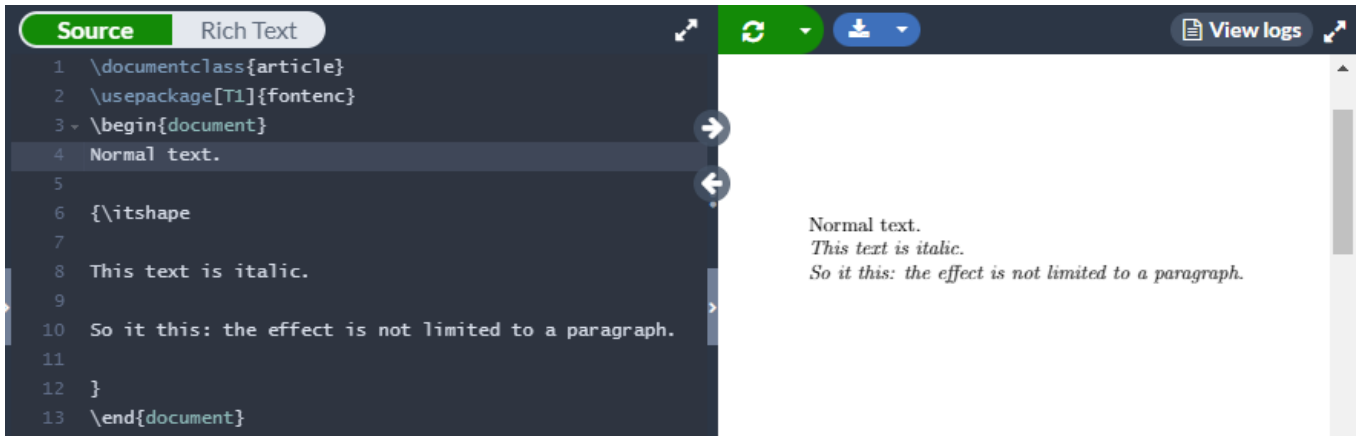



Figure 26: Example of `\itshape` used with a group.

- Relative font size within a group – `\huge`, `\large`, `\normalsize`, `\small`, `\footnotesize`, `\tiny`.
- `\par` – end of paragraph

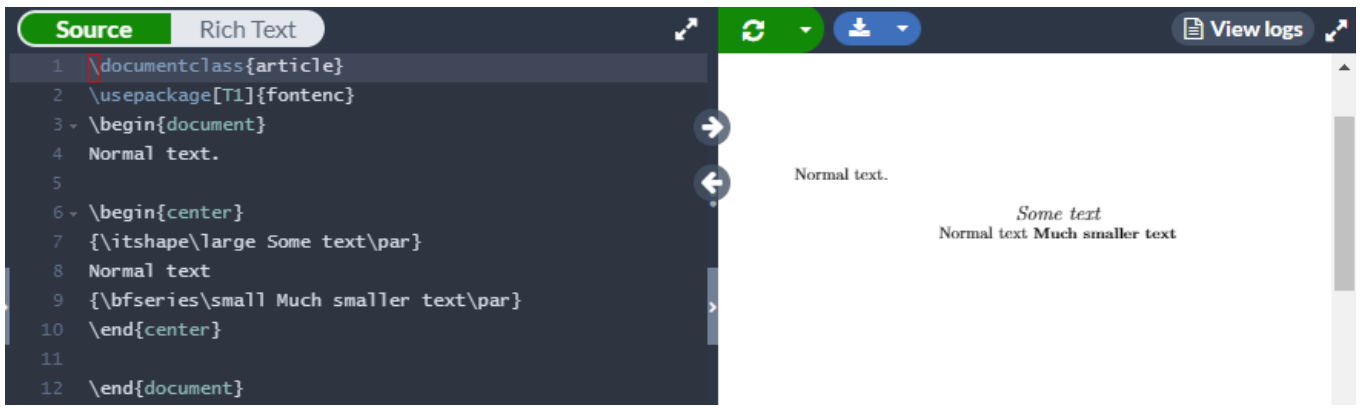



Figure 27: Example of `\large`, `\small` commands used with groups.

# Citations + References

`.bib` files,

Reference Databases (aka, bibliography files, `.bib` files) –

- Contain bibliography entries/references (e.g., `book`, `article`, etc.)
- Each entry contains multiple *fields*.
- `author` field: contains all authors separated by **and** (important!).

```
1 @article{oetiker1995not,
2  title={The {N}ot so {S}hort {I}ntroduction to {LATEX}2$\varepsilon$},
3  author={Oetiker, Tobias and Partl, Hubert and Hyna, Irene and Schlegl, Elisabeth},
4  journal={Electronic document available at http://www. tex. ac. uk/tex-archive/info/
       lshort},
5  year={1995},
6  publisher={Citeseer}
7 }
```

Figure 28: Example .bib entry.

T. Oetiker, H. Partl, I. Hyna, and E. Schlegl, "The Not so Short Introduction to LATEX2$\varepsilon$," *Electronic document available at http://www. tex. ac. uk/tex-archive/info/lshort*, 1995

Behind the scenes, three steps:

1. Compile document; creates list of cited references in document (not always everything in the database!).
2. Run a program (BibTeX or Biber); takes cited references, matches them to database entries, puts them in order.
3. Compile document again; resolves citations in document.

**Note**: Overleaf will abstract out this process. Only need to hit "Compile."

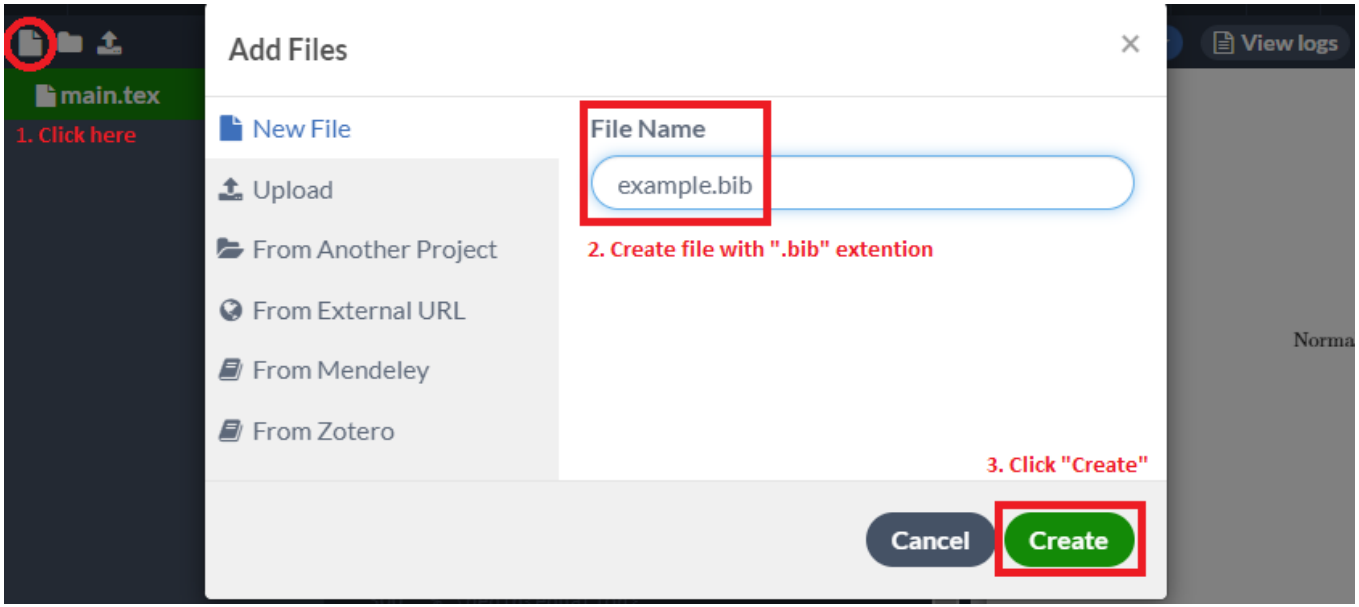



Figure 29: Creating a new `.bib` file in Overleaf.

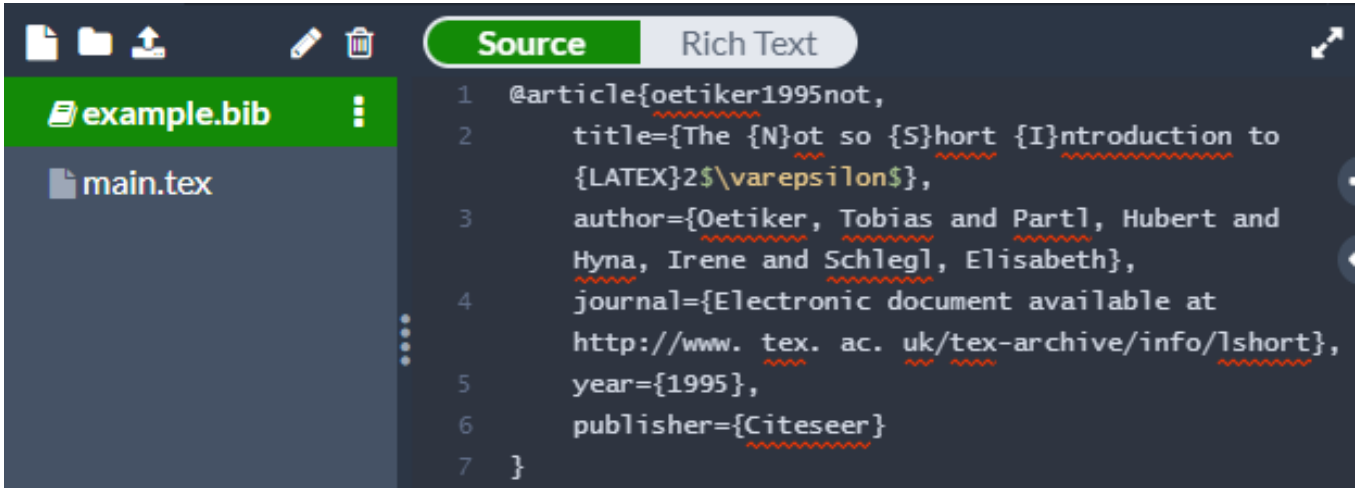



Figure 30: `.bib` file with a single entry.

- Using natbib package (BibTeX-based)
- Parenthetical citation (\citep) vs. Textual citation (\citet)

```
1
2  \documentclass{article}
3  \usepackage[T1]{fontenc}
4  \usepackage{natbib}
5
6  \begin{document}
7
8  A parenthetical citation \citep{oetiker1995not}. A
   textual citation \citet{oetiker1995not}.
9
10 A citation with optional page arguments
   \citep[p.~42]{oetiker1995not}.
11
12 A citation with optional text
   \citep[See][pp.~42-50]{oetiker1995not}.
13
14 A group citation \citep{oetiker1995not,
   kottwitz2011latex}.
15
16 \bibliographystyle{plainnat}
17 \bibliography{example}
18 \end{document}
```

A parenthetical citation [Oetiker et al., 1995]. A textual citation Oetiker et al. [1995].
A citation with optional page arguments [Oetiker et al., 1995, p. 42].
A citation with optional text [See Oetiker et al., 1995, pp. 42-50].
A group citation [Oetiker et al., 1995, Kottwitz, 2011].

**References**

Stefan Kottwitz. *LaTeX beginner's guide*. Packt Publishing Ltd, 2011.

Tobias Oetiker, Hubert Partl, Irene Hyna, and Elisabeth Schlegl. The Not so Short Introduction to LATEX2ε. *Electronic document available at http://www. tex. ac. uk/tex-archive/info/lshort*, 1995.

Figure 31: Textual vs. parenthetical citations using natbib.

# End of Day 02



- Finished: Lessons 1-6 (Day 01) and 7-12 (Day 02) from `learnlatex.org`
- Lessons 13 to 16 – can ask questions re: these on the Slack channel! (#latex101)
- Next time: Resume/CV templates, Beamer


T. Oetiker, H. Partl, I. Hyna, and E. Schlegl, "The Not so Short Introduction to LATEX2$\varepsilon$," *Electronic document available at http://www. tex. ac. uk/tex-archive/info/lshort*, 1995.