

Welcome to

LATEX

OR

TeX

Leslie Lamport made life easier

L^AT_EX

plaintext

plaintext \longrightarrow Formatted Text

plaintext \longrightarrow Formatted Text

Formatting
Information is
Embedded

How is it Embedded?

How is it Embedded?

SYNTAX !

plaintext

Document Structure:

```
\documentclass[12 pt]{article}
```

Preamble

```
\begin{document}
```

Body

```
\end{document}
```

```
\documentclass[12 pt]{article}
```

Preamble

```
\begin{document}
```

```

\documentclass[12pt]{article}

% MATH
\usepackage{mathtools, amssymb, gensymb, commath}
\allowdisplaybreaks
\renewcommand{\dif}{\mathop{}\!\mathrm{d}}

% FLOATS
\usepackage[section]{placeins}
\usepackage{multirow}
\usepackage[margin = 2 cm]{caption}
\usepackage{subcaption}

% SPACING
\usepackage[margin=1in]{geometry}
\renewcommand{\arraystretch}{1.5}
%\setlength{\parindent}{0 pt}
%\renewcommand{\baselinestretch}{1.5}
%\usepackage[moderate]{savetrees}

\usepackage{tikz}
\usepackage{pgfplots}

```

Example Preamble

```
\documentclass[12 pt]{article}
```

Preamble

```
\begin{document}
```

Body

```
\end{document}
```

```
\begin{document}
```

Body

```
\end{document}
```

\$ % ^ & _ { } ~ \

Reserved Characters

Spaces

Lorem ipsum \ldots



Lorem ipsum ...

Spaces

Lorem ipsum \ldots



Lorem ipsum ...

Lorem ipsum \ldots

Extra Spaces Ignored



Lorem ipsum ...

Spaces

Lorem ipsum \ldots



Lorem ipsum ...

Lorem ipsum \ldots



Lorem ipsum ...

Lorem~ipsum \ldots



Lorem ipsum ...

Non-Breaking Space

Breaks

Lorem

ipsum `\ldots`



Lorem
ipsum . . .

Breaks

Lorem

ipsum \ldots



Lorem
ipsum ...

Lorem\\ipsum \ldots



Lorem
ipsum ...

Breaks

Lorem

ipsum \ldots



Lorem
ipsum ...

Lorem\\ipsum \ldots



Lorem
ipsum ...

Lorem
ipsum \ldots



Lorem ipsum ...

Breaks

Lorem

ipsum \ldots



Lorem
ipsum ...

Lorem\\ipsum \ldots



Lorem
ipsum ...

Lorem

ipsum \ldots



Lorem ipsum ...

Single Line Breaks
Ignored

Comments

```
%Lorem ipsum \ldots
```



Comments

```
%Lorem ipsum \ldots
```



```
Lorem
```

```
%
```

```
ipsum \ldots
```



Lorem ipsum ...

Comments

```
%Lorem ipsum \ldots
```



```
Lorem
```

```
%
```

```
ipsum \ldots
```



Lorem ipsum ...

```
Lorem%
```

```
%
```

```
ipsum \ldots
```



Lorem ipsum ...

Comments

```
%Lorem ipsum \ldots
```



```
Lorem
```

```
%
```

```
ipsum \ldots
```



Lorem ipsum ...

```
Lorem%
```

```
%
```

```
ipsum \ldots
```



Lorem ipsum ...

Everything after % is
ignored

Commands

Lorem ipsum \ldots



Lorem ipsum ...

Commands

`{Lorem ipsum \ldots}`



Lorem ipsum ...

Commands

`{Lorem ipsum \ldots}`
Group



Lorem ipsum ...

Commands

`{Lorem ipsum \ldots}`
Group



Lorem ipsum ...

`\textit`

Commands

`{Lorem ipsum \ldots}`
Group



Lorem ipsum ...

`\textit{`
Lorem ipsum \ldots}



Lorem ipsum ...

Commands

`{Lorem ipsum \ldots}`
Group



Lorem ipsum ...

`\textit{`
Lorem ipsum \ldots}



Lorem ipsum ...

`\textbf{`
Lorem ipsum \ldots}



Lorem ipsum ...

Sectioning

```
\section{Lipsum}
```



1 Lipsum

Lorem ipsum dolor sit amet, consectetur
incididunt ut labore et dolore magna a
nostrud exercitation ullamco laboris ni

Sectioning

```
\section{Lipsum}
```



1 Lipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo.

```
\section*{Lipsum}
```

* = not numbered



Lipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo.

Sectioning

```
\section{Lipsum}
```



1 Lipsum

Lorem ipsum dolor sit amet, consectetur
incididunt ut labore et dolore magna a
nostrud exercitation ullamco laboris ni

Sectioning

```
\section{Lipsum}
```



1 Lipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo. Nemo enim ipsam voluptatem quia voluptas sit aspernatur aut odit aut fugit, sed quia consequuntur magni dolores eos qui ratione voluptatem sequi nesciunt, neque porro quisquam est, qui dolorem ipsum quia dolor sit amet, consectetur adipiscing elit, sed qui ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo.

```
\subsection{Lipsum}
```



1.1 Lipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo. Nemo enim ipsam voluptatem quia voluptas sit aspernatur aut odit aut fugit, sed quia consequuntur magni dolores eos qui ratione voluptatem sequi nesciunt, neque porro quisquam est, qui dolorem ipsum quia dolor sit amet, consectetur adipiscing elit, sed qui ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo.

Sectioning

`\section{Lipsum}`



1 Lipsum

Lorem ipsum dolor sit amet, consectetur
incididunt ut labore et dolore magna a
nostrud exercitation ullamco laboris ni

`\subsection{Lipsum}`



1.1 Lipsum

Lorem ipsum dolor sit amet, consectetur
incididunt ut labore et dolore magna a
nostrud exercitation ullamco laboris ni

`\paragraph{Lipsum}`



Lipsum Lorem ipsum dolor sit amet
mod tempor incididunt ut labore et d
veniam, quis nostrud exercitation ullam
consequat.

Environments

```
\begin{<environment>}
```

```
\end{<environment>}
```

Environments

```
\begin{<environment>}
```

```
\end{<environment>}
```

center

itemize

enumerate

align

figure

table

tabular

thebibliography

Environments

```
\begin{<environment>}
```

```
\end{<environment>}
```

center

itemize

enumerate

align

figure

table

tabular

thebibliography

Environments

```
\begin{center}
```

```
\end{center}
```

Environments

Lorem ipsum \ldots

\begin{center}

Lorem ipsum \ldots

\end{center}



Lorem ipsum ...

Lorem ipsum ...

Environments

```
\begin{itemize}
```

```
\end{itemize}
```

Environments

```
\begin{itemize}
```

```
\item Lorem
```

```
\item Ipsum
```

```
\end{itemize}
```



- Lorem
- Ipsum

Environments

```
\begin{enumerate}
```

```
\end{enumerate}
```

Environments

```
\begin{enumerate}
```

```
\item Lorem
```

```
\item Ipsum
```

```
\end{enumerate}
```



1. Lorem

2. Ipsum

Environments

```
\begin{enumerate}
```

```
\item Lorem
```

```
\item Ipsum
```

```
\begin{enumerate}
```

```
\item Lorem
```

```
\item Ipsum
```

```
\end{enumerate}
```

```
\end{enumerate}
```



1. Lorem

2. Ipsum

(a) Lorem

(b) Ipsum

Title Block

```
\title{Paper Title}  
\author{Author Name}  
\date{Month DD, YYYY}
```

```
\maketitle
```



Paper Title

Author Name

Month DD, YYYY


```
\begin{document}
```

```
\end{document}
```

```
\begin{document}
```

Math Mode

```
\end{document}
```

```
$ \frac{12 + 144 + 20 + 3 \sqrt{4}}{7} + 5  
  \times 11 = 9^2 + 0 $
```



$$\frac{12 + 144 + 20 + 3\sqrt{4}}{7} + 5 \times 11 = 9^2 + 0$$

Basics

`\frac{a}{b}`



$$\frac{a}{b}$$

Basics

`\frac{a}{b}`



$$\frac{a}{b}$$

`a^b`



$$a^b$$

`a_b`



$$a_b$$

Basics

`\frac{a}{b}`



$$\frac{a}{b}$$

`a^{b}`



$$a^b$$

`a_{b}`



$$a_b$$

Need `{}` for exponent of
more than one character

Basics

`\frac{a}{b}`



$$\frac{a}{b}$$

`a^{b^c}`



$$a^{b^c}$$

`a_{b_c}`



$$ab_c$$

Need `{}` for exponent of
more than one character

Basics

`\frac{a}{b}`



$$\frac{a}{b}$$

`a^{b^c}`



$$a^{b^c}$$

`a_{b_c}`



$$ab_c$$

`\sqrt[b]{a}`



$$\sqrt[b]{a}$$

Basics

`\frac{a}{b}`



$$\frac{a}{b}$$

`a^{b^c}`



$$a^{b^c}$$

`a_{b_c}`



$$ab_c$$

Optional Argument

`\sqrt[b]{a}`



$$\sqrt[b]{a}$$

Parentheses

(ab)



(*ab*)

Parentheses

(ab)



(ab)

(\frac{a}{b})



$\left(\frac{a}{b}\right)$

Parentheses

`(ab)`



(ab)

`(\frac{a}{b})`



$\left(\frac{a}{b}\right)$

`\left(\frac{a}{b} \right)`



$\left(\frac{a}{b}\right)$

Parentheses

`\left.\frac{a}{b}\right)` →

$$\left.\frac{a}{b}\right)$$

`\left` and `\right` must be
matched
(use `.` for non-printed)

Parentheses

`\left.\frac{a}{b}\right)` →

$$\left.\frac{a}{b}\right)$$

`\left\{\frac{a}{b}\right\}` →

$$\left\{\frac{a}{b}\right\}$$

Parentheses

`\left.\frac{a}{b}\right)` →

$$\left.\frac{a}{b}\right)$$

`\left\{\frac{a}{b}\right]` →

$$\left\{\frac{a}{b}\right]$$

`\left|\frac{a}{b}\right>` →

$$\left|\frac{a}{b}\right>$$

All Combinations Allowed

Spaces

a b



ab

Math Mode Ignores
Ordinary Spaces

Spaces

a b



ab

a \ b



a b

To Insert Space Manually

Spaces

a b



ab

a \ b



a b

a \quad b



a b

More Space

Spaces

a b



ab

a \ b



a b

a \quad b



a b

a \qquad b



a b

Even More

Typefaces

Lorem Ipsum

Text is italic in Math Mode



LoremIpsum

Typefaces

Lorem Ipsum



LoremIpsum

`\text{Lorem Ipsum}`



Lorem Ipsum

`\mathrm{Lorem \ Ipsu}`



Lorem Ipsum

Use `\text{}` for words in
math (spaces work)

Use `\mathrm{}` for
chemical formulae, units
(math commands work)

Typefaces

Lorem Ipsum



LoremIpsum

`\text{Lorem Ipsum}`



Lorem Ipsum

`\mathrm{Lorem \ Ipsu}`



Lorem Ipsum

`\mathbf{v_1}_1`



v₁₁

`\mathbb{Z} \in \mathbb{R}`



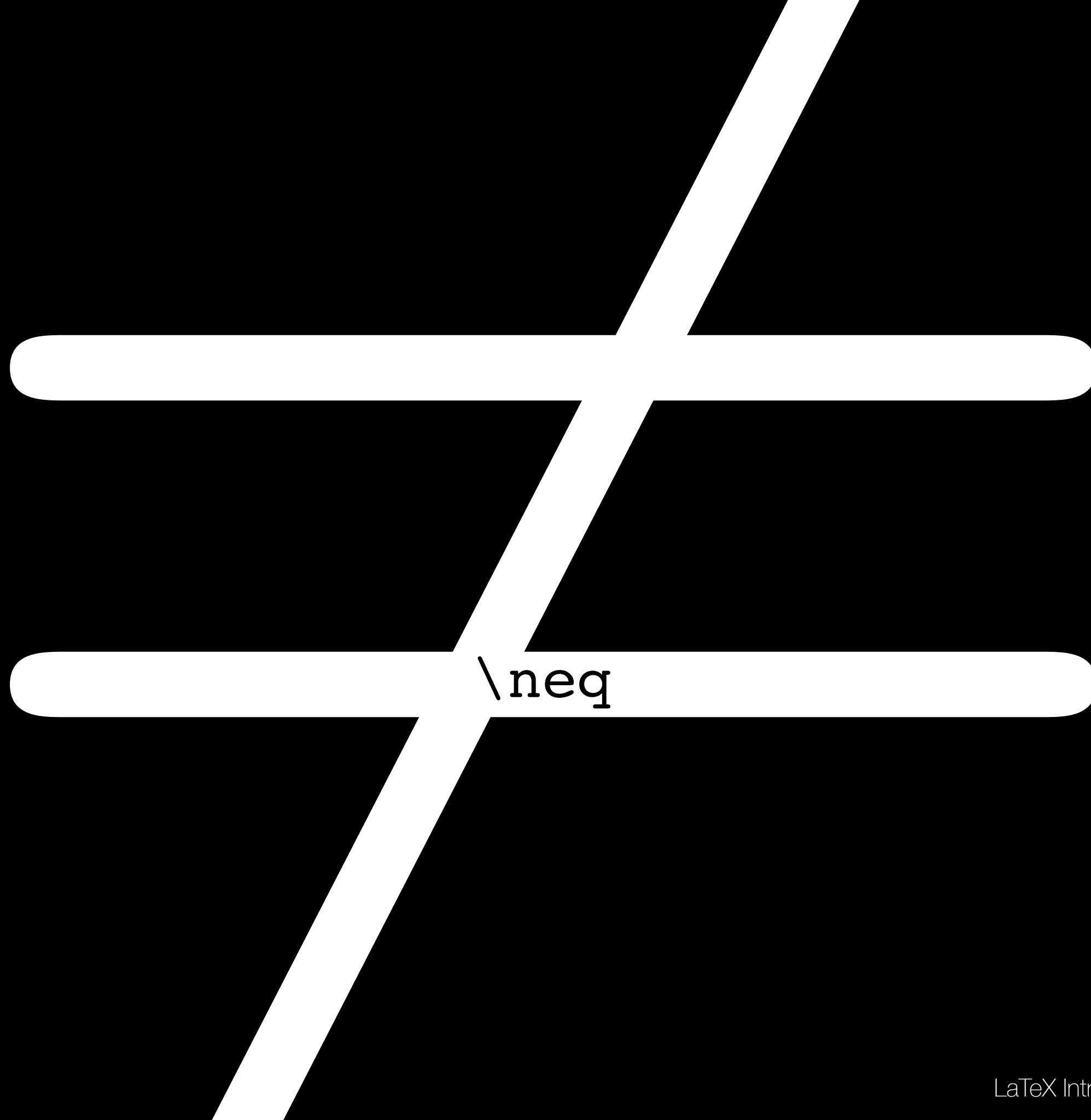
$\mathbb{Z} \in \mathbb{R}$

Bold Face and Double
Struck Fonts

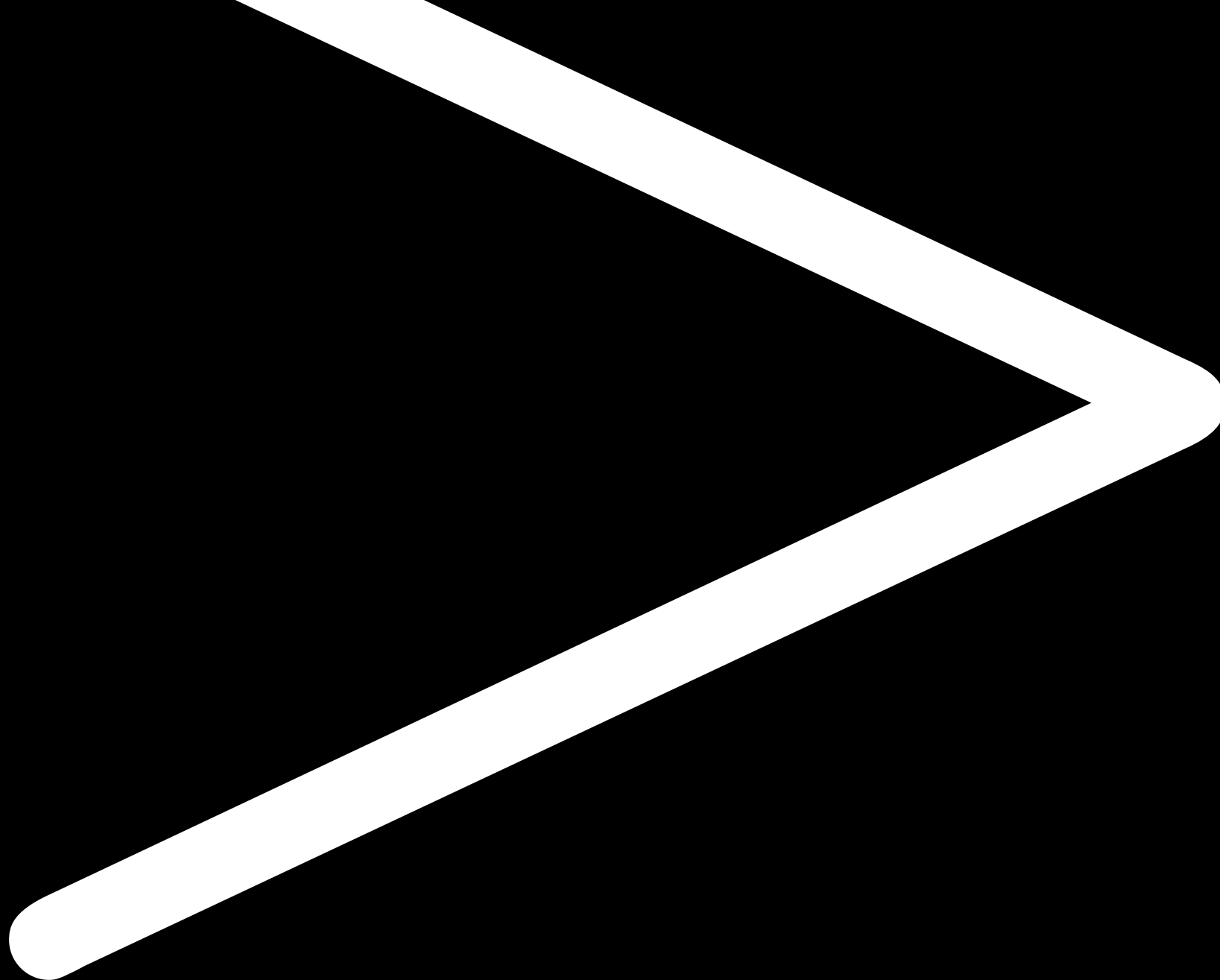
SYNOPSIS



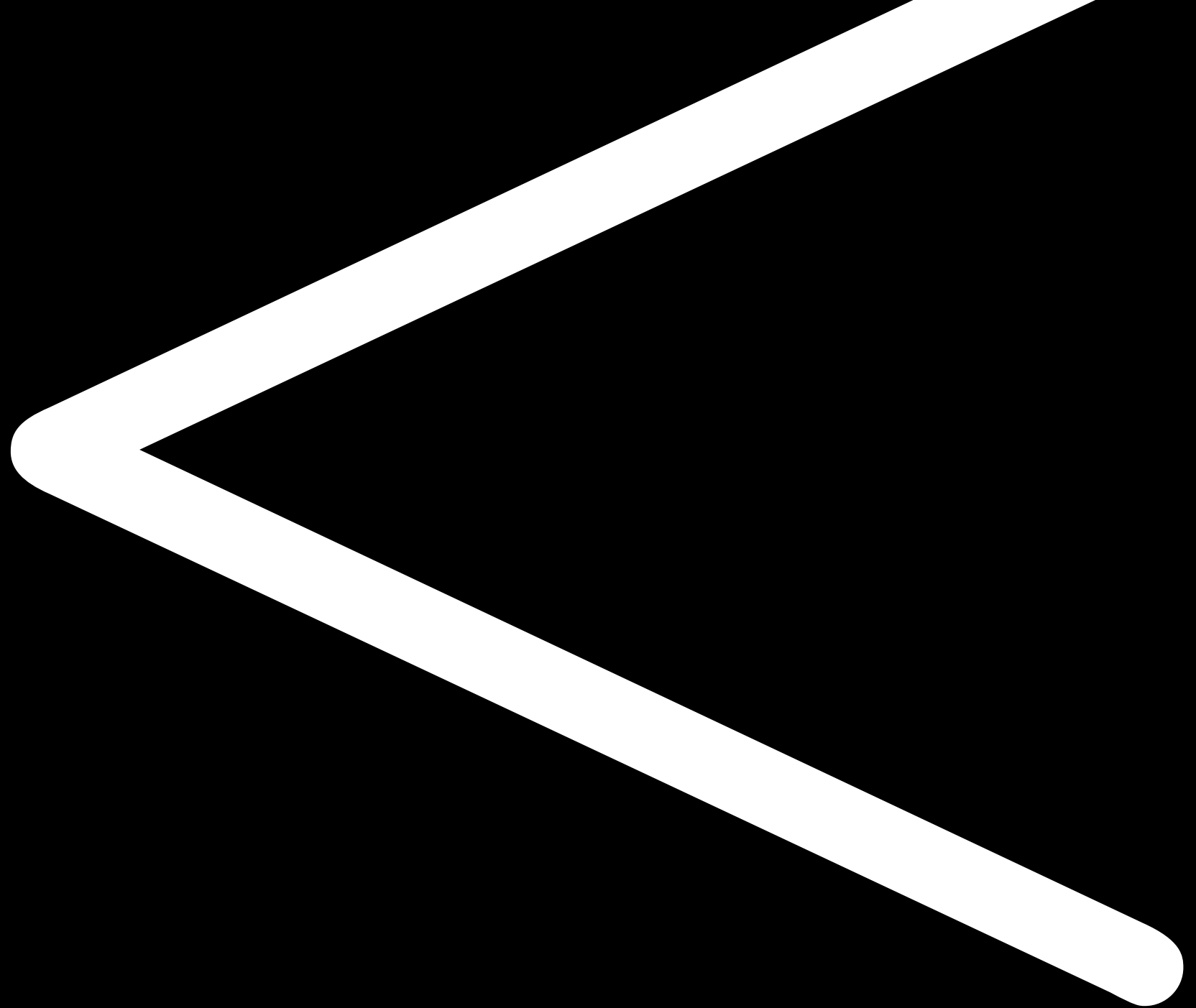
`\times`



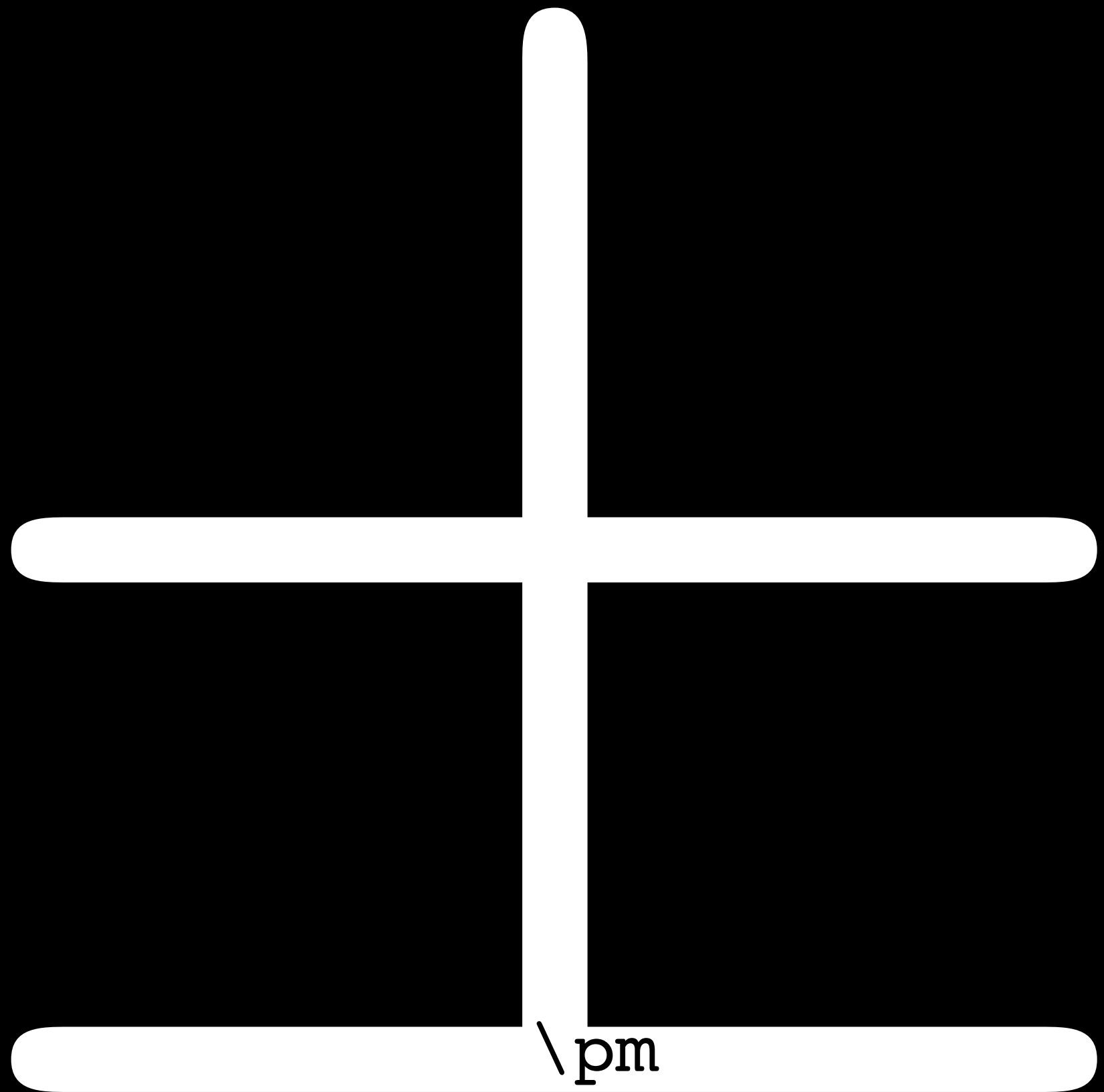
`\neq`

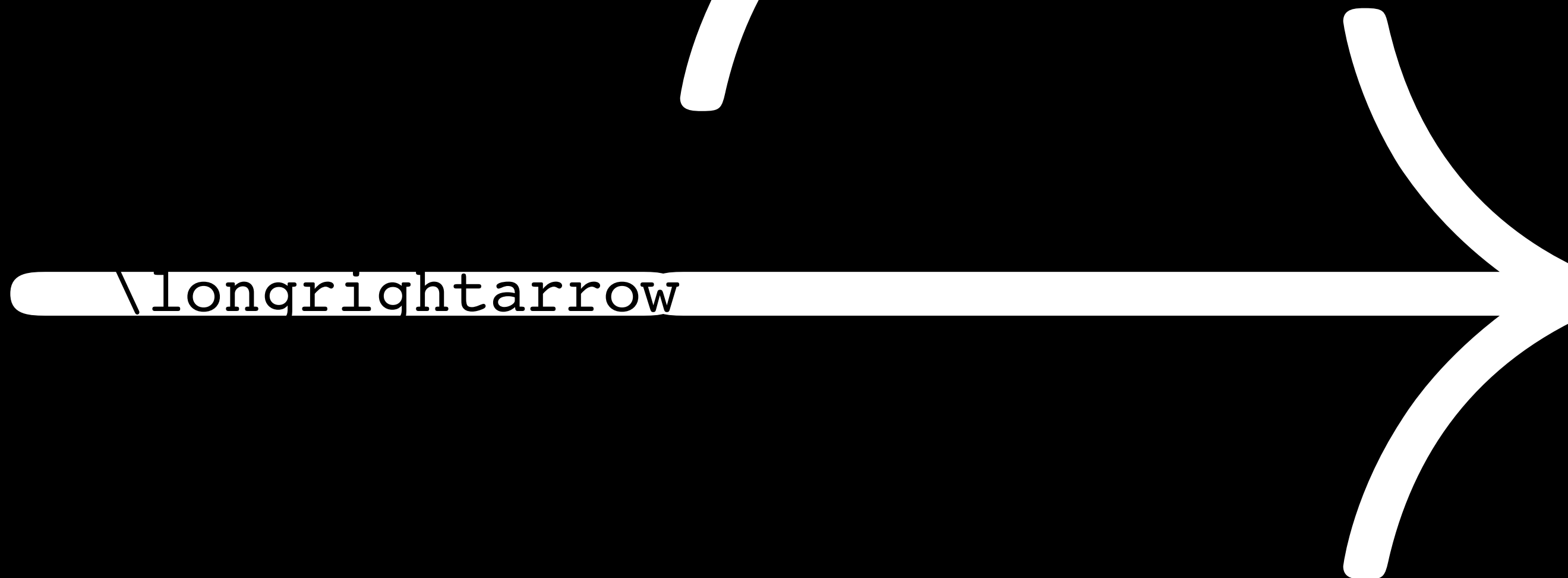
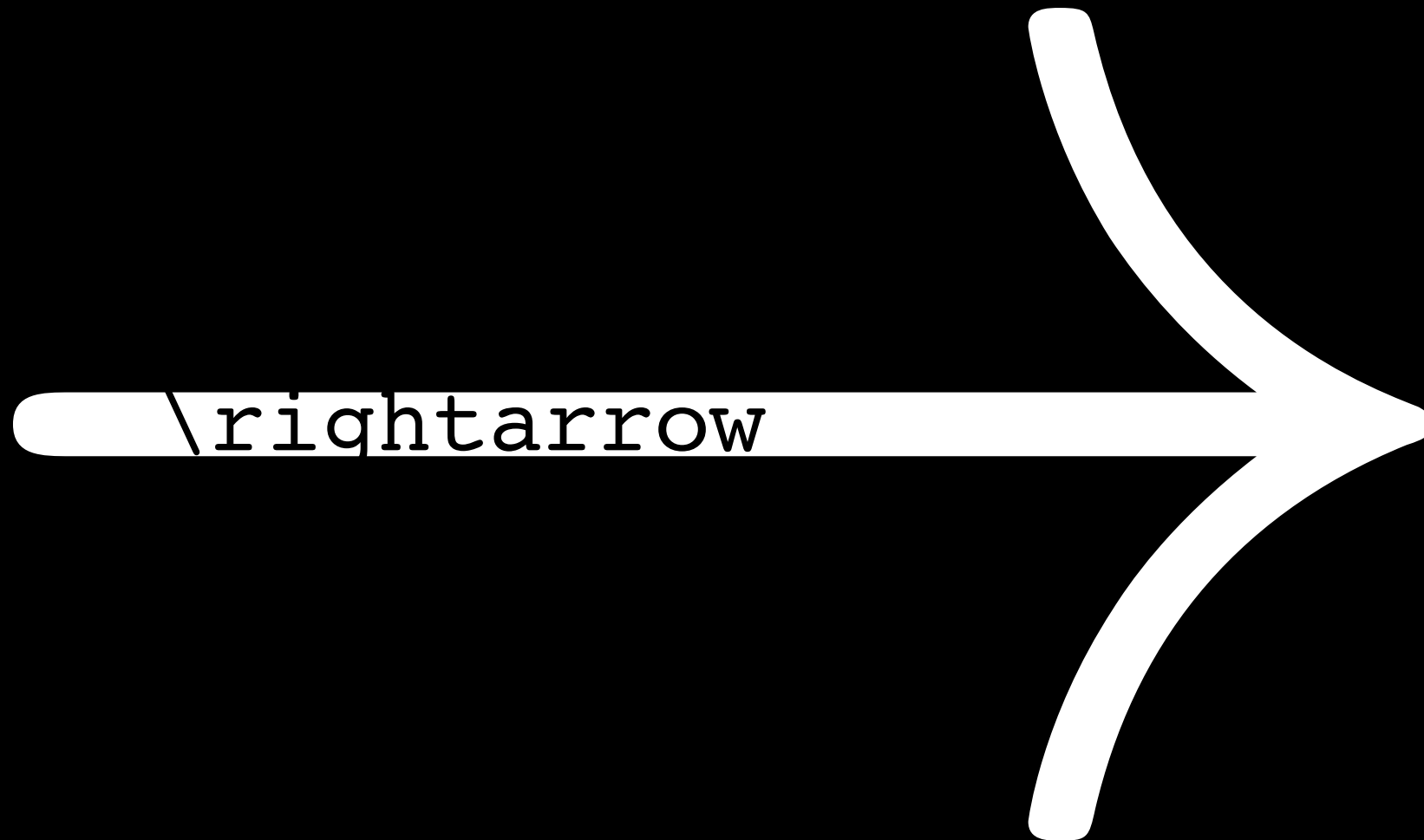


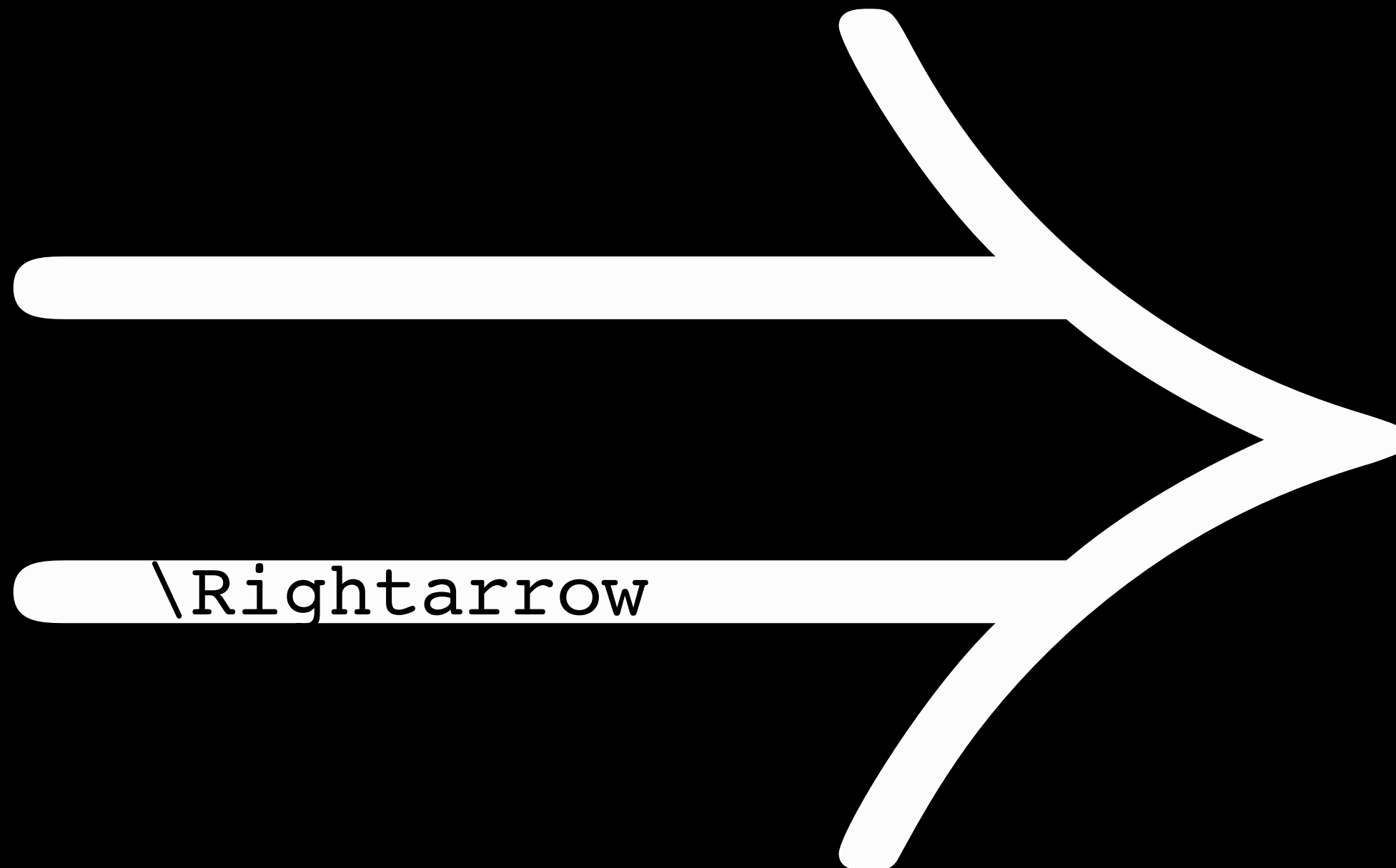
`\geq`

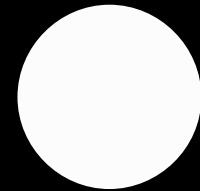


`\leq`

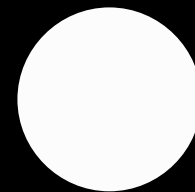
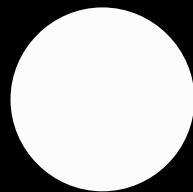




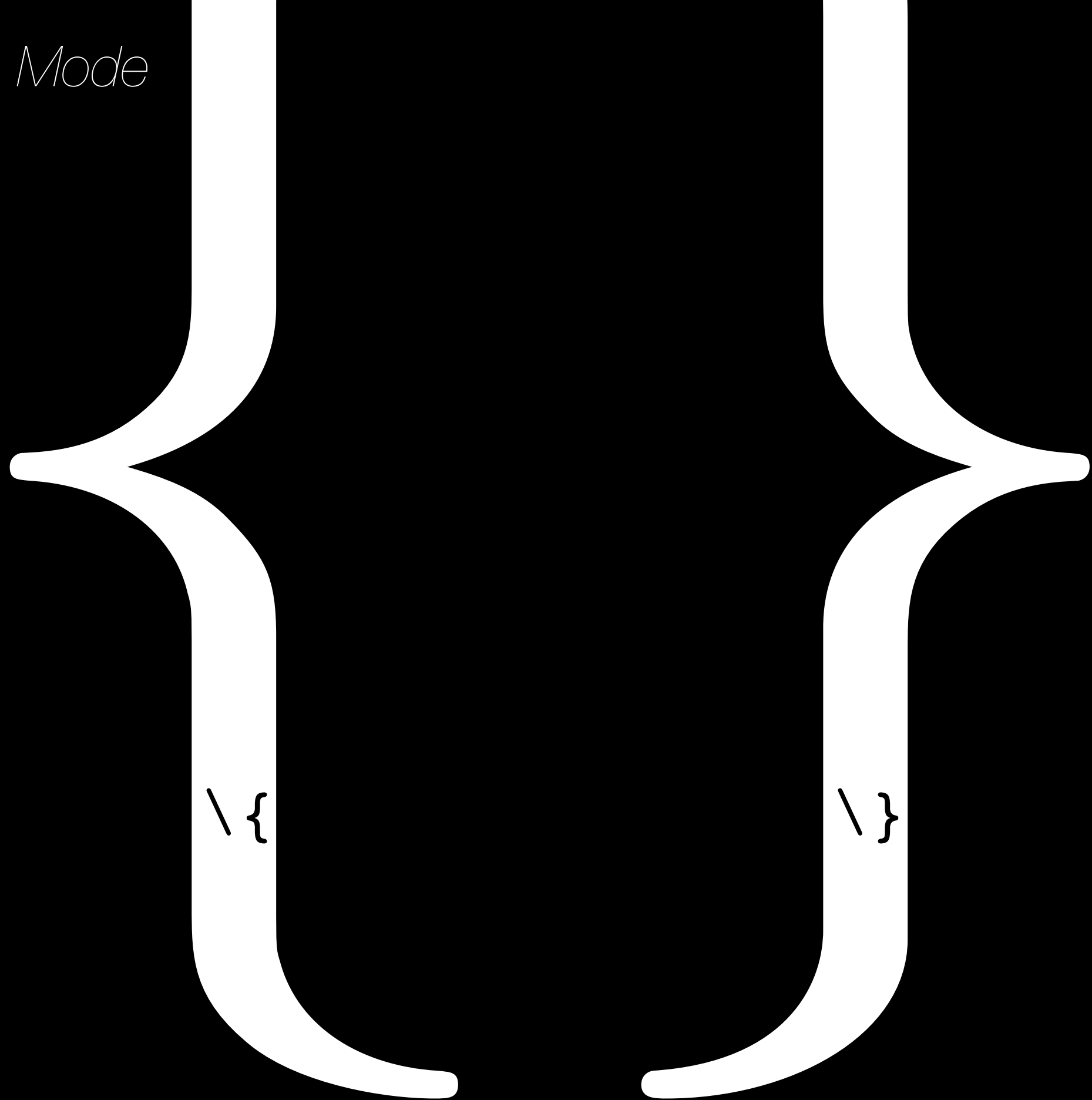




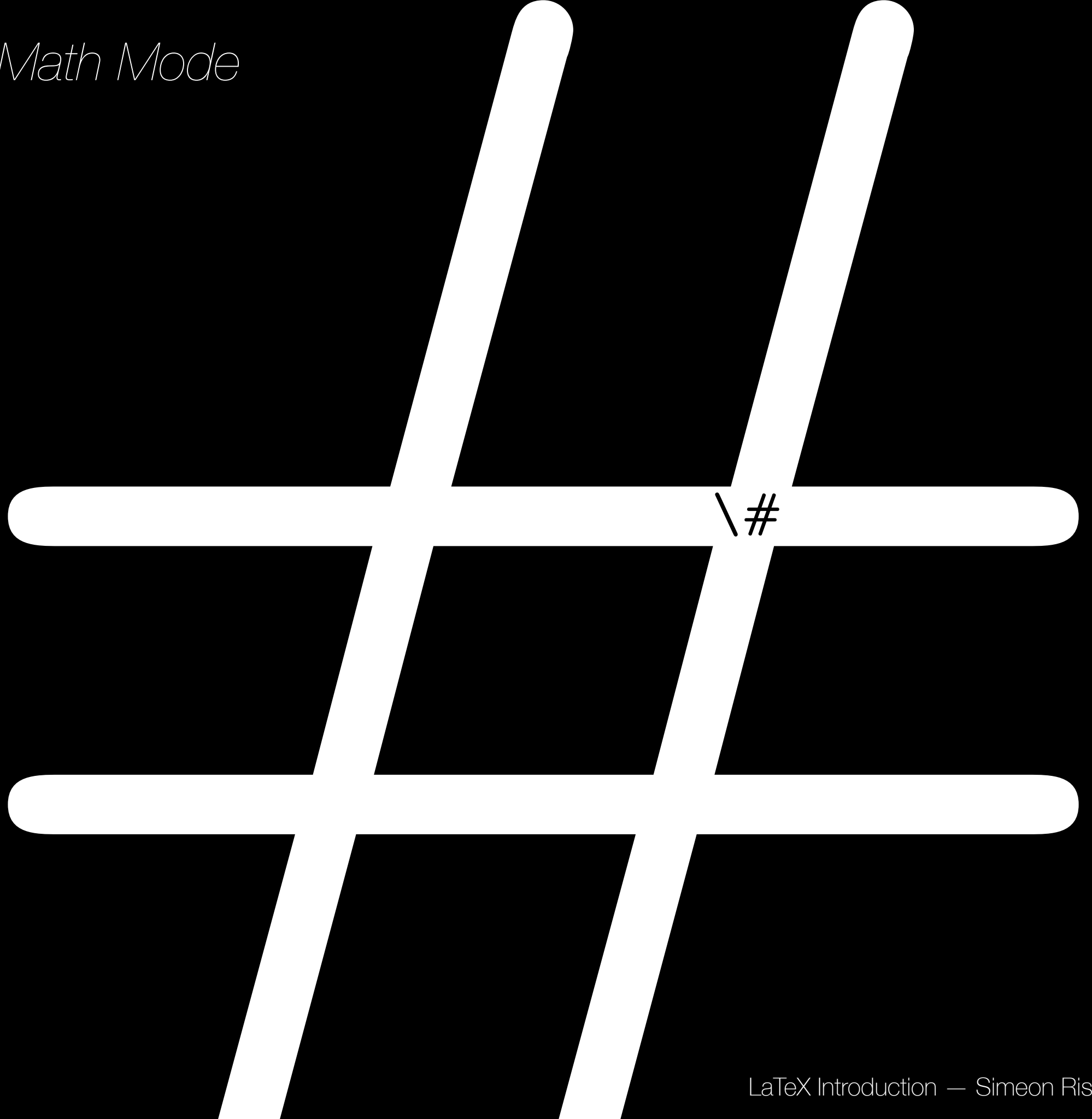
`\therefore`

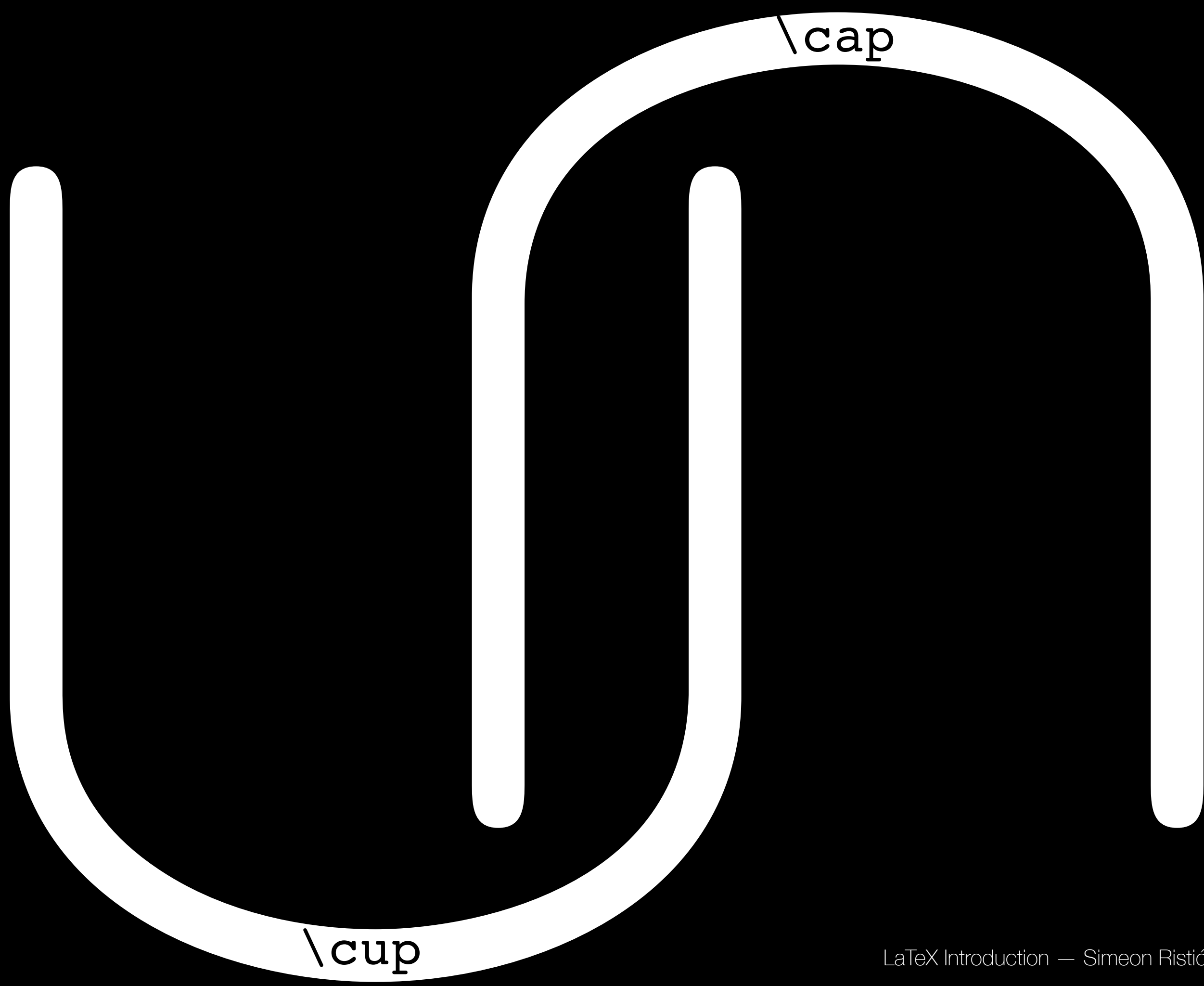


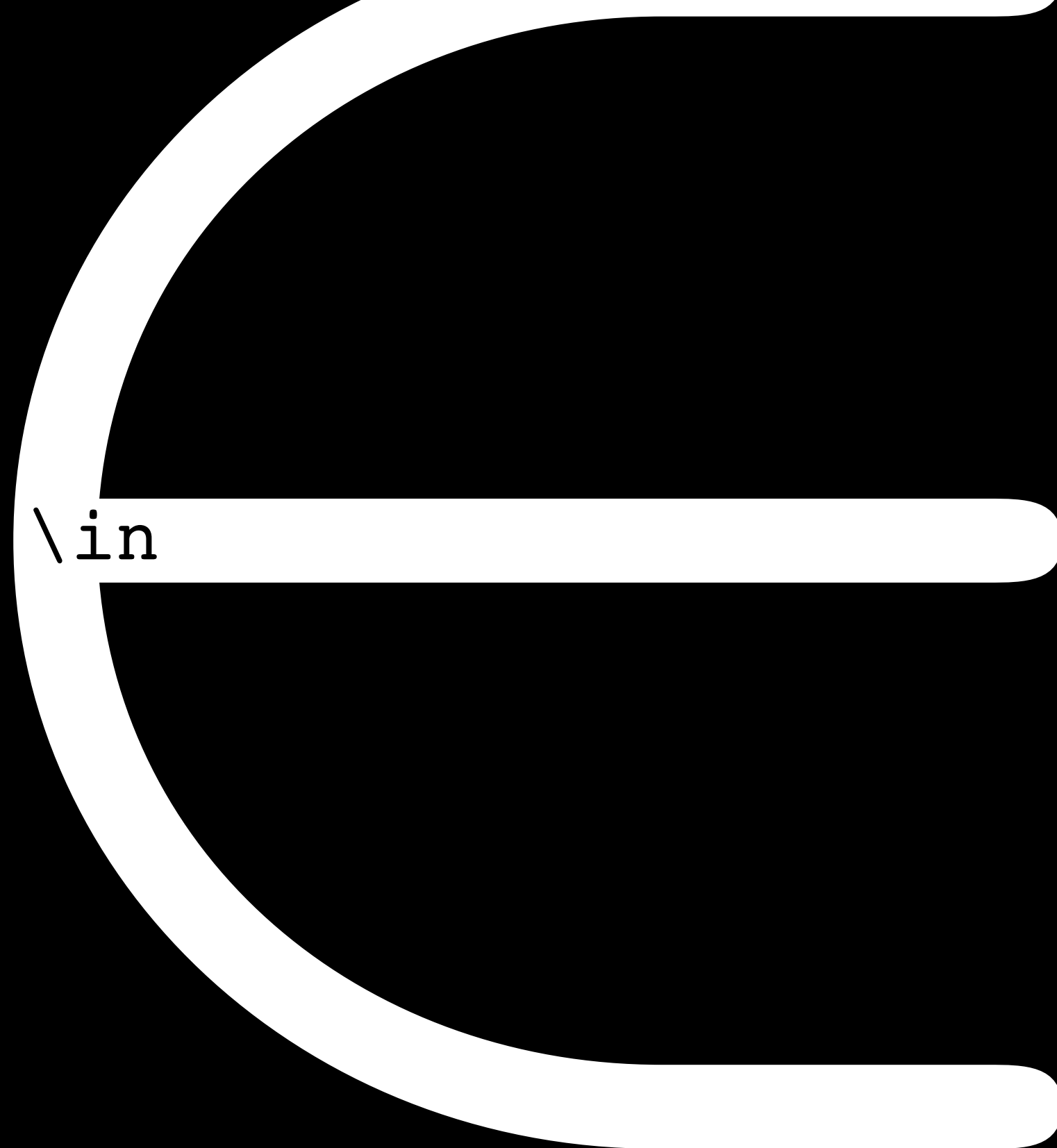
Works Outside Math Mode

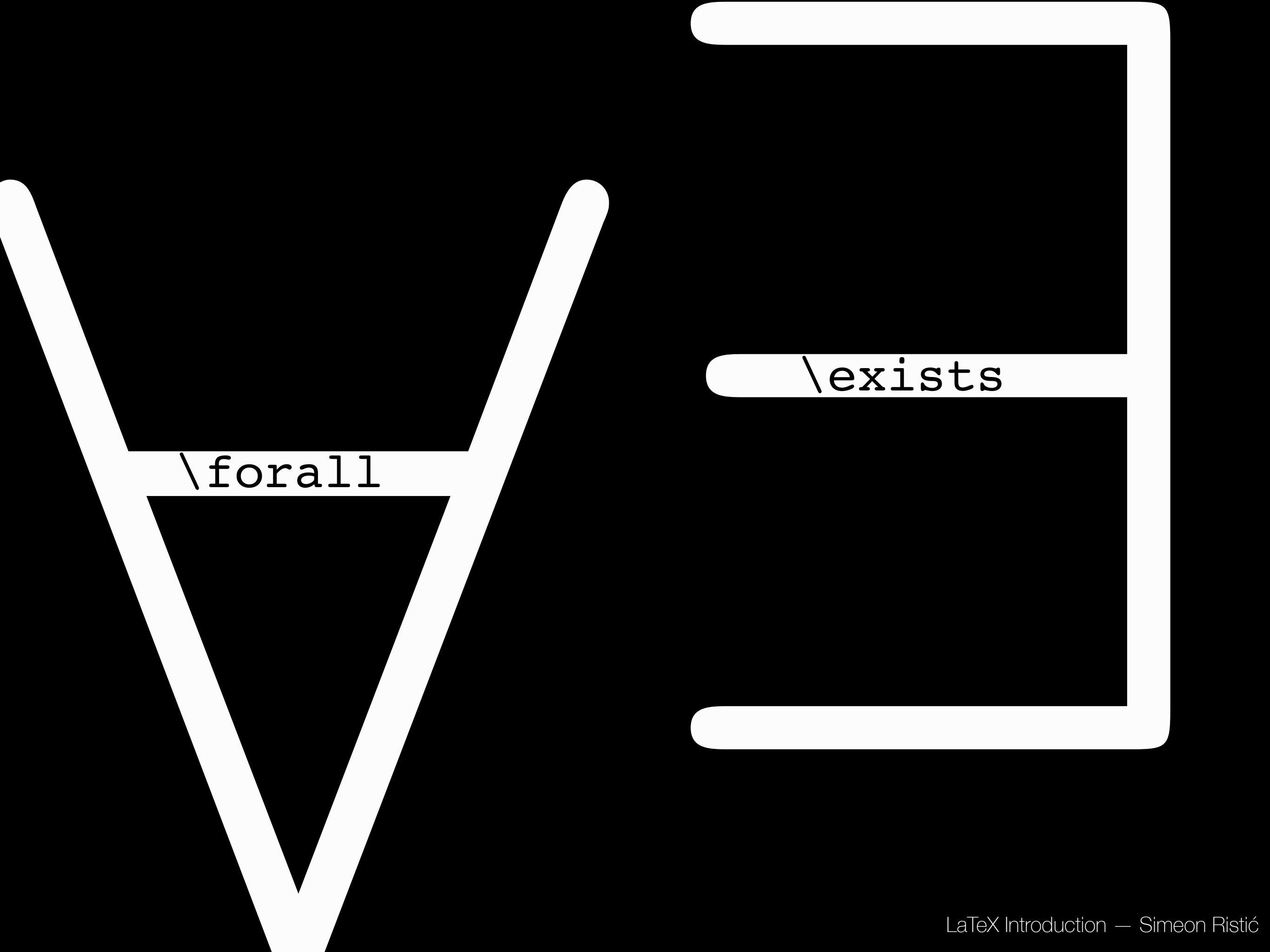


Works Outside Math Mode



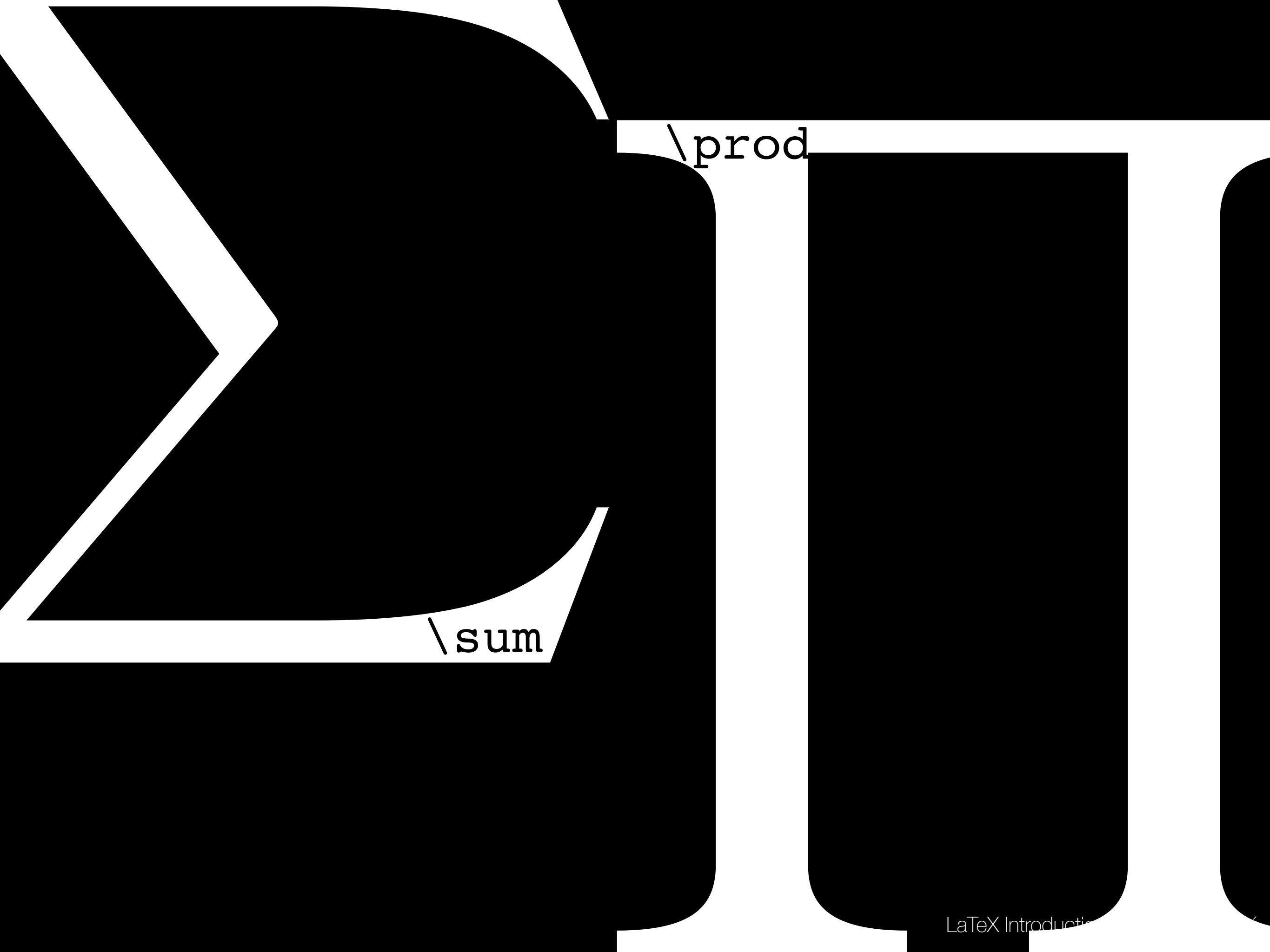






`\forall`

`\exists`



\backslash prod

\backslash sum

int
diff

lin



`\lim`

`\ln`

`^\circ`

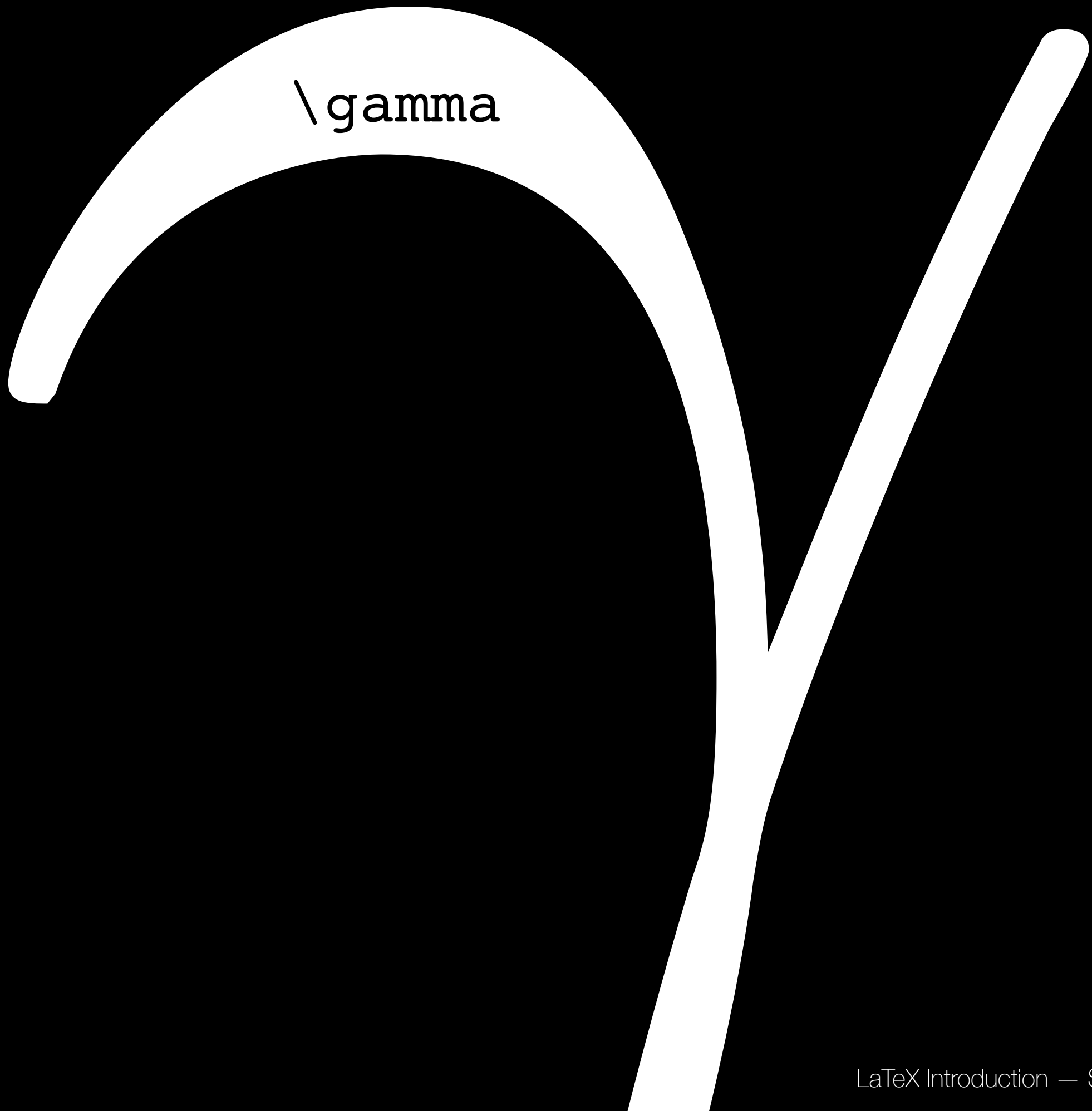
`\infty`



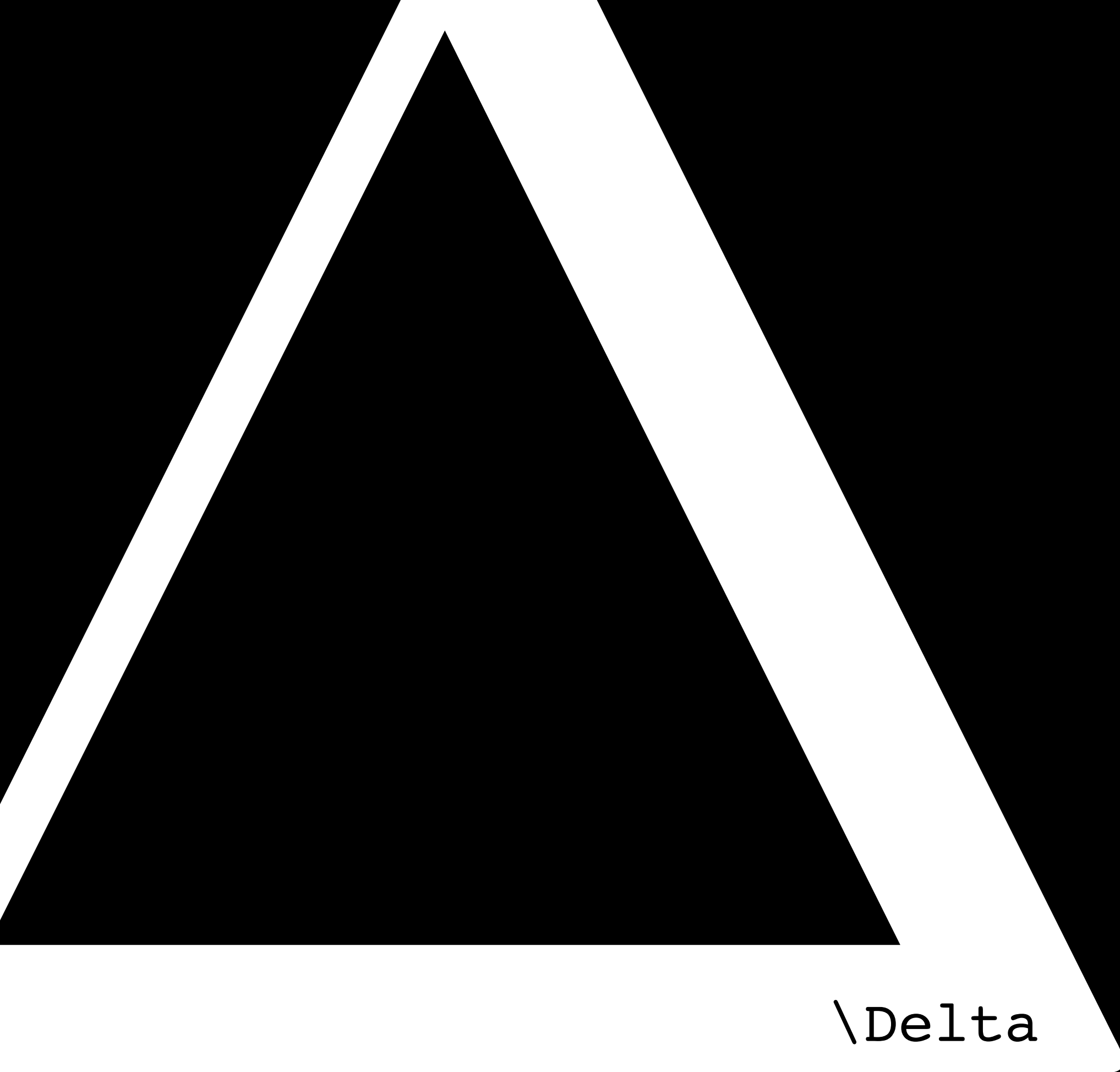
`\alpha`

A large, stylized white letter 'B' is centered on a black background. The letter is composed of thick, smooth curves. The text '\beta' is positioned to the right of the letter's middle section.

`\beta`



`\gamma`





`\Delta`

In Text Math

```
$ \frac{12 + 144 + 20 + 3 \sqrt{4}}{7} + 5  
  \times 11 = 9^2 + 0 $
```



$$\frac{12 + 144 + 20 + 3\sqrt{4}}{7} + 5 \times 11 = 9^2 + 0$$

(Numbered) Equations

```
\begin{equation}
```

```
\frac{12 + 144 + 20 + 3 \sqrt{4}}{7} + 5 \times
```

$$11 = 9^2 + 0$$

```
\end{equation}
```



Equations

```
\begin{equation}
\frac{12 + 144 + 20 + 3 \sqrt{4}}{7} + 5 \times
11 = 9^2 + 0
\end{equation}
```

No Empty Lines!



$$\frac{12 + 144 + 20 + 3\sqrt{4}}{7} + 5 \times 11 = 9^2 + 0 \quad (1)$$

Equations

```
\begin{align}
&\frac{12 + 144 + 20 + 3 \sqrt{4}}{7} + 5 \times \\
11 &= 9^2 + 0
\end{align}
```

Use Align!!!



$$\frac{12 + 144 + 20 + 3\sqrt{4}}{7} + 5 \times 11 = 9^2 + 0 \quad (1)$$

Equations

```
\begin{align*}
\frac{12 + 144 + 20 + 3 \sqrt{4}}{7} + 5 \times
11 = 9^2 + 0
\end{align*}
```

Use Align!!!

* = no numbers



$$\frac{12 + 144 + 20 + 3\sqrt{4}}{7} + 5 \times 11 = 9^2 + 0$$

Equations

```
\begin{align}  
E = m c^2 \\  
E^2 = m^2 c^4 + p^2 c^2  
\end{align}
```



$$E = mc^2 \tag{1}$$

$$E^2 = m^2c^4 + p^2c^2 \tag{2}$$

Equations

```
\begin{align}  
E = m c^2 \\  
E^2 = m^2 c^4 + p^2 c^2  
\end{align}
```



$$E = mc^2 \tag{1}$$

$$E^2 = m^2c^4 + p^2c^2 \tag{2}$$

Equations

```
\begin{align}  
E &= m c^2 \\\br/>E^2 &= m^2 c^4 + p^2 c^2  
\end{align}
```



$$E = mc^2 \tag{1}$$

$$E^2 = m^2 c^4 + p^2 c^2 \tag{2}$$

Equations

```
\begin{align}  
E &= m c^2 \\\br/>E^2 &= m^2 c^4 + p^2 c^2  
\end{align}
```



$$E = mc^2 \tag{1}$$

$$E^2 = m^2 c^4 + p^2 c^2 \tag{2}$$

& is alignment point

Equations

```
\begin{align}  
E &= m c^2 &  
E^2 &= m^2 c^4 + p^2 c^2  
\end{align}
```



$$E = mc^2$$

$$E^2 = m^2 c^4 + p^2 c^2 \quad (1)$$

```
\begin{Float}
```

Floats

```
\end{Float}
```

Figure

```
\begin{Figure}[h]
```

```
\centering
```

```
<stuff>
```

```
\caption{Lorem Ipsum}
```

```
\end{Figure}
```

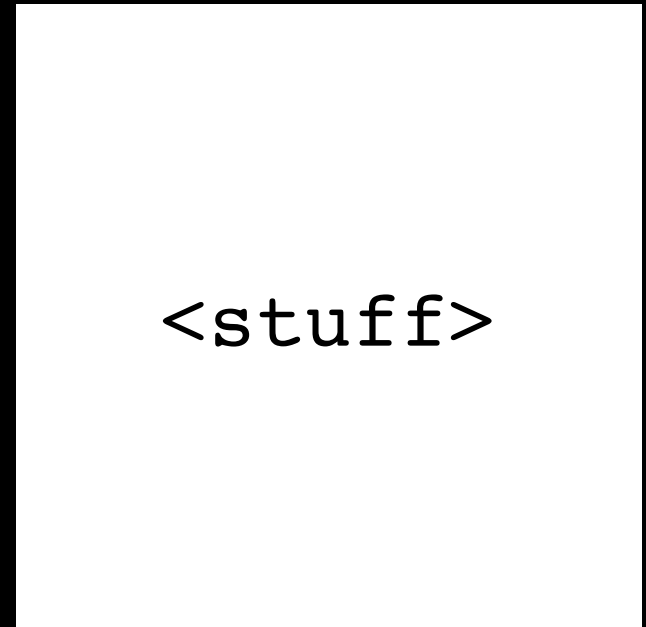


Figure 1: Lorem Ipsum

Table

```
\begin{Table}[h]  
  
\centering  
  
\caption{Lorem Ipsum}  
  
<stuff>  
  
\end{Table}
```



Table 1: Lorem Ipsum

<stuff>

includegraphics

```
\includegraphics[width=<width>]{<filename>}
```



Covers 60% of the width of
the page

Make the Filename Relevant

```
width=0.6\textwidth
```

Tabular

```
\begin{tabular}{c|rl}  
\hline  
    &      A      &      B      & \\ \hline  
C & $ \alpha $ & $ y^x $ & \\  
D & $ \beta x $ & $ xyz $ & \\ \hline  
\end{tabular}
```



	A	B
C	α	y^x
D	βx	xyz

Tabular

```
\begin{tabular}{c|rl}  
\hline  
    &      A      &      B      & \\\ \cline{2-3}  
C & $ \alpha $ & $ y^x $ & \\\  
D & $ \beta x $ & $ xyz $ & \\\ \hline  
\end{tabular}
```



	A	B
C	α	y^x
D	βx	xyz

Tabular

```
\begin{tabular}{c|rl}  
\hline  
    &      A      &      B      & \\ \hline  
C & $ \alpha $ & $ y^x $ & \\  
D & $ \beta x $ & $ xyz $ & \\ \hline  
\end{tabular}
```



	A	B
C	α	y^x
D	βx	xyz

Tabular

```
\begin{tabular}{c|rl}  
\hline  
    & \multicolumn{2}{c}{A}    \\ \hline  
C & $ \alpha $ & $ y^x $ \\ \hline  
D & $ \beta x $ & $ xyz $ \\ \hline  
\end{tabular}
```



	A	
C	α	y^x
D	βx	xyz

Tabular

```
\begin{tabular}{crl}  
\hline  
& \multicolumn{2}{c}{A} \\ \hline  
C & \multicolumn{1}{|r|}{$\alpha$} & $y^x$ \\  
D & \multicolumn{1}{|r|}{$\beta x$} & $xyz$ \\  
\hline  
\end{tabular}
```



A		
C	α	y^x
D	βx	xyz

Tabular

```
\begin{tabular}{crl}  
 \hline  
    & \multicolumn{2}{c}{A} \\ \cline{2-3}  
C & \multicolumn{1}{|r}{ $\alpha$ } &  $y^x$  \\ D & \multicolumn{1}{|r}{ $\beta x$ } &  $xyz$  \\ \hline  
\end{tabular}
```



A		
C	α	y^x
D	βx	xyz

Tabular

```
\begin{tabular}{c|rl}  
\hline  
    &      A      &      B      & \\ \hline  
C & $ \alpha $ & $ y^x $ & \\  
D & $ \beta x $ & $ xyz $ & \\ \hline  
\end{tabular}
```



	A	B
C	α	y^x
D	βx	xyz

Tabular

```
\begin{tabular}{c|rl}  
\hline  
& \multicolumn{2}{|c}{A} \\ \hline  
\multirow{2}{*}{C} & $ \alpha $ & $ y^x $ \\ \hline  
& $ \beta x $ & $ xyz $ \\ \hline  
\end{tabular}
```



	A	
C	α	y^x
	βx	xyz

Cross-References

```
\label{}
```

```
\ref{}
```

```
\cite{}
```

Reference Equations

```
\begin{align} \label{eq:limerick}  
\frac{12 + 144 + 20 + 3 \sqrt{4}}{7} + 5 \times 11  
= 9^2 + 0  
\end{align}
```

A math limerick is shown in (`\ref{eq:limerick}`).



$$\frac{12 + 144 + 20 + 3\sqrt{4}}{7} + 5 \times 11 = 9^2 + 0 \quad (1)$$

A math limerick is shown in (1).

Reference Equations

```
\begin{align}
E &= m c^2 \quad \text{\label{eq:emc2}} \quad \\
E^2 &= m^2 c^4 + p^2 c^2 \quad \text{\label{eq:full_emc2}} \\
\end{align}
\ldots (\text{\ref{eq:limerick}}) \text{ and } (\text{\ref{eq:full_emc2}}).
```



$$E = mc^2 \tag{1}$$

$$E^2 = m^2 c^4 + p^2 c^2 \tag{2}$$

... (1) and (2).

Reference Floats

```
\begin{Figure}
```

```
\centering
```

```
<stuff>
```

```
\caption{Lorem Ipsum}
```

```
\label{fig:<label>}
```

```
\end{Figure}
```

```
\begin{Table}
```

```
\centering
```

```
\caption{Lorem Ipsum}
```

```
\label{tab:<label>}
```

```
<stuff>
```

```
\end{Table}
```

Reference Floats

```
\begin{Figure}
```

```
\centering
```

```
<stuff>
```

```
\caption{Lorem Ipsum}
```

```
\label{fig:<label>}
```

```
\end{Figure}
```

```
\begin{Table}
```

```
\centering
```

```
\caption{Lorem Ipsum}
```

```
\label{tab:<label>}
```

```
<stuff>
```

```
\end{Table}
```

Reference Floats

```
\begin{Figure}
```

```
\centering
```

```
<stuff>
```

```
\caption{Lorem Ipsum}
```

```
\label{fig:<label>}
```

```
\end{Figure}
```

```
\begin{Table}
```

```
\centering
```

```
\caption{Lorem Ipsum}
```

```
\label{tab:<label>}
```

```
<stuff>
```

```
\end{Table}
```

Label after Caption

Reference Floats

Figure `\ref{fig:<label>}` and table `\ref{tab:<label>}`
show `\ldots`



Figure 1 and table 1 show ...

Bibliography

```
\begin{thebibliography}{9}
```

```
\bibitem{<key1>}  
<citation1>
```

```
\bibitem{<key2>}  
<citation2>
```

```
\end{thebibliography}
```



References

[1] citation1

[2] citation2

Reference Bibliography

`\ldots \cite{<key1>} and \cite{<key2>}, or
\cite{<key1>, <key2>}.`



`\ldots [1] and [2], or [1,2].`

For everything else...

For everything else...

ask the 10^{100} — ol + le

AND/OR

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