USING LATEX FOR SCIENTIFIC WRITING

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Agenda

- What is LATEX?

- Why learn LATEX?

- Writing your first piece of latex using Overleaf

- The preamble of document

- Adding title, images, math

- Creating lists

- Adding table of contents

- Adding bibliography

What is LATEX?

- LATEX (pronounced *LAY-tek* or *LAH-tek*) is a tool used to create professional-looking documents

- It is based on the WYSIWYM (what you see is what you mean) idea, meaning you only have focus on the contents of your document and the computer will take care of the formatting (e.g., Microsoft Word or LibreOffice Writer)

Why Learn LATEX?

- LATEX is used all over the world for scientific documents, books, as well as many other forms of publishing

- Allows users to very quickly tackle the more complicated parts of typesetting, such as inputting mathematics, creating tables of contents, referencing and creating bibliographies, and having a consistent layout across all sections

- Separates the content of the document from the style. This means that once you have written the content of your document, we can change its appearance with ease.

- Allows scientific journals to create templates for submissions. These templates have a pre-made layout meaning that only the content needs to be added

Overleaf writeLATEX

Writing Your First Piece of LATEX

- The first step is to create a new LATEX project. You can do this on your own computer by creating a new **.tex** file, or else you can Overleaf

- Overleaf is a great on-line LaTeX editing tool that allows you to create LaTeX documents directly in your web browser

- Let's start with the simplest working example:

```
\documentclass{article}   1


\begin{document}   2
First document. This is a simple example, with no
extra parameters or packages included.
\end{document}   3
```

The Preamble of a Document

- Everything in .tex file *before* \begin{document} command is called the **preamble**

- In the preamble, you can define the type of document you are writing, the language you are writing in, the *packages* you would like to use (more on this later) and several other elements

- A normal document preamble would look like this:

```
\documentclass[12pt, letterpaper]{article}①
\usepackage[utf8]{inputenc}②
```

Adding a Title, Author and Date

- To add a title, author and date to our document, you must add three lines to the **preamble** (NOT the main body of the document). These lines are

  - *\title{First document}*

  - *\author{Hubert Farnsworth}*

    - an optional addition command:\thanks{funded by the Overleaf team}. This can be added after the name of the author, inside the braces of the **author** command

  - *\date{February 2014}*

    - Either enter the date manually or use the command **\today** so the date will be updated automatically at the compilation time

Adding a Title, Author and Date

- With adding the following lines, the preamble should look something like this

```
\documentclass[12pt, letterpaper, twoside]{article}
\usepackage[utf8]{inputenc}

\title{First document}     1
\author{Hubert Farnsworth \thanks{funded by the Overleaf team}}   2
\date{February 2017}   3
```

```
\begin{document}

\maketitle   4

We have now added a title, author and date to our first \LaTeX{} document!

\end{document}
```

Adding Comments

- To make a comment in LATEX, simply write a **%** symbol at the beginning of the line as shown below

- Multi-line (block) comments : \iffalse .....\fi

```
\begin{document}

\maketitle

We have now added a title, author and date to our first \LaTeX{} document!

% This line here is a comment. It will not be printed in the document.   ①

\end{document}
```

Bold, Italics and Underlining

■ **Bold:** Bold text in LaTeX is written with the **\textbf{...}** command.

■ *Italics*: Italicised text in LaTeX is written with the **\textit{...}** command.

■ <u>Underline</u>: Underlined text in LaTeX is written with the **\underline{...}** command.

```
Some of the \textbf{greatest}     ①
discoveries in \underline{science} ②
were made by \textbf{\textit{accident}} ③
```

■ \emph{...}

Bold, Italics and Underlining

■ \emph{...}

```
Some of the greatest \emph{discoveries}  ①
in science
were made by accident.

\textit{Some of the greatest \emph{discoveries}  ②
in science
were made by accident.}

\textbf{Some of the greatest \emph{discoveries}  ③
in science
were made by accident.}
```

Adding Images

■ On Overleaf, you will first have to upload the images

```
\documentclass{article}
\usepackage{graphicx}              1
\graphicspath{ {images/} }      2

\begin{document}
The universe is immense and it seems to be homogeneous,
in a large scale, everywhere we look at.

\includegraphics{universe}  3

There's a picture of a galaxy above
\end{document}
```

Overleaf writeLaTeX

Adding Images

- Captions, Labels and References
  - *\caption{a nice plot}*: this command sets the caption for the figure
  - *\label{fig:mesh1}*: the label will number the image, and combined with the next command will allow you to reference it.
  - *\ref{fig:mesh1}*: this code will be substituted by the number corresponding to the referenced figure.

```
\begin{figure}[h]   ①
    \centering
    \includegraphics[width=0.25\textwidth]{mesh}
    \caption{a nice plot}
    \label{fig:mesh1}   ②
\end{figure}

As you can see in the figure \ref{fig:mesh1},   ③  the
function grows near 0. Also, in the page \pageref{fig:mesh1}
is the same example.
```

Creating Lists in LATEX

■ Lists are created in different list *environments*

■ Lists start with a **\begin{...}** command and end with an **\end{...}** command

■ There are two main different types of lists, *ordered* lists and *unordered* lists. Each will use a different environment

■ **Unordered lists:** are produced by the **itemize** environment. Each entry must be preceded by the control sequence **\item** as shown below.

```
\begin{itemize}                                           ①
    \item The individual entries are indicated with a black dot, a so-called ②
bullet.
    \item The text in the entries may be of any length.
\end{itemize}                                             ③
```

• The individual entries are indicated with a black dot, a so-called bullet.
• The text in the entries may be of any length.

Creating Lists in LATEX

- **Ordered lists:** using the **enumerate** environment

```
\begin{enumerate}  ①
②  \item This is the first entry in our list
   \item The list numbers increase with each entry we add
\end{enumerate}  ③
```

1. This is the first entry in our list

2. The list numbers increase with each entry we add

Adding Math to LATEX

- One of the main advantages of LATEX is the ease at which mathematical expressions can be written

- LATEX allows two writing modes for mathematical expressions: the inline mode (formulas that are part of a text) and the display mode (write expressions that are not part of a text or paragraph)

- *Example (inline mode):* To put your equations in *inline* mode use one of these delimiters: \(... \), $ ... $ or \begin{math} ... \end{math}.
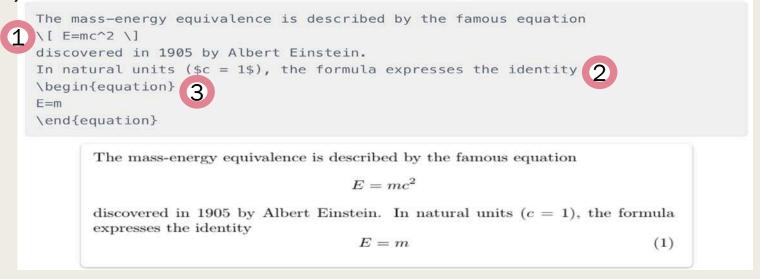
In physics, the mass-energy equivalence is stated
by the equation $E=mc^2$, discovered in 1905 by Albert Einstein.

In physics, the mass-energy equivalence is stated by the equation $E = mc^2$, discovered in 1905 by Albert Einstein.

Adding Math to LATEX

- *Example (Display mode):* use one of these delimiters: \[... \], \begin{displaymath} ... \end{displaymath} or \begin{equation} ... \end{equation}

- Important Note: *equation* environment is provided by an external package* (amsmath)

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Adding Math to LATEX

```
Subscripts in math mode are written as $a_b$ and superscripts are written as
$a^b$. These can be combined an nested to write expressions such as

\[ T^{i_1 i_2 \dots i_p}_{j_1 j_2 \dots j_q} =
T(x^{i_1},\dots,x^{i_p},e_{j_1},\dots,e_{j_q}) \]

We write integrals using $\int$ and fractions using $\frac{a}{b}$. Limits are
placed on integrals using superscripts and subscripts:

\[ \int_0^1 \frac{dx}{e^x} =  \frac{e-1}{e} \]

Lower case Greek letters are written as $\omega$ $\delta$ etc. while upper case
Greek letters are written as $\Omega$ $\Delta$.

Mathematical operators are prefixed with a backslash as $\sin(\beta)$,
$\cos(\alpha)$, $\log(x)$ etc.
```

Subscripts in math mode are written as a_b and superscripts are written as a^b. These can be combined an nested to write expressions such as

$$T_{j_1 j_2 \dots j_q}^{i_1 i_2 \dots i_p} = T(x^{i_1}, \dots, x^{i_p}, e_{j_1}, \dots, e_{j_q})$$
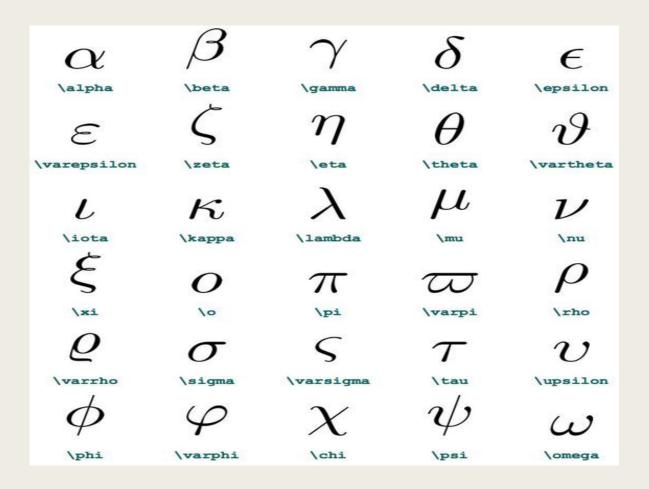
We write integrals using $\int$ and fractions using $\frac{a}{b}$. Limits are placed on integrals using superscripts and subscripts:

$$\int_0^1 \frac{dx}{e^x} = \frac{e-1}{e}$$

Lower case Greek letters are written as ω δ etc. while upper case Greek letters are written as Ω Δ.

Mathematical operators are prefixed with a backslash as $\sin(\beta)$, $\cos(\alpha)$, $\log(x)$ etc.

Adding Math to LATEX (Symbols)

Basic Formatting

■ We will now look at how to write abstracts, as well as how to format
a LATEX document into different chapters, sections and paragraphs

■ **ABSTRACTS**: The **abstract** environment will put the text in a special format at the
top of your document

```
\begin{document}

\begin{abstract}
This is a simple paragraph at the beginning of the
document. A brief introduction about the main subject.
\end{abstract}
\end{document}
```

Basic Formatting

- ■ **Paragraphs and newlines:**

```
\begin{document}

\begin{abstract}
This is a simple paragraph at the beginning of the
document. A brief introduction about the main subject.
\end{abstract}


Now that we have written our abstract, we can begin writing our first paragraph.


This line will start a second Paragraph.
\end{document}
```

New Line
New paragraph

Chapters and Sections

```
\chapter{First Chapter}

\section{Introduction}

This is the first section.

Lorem   ipsum  dolor  sit  amet,  consectetuer  adipiscing
elit.   Etiam  lobortisfacilisis sem.  Nullam nec mi et
neque pharetra sollicitudin.  Praesent imperdietmi nec ante.
Donec ullamcorper, felis non sodales...

\section{Second Section}

Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
Etiam lobortis facilisissem.  Nullam nec mi et neque pharetra
sollicitudin.  Praesent imperdiet mi necante...

\subsection{First Subsection}
Praesent imperdietmi nec ante. Donec ullamcorper, felis non sodales...

\section*{Unnumbered Section}
Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
Etiam lobortis facilisissem
```

Note that \part and **\chapter** are only available in *report* and *book* document classes.

Overleaf writeLATEX

Adding a Table of Contents

■ The command **\tableofcontents** does all the work for you:

```latex
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Sections and Chapters}
\author{Gubert Farnsworth}
\date{ }

\begin{document}

\maketitle

\tableofcontents

\section{Introduction}

This is the first section.

Lorem  ipsum  dolor  sit  amet,  consectetuer  adipiscing
elit.   Etiam   lobortisfacilisis sem.  Nullam nec mi et
neque pharetra sollicitudin.  Praesent imperdietmi nec ante.
Donec ullamcorper, felis non sodales...

\section*{Unnumbered Section}
\addcontentsline{toc}{section}{Unnumbered Section}

Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
Etiam lobortis facilisissem.  Nullam nec mi et neque pharetra
sollicitudin.  Praesent imperdiet mi necante...

\section{Second Section}

Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
Etiam lobortis facilisissem.  Nullam nec mi et neque pharetra
sollicitudin.  Praesent imperdiet mi necante...

\end{document}
```

Page Numbering

- Setting a numbering style is straightforward
  - *Add \pagenumbering{roman} in preamble*
- There are several numbering styles
  - *arabic: arabic numerals*
  - *roman: lowercase roman numerals*
  - *Roman: uppercase roman numerals*
  - *alph: lowercase letters*
  - *Alph: uppercase letters*

Page Numbering

```latex
\documentclass{article}
\usepackage[utf8]{inputenc}
\usepackage[english]{babel}

\pagenumbering{roman}

\begin{document}
\tableofcontents

\section{First section}
\setcounter{page}{3}

Some text here...

\section{Second section}
Some more text here..

\section{Heading on Level 1 (section)}
\pagenumbering{arabic}

More text here...
\end{document}
```

Bibliography management in LaTeX

■ To manage and format the bibliography in a LaTeX document, biblatex is a modern option for processing bibliography information, provides an easier and more flexible interface and a better language localization

■ There are four bibliography-related commands in this example:

– *\usepackage{biblatex}: Imports the package biblatex.*

– *\addbibresource{sample.bib}: Imports the bibliography data file sample.bib (this file contains information about each referenced book, article, etc.)*

– *\cite{einstein}: This command inserts a reference within the document, [1] in this case, that corresponds to an element in the bibliography, einstein is a keyword corresponding to an entry in sample.bib.*

– *\printbibliographyPrints the list of cited references, the default title is References for the article document class and "Bibliography" for books and reports.*

Bibliography

```latex
\documentclass[letterpaper,10pt]{article}
\usepackage{biblatex} %Imports biblatex package
\addbibresource{sample.bib} %Import the bibliography file

\begin{document}
Let's cite! Einstein's journal paper \cite{einstein} and Dirac's
book \cite{dirac} are physics-related items.


\printbibliography %Prints bibliography

\end{document}
```