Writing in Latex Using Overleaf

Killian Anderson

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1 Introduction

You will learn to write mathematical expressions inline and / or on its own display in LaTeX. You may register a free account on OverLeaf and use it as a free editor for LaTeX to compile any files that you write.

2 General Format

Any LaTeX file will have a basic code set block much like the following:

Document Template

```
\documentclass{article}
\usepackage{graphicx} % Required for inserting images
\usepackage{xcolor} % For color definitions
\usepackage{hyperref} % For hyperlinks
\usepackage{float} % For Pictures

% Set hyperlink colors
\hypersetup{
    colorlinks=true, % Enable colored links
    linkcolor=blue, % Color for internal links
    filecolor=blue, % Color for file links
    urlcolor=blue % Color for external links
}

\title{Sample Project}
\author{Killian Anderson}
\date{August 2025}

\begin{document}

\maketitle

\section{Introduction}

\subsection{Highlights} % Highlights

\end{document}
```

2.1 Important Packages

When you need something more specialized in LaTeX, you may generally include a package that has been pre-programmed before you compile or render your document.

- xcolor for coloring definitions.

- hyperref for hyperlinks.

- tcolorbox for graphical box.

- float for embedded pictures.

- enumitem for lists or bullet points.

- multirow for multiple rows in a table.

- longtable for breaking tables across pages.

- makecell for making table cells.

- amsmath for the American Mathematical Society math package.

- amsfont for the American Mathematical Society font package.

- amssymb for the American Mathematical Society math symbology package.

- pgfplots for plotting package.

The packages listed before would be added at the beginning of the written code base with `\usepackage{}` command for each respective package. Subsequently, we would add our personal touch by pressing our settings for each package.

3 Mathematical Expressions

There are a couple of different ways to write mathematical expressions in LaTex that include inline or by display. You may read more specifically about mathematical expressions here at Overleaf.

Inline: is for shorter expressions that are within the expressed line of text. Expressions are to be enclosed in dollar signs (\$) to be written. For example, `$a^2+b^2=c^2$` is shown as $a^2 + b^2 = c^2$ is the Pythagorean Theorem.

Display: is for longer expressions that are written within the document on their lines, respectively, and are typically centered. We often use it for formulas that may use double dollar signs (\$\$) or the `\[ \]` environment. For example,

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

is representative of the quadratic equation used to find roots of a second-degree polynomial.

Superscripts and Subscripts: will be presented by the carrot symbol (^) for exponents and by the underscore symbol (_) respectively in their likeness. If the exponent or subscript has more than one character, place it in curly brackets {}. For example, the expression `$x^2 + x_2$` gives you $x^2 + x_2$ or the expressions `$x_{j,k}^3$` give you $x_{j,k}^3$.

Fractions: may be created using the built-in command. `$\frac{numerator}{denominator}$`. For example, the fraction `$\frac{1}{2}$` will appear as $\frac{1}{2}$.

Roots: may be represented by a couple of different built-in commands. The square root command is `$\sqrt{expression}$` and the n-th root command is `$\sqrt[n]{expression}$`. For example, `$\sqrt{2}$` is $\sqrt{2}$ and `$\sqrt[3]{8}$` is $\sqrt[3]{8}$.

Greek Letters: are written with a backslash followed by the letter's alliteration. For example `$\alpha, \beta, \gamma, \delta$` will yield $\alpha, \beta, \gamma, \delta$

and if you want uppercase `$\Gamma, \Delta$` shows Γ, Δ. Note that some uppercase Greek letters are not supported and must be coded.

Sums: may be represented with the built-in `$\sum$` command. To add limits, use (`_`) for the lower limit and (`^`) for the upper limit. For example, the summation $\sum_{i=0}^{10} i^5$ is commanded by `$\sum_{i=0}^{10} i^5$`.
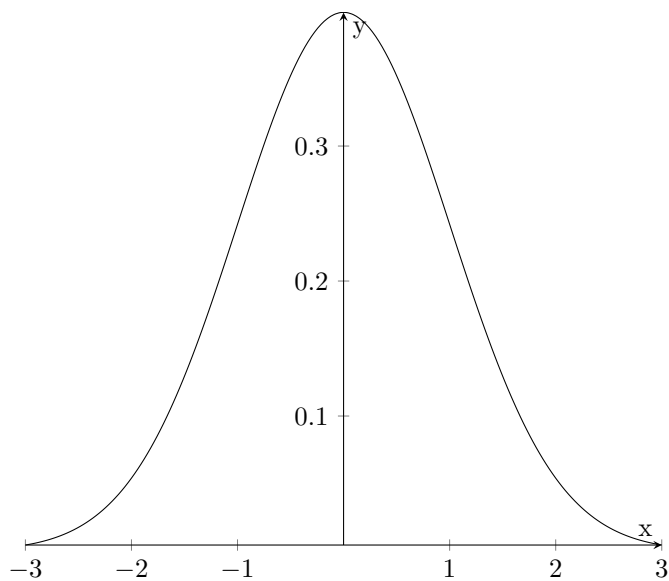
3.1 Graphing

Graphing is an important way to visualize data sets in mathematics or in any sort of material. An important concept in statistics is the standard normal distribution, i.e.

$$y = \frac{1}{\sqrt{2\pi}} e^{\frac{-x^2}{2}}$$

which has been plotted below.

Standard Normal Distribution

You may review the code block below for your own graphs throughout this course. Make sure to include `\usepackage{pgfplots}` and any other relevant packages at the beginning of your document, otherwise it will not be able to render.

Graphing Template

```
\begin{tikzpicture}
\begin{axis}[
    title={Standard Normal Distribution},
    xlabel={x},
    ylabel={y},
    axis lines=middle, % Axes in the middle of the plot
]
\addplot[
    domain=-3:3, % X-range for the plot
    samples=100, % Sample size
    mark=none,
    smooth,
    black,
] {1/(sqrt(2*pi)) * exp(-x^2/2)}; % Equation
\end{axis}
\end{tikzpicture}
```

3.2   Picture

Using the built-in plotting functions may be difficult at times. As a result, you can take a screenshot or download graphs you made through various resources such as what we see below.
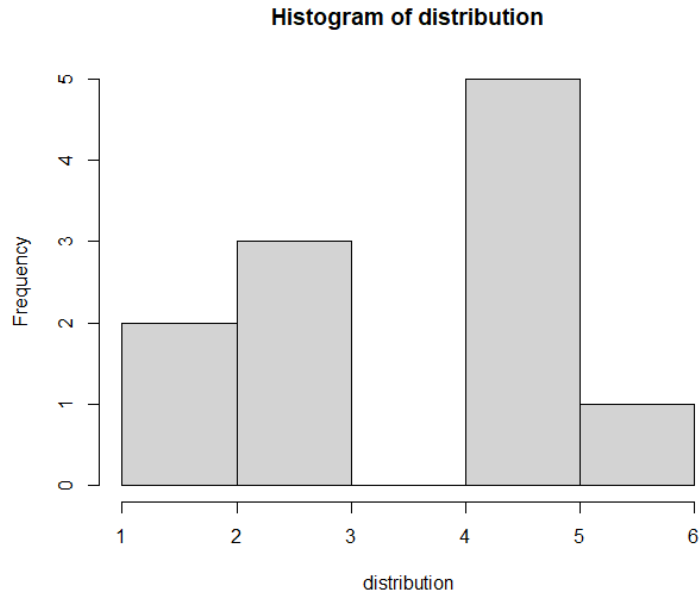
Histogram of distribution

Figure 1: Histogram of Random Sample

You may review the code block below for your own picture embeds throughout this course. Make sure to include `\usepackage{float}`, `\usepackage{graphicx}`, and any other relevant packages at the beginning of your document, otherwise it will not be able to render.

```
\begin{figure}[H]
   \centering
   \includegraphics[width=10cm]{Histogram.png}
   \caption{Histogram of Random Sample}
   \label{fig:example}
\end{figure}
```

4 Citations

References are important in any report or documentation. This ensures that proper credit has been given and shows where knowledge has been furthered in your studies.

We may cite your instructor using the `\cite{kandrsn}` command in much this way [1].

> **Citation Template**
>
> ```
> \begin{thebibliography}{99} % Number of references
>
> \bibitem{kandrsn}
> Anderson, K. (1995). \textit{LaTeX Basics}. South Louisiana
> Community College Publishing.
> \end{thebibliography}
> ```

References

[1] Anderson, K. (1995). *LaTeX Basics*. South Louisiana Community College Publishing.