
Practical Work 4: Document Structure and Formatting

Author: Your Name

Date: \today.

1. Introduction

This document demonstrates the structure and formatting capabilities of $\text{\LaTeX}$.

To add a table of contents, we write after `\begin{document}` and `\maketitle` the command `\tableofcontents`.

2. Text Formatting

Here are some examples of text formatting:

- **Bold text** using `\textbf`.
- *Italic text* using `\textit`.
- Underlined text using `\underline`.
- Monospaced text using `\texttt`.

3. Lists

$\text{\LaTeX}$ supports both ordered and unordered lists.

Unordered List

```
\begin{itemize}
\item First item
\item Second item
\end{itemize}
```

Ordered List

```
\begin{enumerate}
\item First item
\item Second item
\end{enumerate}
```

4. Table of Contents Example

The following example shows a document containing mathematical content and a table of contents.

4.1 Introduction

This document introduces some fundamental **mathematical concepts** and demonstrates how to typeset them using $\text{\LaTeX}$. We will cover basic *algebra*, *calculus*, and *geometry*, along with examples of how to format mathematical expressions.

4.2 Basic Algebra

Algebra is the branch of mathematics that deals with symbols and the rules for manipulating them.

4.2.1 Linear Equations

A linear equation in one variable is an equation of the form:

$$ax + b = 0 \quad (1)$$

where a and b are constants, and x is the variable. The solution is:

$$x = -\frac{b}{a} \quad (2)$$

4.2.2 Quadratic Equations

A **quadratic equation** is of the form:

$$ax^2 + bx + c = 0 \quad (3)$$

The solutions are given by the quadratic formula:

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

4.3 Calculus

Calculus is the study of change and motion. It has two main branches: differential calculus and integral calculus.

4.3.1 Derivatives

1. The derivative of a function $f(x)$ with respect to x is defined as:

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \quad (5)$$

2. For example, the derivative of $f(x) = x^2$ is:

$$f'(x) = 2x \quad (6)$$

4.3.2 Integrals

The integral of a function $f(x)$ represents the area under its curve.

- The definite integral from a to b is:

$$\int_a^b f(x)dx = F(b) - F(a). \quad (7)$$

- For example, the integral of $f(x) = x^2$ is:

$$\int x^2 dx = \frac{x^3}{3} + C \quad (8)$$

where C is the constant of integration.

4.4 Geometry

Geometry is the study of shapes, sizes, and properties of space.

4.4.1 Pythagorean Theorem

In a right-angled triangle, the square of the hypotenuse (c) is equal to the sum of the squares of the other two sides (a and b):

$$c^2 = a^2 + b^2 \quad (9)$$

4.4.2 Area of a Circle

The area A of a circle with radius r is:

$$A = \pi r^2. \quad (10)$$

5. Displaying L^AT_EX Code

Here is the L^AT_EX code used in this document.

```
\documentclass[a4paper,11pt]{article}

\usepackage[utf8]{inputenc}
\usepackage{amsmath, amssymb}
\usepackage{geometry}
\geometry{a4paper, top=2cm, bottom=2cm, left=3cm, right=3cm}

\title{Document Structure and Formatting}
\author{Your Name}
\date{\today}

\begin{document}
```

```

\maketitle
\tableofcontents % Add a table of contents

\section{Introduction}
This document introduces some fundamental \textbf{mathematical concepts}
and demonstrates how to typeset them using \LaTeX. We will cover basic
\textit{algebra}, \textit{calculus}, and \textit{geometry}, along with
examples of how to format mathematical expressions.

\section{Basic Algebra}
Algebra is the branch of mathematics that deals with symbols and the rules
for manipulating them.

\subsection{Linear Equations}
A linear equation in one variable is an equation of the form:
\begin{equation}
ax + b = 0
\end{equation}
where $ a $ and $ b $ are constants, and $ x $ is the variable. The solution is:
\begin{equation}
x = -\frac{b}{a}
\end{equation}

\subsection{Quadratic Equations}
A \textbf{quadratic equation} is of the form:
\begin{equation}
ax^2 + bx + c = 0
\end{equation}
The solutions are given by the quadratic formula:
\begin{equation}
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\end{equation}

\section{Calculus}
\textit{Calculus} is the study of change and motion. It has two main branches:
\textit{differential calculus} and \textit{integral calculus}.

\subsection{Derivatives}
\begin{enumerate}
\item The derivative of a function $ f(x) $ with respect to $ x $ is defined as:
\begin{equation}

```

```

    f'(x) = \lim_{h \to 0} \frac{f(x + h) - f(x)}{h}
\end{equation}
\item For example, the derivative of $ f(x) = x^2 $ is:
\begin{equation}
    f'(x) = 2x
\end{equation}
\end{enumerate}

\subsection{Integrals}
The integral of a function $ f(x) $ represents the area under its curve.
\begin{itemize}
\item The definite integral from $ a $ to $ b $ is:
\begin{equation}
    \int_a^b f(x) \, dx = F(b) - F(a),
\end{equation}
\item For example, the integral of $ f(x) = x^2 $ is:
\begin{equation}
    \int x^2 \, dx = \frac{x^3}{3} + C
\end{equation}
where $ C $ is the constant of integration.
\end{itemize}

\section{Geometry}
Geometry is the study of shapes, sizes, and properties of space.

\subsection{Pythagorean Theorem}
In a right-angled triangle, the square of the hypotenuse ($ c $) is equal to the sum of the squares of the other two sides ($ a $ and $ b $):
\begin{equation}
    c^2 = a^2 + b^2
\end{equation}

\subsection{Area of a Circle}
The area $ A $ of a circle with radius $ r $ is:
\begin{equation}
    A = \pi r^2.
\end{equation}

\end{document}

```