

LABORATORY03: Report and Presentation of work on Mathematical Mode

PELE TETE

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1 MathMode.tex - Basic Math Mode Introduction

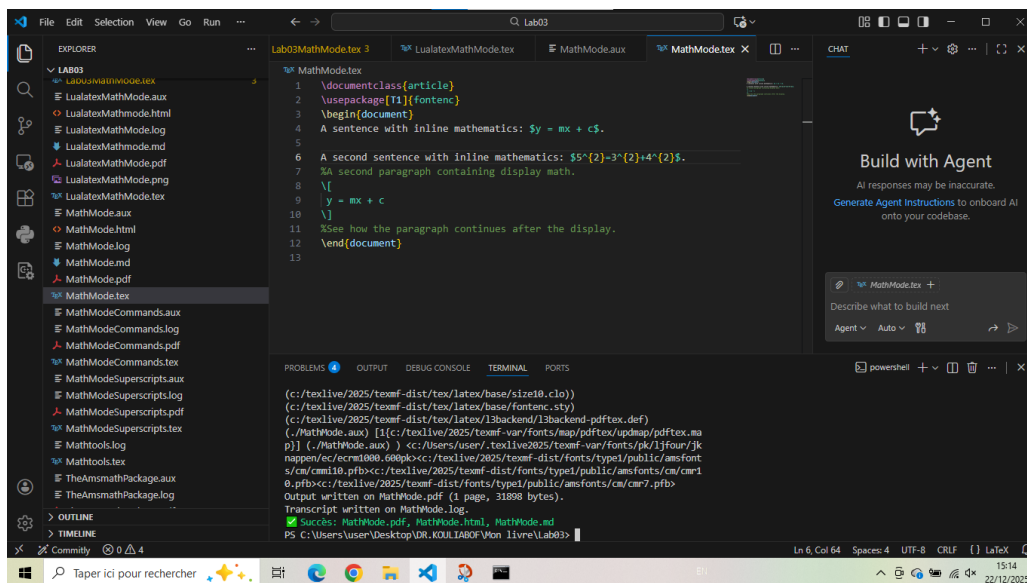
```
\documentclass{article}
\usepackage[T1]{fontenc}
\begin{document}
A sentence with inline mathematics:  $y = mx + c$ .

A second sentence with inline mathematics:  $5^2=3^2+4^2$ .
%A second paragraph containing display math.
\[
y = mx + c
\]
%See how the paragraph continues after the display.
\end{document}
```

Generated figure

Basic inline and display math mode examples.

Screenshot



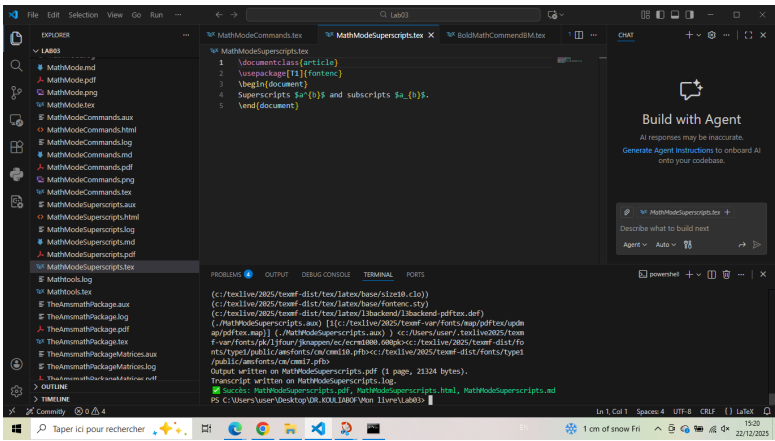
2 MathModeSuperscripts.tex - Superscripts and Subscripts

```
\documentclass{article}
\usepackage[T1]{fontenc}
\begin{document}
Superscripts  $a^b$  and subscripts  $a_b$ .
\end{document}
```

Generated figure

Demonstration of superscript and subscript notation.

Screenshot



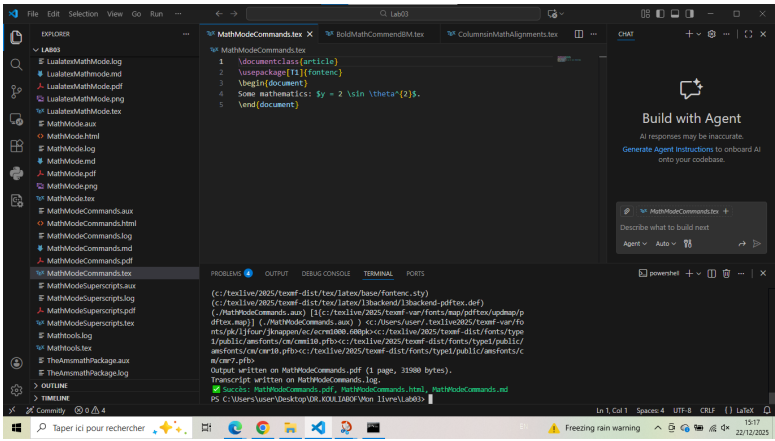
3 MathModeCommands.tex - Math Commands

```
\documentclass{article}
\usepackage[T1]{fontenc}
\begin{document}
Some mathematics:  $y = 2 \sin \theta^2$ .
\end{document}
```

Generated figure

Using mathematical functions like `\sin` and Greek letters.

Screenshot



4 DisplayMathematics.tex - Display Mathematics

```
\documentclass{article}
```

```

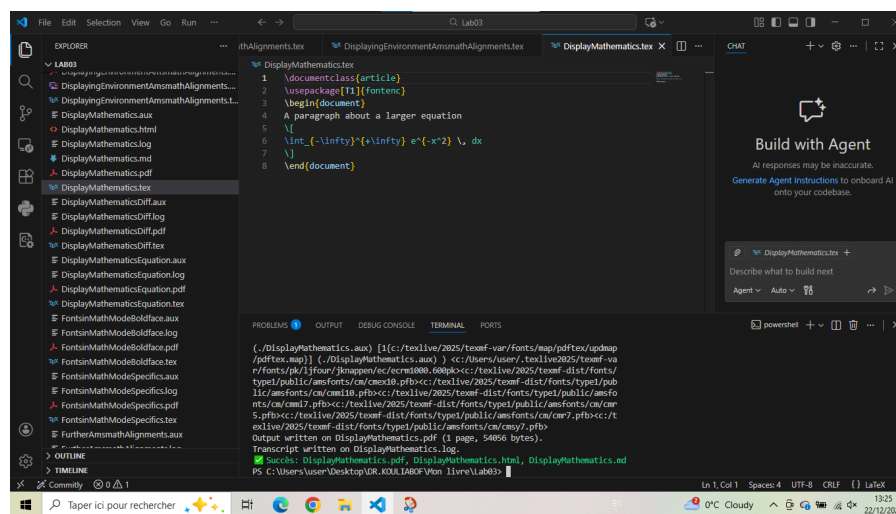
\usepackage[T1]{fontenc}
\begin{document}
A paragraph about a larger equation
\[
\int_{-\infty}^{+\infty} e^{-x^2} \, dx
\]
\end{document}

```

Generated figure

Display math with integral and Gaussian function.

Screenshot



5 DisplayMathematicsEquation.tex - Numbered Equations

```

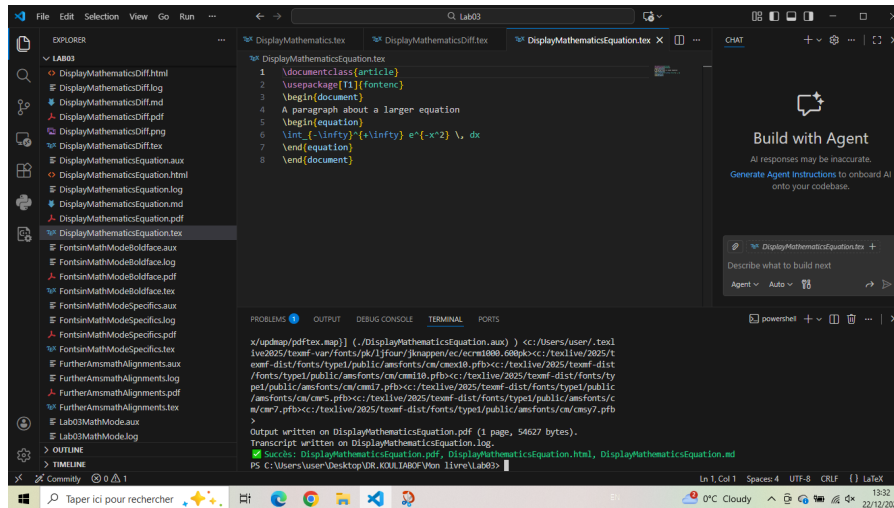
\documentclass{article}
\usepackage[T1]{fontenc}
\begin{document}
A paragraph about a larger equation
\begin{equation}
\int_{-\infty}^{+\infty} e^{-x^2} \, dx
\end{equation}
\end{document}

```

Generated figure

Numbered equation using equation environment.

Screenshot



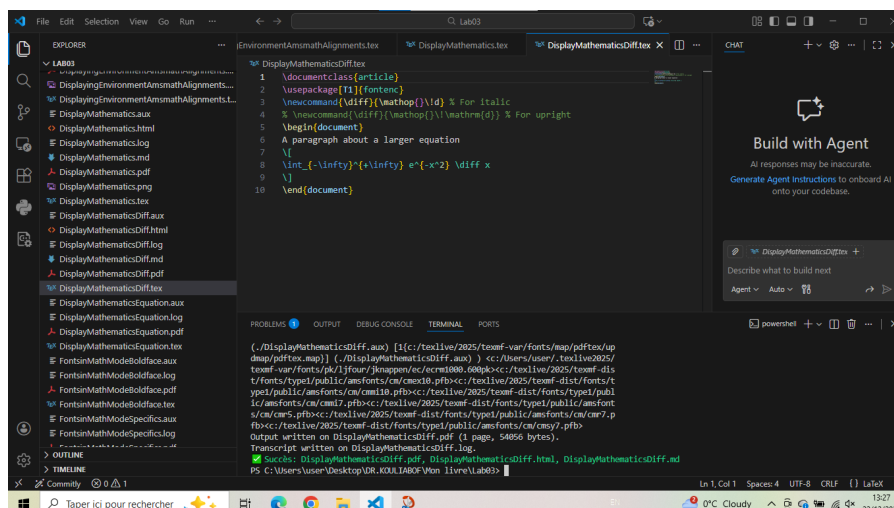
6 DisplayMathematicsDiff.tex - Custom Differential

```
\documentclass{article}
\usepackage[T1]{fontenc}
\newcommand{\diff}{\mathop{}\!\!d} % For italic
% \newcommand{\diff}{\mathop{}\!\!\mathrm{d}} % For upright
\begin{document}
A paragraph about a larger equation
\[
\int_{-\infty}^{+\infty} e^{-x^2} \diff x
\]
\end{document}
```

Generated figure

Custom differential command for better spacing.

Screenshot




```

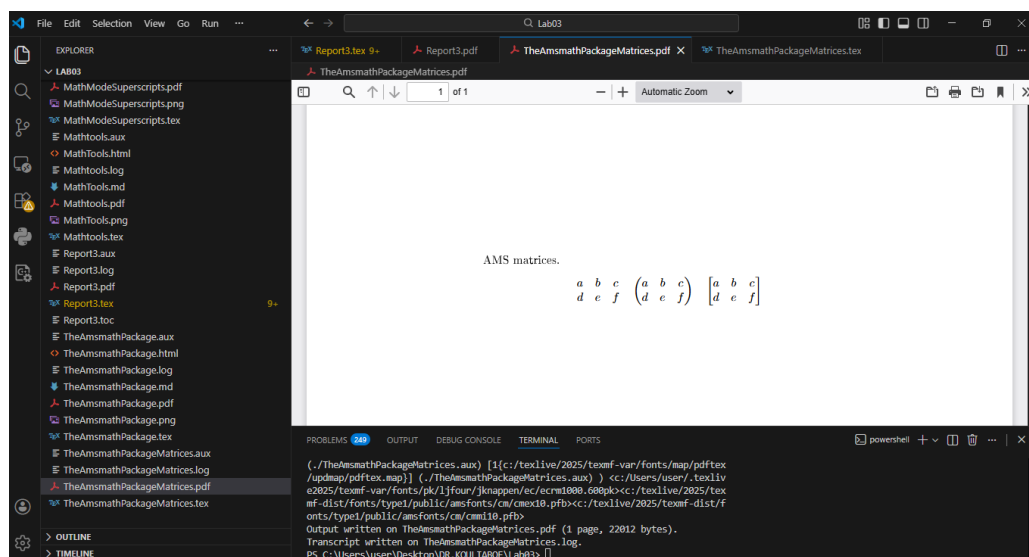
\[
\begin{matrix}
a & b & c \\
d & e & f
\end{matrix}
\quad
\begin{pmatrix}
a & b & c \\
d & e & f
\end{pmatrix}
\quad
\begin{bmatrix}
a & b & c \\
d & e & f
\end{bmatrix}
\]
\end{document}

```

Generated figure

Different matrix environments from amsmath.

Screenshot



9 ColumnsinMathAlignments.tex - Column Alignments

```

\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{amsmath}
\begin{document}
Aligned equations
\begin{align*}

```

```

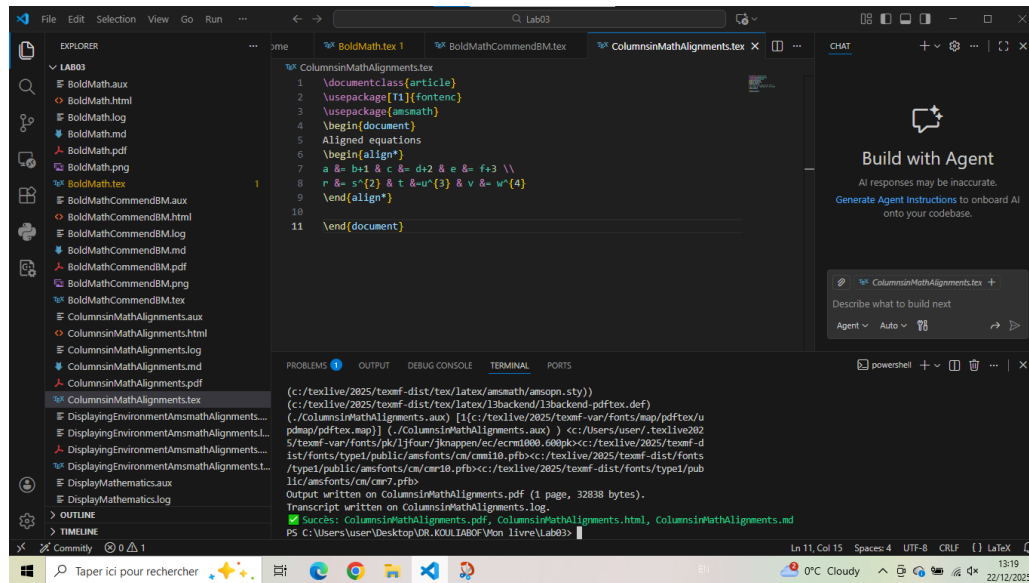
a &= b+1 & c &= d+2 & e &= f+3 \\
r &= s^{2} & t &= u^{3} & v &= w^{4}
\end{align*}
\end{document}

```

Generated figure

Multiple columns in align environment.

Screenshot



10 DisplayingEnvironmentAmsmathAlignments.tex - Aligned Subenvironment

```

\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{amsmath}
\begin{document}
\begin{itemize}
\item

$$\begin{aligned} & t \\ a &= b \\ c &= d \end{aligned}$$

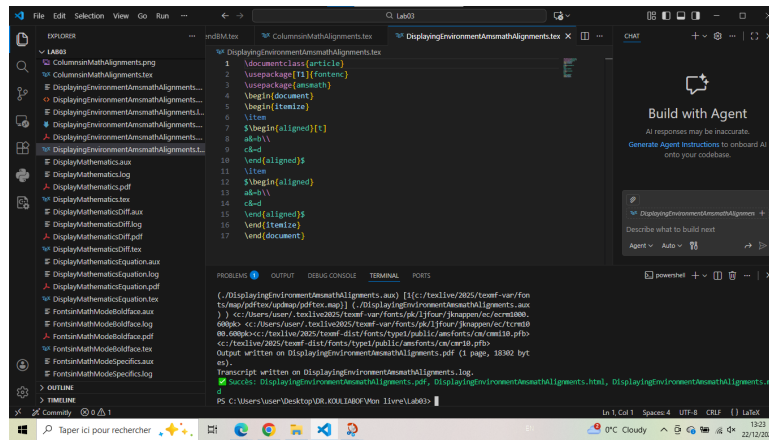
\end{item}
\begin{aligned} & t \\ a &= b \\ c &= d \end{aligned}
\end{aligned}
\end{itemize}
\end{document}

```


Generated figure

Aligned subenvironment with vertical positioning.

Screenshot



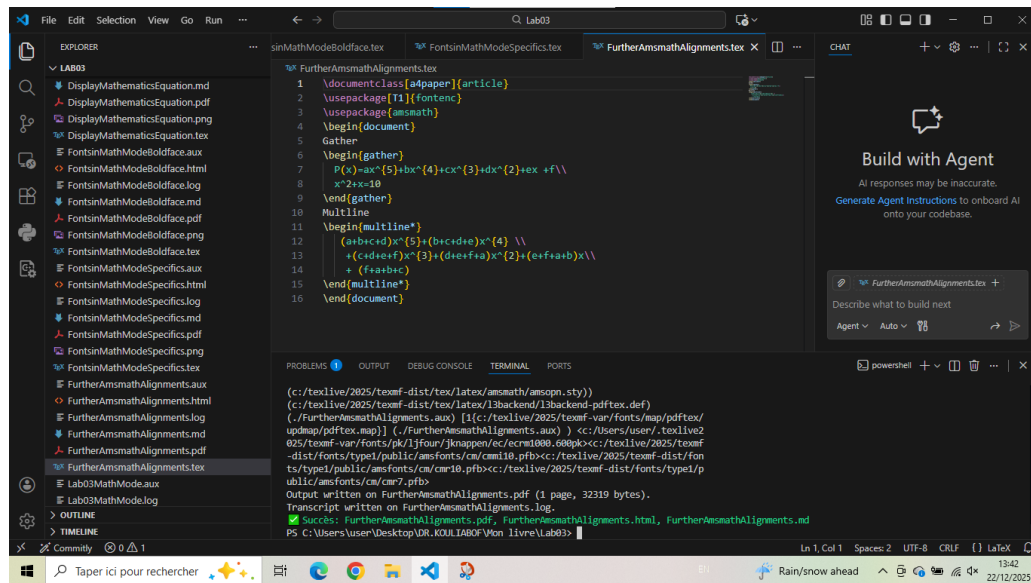
11 FurtherAmsmathAlignments.tex - Gather and Multline

```
\documentclass[a4paper]{article}
\usepackage[T1]{fontenc}
\usepackage{amsmath}
\begin{document}
Gather
\begin{gather}
P(x)=ax^5+bx^4+cx^3+dx^2+ex +f\\
x^2+x=10
\end{gather}
Multline
\begin{multline*}
(a+b+c+d)x^5+(b+c+d+e)x^4 \\\
+(c+d+e+f)x^3+(d+e+f+a)x^2+(e+f+a+b)x\\
+ (f+a+b+c)
\end{multline*}
\end{document}
```

Generated figure

Gather and multline environments for multi-line equations.

Screenshot



12 BoldMath.tex - Bold Mathematics

```
\documentclass[a4paper]{article}
```

```
\usepackage[T1]{fontenc}
```

```
\begin{document}
```

```
$(x+y)(x-y)=x^{\{2\}}-y^{\{2\}}$
```

```
{\boldmath $(x+y)(x-y)=x^{\{2\}}-y^{\{2\}}$ $\pi r^2$}
```

```
$(x+\mathbf{y})(x-\mathbf{y})=x^{\{2\}}-\{\mathbf{y}\}^{\{2\}}$
```

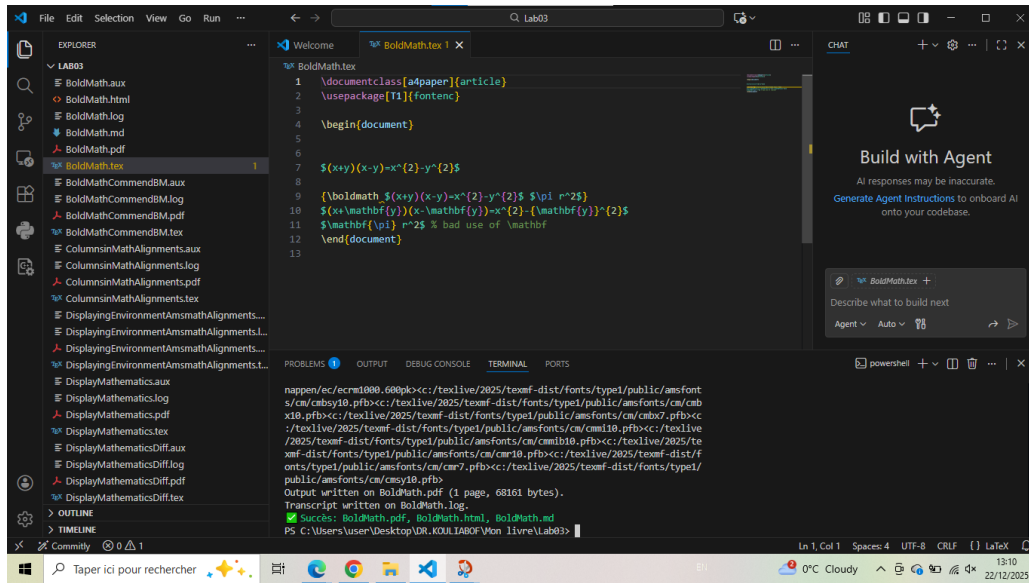
```
$\mathbf{\pi} r^2$ % bad use of \mathbf
```

```
\end{document}
```

Generated figure

Bold math using `\boldsymbol` and `\mathbf`.

Screenshot



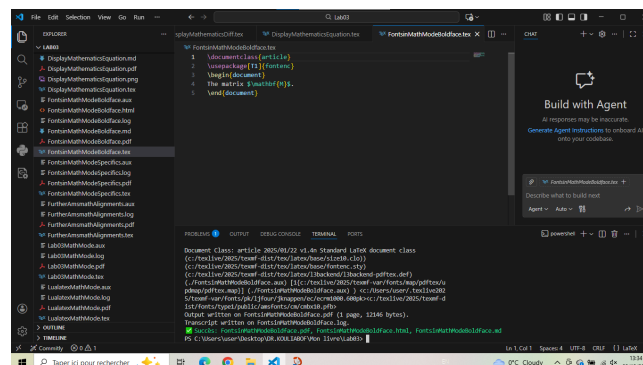
13 FontsinMathModeBoldface.tex - Boldface in Math

```
\documentclass{article}
\usepackage[T1]{fontenc}
\begin{document}
The matrix  $\mathbf{M}$ .
\end{document}
```

Generated figure

Bold math symbols.

Screenshot



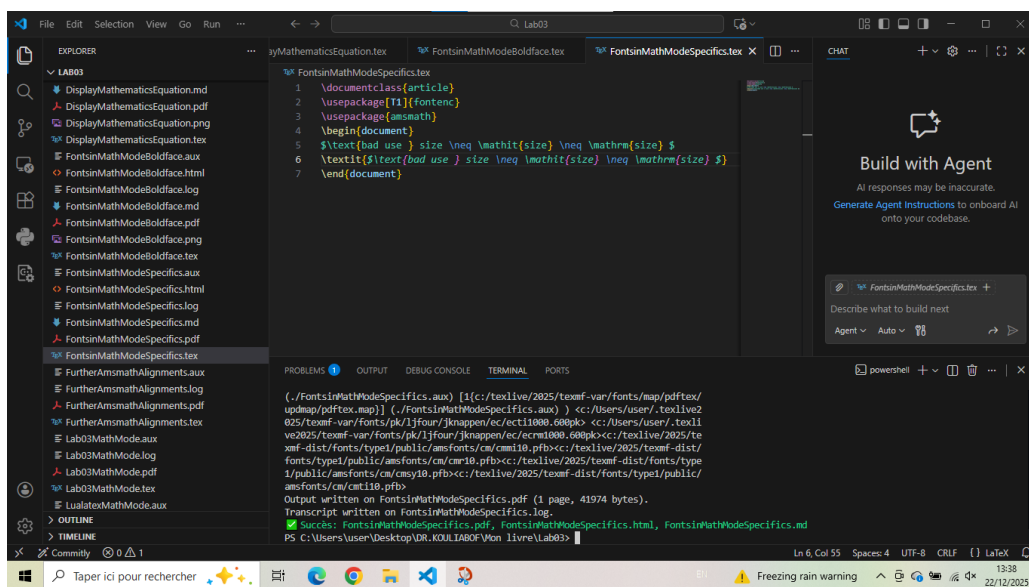
14 FontsinMathModeSpecifics.tex - Math Font Specifics

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{amsmath}
\begin{document}
 $\text{bad use } \text{size} \neq \mathit{\text{size}} \neq \mathrm{\text{size}}$ 
 $\textit{\text{\text{bad use } \text{size} \neq \mathit{\text{size}} \neq \mathrm{\text{size}}}}$ 
\end{document}
```

Generated figure

Different math font styles.

Screenshot



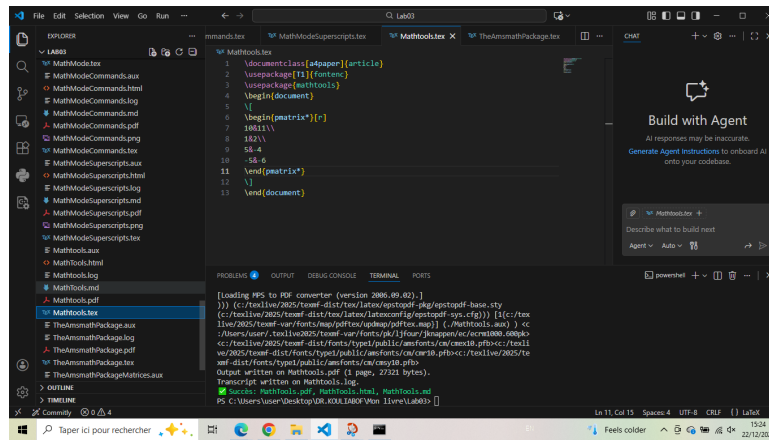
15 Mathtools.tex - Mathtools Package

```
\documentclass[a4paper]{article}
\usepackage[T1]{fontenc}
\usepackage{mathtools}
\begin{document}
\[
\begin{pmatrix} r \\
10&11\\
1&2\\
5&-4 \\
-5&-6 \end{pmatrix}
\]
\end{document}
```

Generated figure

Mathtools package with starred matrix for alignment.

Screenshot



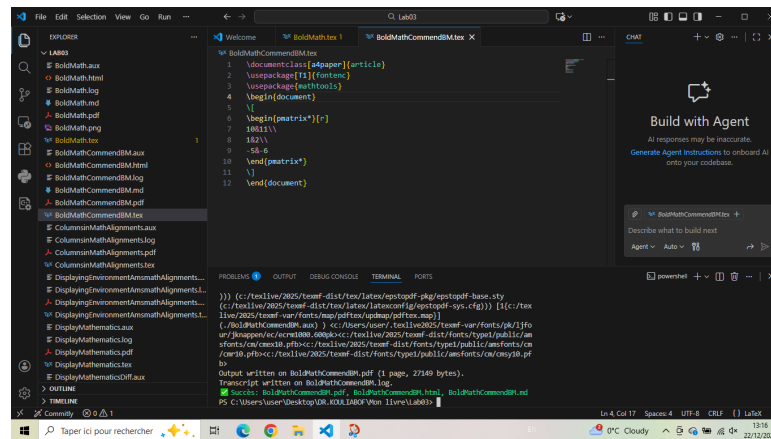
16 BoldMathCommendBM.tex - pmatrix* Environment

```
\documentclass[a4paper]{article}
\usepackage[T1]{fontenc}
\usepackage{mathtools}
\begin{document}
\begin{pmatrix*}[r]
10&11\\
1&2\\
-5&-6
\end{pmatrix*}
\end{document}
```

Generated figure

Matrix with right-aligned negative numbers.

Screenshot



17 LualatexMathMode.tex - Unicode Math with LuaLa-TeX

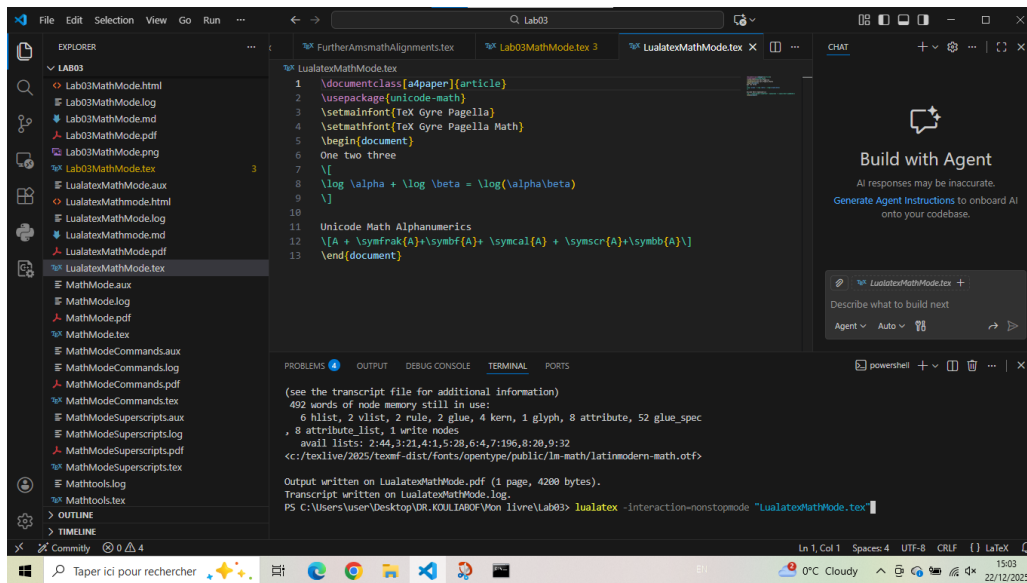
```
\documentclass[a4paper]{article}
\usepackage{unicode-math}
\setmainfont{TeX Gyre Pagella}
\setmathfont{TeX Gyre Pagella Math}
\begin{document}
One two three
\[
\log \alpha + \log \beta = \log(\alpha\beta)
\]
```

```
Unicode Math Alphanumeric
\[A + \symfrac{A}{+}\symbf{A}+ \symcal{A} + \symscr{A}+\symbb{A}\]
\end{document}
```

Generated figure

LuaLaTeX with unicode-math for modern font handling.

Screenshot



18 Lab03MathMode.tex - Comprehensive Lab Examples

```
\documentclass{article}
\usepackage[T1]{fontenc}
\begin{document}
```

```
%% 3-1) Math Mode
```

A sentence with inline mathematics: $\$y = mx + c\$$.

A second sentence with inline mathematics: $\$5^{\{2\}}=3^{\{2\}}+4^{\{2\}}\$$.

A second paragraph containing display math.

```
\[
  y = mx + c
\]
```

See how the paragraph continues after the display.

```
\end{document}
```

```
\textasciitilde
```

%% 3-2) Examples where simple super- and subscripts are entered without braces

```
\usepackage[T1]{fontenc}
```

```
\begin{document}
```

Superscripts $\$a^{\{b\}}\$$ and subscripts $\$a_{\{b\}}\$$.

```
\end{document}
```

```
\textasciitilde
```

```
documentclass[a4paper]{article}
```

```
\usepackage[T1]{fontenc}
```

```
\usepackage{mathtools}
```

```

\begin{document}
\[
\begin{pmatrix*}{r}
10&11\\
1&2\\
-5&-6
\end{pmatrix*}
\]
\end{document}

```

```

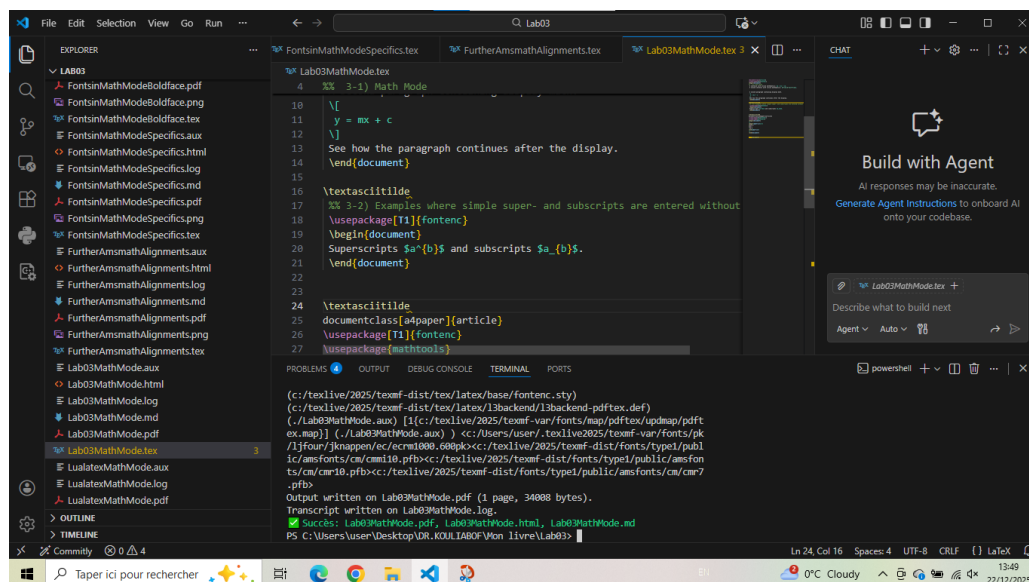
\end{document}

```

Generated figure

Multiple examples combined from laboratory exercises.

Screenshot



Conclusion: Methodology for Mathematical Typesetting

After comprehensive analysis of mathematical mode examples, here is the structured methodology for effective mathematical typesetting in LaTeX:

1. Essential math mode structures

```

% Inline math: $...$ or \(...\)
$E = mc^2$

```

```

% Display math unnumbered: \[...\]
\[

```



```

\int_a^b f(x)\,dx
\]

% Display math numbered: \begin{equation}...\end{equation}
\begin{equation}
\sum_{i=1}^n i = \frac{n(n+1)}{2}
\end{equation}

% Multi-line equations: \begin{align}...\end{align}
\begin{align}
x &= y + z \\
u &= v + w
\end{align}

```

2. Math mode environments comparison

Environment	Package	Purpose
equation	amsmath	Numbered single equation
align	amsmath	Multi-line alignment with multiple columns
gather	amsmath	Multi-line equations without alignment
multline	amsmath	Single equation split over multiple lines
matrix	amsmath	Unbracketed matrix
pmatrix	amsmath	Matrix with parentheses
bmatrix	amsmath	Matrix with square brackets
pmatrix*	mathtools	Matrix with column alignment options
aligned	amsmath	Subenvironment for blocks within other math

5. Essential practices

Best practices for mathematical typesetting:

1. **Always use math mode for mathematics:** Never use regular text for mathematical symbols
2. **Load amsmath:** It's essential for professional math typesetting
3. **Use appropriate brackets:** For matrices, choose the right bracket style
4. **Be careful with bold:** Use `\mathbf` for variables, `\boldsymbol` for symbols
5. **Differentiate d and e:** Consider upright d for differential, italic e for Euler's number
6. **Align at equals signs:** Use `&` in align environments
7. **Label important equations:** Use `\label` and `\ref` for cross-referencing

Final : Mastering mathematical typesetting is essential for scientific writing. Start with simple inline math, progress to displayed equations, then advance to multi-line alignments and matrices. Always use the appropriate packages (amsmath, mathtools) and choose the compilation engine that best suits your needs. Well-formatted mathematics enhances readability and professionalism of academic documents.