

# LaTeX intro



CMPT 727 spring 2023  
Simon Fraser University

# LaTeX

## Why using LaTeX?

Generally,

- Broad range of formatting templates: simple reports to journal articles and books
- Very easy control over large documents having multiple chapters and sections, cross-references, ...
- Complete and beautiful set of mathematical symbols and formulas

For this class,

- You will practice working with LaTeX math equations
- Beautiful assignments that are easy to read

# Overleaf

- We recommend using an online LaTeX editor, overleaf
  - No installation requirements
  - Very fast to compile

<https://www.overleaf.com/>

- Some essential LaTeX commands are summarized in this presentation

Full guide: <https://www.overleaf.com/learn>

# Preamble

.tex file starts with preamble that includes all information about formatting the document and required packages and parameters.

Editor

PDF

The screenshot displays a LaTeX editor interface with two main panes. The left pane shows the source code of a .tex file, and the right pane shows the rendered PDF output.

**Source Code (Left Pane):**

```
1 \documentclass[12pt,letterpaper]{article}
2 \usepackage{fullpage}
3 \usepackage[top=2cm, bottom=4.5cm, left=2.5cm,
4 right=2.5cm]{geometry}
5 \usepackage{amsmath,amsthm,amsfonts,amssymb}
6 \usepackage{fancyhdr}
7 \usepackage{xcolor}
8 \usepackage{graphicx}
9 \usepackage{esvect}
10
11 \setlength{\parindent}{0.0in}
12 \setlength{\parskip}{0.05in}
13
14 \newcommand\course{CMPT 727}
15 \newcommand\semester{Spring 2023}
16 \newcommand\hwnumber{1}
17 \newcommand\NetIDa{Your Name}
18 \newcommand\NetIDb{301XYYZZ}
19
20 \pagestyle{fancyplain}
21 \headheight 35pt
22 \chead{\textbf{\Large Assignment \hwnumber}}
23 \rhead{\course \ \ semester}
24 \lhead{\NetIDa \ \ \NetIDb}
```

**Rendered PDF (Right Pane):**

The PDF output shows a document titled "Assignment 1" for "CMPT 727 Spring 2023". The header includes "Your Name: 301XYYZZ". The document contains three problems:

**Problem 1**

For each member of your group, write their name, program, where they're from, and one other fact about them (e.g. hobby, favorite food).

**Problem 2**

Shamille O'Keal shoots free throws on a basketball court with 0.7 accuracy. What is the probability she hits exactly 70 of her first 100 shots? (A mathematical expression that could be plugged into a calculator is sufficient; you do not need to give the number itself.)

**Problem 3**

Consider the following Bayesian Network containing four Boolean random variables: global warming ( $A$ ), clear sky over Vancouver ( $B$ ), ice melting in arctic ( $C$ ), and high temperature in Vancouver ( $D$ ). Each variable can be either True or False. The probability that variable  $X$  is true is written  $P(X)$ ; the probability that  $X$  is false is written  $P(\neg X) = 1 - P(X)$ .

The Bayesian Network structure is as follows:

- Nodes:  $A$ ,  $B$ ,  $C$ ,  $D$
- Edges:  $A \rightarrow C$ ,  $A \rightarrow D$ ,  $B \rightarrow D$

Conditional Probability Tables (CPTs) for each node:

$P(A)$	0.1
--------	-----

$P(B)$	0.5
--------	-----

$P(C A)$	0.7
$P(C \neg A)$	0.2

$P(D A, B)$	0.9
$P(D \neg A, B)$	0.6
$P(D A, \neg B)$	0.7
$P(D \neg A, \neg B)$	0.3

**Problems:**

1. Compute  $P(A|C)$
2. Compute  $P(\neg A, B, \neg C, D)$

**Problem 4**

Prove the following:

# Preamble

Editor

PDF

```
\documentclass{12pt,letterpaper}{article}
```

Document general formatting,  
font size, physical size, ...

The screenshot displays a LaTeX editor interface with two main panes. The left pane shows the source code of a LaTeX document preamble, and the right pane shows the rendered PDF output.

**Source Code (Left Pane):**

```
1 \documentclass[12pt,letterpaper]{article}
2 \usepackage{fullpage}
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4   right=2.5cm]{geometry}
5 \usepackage{amsmath,amsthm,amsfonts,amssymb}
6 \usepackage{fancyhdr}
7 \usepackage{xcolor}
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21 \headheight 35pt
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23 \rhead{\course \ \ semester}
24 \lhead{\NetIDa \ \ \NetIDb}
```

**PDF Output (Right Pane):**

The PDF shows the rendered document. At the top, it includes the course and semester information: "Your Name: 301XYYZZ", "Assignment 1", and "CMPT 727 Spring 2023".

**Problem 1:**

For each member of your group, write their name, program, where they're from, and one other fact about them (e.g. hobby, favorite food).

**Problem 2:**

Shanille O'Keal shoots free throws on a basketball court with 0.7 accuracy. What is the probability she hits exactly 70 of her first 100 shots? (A mathematical expression that could be plugged into a calculator is sufficient; you do not need to give the number itself.)

**Problem 3:**

Consider the following Bayesian Network containing four Boolean random variables: global warming ( $A$ ), clear sky over Vancouver ( $B$ ), ice melting in arctic ( $C$ ), and high temperature in Vancouver ( $D$ ). Each variable can be either True or False. The probability that variable  $X$  is true is written  $P(X)$ ; the probability that  $X$  is false is written  $P(\neg X) = 1 - P(X)$ .

The Bayesian Network structure is as follows:

- Nodes:  $A$ ,  $B$ ,  $C$ ,  $D$
- Edges:  $A \rightarrow C$ ,  $A \rightarrow D$ ,  $B \rightarrow D$

The probability tables for each node are:

Node	Variable	True	False
$A$	Global warming	$P(A)$	$P(\neg A)$
$B$	Clear sky over Vancouver	$P(B)$	$P(\neg B)$
$C$	Ice melting in arctic	$P(C A)$	$P(C \neg A)$
$D$	High temperature in Vancouver	$P(D A, B)$	$P(D \neg A, \neg B)$

The numerical values for the probabilities are:

- $P(A) = 0.1$
- $P(B) = 0.5$
- $P(C|A) = 0.7$
- $P(C|\neg A) = 0.2$
- $P(D|A, B) = 0.9$
- $P(D|\neg A, B) = 0.6$
- $P(D|A, \neg B) = 0.7$
- $P(D|\neg A, \neg B) = 0.3$

**Problem 4:**

Prove the following:

# Preamble

Editor

PDF

`\usepackage{fullpage}`  
`\usepackage{top=2cm, bottom=4.5cm, left=2.5cm, right=2.5cm}{geometry}`  
You can change default options of used documentclass, for example modifying the margins with geometry package.

The screenshot displays a LaTeX editor interface with two main panes. The left pane shows the source code of a LaTeX document, and the right pane shows the rendered PDF output.

**Source Code (Left Pane):**

```
1 \documentclass[12pt,letterpaper]{article}
2 \usepackage{fullpage}
3 \usepackage[top=2cm, bottom=4.5cm, left=2.5cm, right=2.5cm]{geometry}
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5 \usepackage{fancyhdr}
6 \usepackage{xcolor}
7 \usepackage{graphicx}
8 \usepackage{esvect}
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19 \pagestyle{fancyplain}
20 \headheight 35pt
21 \chead{\textbf{\Large Assignment \hwnumber}}
22 \rhead{\course \ \ semester}
23 \lhead{\NetIDa \ \ \NetIDb}
```

**PDF Output (Right Pane):**

The PDF output shows a document titled "Assignment 1" for "CMPT 727 Spring 2023". The header includes the student's name "301XYYZZ". The document contains three problems:

- Problem 1:** For each member of your group, write their name, program, where they're from, and one other fact about them (e.g. hobby, favorite food).
- Problem 2:** Shanille O'Keal shoots free throws on a basketball court with 0.7 accuracy. What is the probability she hits exactly 70 of her first 100 shots? (A mathematical expression that could be plugged into a calculator is sufficient; you do not need to give the number itself.)
- Problem 3:** Consider the following Bayesian Network containing four Boolean random variables: global warming ( $A$ ), clear sky over Vancouver ( $B$ ), ice melting in arctic ( $C$ ), and high temperature in Vancouver ( $D$ ). Each variable can be either True or False. The probability that variable  $X$  is true is written  $P(X)$ ; the probability that  $X$  is false is written  $P(\neg X) = 1 - P(X)$ .

The Bayesian Network diagram shows the following structure and probabilities:

- Node  $A$  (Global warming) has  $P(A) = 0.1$ .
- Node  $B$  (Clear sky over Vancouver) has  $P(B) = 0.5$ .
- Node  $C$  (Ice melting in arctic) has  $P(C|A) = 0.7$  and  $P(C|\neg A) = 0.2$ .
- Node  $D$  (High temperature in Vancouver) has  $P(D|A, B) = 0.9$ ,  $P(D|\neg A, B) = 0.6$ ,  $P(D|A, \neg B) = 0.7$ , and  $P(D|\neg A, \neg B) = 0.3$ .

The problems listed below the diagram are:

1. Compute  $P(A|C)$
2. Compute  $P(\neg A, B, \neg C, D)$

**Problem 4:** Prove the following:

# Preamble

Editor

PDF

`\usepackage{amsmath,amsthm,amsfonts,amssymb}`  
Required commands for typesetting math documents are stored in these packages by American Math Society (ams).

The screenshot displays a LaTeX editor interface with two main panes. The left pane shows the source code of a LaTeX document preamble, and the right pane shows the rendered PDF output.

**Source Code (Left Pane):**

```
1 \documentclass[12pt,letterpaper]{article}
2 \usepackage{fullpage}
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4   right=2.5cm]{geometry}
5 \usepackage{amsmath,amsthm,amsfonts,amssymb}
6 \usepackage{fancyhdr}
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20 \headheight 35pt
21 \chead{\textbf{\Large Assignment \hwnumber}}
22 \rhead{\course \ \ semester}
23 \lhead{\NetIDa \ \ \NetIDb}
```

**PDF Output (Right Pane):**

The PDF shows the rendered document. At the top, it includes the course and semester information: "Your Name: 301XYYZZ", "Assignment 1", and "CMPT 727 Spring 2023".

**Problem 1:**

For each member of your group, write their name, program, where they're from, and one other fact about them (e.g. hobby, favorite food).

**Problem 2:**

Shamille O'Neal shoots free throws on a basketball court with 0.7 accuracy. What is the probability she hits exactly 70 of her first 100 shots? (A mathematical expression that could be plugged into a calculator is sufficient; you do not need to give the number itself.)

**Problem 3:**

Consider the following Bayesian Network containing four Boolean random variables: global warming ( $A$ ), clear sky over Vancouver ( $B$ ), ice melting in arctic ( $C$ ), and high temperature in Vancouver ( $D$ ). Each variable can be either True or False. The probability that variable  $X$  is true is written  $P(X)$ ; the probability that  $X$  is false is written  $P(\neg X) = 1 - P(X)$ .

The Bayesian Network structure is as follows:

- $A$  is a parent of  $C$  and  $D$ .
- $B$  is a parent of  $D$ .
- $C$  and  $D$  are independent given  $A$  and  $B$ .

The probability tables for the variables are:

$P(A)$	
$A$	0.1

$P(B)$	
$B$	0.5

$P(C A)$	
$C$	0.7
$\neg C$	0.2

$P(D A, B)$	
$D$	0.9
$\neg D$	0.6
$A, \neg B$	0.7
$\neg A, \neg B$	0.3

1. Compute  $P(A|C)$   
2. Compute  $P(\neg A, B, \neg C, D)$

**Problem 4:**

Prove the following:

# Preamble

Editor

PDF

`\usepackage{xcolor}`

Colored fonts.

`\usepackage{graphicx}`

Required commands for  
embedding the image filed in  
the document.

The screenshot displays a LaTeX editor interface with a source code editor on the left and a PDF preview on the right.

**Source Code Editor:**

```
1 \documentclass[12pt,letterpaper]{article}
2 \usepackage{fullpage}
3 \usepackage[top=2cm, bottom=4.5cm, left=2.5cm,
4   right=2.5cm]{geometry}
5 \usepackage{amsmath,amsthm,amsfonts,amssymb}
6 \usepackage{fancyhdr}
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21 \headheight 35pt
22 \chead{\textbf{\Large Assignment \hwnumber}}
23 \rhead{\course \ \ semester}
24 \lhead{\NetIDa \ \ \NetIDb}
```

**PDF Preview:**

The rendered PDF shows the header information and the assignment title. The header includes "Your Name: 301XYYZZ" and "CMPT 727 Spring 2023". The title is "Assignment 1".

**Problem 1:**

For each member of your group, write their name, program, where they're from, and one other fact about them (e.g. hobby, favorite food).

**Problem 2:**

Shamille O'Keal shoots free throws on a basketball court with 0.7 accuracy. What is the probability she hits exactly 70 of her first 100 shots? (A mathematical expression that could be plugged into a calculator is sufficient; you do not need to give the number itself.)

**Problem 3:**

Consider the following Bayesian Network containing four Boolean random variables: global warming ( $A$ ), clear sky over Vancouver ( $B$ ), ice melting in arctic ( $C$ ), and high temperature in Vancouver ( $D$ ). Each variable can be either True or False. The probability that variable  $X$  is true is written  $P(X)$ ; the probability that  $X$  is false is written  $P(\neg X) = 1 - P(X)$ .

The Bayesian Network structure is as follows:

- $A$  is a parent of  $C$  and  $D$ .
- $B$  is a parent of  $D$ .
- $C$  and  $D$  are children of  $A$  and  $B$ .

The probability tables for the variables are:

Variable	True	False
$A$	$P(A) = 0.1$	$P(\neg A) = 0.9$
$B$	$P(B) = 0.5$	$P(\neg B) = 0.5$
$C$	$P(C A) = 0.7$	$P(C \neg A) = 0.2$
$D$	$P(D A, B) = 0.9$ $P(D \neg A, B) = 0.6$ $P(D A, \neg B) = 0.7$ $P(D \neg A, \neg B) = 0.3$	$P(\neg D A, B) = 0.1$ $P(\neg D \neg A, B) = 0.4$ $P(\neg D A, \neg B) = 0.3$ $P(\neg D \neg A, \neg B) = 0.7$

**Problems:**

- Compute  $P(A|C)$
- Compute  $P(\neg A, B, \neg C, D)$

**Problem 4:**

Prove the following:



# Preamble

Editor

PDF

Most commands you need are available in mentioned packages, but you may search for and use other packages for more beautiful or complex typesetting. For example:

`\usepackage{esvect}`

For typesetting vectors, for example different kinds of arrowheads are available.

The screenshot displays a LaTeX editor interface with a source code editor on the left and a PDF preview on the right.

**Source Code Editor:**

```
1 \documentclass[12pt,letterpaper]{article}
2 \usepackage{fullpage}
3 \usepackage[top=2cm, bottom=4.5cm, left=2.5cm,
4 right=2.5cm]{geometry}
5 \usepackage{amsmath,amsthm,amsfonts,amssymb}
6 \usepackage{fancyhdr}
7 \usepackage{xcolor}
8 \usepackage{graphicx}
9 \usepackage{esvect}
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11 \setlength{\parindent}{0.0in}
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15 \newcommand\semester{Spring 2023}
16 \newcommand\hwnumber{1}
17 \newcommand\NetIDa{Your Name}
18 \newcommand\NetIDb{301XYYZZ}
19
20 \pagestyle{fancyplain}
21 \headheight 35pt
22 \chead{\textbf{\Large Assignment \hwnumber}}
23 \rhead{\course \semester}
24 \lhead{\NetIDa \NetIDb}
```

**PDF Preview:**

The rendered PDF shows the output of the preamble. At the top, it displays "Your Name: 301XYYZZ" and "Assignment 1" for "CMPT 727 Spring 2023". Below this, the text "Problem 1" is followed by instructions for a group assignment. "Problem 2" describes a probability problem about a basketball player. "Problem 3" introduces a Bayesian Network with four variables: global warming (A), clear sky over Vancouver (B), ice melting in arctic (C), and high temperature in Vancouver (D). The network structure is shown as a directed acyclic graph (DAG) with nodes A, B, C, and D. The conditional probability tables (CPTs) for each node are provided:

- Node A:  $P(A) = 0.1$
- Node B:  $P(B) = 0.5$
- Node C:  $P(C|A) = 0.7$ ,  $P(C|\neg A) = 0.2$
- Node D:  $P(D|A, B) = 0.9$ ,  $P(D|\neg A, B) = 0.6$ ,  $P(D|A, \neg B) = 0.7$ ,  $P(D|\neg A, \neg B) = 0.3$

Below the CPTs, the problems are listed:

1. Compute  $P(A|C)$
2. Compute  $P(\neg A, B, \neg C, D)$

**Problem 4**

Prove the following:

# Preamble

Editor

PDF

You can use `\newcommand` to define commands (functions) given arguments or parameters.

The screenshot displays a LaTeX editor interface with a source code window on the left and a PDF preview window on the right.

**Source Code (Preamble):**

```
1 \documentclass[12pt,letterpaper]{article}
2 \usepackage{fullpage}
3 \usepackage[top=2cm, bottom=4.5cm, left=2.5cm,
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5 \usepackage{amsmath,amsthm,amssymb}
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19 \pagestyle{fancyplain}
20 \headheight 35pt
21 \chead{\textbf{\Large Assignment \hwnumber}}
22 \rhead{\course \ \ semester}
23 \lhead{\NetIDa \ \ \NetIDb}
```

**PDF Preview:**

The rendered PDF shows the output of the preamble. At the top right, it says "CMPT 727 Spring 2023". The main title is "Assignment 1". Below the title, there are two problems:

**Problem 1**

For each member of your group, write their name, program, where they're from, and one other fact about them (e.g. hobby, favorite food).

**Problem 2**

Shanille O'Keal shoots free throws on a basketball court with 0.7 accuracy. What is the probability she hits exactly 70 of her first 100 shots? (A mathematical expression that could be plugged into a calculator is sufficient; you do not need to give the number itself.)

**Problem 3**

Consider the following Bayesian Network containing four Boolean random variables: global warming ( $A$ ), clear sky over Vancouver ( $B$ ), ice melting in arctic ( $C$ ), and high temperature in Vancouver ( $D$ ). Each variable can be either True or False. The probability that variable  $X$  is true is written  $P(X)$ ; the probability that  $X$  is false is written  $P(\neg X) = 1 - P(X)$ .

The Bayesian Network diagram shows nodes  $A$ ,  $B$ ,  $C$ , and  $D$ . Node  $A$  is a parent of  $C$  and  $D$ . Node  $B$  is a parent of  $D$ . The conditional probability tables (CPTs) are:

$P(A)$	
$A$	0.1

$P(B)$	
$B$	0.5

$P(C A)$	
$C$	0.7
$\neg C$	0.2

$P(D A, B)$	
$D$	0.9
$\neg D$	0.6
$A, B$	0.7
$\neg A, \neg B$	0.3

1. Compute  $P(A|C)$

2. Compute  $P(\neg A, B, \neg C, D)$

**Problem 4**

Prove the following:

# Preamble

Editor

PDF

Adding the assignment  
and your information to  
the fancy header.

The document begins  
from here.

The screenshot displays a LaTeX editor interface with two main panes. The left pane shows the source code of a LaTeX document, and the right pane shows the compiled PDF output.

**Source Code (Left Pane):**

```
12
13 \newcommand\course{CMPT 727}
14 \newcommand\semester{Spring 2023}
15 \newcommand\hwnumber{1}
16 \newcommand\NetIDA{Your Name}
17 \newcommand\NetIDb{301XXYYZZ}
18
19 \pagestyle{fancyplain}
20 \headheight 35pt
21 \chead{\textbf{\Large Assignment \hwnumber}}
22 \rhead{\course \ \ semester}
23 \lhead{\NetIDA \ \ NetIDb}
24 \lfoot{}
25 \cfoot{}
26 \rfoot{\small\thepage}
27 \headsep 1.5em
28
29 \begin{document}
30
31 \section*{Problem 1}
32 For each member of your group, write their name,
33 program, where they're from, and one other fact
34 about them (e.g. hobby, favorite food).
```

**PDF Output (Right Pane):**

The PDF shows the rendered document. At the top, it displays "Your Name" and "301XXYYZZ" on the left, "Assignment 1" in the center, and "CMPT 727 Spring 2023" on the right. Below this, "Problem 1" is followed by the instruction: "For each member of your group, write their name, program, where they're from, and one other fact about them (e.g. hobby, favorite food)."

**Problem 2:**

Shanille O'Keal shoots free throws on a basketball court with 0.7 accuracy. What is the probability she hits exactly 70 of her first 100 shots? (A mathematical expression that could be plugged into a calculator is sufficient; you do not need to give the number itself.)

**Problem 3:**

Consider the following Bayesian Network containing four Boolean random variables: global warming ( $A$ ), clear sky over Vancouver ( $B$ ), ice melting in arctic ( $C$ ), and high temperature in Vancouver ( $D$ ). Each variable can be either True or False. The probability that variable  $X$  is true is written  $P(X)$ ; the probability that  $X$  is false is written  $P(\neg X) = 1 - P(X)$ .

The Bayesian Network diagram shows nodes  $A$ ,  $B$ ,  $C$ , and  $D$ . Arrows point from  $A$  to  $C$  and  $D$ , and from  $B$  to  $D$ .

Conditional Probability Tables (CPTs) are provided for each node:

- $P(A)$ : 0.1
- $P(B)$ : 0.5
- $P(C|A)$ :

$P(C A)$	0.7
$P(C \neg A)$	0.2
- $P(D|A, B)$ :

$P(D A, B)$	0.9
$P(D \neg A, B)$	0.6
$P(D A, \neg B)$	0.7
$P(D \neg A, \neg B)$	0.3

**Problems:**

1. Compute  $P(A|C)$
2. Compute  $P(\neg A, B, \neg C, D)$

**Problem 4:**

Prove the following:

# Text formatting

Text formatting defaults are specified in preamble.

You can still change the formatting of specific words, sentences, paragraphs, ...

## Font sizes

Command	Output
---------	--------

<code>\tiny</code>	Lorem ipsum
--------------------	-------------

<code>\scriptsize</code>	Lorem ipsum
--------------------------	-------------

<code>\footnotesize</code>	Lorem ipsum
----------------------------	-------------

<code>\small</code>	Lorem ipsum
---------------------	-------------

<code>\normalsize</code>	Lorem ipsum
--------------------------	-------------

<code>\large</code>	Lorem ipsum
---------------------	-------------

<code>\Large</code>	Lorem ipsum
---------------------	-------------

<code>\LARGE</code>	Lorem ipsum
---------------------	-------------

<code>\huge</code>	Lorem ipsum
--------------------	-------------

<code>\Huge</code>	Lorem ipsum
--------------------	-------------

# Text formatting

Text formatting defaults are specified in preamble.

You can still change the formatting of specific words, sentences, paragraphs, ...

Font styles

style	command	switch command	output
medium	<code>\textmd{Sample Text 0123}</code>	<code>\mdseries</code>	Sample Text 0123
bold	<code>\textbf{Sample Text 0123}</code>	<code>\bfseries</code>	<b>Sample Text 0123</b>
upright	<code>\textup{Sample Text 0123}</code>	<code>\upshape</code>	Sample Text 0123
italic	<code>\textit{Sample Text 0123}</code>	<code>\itshape</code>	<i>Sample Text 0123</i>
slanted	<code>\textsl{Sample Text 0123}</code>	<code>\slshape</code>	<i>Sample Text 0123</i>
small caps	<code>\textsc{Sample Text 0123}</code>	<code>\scshape</code>	SAMPLE TEXT 0123

# Math equations

```
11  
12 The inline equation is \(\ x^2 + y^2 = 1\).  
13  
14 In math display mode, you can write the equation in its own paragraph:  
15 \[ x^2 + y^2 = 1.\]  
16  
17 You may need aligning multiline equations using align environment:  
18 \begin{align*}  
19 y &= (x+y)^2 \\  
20 &= x^2 + y^2 + 2xy  
21 \end{align*}  
22  
23
```

The inline equation is  $x^2 + y^2 = 1$ .

In math display mode, you can write the equation in its own paragraph:

$$x^2 + y^2 = 1.$$

You may need aligning multiline equations using align environment:

$$\begin{aligned} y &= (x + y)^2 \\ &= x^2 + y^2 + 2xy \end{aligned}$$

# Basic math operations

## Arithmetic:

- $3 + 2 \rightarrow 3 + 2$
- $3 - 2 \rightarrow 3 - 2$
- $3 \times 2 \rightarrow 3 \times 2$
- $3 \div 2 \rightarrow 3 \div 2$
- $3 \cdot 2 \rightarrow 3 \cdot 2$
- $\frac{3}{2} \rightarrow \frac{3}{2}$

## Subscript and superscript:

- $x_2 \rightarrow x_2$
- $x^2 \rightarrow x^2$
- $x_2^2 \rightarrow x_2^2$
- $X_{ij} \rightarrow x_{ij}$
- $e^{kx} \rightarrow e^{kx}$

# Other math operations and symbols

## Arrows

$\leftarrow$	<code>\leftarrow</code>	$\Leftarrow$	<code>\Leftarrow</code>
$\rightarrow$	<code>\rightarrow</code>	$\Rightarrow$	<code>\Rightarrow</code>
$\leftrightarrow$	<code>\leftrightarrow</code>	$\rightleftharpoons$	<code>\rightleftharpoons</code>
$\uparrow$	<code>\uparrow</code>	$\downarrow$	<code>\downarrow</code>
$\Uparrow$	<code>\Uparrow</code>	$\Downarrow$	<code>\Downarrow</code>
$\Leftrightarrow$	<code>\Leftrightarrow</code>	$\Updownarrow$	<code>\Updownarrow</code>
$\mapsto$	<code>\mapsto</code>	$\longmapsto$	<code>\longmapsto</code>
$\nearrow$	<code>\nearrow</code>	$\searrow$	<code>\searrow</code>
$\swarrow$	<code>\swarrow</code>	$\nwarrow$	<code>\nwarrow</code>
$\leftharpoonup$	<code>\leftharpoonup</code>	$\rightharpoonup$	<code>\rightharpoonup</code>
$\leftharpoondown$	<code>\leftharpoondown</code>	$\rightharpoondown$	<code>\rightharpoondown</code>



# Functions

Integrals, sums and products:

$$\int_{x=0}^{\infty} \ln(x) \, dx \qquad \int_{x=0}^{\infty} \ln(x) \, dx$$

$$\sum_{x=1}^n f(x) \qquad \sum_{x=1}^n f(x)$$

$$\prod_{x=1}^n f(x) \qquad \prod_{x=1}^n f(x)$$

$$\prod_{x=1}^n f(x) \qquad \prod_{x=1}^n f(x)$$

# Text and spacing in math mode

- Text is also assumed as a math variable by default:

$$x^2 + y^2 = 1 \text{ and } x < y \rightarrow x^2 + y^2 = 1 \text{ and } x < y$$

$$x^2 + y^2 = 1 \ \backslash \ \text{and} \ \backslash x < y \rightarrow x^2 + y^2 = 1 \text{ and } x < y$$

# Tables

**Tabular** environment is used for drawing tables (`\usepackage{tabularx}`):

```
26 \begin{center}  
27 \begin{tabular}{c c c }  
28 cell1 & cell2 & cell3 \\  
29 cell4 & cell5 & cell6  
30 \end{tabular}  
31 \end{center}  
32  
33 \begin{center}  
34 \begin{tabular}{|c|c|c| }  
35 \hline  
36 cell1 & cell2 & cell3 \\  
37 \hline  
38 cell4 & cell5 & cell6 \\  
39 \hline  
40 \end{tabular}  
41 \end{center>  
42
```

cell1   cell2   cell3  
cell4   cell5   cell6

cell1	cell2	cell3
cell4	cell5	cell6

# Vectors and Arrays

`\[ \vv{v} = \langle 0,0,1 \rangle ]`

$$\vec{v} = \langle 0, 0, 1 \rangle$$

```
\begin{matrix}
1 & 2 & 3 \\
a & b & c
\end{matrix}
```

$$\begin{matrix} 1 & 2 & 3 \\ a & b & c \end{matrix}$$

```
\begin{pmatrix}
1 & 2 & 3 \\
a & b & c
\end{pmatrix}
```

$$\begin{pmatrix} 1 & 2 & 3 \\ a & b & c \end{pmatrix}$$

```
\begin{bmatrix}
a_{11} & a_{12} & \cdots \\
a_{21} & a_{22} & \cdots \\
\vdots & \vdots & \ddots
\end{bmatrix}
```

$$\begin{bmatrix} a_{11} & a_{12} & \cdots \\ a_{21} & a_{22} & \cdots \\ \vdots & \vdots & \ddots \end{bmatrix}$$

# Practicing math functions in overleaf

# Graphical models and diagrams

- You may draw some figures and attach their images in your document

```
\usepackage{graphicx}
```

```
\includegraphics{/path/to/image}
```

```
\includegraphics[scale = 1, angle = 45]{/path/to/image}
```

```
\includegraphics[height = 4cm, width = 5cm]{/path/to/image}
```

```
\includegraphics[width = \textwidth]{/path/to/image}
```

# Graphical models and diagrams

- It is possible to draw bayesian networks or other diagrams in LaTeX using tikz libraries

```
\usetikzlibrary{bayesnet}
```

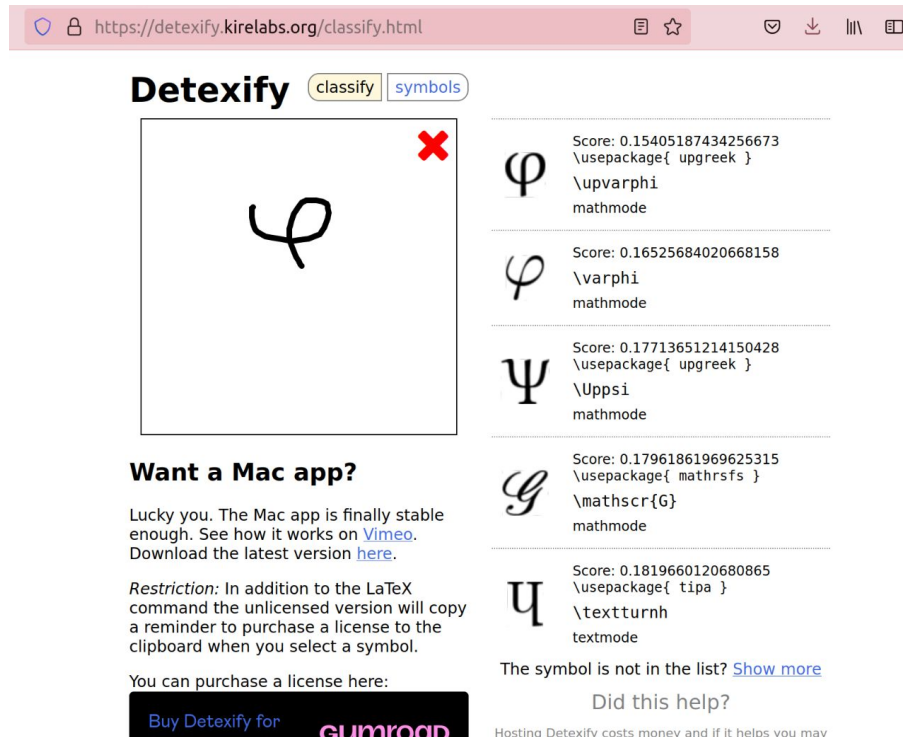
```
\usetikzlibrary{arrows}
```

- Resources:
  - <https://github.com/jluttine/tikz-bayesnet>
  - <https://medium.com/@xinyu.chen/awesome-latex-drawing-a-collection-of-academic-drawing-examples-using-latex-e07916b2c860>

# Useful tool, detexify

<https://detexify.kirelabs.org/classify.html>

Hand draw the symbol and it will suggest the closely looked symbols and their LaTeX commands.



The screenshot shows the Detexify web application. At the top, there's a navigation bar with "classify" and "symbols" tabs. The main area features a large square box where a hand-drawn symbol (a stylized phi) is shown. To the right of this box, a list of suggested symbols and their LaTeX commands is displayed, each with a score. The suggestions include  $\varphi$  (upgreek),  $\varphi$  (varphi),  $\Psi$  (Uppsi),  $\mathscr{G}$  (mathscr), and  $\text{U}$  (tipa). Below the drawing box, there's a section titled "Want a Mac app?" with text about the app's stability and a link to the Mac app page. At the bottom, there's a "Buy Detexify for" button with a Gumroad logo.

**Detexify** classify symbols

Score: 0.15405187434256673  
 $\varphi$   
`\usepackage{ upgreek }`  
`\upvarphi`  
mathmode

Score: 0.16525684020668158  
 $\varphi$   
`\varphi`  
mathmode

Score: 0.17713651214150428  
 $\Psi$   
`\usepackage{ upgreek }`  
`\Uppsi`  
mathmode

Score: 0.17961861969625315  
 $\mathscr{G}$   
`\usepackage{ mathrsfs }`  
`\mathscr{G}`  
mathmode

Score: 0.1819660120680865  
 $\text{U}$   
`\usepackage{ tipa }`  
`\textturnh`  
textmode

The symbol is not in the list? [Show more](#)

Did this help?

Hostina Detexify costs money and if it helps you may

**Want a Mac app?**

Lucky you. The Mac app is finally stable enough. See how it works on [Vimeo](#). Download the latest version [here](#).

*Restriction:* In addition to the LaTeX command the unlicensed version will copy a reminder to purchase a license to the clipboard when you select a symbol.

You can purchase a license here:

[Buy Detexify for](#) **GUMROAD**



# References

- <https://www.overleaf.com/learn>
- <https://detexify.kirelabs.org/classify.html>
- <https://www.youtube.com/watch?v=fCzF5gDy60g>
- <https://github.com/jluttine/tikz-bayesnet>
- <https://medium.com/@xinyu.chen/awesome-latex-drawing-a-collection-of-academic-drawing-examples-using-latex-e07916b2c860>