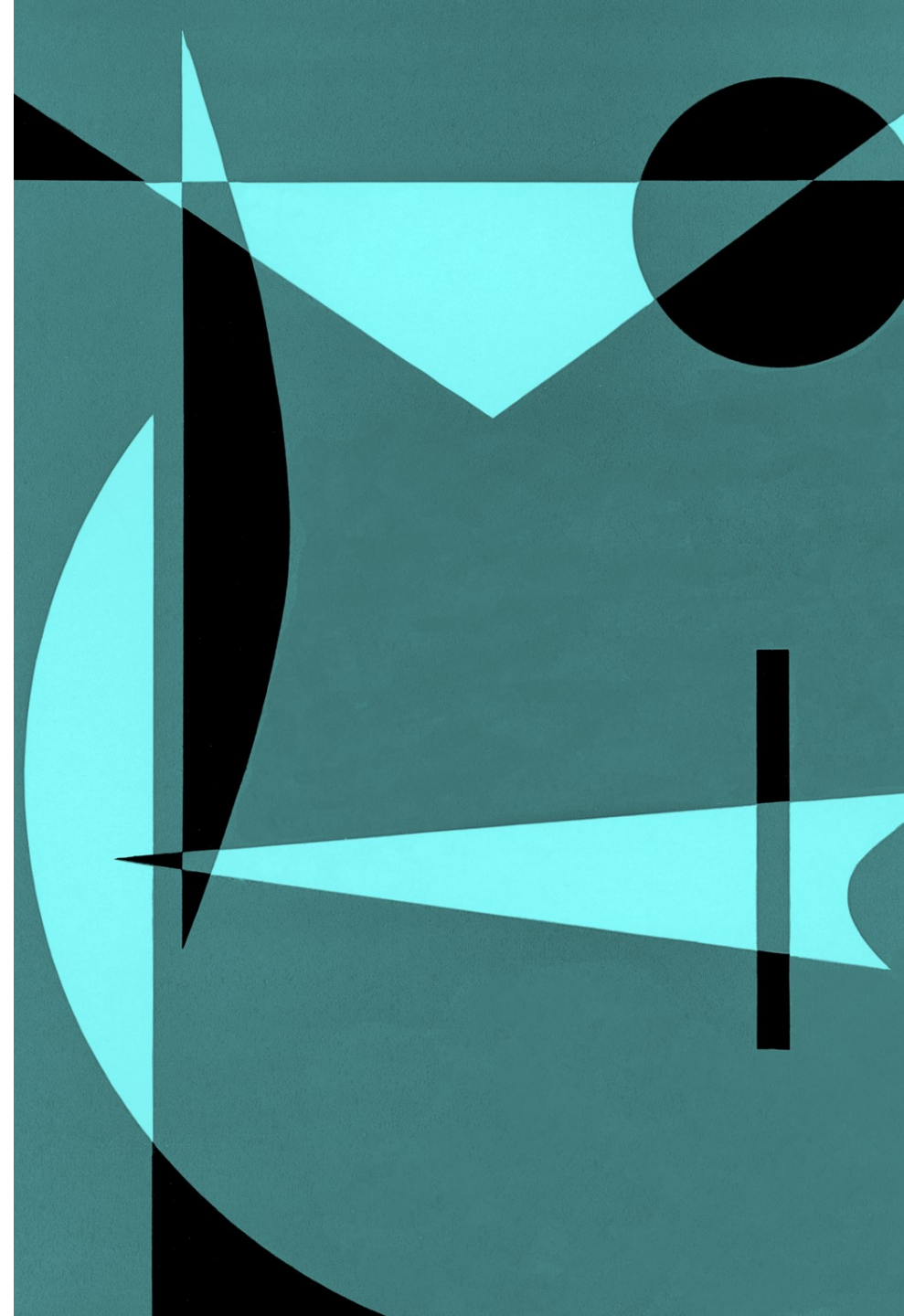




Introduction to technical writing with LaTeX

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Why use LaTeX

- High quality typesetting
- Produce technical or scientific documents
- Printed look
- Easily integrate mathematical symbols and equations
- Footnotes, references, table of contents, bibliographies can be generated easily

Installing LaTeX

MikTeX

Typesetting system

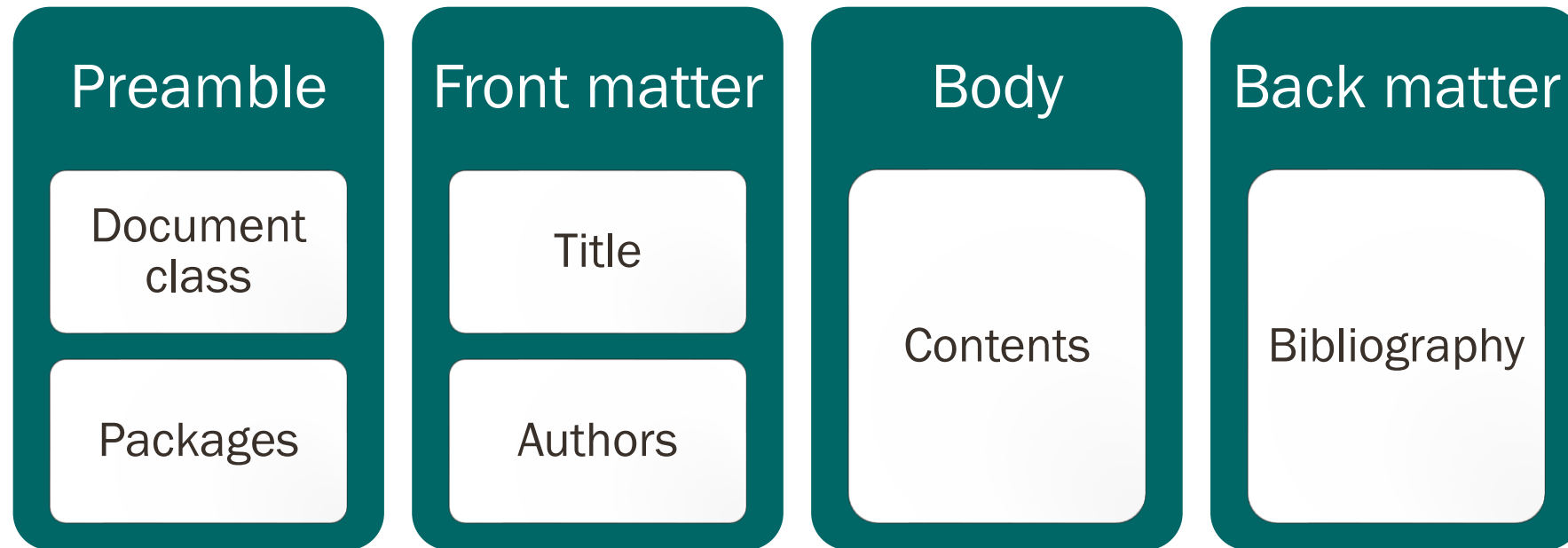
Install MikTeX first and then the text editor

WinEdt

Is a text editor

Create the source file (.tex)

Basic document structure



Basic layout of a LaTeX file

```
\documentclass{article}
```

```
\begin{document}
```

```
Hello ICATC 2021 !
```

```
\end{document}
```

Hello ICATC 2021 !

```
\documentclass[12pt]{article}
```

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

```
\documentclass[twoside]{report}
```

```
\documentclass[<options>]{elsarticle}
```

```
\documentclass[b5paper,10pt,twoside]{article}
```

LaTeX packages

```
\documentclass{article}
```

```
\usepackage{PACKAGENAME}
```

```
\begin{document}
```

```
.....
```

```
\end{document}
```

LaTeX packages

```
\documentclass{article}
```

```
\begin{document}
```

```
\begin{equation}
```

```
f(x) = x^2
```

```
\end{equation}
```

```
\end{document}
```

```
\documentclass{article}
```

```
\usepackage{amsmath}
```

```
\begin{document}
```

```
\begin{equation*}
```

```
f(x) = x^2
```

```
\end{equation*}
```

```
\end{document}
```

Title page

```
\documentclass{article}
\usepackage{blindtext}
\title{This is an article}
\date{01-01-2020}
\author{author name}
\begin{document}

\begin{abstract}
\blindtext
\end{abstract}
\end{document}
```

```
\documentclass{article}
\usepackage{blindtext}
\title{This is an article}
\date{01-01-2020}
\author{author name}
\begin{document}
\maketitle
\begin{abstract}
\blindtext
\end{abstract}
\end{document}
```

Change article to report and see

Environment (`\begin` & `\end`)

`\begin{document}`

`\begin{abstract}`

`\blindtext`

`\end{abstract}`

`\end{document}`

```
\begin{document}
```

```
\begin{environment1}
```

```
\begin{environment2}
```

```
\end{environment2}
```

```
\end{environment1}
```

```
\end{document}
```

Page numbering

Useful settings

for *pagenumbering*:

- *gobble* - no numbers
- *arabic* - arabic numbers
- *roman* - roman numbers

```
\documentclass{article}
```

```
\usepackage{blindtext}
```

```
\title{This is an article}
```

```
\date{01-01-2020}
```

```
\author{author name}
```

```
\begin{document}
```

```
  \pagenumbering{gobble}
```

```
  \maketitle
```

```
  \newpage
```

```
  \pagenumbering{roman}
```

```
  \blindtext
```

```
  \newpage
```

```
  \pagenumbering{arabic}
```

```
  \blindtext
```

```
\end{document}
```

Sectioning elements

```
\documentclass{article}
```

```
\begin{document}
```

```
\section{Introduction}
```

This is the introduction

```
\subsection{Background of research}
```

This is background

```
\subsubsection{Research problem}
```

This is the research problem

```
\section{Methodology}
```

```
\end{document}
```

Equations (Using inline math - embed formulas in your text)

```
\documentclass{article}
```

```
\begin{document}
```

```
\section{Introduction}
```

This is the introduction. This formula
 $f(x) = x^2$ is an example.

```
\subsection{Background of research}
```

This is background

```
\subsubsection{Research problem}
```

This is the research problem

```
\section{Methodology}
```

```
\end{document}
```

1 Introduction

This is the introduction. This formula $f(x) = x^2$ is an example.

1.1 Background of research

This is background

1.1.1 Research problem

This is the research problem

2 Methodology

The equation and align environment

```
\documentclass{article}
```

```
\usepackage{amsmath}
```

```
\begin{document}
```

```
\begin{equation*}
```

```
1 + 2 = 3
```

```
\end{equation*}
```

$$1 + 2 = 3$$

```
\begin{equation*}
```

```
1 = 3 - 2
```

```
\end{equation*}
```

$$1 = 3 - 2$$

```
\begin{align*}
```

```
1 + 2 &= 3 \\
```

```
1 &= 3 - 2
```

```
\end{align*}
```

```
\end{document}
```

$$1 + 2 = 3$$

$$1 = 3 - 2$$

Fractions

```
\documentclass{article}

\usepackage{amsmath}

\begin{document}

\begin{align*}
f(x) &= x^2 \\
g(x) &= \frac{1}{x} \\
F(x) &= \int^a_b \frac{1}{3}x^3
\end{align*}

\end{document}
```

$$f(x) = x^2$$
$$g(x) = \frac{1}{x}$$
$$F(x) = \int_b^a \frac{1}{3}x^3$$

View → **TeX symbols...**

Matrices

```
\begin{matrix}
1 & 0 \\
0 & 1
\end{matrix}
```

$$\begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$$

```
[
\begin{matrix}
1 & 0 \\
0 & 1
\end{matrix}
]
```

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

```
\left[
\begin{matrix}
1 & 0 \\
0 & 1
\end{matrix}
\right]
```

$$\left[\begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix} \right]$$

Figures

```
\documentclass{article}
\usepackage{graphicx}

\begin{document}

\begin{figure}
\includegraphics[width=\linewidth]{SUDS.jpg}
\caption{Sustainable urban drainage system}
\label{fig:SUDS}
\end{figure}
```

Figure `\ref{fig:SUDS}` shows an example for a sustainable urban drainage system.

```
\end{document}
```



Figure 1: Sustainable urban drainage system

Figure 1 shows an example for a sustainable urban drainage system.

Image positioning

```
%...  
\begin{figure}[h!]  
%...
```

- h (here) - same location
- t (top) - top of page
- b (bottom) - bottom of page
- p (page) - on an extra page
- ! (override) - will force the specified location

```
\documentclass{article}  
\usepackage{graphicx}  
\usepackage{blindtext}
```

```
\begin{document}  
\blindtext
```

```
\begin{figure}  
\includegraphics[width=\linewidth]{SUDS.jpg}  
\caption{Sustainable urban drainage system}  
\label{fig:SUDS}  
\end{figure}
```

Figure `\ref{fig:SUDS}` shows an example for a sustainable urban drainage system. \\

```
\blindtext
```

```
\end{document}
```

Multiple images / subfigures

```
\documentclass{article}
\usepackage{graphicx}
\usepackage{subcaption}
```

```
\begin{document}
\begin{figure}[h!]
\centering
```

```
\begin{subfigure}[b]{0.4\linewidth}
\includegraphics[width=\linewidth]{SUDS.jpg}
\caption{SUDS 1}
\end{subfigure}
\begin{subfigure}[b]{0.4\linewidth}
\includegraphics[width=\linewidth]{SUDS2.jpg}
\caption{SUDS 2}
\end{subfigure}
```

```
\caption{Sustainable urban drainage systems}
\label{fig:suds}
```

```
\end{figure}
\end{document}
```



(a) SUDS 1



(b) SUDS 2

Figure 1: Sustainable urban drainage systems

Table of contents

`\documentclass{article}`
`\usepackage{blindtext}`
`\begin{document}`

`\tableofcontents`

`\newpage`

`\section{Section}`

`\blindtext`

`\subsection{Subsection}`

`\blindtext`

`\subsubsection{subsubsection}`

`\blindtext`

`\end{document}`

Contents

1	Section	2
1.1	Subsection	2
1.1.1	subsubsection	2

`\documentclass{article}`

`\usepackage{blindtext}`

`\usepackage{setspace}`

`\begin{document}`

`\doublespacing`

`\tableofcontents`

`\singlespacing`

`\newpage`

.....

`\end{document}`

List of figures / tables

```
\documentclass{article}
```

```
\begin{document}
```

```
...
```

```
\begin{figure}
```

```
\caption{Dummy figure}
```

```
\end{figure}
```

```
\begin{table}
```

```
\caption{Dummy table}
```

```
\end{table}
```

```
...
```

```
\begin{appendix}
```

```
\listoffigures
```

```
\listoftables
```

```
\end{appendix}
```

```
\end{document}
```

List of Figures

1 Dummy figure 1

List of Tables

1 Dummy table 1

Referencing - Bibtex

- Creating a .bib file
- Using BibTex

```
\documentclass{article}
```

```
\begin{document}
```

Random citation `\cite{John2100}` embeddeed in text.

```
\newpage
```

```
\bibliography{lesson7a1}
```

```
\bibliographystyle{ieeetr}
```

```
\end{document}
```

Random citation [1] embeddeed in text.

References

[1] J. Doe, *The Book without Title*. Dummy Publisher, 2100.

```
@BOOK{John2100,  
AUTHOR="John Doe",  
TITLE="The Book without Title",  
PUBLISHER="Dummy Publisher",  
YEAR="2100",  
}
```

Other BibTex styles

- Abbrv
- Alpha
- Apalike
- IEEEtr
- Plain

Referencing

```
\begin{thebibliography}{100} % 100 is a random guess of the total number of references
```

```
\bibitem{ref1}
```

G.I.P. De Silva and W.C.Perera, Improvement of the Mechanical Properties of Aluminum 6063 T5 Extrudates by Varying the Aging Condition Cost-Effectively, Proc. Research Symposium on Advancement of Science, South Asian Institute of Technology and Medicine (SAITM), Sri Lanka, 2012, pp.54-58.

```
\end{thebibliography}
```

Tables

```
\begin{table}[h!]  
  \begin{center}  
    \caption{Your first table.}  
    \label{tab:table1}  
    \begin{tabular}{l|c|r} % <-- Alignments: 1st column left, 2nd middle and 3rd right, with vertical lines in between  
      \textbf{Value 1} & \textbf{Value 2} & \textbf{Value 3} \\ \hline  
      $\alpha$ & $\beta$ & $\gamma$ \\ \hline  
      1 & 10 & a \\ \hline  
      2 & 20 & b \\ \hline  
      3 & 30 & c \\ \hline  
    \end{tabular}  
  \end{center}  
\end{table}
```

Table 1: Your first table.

Value 1	Value 2	Value 3
α	β	γ
1	10	a
2	20	b
3	30	c

Multirow

Table 1: Your first table.

Value 1	Value 2	Value 3
α	β	γ
1	10	a
2	20	b
3	30	c

Table 1: Multirow table.

Value 1	Value 2	Value 3
α	β	γ
12	10	a
	15	b
3	20	c
4	30	d

`\multirow{NUMBER_OF_ROWS}{WIDTH}{CONTENT}`

```
\documentclass{article}
```

```
\usepackage{multirow} % Required for multirows
```

```
\begin{document}
```

```
\begin{table}[h!]
```

```
\begin{center}
```

```
\caption{Multirow table.}
```

```
\label{tab:table1}
```

```
\begin{tabular}{|l|c|r}
```

```
\textbf{Value 1} & \textbf{Value 2} & \textbf{Value 3} \\
```

```
 $\alpha$  &  $\beta$  &  $\gamma$  \\
```

```
\hline
```

```
\multirow{2}{*}{12} & 10 & a \\ % <-- Combining 2 rows
```

with arbitrary with (*) and content 12

```
& 15 & b \\ % <-- Content of first column omitted.
```

```
\hline
```

```
3 & 20 & c \\
```

```
4 & 30 & d \\
```

```
\end{tabular}
```

```
\end{center}
```

```
\end{table}
```

```
\end{document}
```


Multi column

Table 1: Multicolumn table.

Value 1	Value 2	Value 3
α	β	γ
12		a
2	15	b
3	20	c
4	30	d

Table 1: Multirow and -column table.

Value 1	Value 2	Value 3
α	β	γ
1234		a
		b
3	20	c
4	30	d

```

\begin{tabular}{|l|c|r}
  \textbf{Value 1} & \textbf{Value 2} & \textbf{Value 3} \\
  $\alpha$ & $\beta$ & $\gamma$ \\
  \hline
  \multicolumn{2}{c|}{12} & a \\
  \hline
  2 & 15 & b \\
  3 & 20 & c \\
  4 & 30 & d \\
\end{tabular}

```

`\multicolumn{2}{c|}{12} & a` % <-- Combining two cells with alignment c| and content 12.

```

\multicolumn{2}{c|}{\multirow{2}{*}{1234}} & a \\
\multicolumn{2}{c|}{} & b

```

Multicolumn spanning 2 columns, content multirow spanning two rows

`\multicolumn{2}{c|}{} & b` % <-- Multicolumn spanning 2 columns with empty content as placeholder

```

\hline
3 & 20 & c \\
4 & 30 & d \\

```

Horizontal separators - tables

Table 1: Table using booktabs.

Value 1	Value 2	Value 3
α	β	γ
1	10	a
2	20	b
3	30	c

```
\documentclass{article}
```

```
\usepackage{booktabs} % For prettier tables
```

```
\begin{document}
```

```
\begin{table}[h!]
```

```
\begin{center}
```

```
\caption{Table using booktabs.}
```

```
\label{tab:table1}
```

```
\begin{tabular}{l|c|r}
```

```
\toprule % <-- Top rule here
```

```
\textbf{Value 1} & \textbf{Value 2} & \textbf{Value 3} \\
```

```
$\alpha$ & $\beta$ & $\gamma$ \\
```

```
\midrule % <-- Mid rule here
```

```
1 & 10 & a \\
```

```
2 & 20 & b \\
```

```
3 & 30 & c \\
```

```
\bottomrule % <-- Bottom rule here
```

```
\end{tabular}
```

```
\end{center}
```

```
\end{table}
```

```
\end{document}
```

Lists

Unordered list

```
\begin{itemize}
  \item One
  \item Two
  \item Three
\end{itemize}
```

- One
- Two
- Three

Ordered list

```
\begin{enumerate}
  \item One
  \item Two
  \item Three
\end{enumerate}
```

1. One
2. Two
3. Three

Nested list

```
\begin{enumerate}
  \item One
  \begin{enumerate}
    \item Two
    \item Three
    \item Four
  \end{enumerate}
  \item Five
  \item Six
\end{enumerate}
```

1. One
 - (a) Two
 - (b) Three
 - (c) Four
2. Five
3. Six

Changing bullets

%From bullet to dash

`\item[--]` or `\item[$-]`

% From bullet to asterisk

`\item[$\ast]`

%Use any math character

`\item[$\CHARACTER]`

`\begin{itemize}`

`\item[--]` Dash

`\item[$-]` Dash

`\item[$\ast]` Asterisk

`\end{itemize}`

– Dash

– Dash

* Asterisk

Changing enumeration

```
\documentclass{article}           %Roman numbers
                                  \begin{enumerate}[label=(\roman*)]
\usepackage{enumitem}           %...

\begin{document}                % Arabic numbers
                                  \begin{enumerate}[label=\arabic*]
                                  %...

                                  % Alphabetical
                                  \begin{enumerate}[label=\alph*]
                                  %...
```

Draw pictures – with tikz

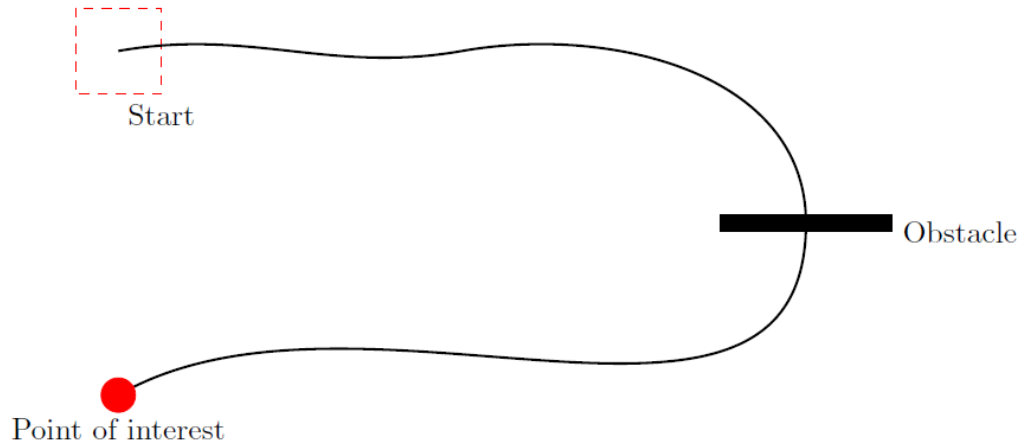


Figure 1: Example graphic made with tikz.

```
\documentclass{article}

\usepackage{tikz}

\begin{document}
\begin{figure}[h!]
\begin{center}
\begin{tikzpicture}
\draw [red,dashed] (-2.5,2.5) rectangle (-1.5,1.5) node
[black,below] {Start}; % Draws a rectangle
\draw [thick] (-2,2) % Draws a line
to [out=10,in=190] (2,2)
to [out=10,in=90] (6,0)
to [out=-90,in=30] (-2,-2);
\draw [fill] (5,0.1) rectangle (7,-0.1) node [black,right]
{Obstacle}; % Draws another rectangle
\draw [red,fill] (-2,-2) circle [radius=0.2] node
[black,below=4] {Point of interest}; % Draws a circle
\end{tikzpicture}
\caption{Example graphic made with tikz.}
\end{center}
\end{figure}
\end{document}
```

Tikz graphics

`\usepackage{tikz}`

`\begin{tikzpicture}`

`<code goes here>`

`\end{tikzpicture}`

`\draw (0,0) -- (4,0);`

`\draw (0,0) -- (4,0) -- (4,4) -- (0,4) -- (0,0);`

`\draw (0,0) -- (4,0) -- (4,4) -- (0,4) -- cycle;`

`\draw (0,0) rectangle (4,4);`

`\draw (0,0) parabola (4,4);`

`\draw (0,0) .. controls (0,4) and (4,0) .. (4,4);`

`\draw (2,2) circle (3cm);`

`\draw (2,2) ellipse (3cm and 1cm);`

`\draw (3,0) arc (0:75:3cm);`

`\draw[red,thick,dashed] (2,2) circle (3cm);`

Tikz - Grids

```
\draw[step=1cm,gray,very thin] (-2,-2) grid (6,6);
```

```
\draw[step=1cm,gray,very thin] (-1.9,-1.9) grid (5.9,5.9);
```

```
\fill[blue!40!white] (0,0) rectangle (4,4);
```

```
\filldraw[fill=blue!40!white, draw=black] (0,0) rectangle (4,4);
```

```
\shade[left color=blue,right color=red] (0,0) rectangle (4,4);
```

```
\shade[top color=blue,bottom color=red] (0,0) rectangle (4,4);
```

```
\shade[inner color=blue,outer color=red] (0,0) rectangle (4,4);
```


Tikz - Axes

```
\draw[thick,->] (0,0) -- (4.5,0);
```

```
\draw[thick,->] (0,0) -- (0,4.5);
```

```
\draw[thick,->] (0,0) -- (4.5,0) node[anchor=north west] {x axis};
```

```
\draw[thick,->] (0,0) -- (0,4.5) node[anchor=south east] {y axis};
```

```
\foreach \x in {0,1,2,3,4}
```

```
  \draw (\x cm,1pt) -- (\x cm,-1pt) node[anchor=north] {$\x$};
```

```
\foreach \y in {0,1,2,3,4}
```

```
  \draw (1pt,\y cm) -- (-1pt,\y cm) node[anchor=east] {$\y$};
```

www.geogebra.org.

[https://www.overleaf.com/learn/latex/LaTeX_Graphics_using_TikZ:_A_Tutorial_for_Beginners_\(Part_2\)%E2%80%94Generating_TikZ_Code_from_GeoGebra](https://www.overleaf.com/learn/latex/LaTeX_Graphics_using_TikZ:_A_Tutorial_for_Beginners_(Part_2)%E2%80%94Generating_TikZ_Code_from_GeoGebra)