



LaTeX

2023

Intro to LaTex

Math 199 Tutorial

Winter 2023

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01

Basic Command

02

Graphing

03

Topic
Structure

04

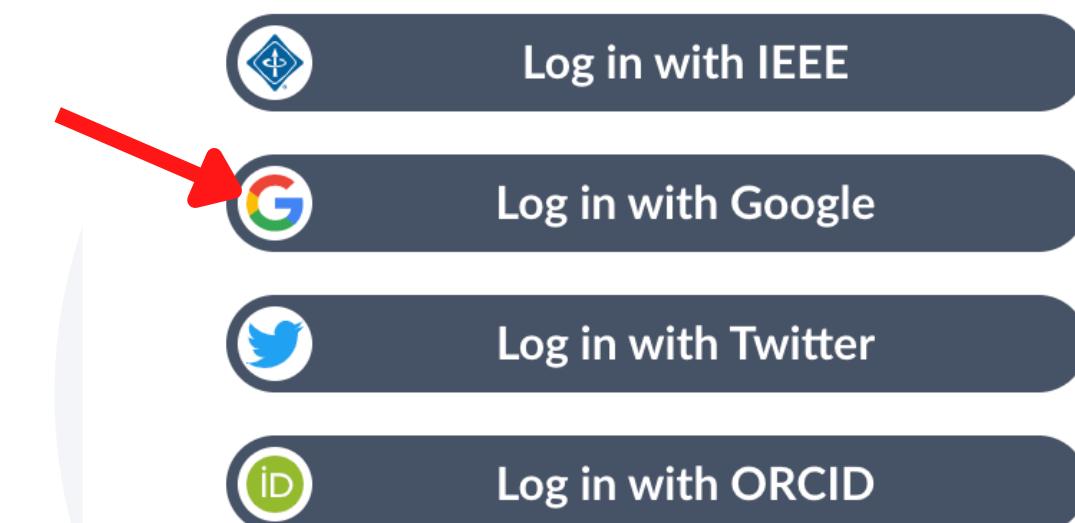
Example

Contents

CONTENTS

Latex and Overleaf

- LaTex: a system for document preparation
- Overleaf: cloud-based LaTeX editor
 - www.overleaf.com
 - Use your UCI Email to log in for free



01

Create your document

◆ Choose Templates

◆ Identify Documentclass

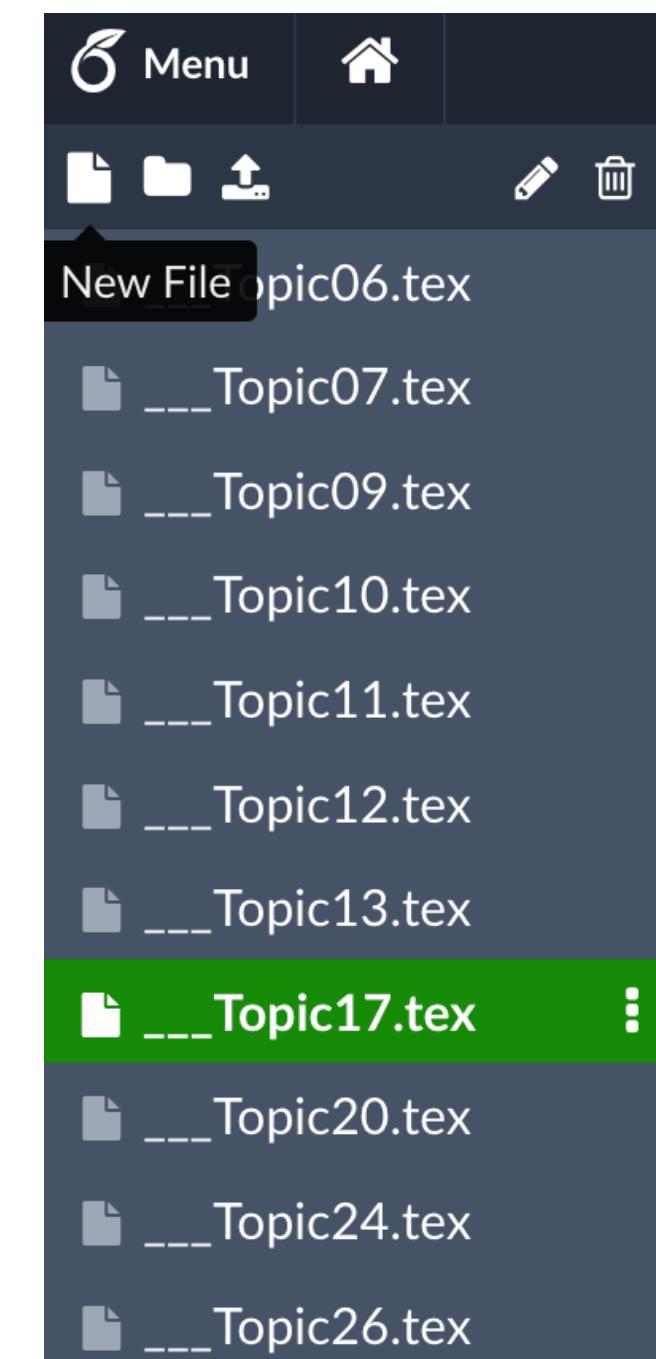
◆ Setup Fonts

◆ Choose Packages

Note: For our GDP project, Dr. Lu has provided all the necessary background setup commands for us. We just need to copy & paste all the setup commands and directly start writing our project!

```

3 \documentclass[lang=en,11pt,blue,fancy]{elegantbook-gdp}
4
5 \usepackage{mathtools}
6 \usepackage{amsmath,mathrsfs,amssymb,amscd}
7
8
9 \usepackage{tikz}
10 \usetikzlibrary{calc}
11 \usetikzlibrary{shapes, positioning}
12 \usepackage{tkz-euclide}
13 \usetikzlibrary{shapes.geometric}
14 \usepackage[framemethod=TikZ]{mdframed}
15 \usepackage{pgfplots}
16
17
18 \newenvironment{hints}{\it{\green{Hint:}}}{}
19 \newcommand{\elinkname}{External Link.}
20
21
22
23
24 \surroundwithmdframed[
25   %topline=false,
26   % rightline=false,
27   % bottomline=false,
28   %leftmargin=\parindent,
29   skipabove=.2in,
30   skipbelow=\medskipamount,
31   linewidth=.5pt,
32   linecolor=green,
33   innertopmargin=.1in,
34   innerbottommargin=.1in,
35 ]{hints}
```



01 Begin Document

Basic commands:

- `\begin{document}` : the beginning of your whole document
- `\begin{center}` : start a new line in the middle
- `\begin{tikzpicture}` : draw a graph
- `\begin{elink}` : create a external link
- `\begin{definition} {(xxxxx)}`: create a definition box
- `\begin{theorem} {(xxxxx)}`: create a theorem box
- `\begin{Lemma} {}{}`: create a lemma box
- `\begin{proof}` : start a proof section
- `\begin{enumerate}` : start a numerical list
 - `\item 1`
 - `\item 2`

WARNING: all `\begin` commands must end with the same `\end` commands!

Lemma 1

1. In $\triangle ABC$, the Fermat point F is the only point in the triangle that satisfies:

$$\angle AFB = \angle BFC = \angle CFA = 120^\circ$$

2. Two points F and J are isogonal conjugate points if and only if:

$$\angle BFC + \angle BJC = 180^\circ + \angle A.$$

(Above is a lemma box in a proof section)

01 Sections and Paragraphs

Basic commands:

- `\section{xxx}`
- `\subsection{xxx}`
- `\subsubsection{xxx}`
- ...

The screenshot shows the Overleaf LaTeX editor interface. On the left, the file tree displays files like 'topic 33', 'elegantbook-gdp.cls', 'Latex Intro.tex', 'main.tex' (which is currently selected and highlighted in green), 'Task 33.tex', and 'test1.tex'. A 'File outline' panel shows a hierarchical structure: 'Intro' has a child 'detail 1', which in turn has a child 'example 1'. The main workspace shows the LaTeX code:

```
109 \begin{document}
110 \section{Intro}
111 \subsection{detail 1}
112 \subsubsection{example 1}
113 \end{document}
```

To the right, the rendered output is displayed in three levels of headings: '1 Intro', '1.1 detail 1', and '1.1.1 example 1'. Navigation arrows between the code and the output are visible.

01 Writing in Math

Basic commands:

- $\$ \text{xxx} \$$: write maths inline with text xxx
- $\$\$ \text{xxx} \$\$$: write maths in an individual line
 - $x^{\{ \}}$ and $x_{\{ \}}$: superscript/subscript
 - $\backslash \alpha$: write greek letters (α in this example)
 - $\backslash \frac{a}{b}$: a/b
 - $\backslash \sqrt{x}$: square root of x
 - $\backslash \sum_{n=x}^{y}$: sum from x adding up to y
 - $\backslash \int_{x}^{y} X dx$: the integral from x to y for function X
 - $\backslash \angle ABC$ and $\backslash \triangle ABC$: draw angle ABC and triangle ABC

Note: All math signs must be written inside \$'s. To formally write an equation, you could also use commands $\begin{equation}$ and $\end{equation}$ instead of " \$\$ \text{xxx} \$\$ "

01 Writing in Math

After recompiling:

```
111 $$x^{\{2\}}$$ %write square  
112 $$\alpha$$ %write greek letters  
113 $$\frac{a}{b}$$ %a/b  
114 $$\sqrt{x}$$ %root(x)  
115 $$\sum_{n=x}^y$$ %sum from x adding up to y  
116 $$\int_x^y X dx$$ %the integral from x to y for function X$$  
117 $$\angle ABC$$  
118 $$\triangle ABC$$
```

x^2

α

$\frac{a}{b}$

\sqrt{x}

$\sum_{n=x}^y$

$\int_x^y X dx$

$\angle ABC$

$\triangle ABC$

01 Example

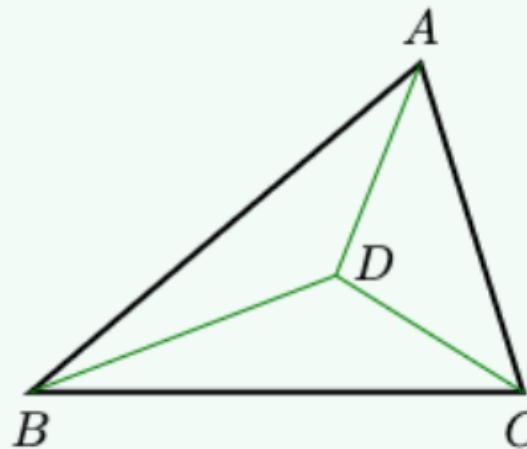
```
266 \begin{definition}{(Isodynamic Point)}{}  
267 Let  $\triangle ABC$  be a triangle, and let  $D$  be a point such that  
268 
$$\begin{aligned} AD \cdot BC &= BD \cdot CA = CD \cdot AB. \\ \end{aligned}$$
  
270 Then we call  $D$  an isodynamic point.
```

Definition 3. (Isodynamic Point)

Let $\triangle ABC$ be a triangle, and let D be a point such that

$$AD \cdot BC = BD \cdot CA = CD \cdot AB.$$

Then we call D an **isodynamic point**.



```

274 \begin{center}
275 \begin{tikzpicture}[scale=.8]
276 \coordinate (b) at (0,0);
277 \coordinate (c) at (4.8,0);
278 \coordinate (a) at (3.8,3.2);
279
280 \tkzDefTriangle[equilateral](b,a)\tkzGetPoint{s1}
281 \tkzDefTriangle[equilateral](c,b)\tkzGetPoint{s2}
282 \tkzInterLL(s1,c)(s2,a)
283 \tkzGetPoint{p}
284 \draw[black,very thick] (a)node[above]{$A$}--(b)node[below]{$B$}-
(c)node[below]{$C$}--cycle;
285 \tkzInterLL(a,p)(b,c)\tkzGetPoint{d}
286 \tkzInterLL(b,p)(a,c)\tkzGetPoint{e}
287 \tkzInterLL(c,p)(a,b)\tkzGetPoint{f}
288
289 \tkzFindAngle(b,a,d)\tkzGetAngle{xb}
290 \tkzDefPointBy[rotation= center a angle -\xb](c)
291 \tkzGetPoint{d1}
292 \tkzFindAngle(a,b,e)\tkzGetAngle{yb}
293 \tkzDefPointBy[rotation= center b angle -\yb](c)
294 \tkzGetPoint{e1}
295 \tkzFindAngle(a,c,f)\tkzGetAngle{zb}
296 \tkzDefPointBy[rotation= center c angle -\zb](b)
297 \tkzGetPoint{f1}
298
299 \tkzInterLL(a,d1)(b,c)\tkzGetPoint{d'}
300 \tkzInterLL(b,e1)(a,c)\tkzGetPoint{e'}
301 \tkzInterLL(c,f1)(b,a)\tkzGetPoint{f'}
302 \tkzInterLL(a,d')(b,e')\tkzGetPoint{d}
303
304 \draw [dgreen](a)--(d);
305 \draw [dgreen](b)--(d);
306 \draw [dgreen](c)--(d)node[right,black,yshift=1mm]{$D$};
307 \end{tikzpicture}
308 \end{center}
309 \end{definition}

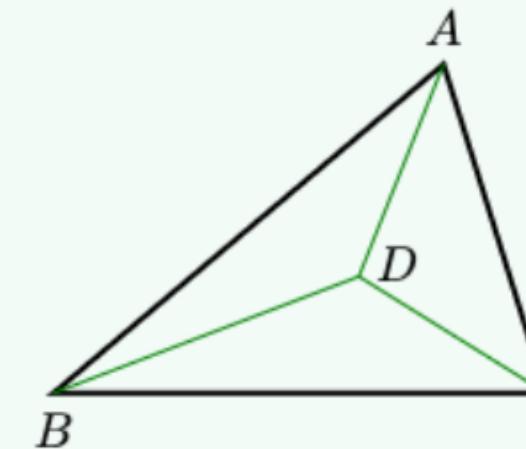
```

Definition 3. (Isodynamic Point)

Let $\triangle ABC$ be a triangle, and let D be a point such that

$$AD \cdot BC = BD \cdot CA = CD \cdot AB.$$

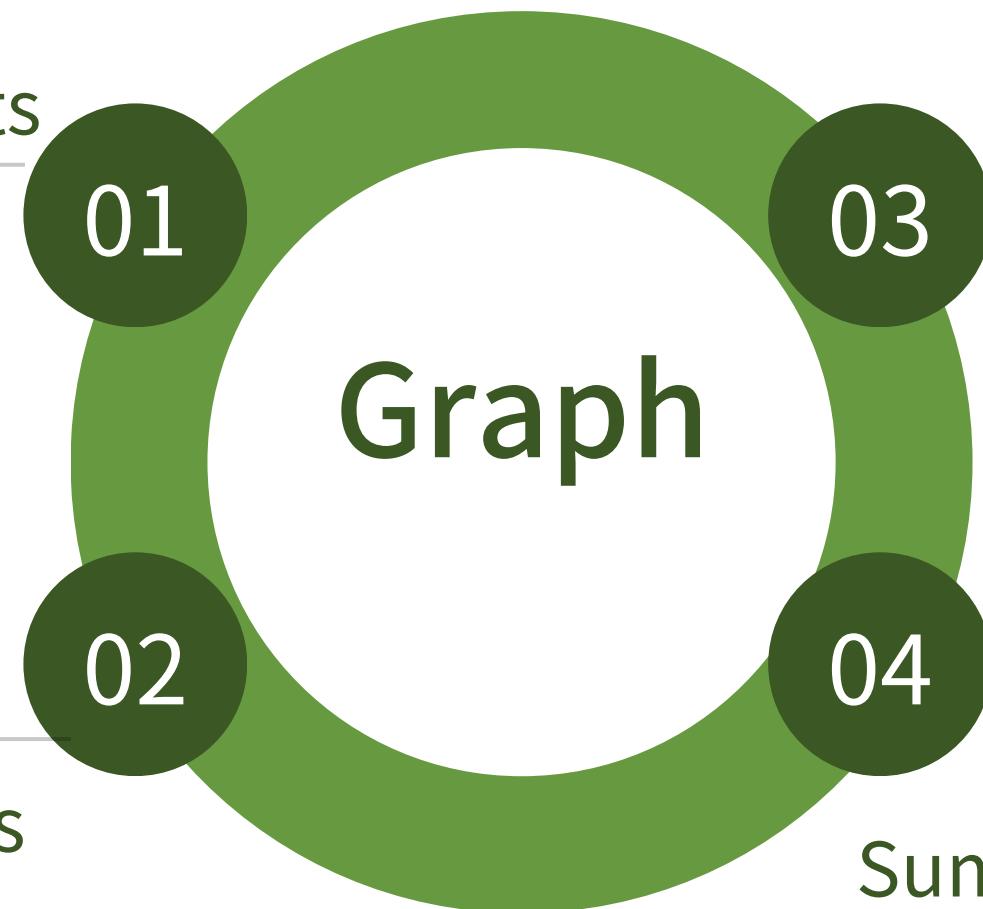
Then we call D an **isodynamic point**.



02

Graphing with Tikz

Set up coordingnates as default points



Draw guide lines and shapes

Find and set extra points

Summarize and visualize needed points



Basic commands:

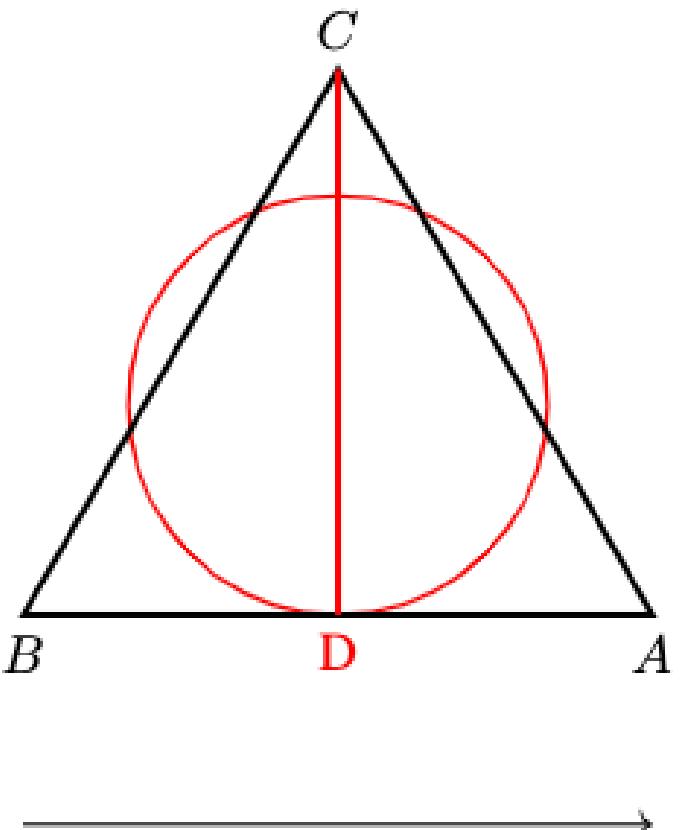
- `\begin{tikzpicture}`: insert package and begin graph
- `\coordinate (a) at (0,0)` : set point A
- `\tkzGetPoint{}` : create and define new point by other commands
- `\draw(a,b) circle (1)` : draw circle centered at (a,b) with r=1
- `\draw[->](0,-1)--(3,-1)` : draw vector from(0,1) to (3,-1).
- `\tkzDefTriangle[equilateral](b,a)`: define an equilateral triangle with the edge ab
- `\tkzInterLL(a,b)(c,d)` : find the intersection of line ab and line cd
- `\(a)node[below]{A}`: label point a with letter A below
- `\tkzDefPointBy[rotation = center a angle b](c)`: define point c by rotate b° from a

For more command, the best way is to search directly!



02 Example

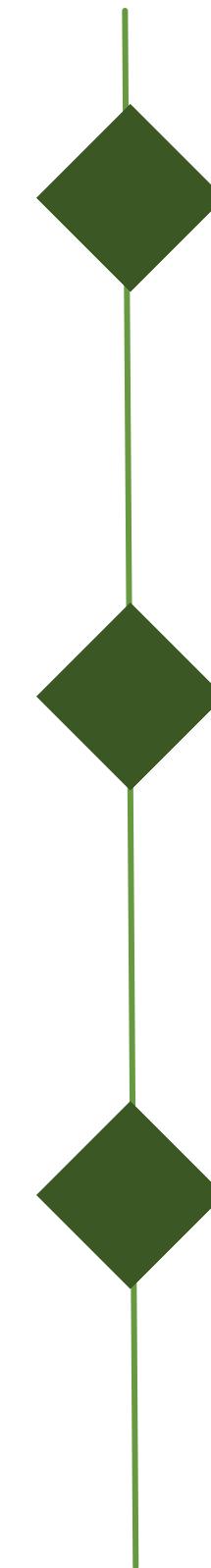
```
122 \begin{center}
123 \begin{tikzpicture}[scale=1.5]
124 \coordinate (b) at (0,0);
125 \coordinate (a) at (3,0);
126 \draw[red, thick](1.5,1) circle (1);
127 \draw[->](0,-1)--(3,-1);
128 \tkzDefTriangle[equilateral](b,a)\tkzGetPoint{c}
129 \coordinate(d) at (1.5,-1);
130 \tkzInterLL(a,b)(c,d)\tkzGetPoint{p}
131 \draw[black,very thick] (a)node[below]{\$A\$}--(b)node[below]{\$B\$}--(c)node[above]{\$C\$}--cycle;
132 \tkzInterLL(a,p)(b,c)\tkzGetPoint{d};
133 \draw[red, very thick] (c) --(p)node[below]{D};
134
135 \end{tikzpicture}
136 \end{center}
```



Definition

List several theorems related
to the topic AND prove it

Application



Give a definition of your topic

Theorems

List some applications or
questions that your topic might be
related to other topics/studies

LaTex Requirement

(suggested)

- Around 6-9 PDF pages (~500-1000 lines)
- Follow the given template
- Include several theorems and applications
- Prove theorems with graphs
- Citiations

03

Presentation Requirement

(suggested)

- Around 10 content pages (depending)
- Decorate your slides properly
 - (you may look this tutorial as an example)
- Present concisely and only include core concepts
 - DO NOT INCLUDE COMPLICATED PROOFS AND STEPS! Otherwise, your audiences won't digest well in a short time!
- Eye contact and control total time
- Feel welcome to add a thank you page

03

- For more examples, please refer to the GDP website and our OverLeaf project page:
 - <https://gdp.math.uci.edu/>



Geometric Information:

- Wikipedia
- Research articles
- Other GDP Topics



01



02



03

LaTex Writing and Correction:

- Youtube Videos
- ChatGPT
- Appointment with Dr. Lu

THANK YOU FOR WATCHING

Special Thanks to:

- Dr. Lu for his help and guidance
- Canva for designing slides
- ShareLaTeX's YouTube videos for tutorials

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