

Accessibility in LaTeX

Emanuel József Godfried

The status quo

- Pure mathematics uniquely only requires imagination
- LaTeX makes beautiful documents
 - "Mostly"
- STEM subjects naturally contain equations
 - 50-100 maths elements per page!
- Screen readers and other Assistive Technologies (AT) cannot parse equations
- <https://youtu.be/oCTsAqZqm9A?t=262>

Other teaching tools

- <https://vimeo.com/1101373386/0242dabc46?fl=pl&fe=cm>
- Less mathematically dense subjects
- New subjects

[ADD YOUR WELCOME MESSAGE HERE - Can be text, video or audio]

To read an overview for the subject, go to the [Subject Overview](#) page.

To see the components of this subject, go to [Modules](#)

Below is an equation:

$$a^2 + b^2 = c^2$$

Theorem:

If $\triangle ABC$ has a right angle $\angle C = 90^\circ$ then the above equation holds.

Theorem:

If x solves the equation $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Here are the solutions to the previous exercise sheet.

[test-document.pdf](#) ↓

[test-document-1.pdf](#) ↓

STEM Research

- Much more mathematically dense
- Longer
- Dissemination through ArXiv/Journals (in PDF format)
- ATs for HTML/Markdown require knowledge of LaTeX anyway
- LLMs/OCR are not sufficient
 - Generating alt-texts

C_K such that

$$(2.13) \quad |G_0(x; y)| \leq C_K \rho_0(y)$$

for $x \in K, y \in M^\circ$ with $\rho_0(y) \ll \min_{x \in K} \rho_0(x)$.

Proof. For each fixed $x_0 \in M^\circ$ and $y \in \partial M$ we have

$$(2.14) \quad G_0(x_0, y)|_{y \in \partial M} = 0.$$

Now, because $G_0(x_0; y)$ is smooth for each fixed $x_0 \in M^\circ$ and $y \in \partial M$, by applying Taylor's theorem in its integral from to the function $G_0(x_0; \cdot)$, it follows that at $y = (\rho_0(y), \theta(y))$

$$G_0(x_0; y) = \rho_0(y) \int_0^1 \frac{\partial G_0(x_0; t\rho_0(y), \theta(y))}{\partial \rho_0(y)} dt.$$

Hence, there is a positive constant C_{x_0} such that

$$|G_0(x_0; y)| \leq C_{x_0} \rho_0(y)$$

for $y \in M^\circ$ such that $\rho_0(y) \ll \rho_0(x_0)$. If $K \in M^\circ$ is compact, we can take $C_K = \max_{x \in K} C_x$, then

$$|G_0(x; y)| \leq C_K \rho_0(y)$$

for $x \in K, y \in M^\circ$ with $\rho_0(y) \ll \min_{x \in K} \rho_0(x)$. \square

We will now give a decomposition of the Green's function $G_0(x; y)$ into a sum of a *principal Green's function* $G_{0,\text{prin}}(x; y)$ and *remainder Green's function* $G_{0,\text{rem}}(x; y)$.

DEFINITION 2.8. Assume without loss of generality that $(M \setminus M_\delta, \bar{g}_0)$ can be extended to some manifold $(\tilde{M} \setminus M_\delta, \bar{g}_0)$ isometric to $(\mathbb{R}^2 \setminus \mathbb{D}_{1-\delta}, g_{\text{Euc}})$, and let $\Phi: \tilde{M} \setminus M_\delta \rightarrow \mathbb{R}^2 \setminus \mathbb{D}_{1-\delta}$ be this isometry.

For $x, y \in M \setminus M_\delta$ denote

$$(2.15) \quad |x| := |\Phi(x)|, \quad |x - y| := |\Phi(x) - \Phi(y)|, \quad \text{and} \quad \frac{x}{|x|^2} := \Phi^{-1} \left(\frac{\Phi(x)}{|\Phi(x)|^2} \right) \in \tilde{M} \setminus M_\delta,$$

then define the distribution $G_{0,\text{prin}}(x; y) \in \mathcal{D}'(M \times M)$ by

$$(2.16) \quad G_{0,\text{prin}}(x; y) = \frac{\kappa(x; y)}{2\pi} \left[\log |x - y| - \log \left| x \cdot \left(y - \frac{x}{|x|^2} \right) \right| \right],$$

where $\kappa(x; y) = \kappa_1(x) \cdot \kappa_1(y) \cdot \kappa_0(x; y)$ and $\kappa_1 \in C^\infty(M), \kappa_0(x; y) \in C^\infty(M \times M)$ are smooth cutoff functions on M with the properties that

$$(2.17) \quad \begin{cases} \kappa_1(x) \equiv 1 & \text{if } \rho_0(x) \leq \delta/4 \\ \kappa_1(x) \equiv 0 & \text{if } \rho_0(x) \geq \delta/3 \end{cases} \quad \text{and} \quad \begin{cases} \kappa_0(x; y) \equiv 1 & \text{if } d_{\bar{g}_0}(x; y) < \delta/4 \\ \kappa_0(x; y) \equiv 0 & \text{if } d_{\bar{g}_0}(x; y) > \delta/3 \\ \kappa_0(x; y) \equiv \kappa_0(y; x) & \text{for all } x, y \in M. \end{cases}$$

Remark 2.9. The distribution

$$(2.18) \quad G_{0,\text{prin},\mathcal{A}}(z_1; z_2) = \frac{1}{2\pi} \left[\log |z_1 - z_2| - \log \left| z_1 \cdot \left(z_2 - \frac{z_1}{|z_1|^2} \right) \right| \right]$$

is the symmetric Green's function on the unit disc, with the properties of (2.11) for the Euclidean metric g_{Euc} [14, Section 2.2 Equation (41)]. We therefore have

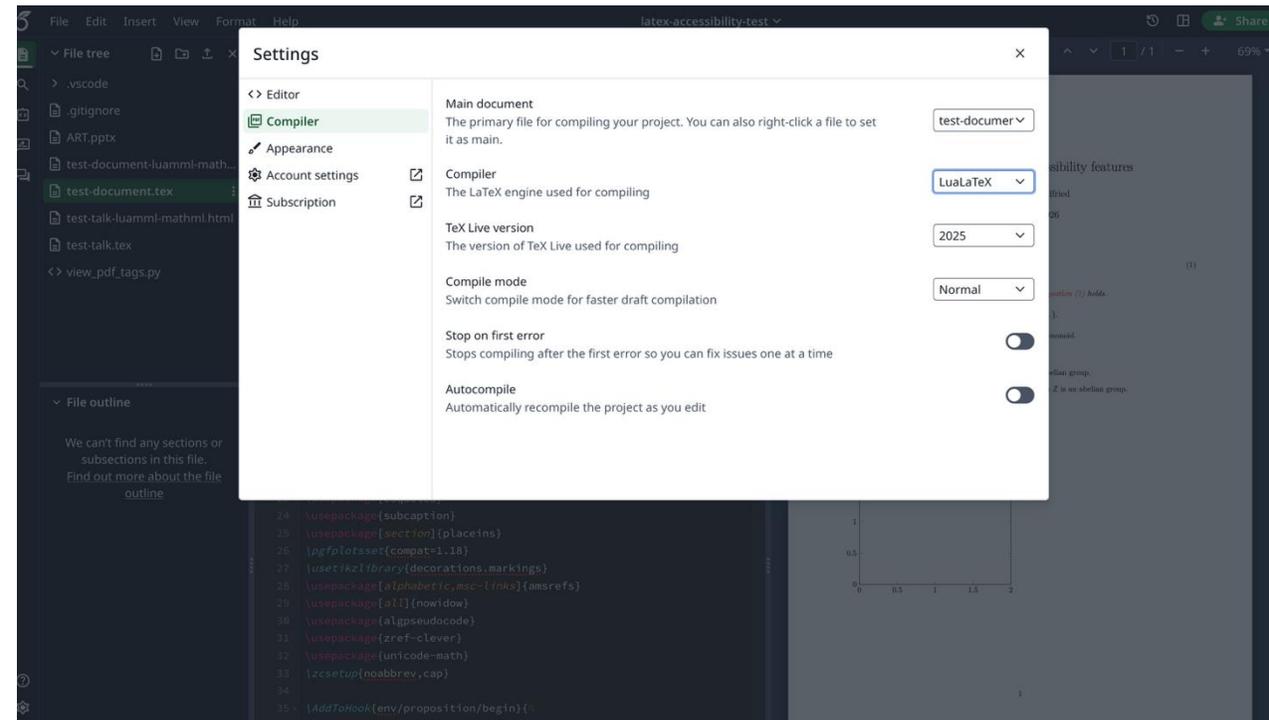
Tagged PDF

- “New” standards add ‘tagging support’
 - PDF 2.0 (Originally specified in 2017, clarified in 2020)
 - Complete mathematics support
 - LaTeX3/LaTeX tagging project (started 2018)
 - Proper support since August 2025
- Minimal author input required
- <https://youtu.be/oCTsAqZqm9A?t=1288>



“Minimal author input”

- TeXLive ≥ 2025.11
- LuaLaTeX
- 4 lines of code
 - `\DocumentMetadata{uncompress, lang=en-AU, tagging=on, pdfstandard=ua-2,pdfstandard=a-4f}`
- Alternate text for images



“Maximal author input”

- LaTeX has been expanded by packages and classes
 - **amsmath**
 - **hyperref**
 - etc
 - **article**
 - **amsart**
- \geq 4000 packages total
 - ~1700 in the database
 - 747 fully compatible
 - 239 partially compatible
- Author needs to check compatibility
 - **amsart** (and its derivatives)
 - **beamer**
 - **tikz** (and its derivatives)
 - **cleveref**
- How many packages do you use?
 - Outdated (using base TeX)

How does a mathematician write mathematical documents

- Have a “starting document” or class with packages
- Copy this document every time you start a new project

```
test-document.tex > ...
1 \DocumentMetadata{uncompress, lang=en-GB,
2 tagging=on,
3 tagging-setup={math/setup=mathml-SE},
4 pdfstandard=ua-2, pdfstandard=a-4f}
5
6 \documentclass{article}
7 \usepackage[british]{babel}
8 \usepackage{amsmath}
9 \usepackage{amsthm}
10 \usepackage{amssymb}
11 \usepackage{wasysym}
12 \usepackage{graphicx}
13 \usepackage{mathtools}
14 \usepackage[bottom]{footmisc}
15 \usepackage[a4paper, margin=1in]{geometry}
16 \usepackage[dvipsnames]{xcolor}
17 \usepackage[colorlinks=true, linkcolor=Red, citecolor=Green]{hyperref}
18 \usepackage{caption}
19 \usepackage[no-math]{fontspec}
20 \usepackage{tikz-cd}
21 \usepackage[depth=2]{bookmark}
22 \usepackage{pgfplots}
23 \usepackage{csquotes}
24 \usepackage{subcaption}
25 \usepackage[section]{placeins}
26 \pgfplotsset{compat=1.18}
27 \usetikzlibrary{decorations.markings}
28 \usepackage[alphabetic, msc-links]{amsrefs}
29 \usepackage[all]{nowidow}
30 \usepackage{algpseudocode}
31 \usepackage{zref-clever}
32 \usepackage{unicode-math}
33 \zcsetup{noabbrev, cap}
34
35 \AddToHook{env/proposition/begin}{%
36 \zcsetup{countertype={definition=proposition}}}
37
38 \AddToHook{env/lemma/begin}{%
39 \zcsetup{countertype={definition=lemma}}}
40 \AddToHook{env/remark/begin}{%
41 \zcsetup{countertype={definition=remark}}}
42 \AddToHook{env/example/begin}{%
43 \zcsetup{countertype={definition=example}}}
44 \AddToHook{env/corollary/begin}{%
45 \zcsetup{countertype={definition=corollary}}}
46 \theoremstyle{plain}
47 \newtheorem{theorem}{Theorem}
48 \newtheorem*{theorem*}{Theorem}
49
50 \theoremstyle{definition}
51 \newtheorem{definition}{Definition}
52 \newtheorem{proposition}[definition]{Proposition}
```

Tips for making accessible documents

- Use LaTeX instead of “plain TeX”
 - `\(inline mathmode \)` instead of `$ inline mathmode $`
 - `\[display mathmode \]` instead of `$$ display mathmode $$`
- Give good descriptive alternative texts to figures
- Don't make paragraphs by newlines `\\`
- Remove any unnecessary packages/classes
 - **ltx-talk** instead of **beamer**
 - **article** instead of **amsart**
 - **zref-clever** instead of **cleveref**
 - Etc
- Use dyslexia-friendly fonts
- Use **contrasting** colours

One-time investment into making accessible documents

Using tagged PDFs

- PDF-readers such as Adobe Acrobat Reader and Foxit reader
- Screen readers also need support for MathML
 - NVDA + MathCAT add-on
 - <https://www.nvaccess.org/download/>
 - <https://nvda-addons.org/addon.php?id=272>
- Windows only ☹️



Checking if the document is accessible

- The “new” pdf standard is still not widely supported
- Canvas accessibility checker
- Manually check with NVDA + MathCAT on a Windows PC
 - Unimelb has remote Windows desktops
 - <https://rcp.research.unimelb.edu.au/>
- **Don't make documents less accessible to satisfy Canvas!**

The screenshot displays a PDF accessibility checker interface. At the top, it shows "Page 1 of 1" and a notification "6 Images without a description". The main content area shows a document titled "A short test to check accessibility features" by Emanuel József Godfried, dated 4th March 2026. The document includes several sections: "Here is some text, and below an equation" with a red box highlighting "1 / 6"; "Theorem 1. If $\triangle ABC$ has a right angle $\angle C = 90^\circ$ then Equation (1) holds."; "Definition 1. The natural numbers are the set $\mathbb{N} = \{1, 2, \dots\}$ "; "Proposition 2. The natural numbers form a commutative monoid."; "Proposition 2 has the following corollary."; "Corollary 3. Grothendieck group construction $\mathbb{Z}[S]$ is an abelian group."; "Corollary 3 is equivalent to saying that the group of integers \mathbb{Z} is an abelian group." Below the text is a commutative diagram with nodes A, B, C, D and arrows A to B, A to C, B to D, C to D. At the bottom is a coordinate system with y-axis values 1, 1.5, 2. On the right side, the accessibility score is 58% for "test-document-1.pdf". Below the score, it states "This PDF contains images without description" and provides buttons for "What this means" and "How to add descriptions". At the bottom right, there is a section for "Upload a version with image descriptions" with a "Browse" button and a "Help" icon.

Make maths accessible to everyone!

- Find more information and documentation and discussion
 - <https://latex3.github.io/tagging-project/>
 - <https://github.com/latex3/tagging-project>
 - <https://www.reddit.com/r/LaTeX/>
 - https://www.reddit.com/user/u_fischer/

