CREATING ACCESSIBLE MATERIALS

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1 INTRODUCTION

2 GOALS TODAY

- Awareness of your current practices
- Simple and effective techniques when authoring materials
- News of current and emerging technological solutions
- NOT: what **accessibility** means
- NOT: why accessibility is important

3 BACKGROUND

- A First Course In Linear Algebra: textbook born with an open license (2004)

- PreTeXt: a system for authoring and publishing scholarly documents with open licenses (2013)

  - A modern replacement for LaTeX
  - Over 100 textbooks with open licenses
  - This talk is not *meant* to be a PreTeXt advertisement

- UTMOST—NSF CCLI/TUES/IUSE supported research studies (2010-14, 2016-22)
- Braille production: National Federation of the Blind, American Institute of Mathematics (2019)

4 WHY MAKE MATERIALS ACCESSIBLE?

W3 Web Accessibility Initiative (WCAG 2.0, ISO/IEC 40500)

The Web is fundamentally designed to work for all people, whatever their hardware, software, language, location, or ability. When the Web meets this goal, it is accessible to people with a diverse range of hearing, movement, sight, and cognitive ability.

Thus the impact of disability is radically changed on the Web because the Web removes barriers to communication and interaction that many people face in the physical world. However, when websites, applications, technologies, or tools are badly designed, they can create barriers that exclude people from using the Web.

Accessibility is essential for developers and organizations that want to create high-quality websites and web tools, and not exclude people from using their products and services.

5 PRACTICAL EXAMPLES

6 COLOR

- Color is an effective way to communicate an extra layer of information
- But is totally ineffective for some readers
- Use color, but also use a "black-and-white" mechanism
- Contrast is important for links, highlight, hover, etc.
- There are well-defined (mathematical) standards for contrast
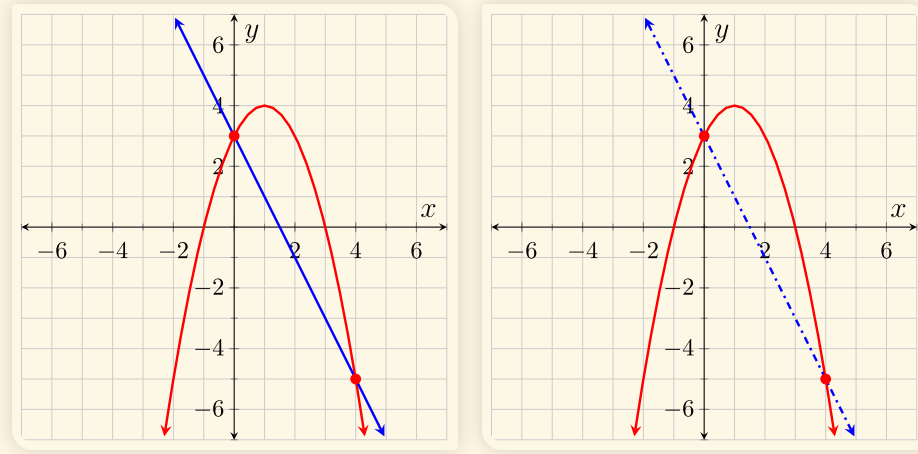
Left is bad, right is better.

Credit (right): Calculus Lab Manual, Portland Community College

8 CONTRAST

PreTeXt has 17 color schemes, all designed with acceptable levels of contrast.

This "pastel blue/orange" theme is evident in the Contents sidebar.

9 IMAGE DESCRIPTIONS (AKA "ALT TEXT")

The lefthand graph is a lattice of subgroups of the group (identity, sigma, tau, mu). The righthand graph is a lattice of subfields of the rationals with the square root of three and the square root of five attached. The group (identity, sigma, tau, mu) has subgroups (identity, sigma), (identity, tau), and (identity, mu). At level three there is the subgroup (identity), which is contained in all subgroups. The field of the rationals with the square root of three and the square root of five attached, has subfields of the rationals with the square root of three attached, the rationals with the square root of five attached, and the rationals with the square root of fifteen attached. At level three there are the rationals which are contained in all of the fields above.

Credit: Abstract Algebra: Theory and Applications, Judson

10 AN ILL-ADVISED IMAGE DESCRIPTION

A curve that begins at point A at (0,-2), then increases concave down to a absolute maximum at a point B at (1,3). Then the curve decreases, still concave down...

Credit (image only!): APEX Calculus, Hartman, Fitzpatrick, et al.

Video clip from Portland Community College

YouTube `eks3r-nE9lU`, link at end

(Separate window)

12 MOBILITY AND INTERACTIVITY

- Demonstration: keyboard shortcuts for rotatable 3D figures (Asymptote)
- Demonstration: Applied Linear Algebra, Austin

- Interactive Demos (blind readers, too?)

  - Geogebra
  - Desmos
  - Sage Interacts

13 VIDEOS

- Captions: for viewers who *cannot* hear the audio, so includes text describing *sounds*.
- (Subtitles: for viewers who *do not know* the language in use.)
- Demonstration: ORCAA, human transcription (not automatic!)
- Demonstration: PreTeXt Demo, captions supplied by author

Credit: ORCCA (Open Resources for Community College Algebra), Portland Community College

14 WEB PAGES, HTML

- Create according to standards, so screen readers behave
- Elements for structure, as semantic as possible
- Use CSS and class names for presentation
- (PreTeXt does this all for you)

- Demonstration: Skip to Main Content

  - Approximately 100 sections
  - "Tabbing" hits *all* of these first

- Javascript library to render LaTeX in web pages
- (Formerly jsMath)
- Lead: Davide Cervone, also Volker Sorge, Peter Krautzberger

- Speech Rule Engine

  - Sub-project: convert LaTeX to text/speech
  - Also converts to Nemeth braille
  - Lead: Volker Sorge

- Can also process LaTeX offline (!)
- Always: the "enabling technology" for PreTeXt

16 MATHJAX AND SCREEN READERS

- Text versions of LaTeX *always* available, once activated
- Embedded so that a screen-reader will pick them up
- Expressions can be "walked" as trees
- No plug-ins or extra software necessary beyond a screen-reader
- Demonstration: Seperable DiffEqs, Active Calculus

Credit: Active Calculus, Boelkins, et al.

17 BRAILLE

Braille is a complicated markup language (many, really), not unlike LaTeX or PreTeXt.

- Six dots per cell, alphabet size $2^6 = 64$
- Grade 1: literal translation of characters
- Grade 2: many "contractions": 2-3-4-6 cell = "the"
- Nemeth (1972): mathematics (advanced), switch like LaTeX "$"

18 BRAILLE PRODUCTION

- Initiated January 2019
- Begin with PreTeXt source
- Convert math via Speech Rule Engine
- Convert literary text via `liblouis`
- `liblouis` also formats lines and pages
- Display on an electronic one-line reader (refreshable pins)
- Emboss on paper, 40 lines of 25 cells
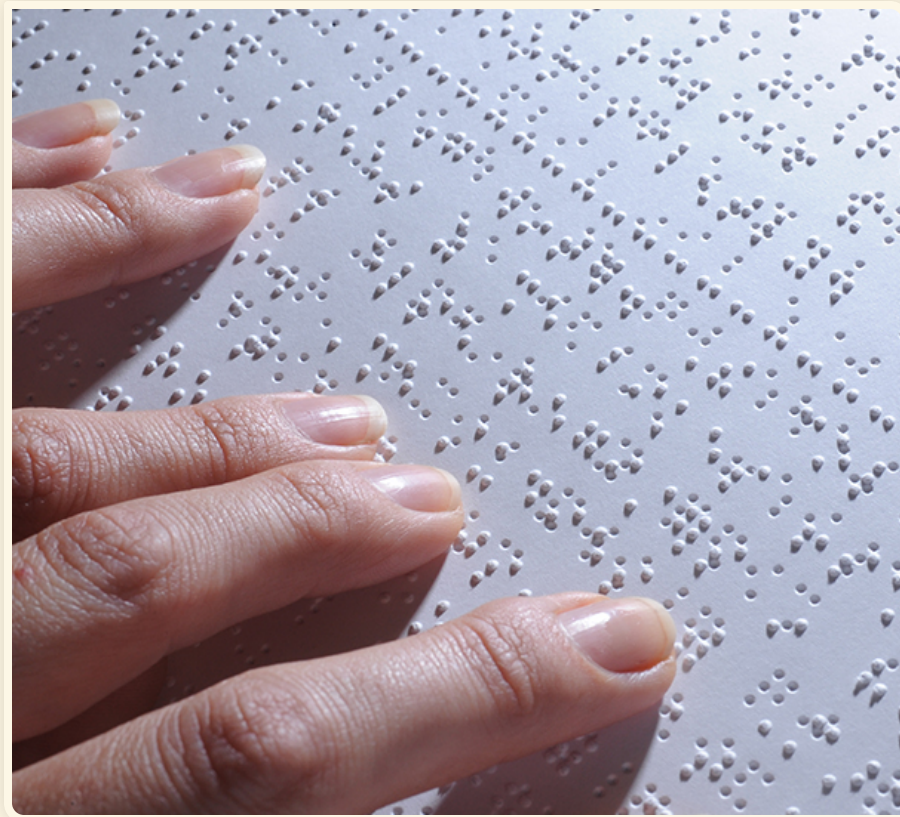
Meta-example: slide with W3 statement from beginning.

```
      ,slide #d ,:y ,make ,mat}ials
           ,a3essible8

  ,w#c ,web ,a3essibil;y ,9itiative
"<,,wcag #b4j1 ,,iso_/,,iec #djejj">
  ,! ,web is funda;tally design$ to "w =
all p1 :at"e _! h>dw>e1 s(tw>e1
language1 loca;n1 or abil;y4 ,:5 ! ,web
meets ? goal1 x is a3essible to p ) a
div}se range ( he>+1 move;t1 si<t1 &
cognitive abil;y4
  ,?us ! impact ( 4abil;y is radically
*ang$ on ! ,web 2c ! ,web removes b>ri}s
to communica;n & 9t}ac;n t _m p face 9 !
physical _w4 ,h{"e1 :5 websites1
applica;ns1 te*nologies1 or tools >e
badly design$1 !y c cr1te b>ri}s t
exclude p f us+ ! ,web4
  ,a3essibil;y is ess5tial = develop}s &
organiza;ns t want to cr1te hi<-qual;y
websites & web tools1 & n exclude p f
us+ _! products & s}vices4
```

20 AUDIO BOOKS

- Experimental!
- Speech Rule Engine converts math to text/speech
- Convert PreTeXt to text
- Provide timing marks (chapters, sections)
- Voice via services like Amazon Polly

21 PDF AND EPUB

- PDF

  - PDF is a great precursor for a print-on-demand hardcopy book
  - But a physical book is a poor model for an electronic format
  - Margins, hyphenation, page breaks, page numbers, …
  - There are LaTeX/PDF accessibility efforts (link later)
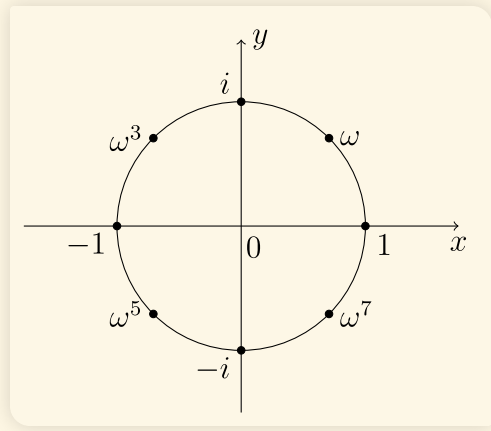
- EPUB

  - We like making EPUB better as an offline format
  - For example, an EPUB reflows with a font size change
  - There are accessibility standards for EPUB (unexplored, link later)

22 FROM THE LABS

23 GRAPHICS: ACCESSIBLE?

The 8-th roots of unity in the complex plane. Authored in TikZ (drawing library for LaTeX).

Credit: Abstract Algebra: Theory and Applications, Judson

24 GRAPHICS: TACTILE WITH BRAILLE AND MORE ACCESSIBLE

- Braille cells and diagram embossable on ViewPlus Tiger
- Diagram components labeled with individual descriptions
- Goal: also explorable like MathJax expressions (Peter Krautzberger)
- Demonstration: "tab" through components of the image
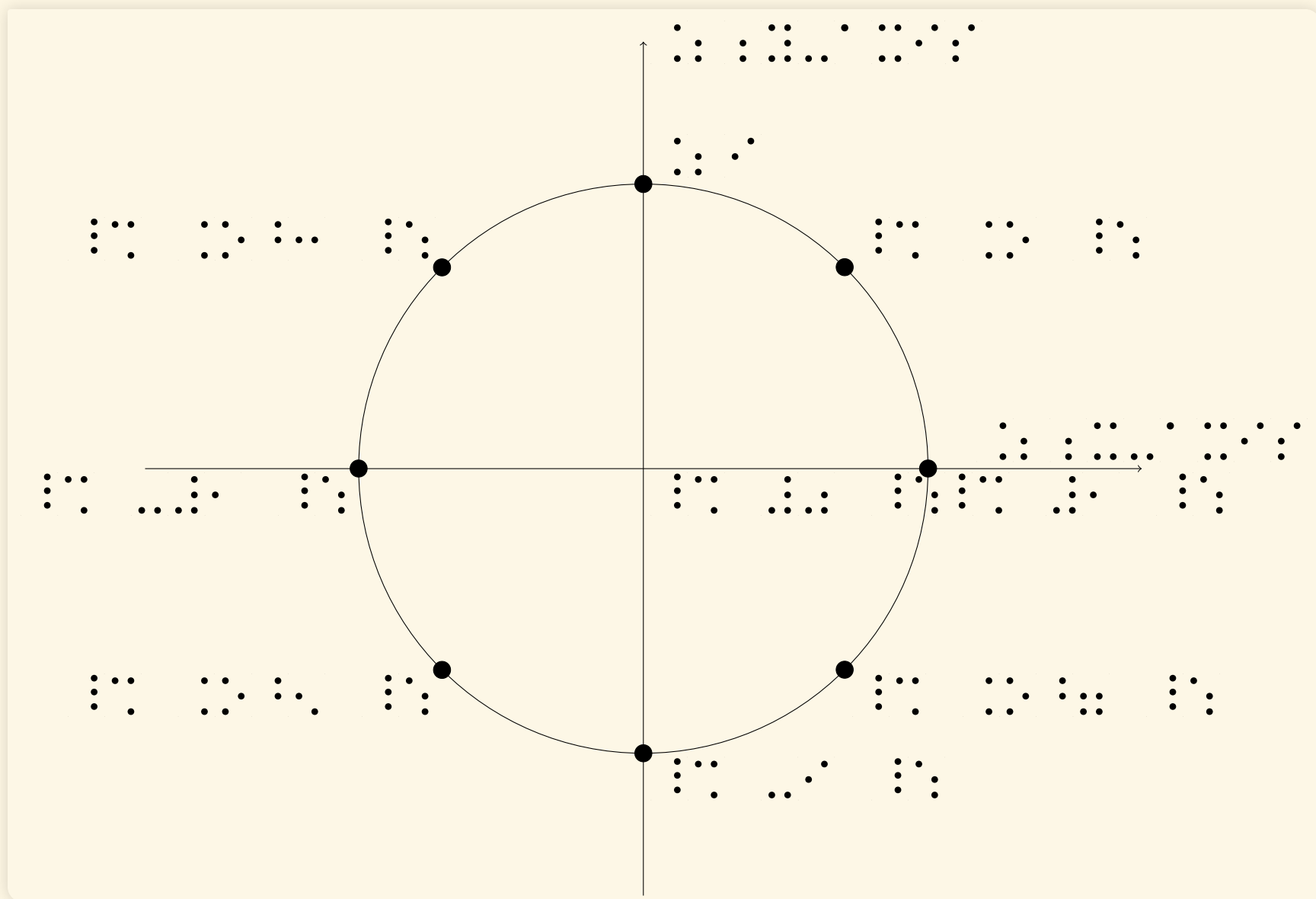
25 CONCLUSION

26 LINKS

- `buzzard.ups.edu/talks.html`
- `pretextbook.org`
- PreTeXt Accessibility Discussion
- PCC Mobility Video, YouTube `eks3r-nE9lU` (at 4:08)
- TeX Users' Group "PDF accessibility and PDF standards"
- EPUB Accessibility Specification

27 ACKNOWLEDGEMENTS