Technology *enabled* mathematical science education

Bridging Research and Practice

Emma Cliffe

Defining the problem

- Enabling access
  - Defining the problem
  - From research to practice
  - Change
- What next?
  - Dissemination and core challenges

We want. . .

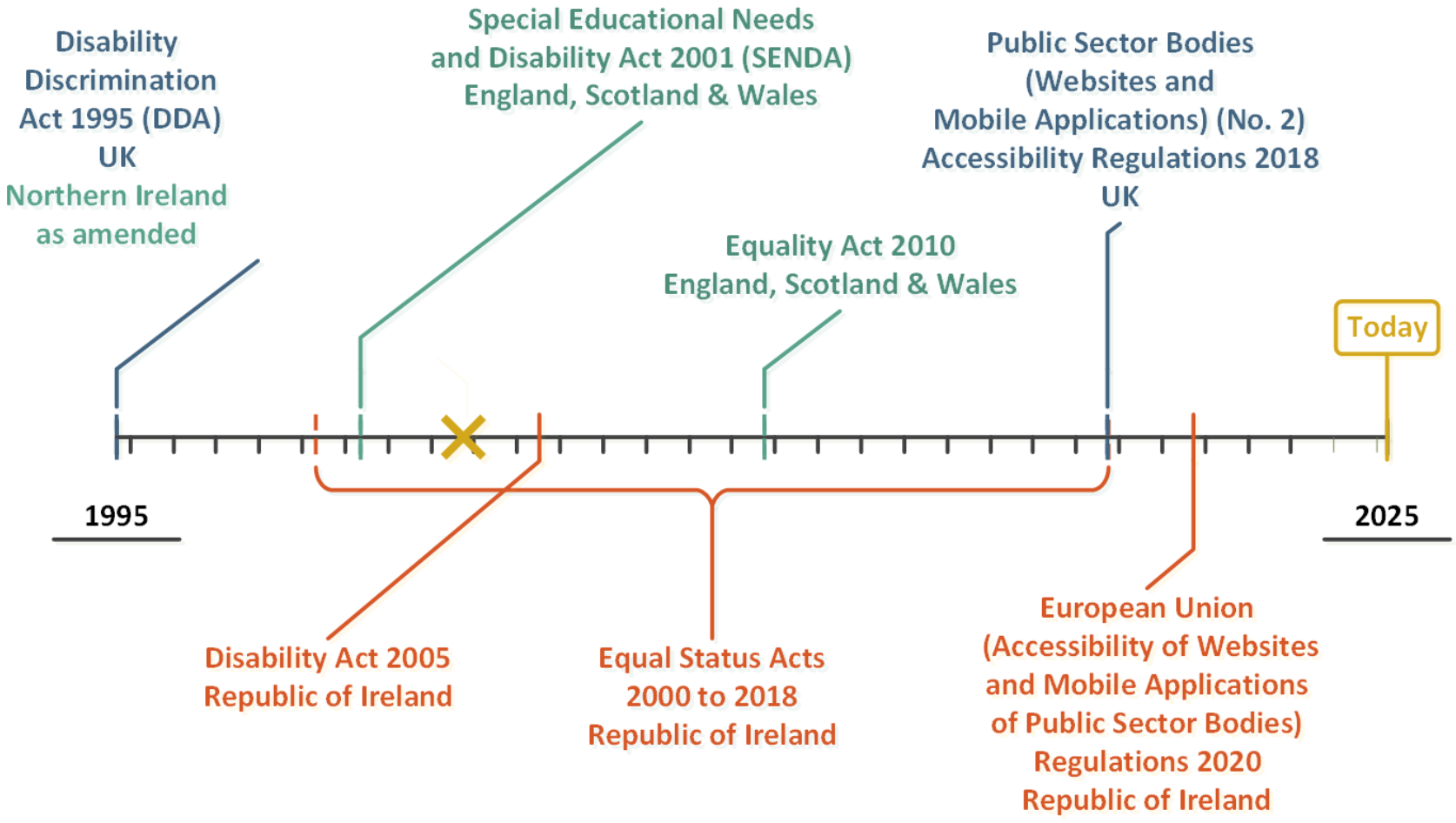
. . . to enable access to mathematical content by:

- People using assistive technology
- People reading on small screen devices, e-book readers. . .
- People searching, copying and pasting
- People verifying reproducibility of results
- Software parsing, transforming, generating and manipulating input and output
- AIs consuming and generating mathematical content. . . ?

But. . .

$$x \not= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Legal


Disability Discrimination Act 1995 (DDA) UK Northern Ireland as amended
Special Educational Needs and Disability Act 2001 (SENDA) England, Scotland & Wales
Equality Act 2010 England, Scotland & Wales
Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations 2018 UK
Today
1995
2025
Disability Act 2005 Republic of Ireland
Equal Status Acts 2000 to 2018 Republic of Ireland
European Union (Accessibility of Websites and Mobile Applications of Public Sector Bodies) Regulations 2020 Republic of Ireland

From research to practice

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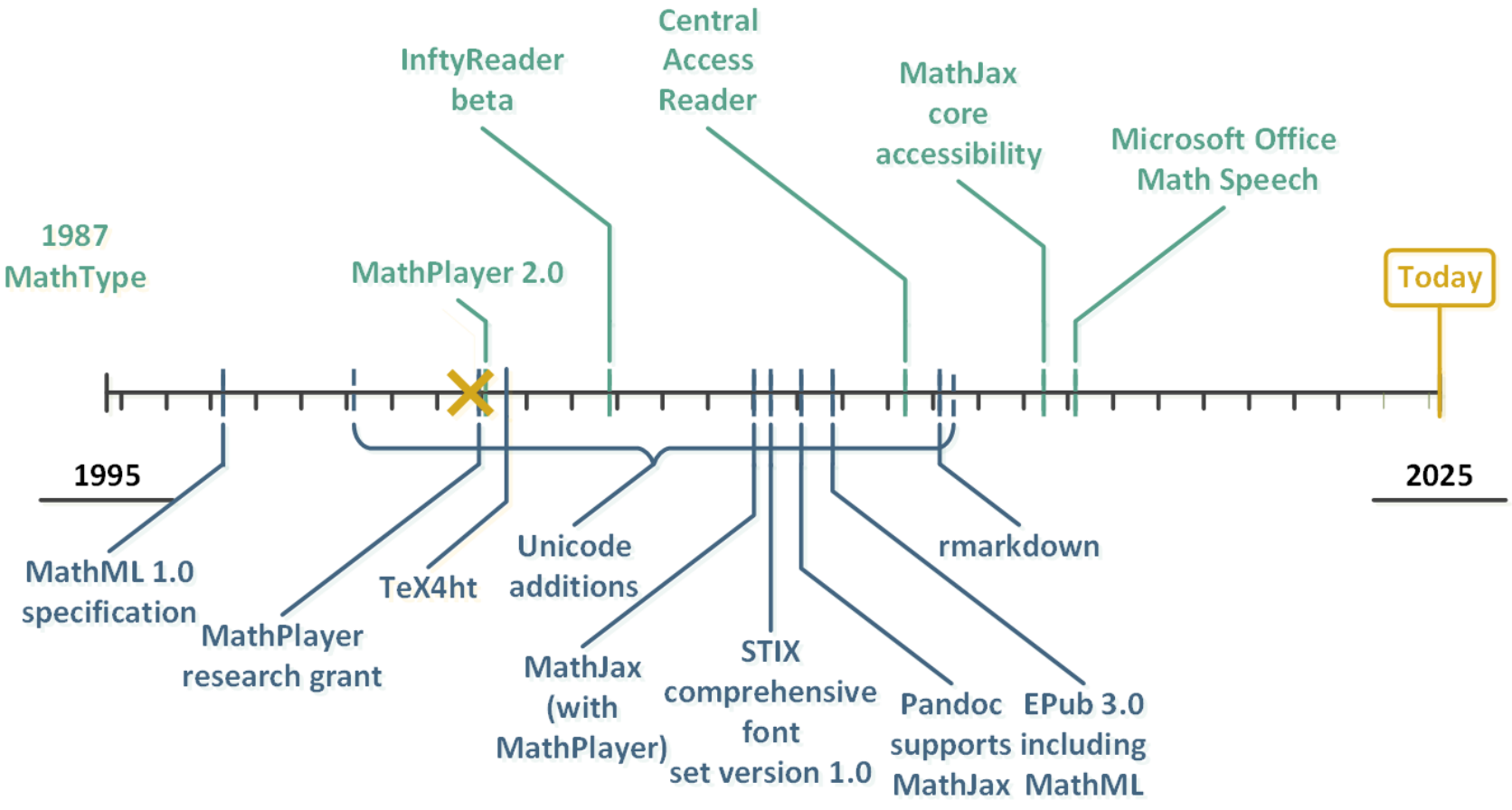
Technical


1987
MathType
InftyReader
beta
MathPlayer 2.0
Central
Access
Reader
MathJax
core
accessibility
Microsoft Office
Math Speech
Today
1995
2025
MathML 1.0
specification
MathPlayer
research grant
TeX4ht
Unicode
additions
MathJax
(with
MathPlayer)
STIX
comprehensive
font
set version 1.0
Pandoc
supports
MathJax
EPub 3.0
including
MathML
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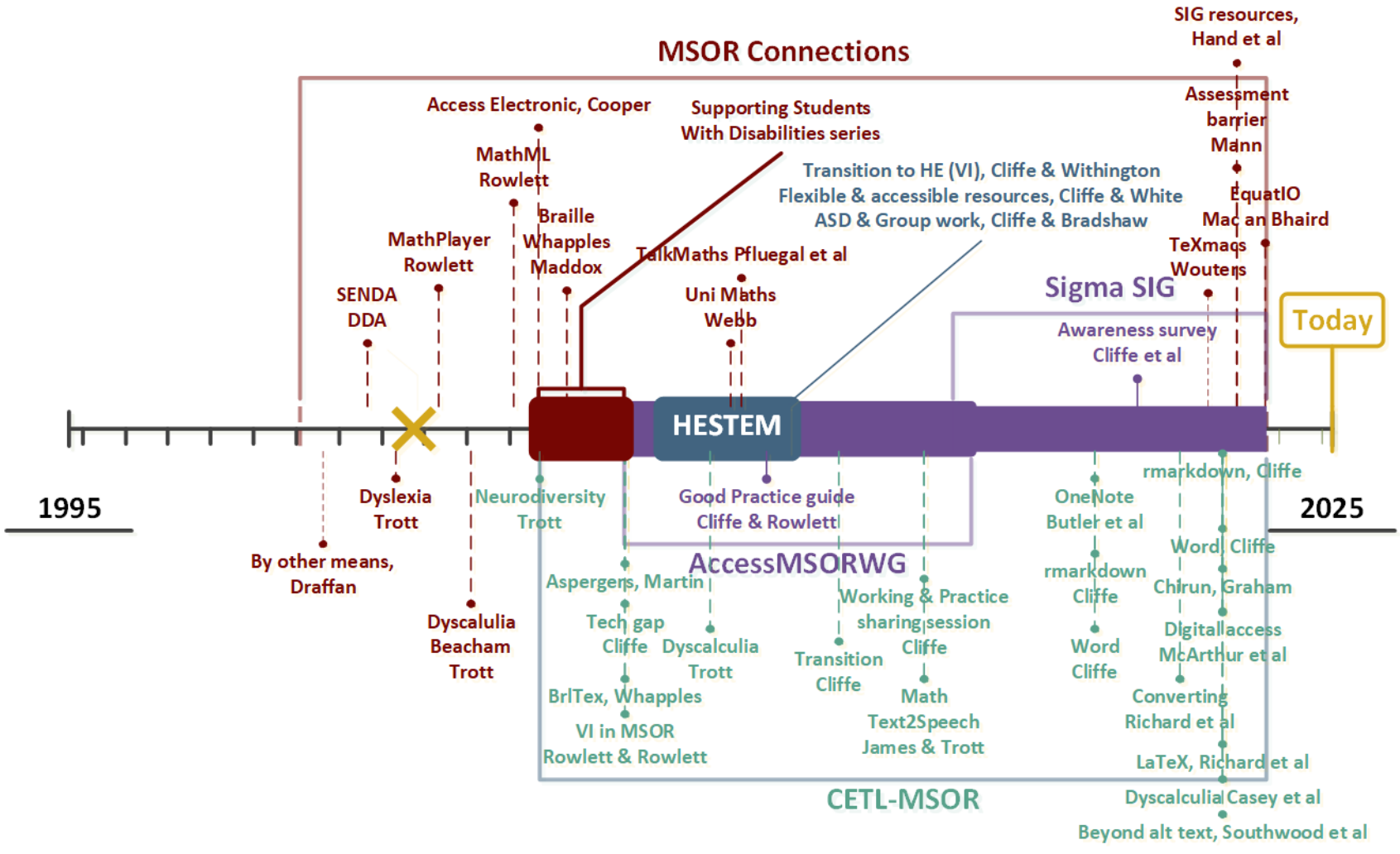
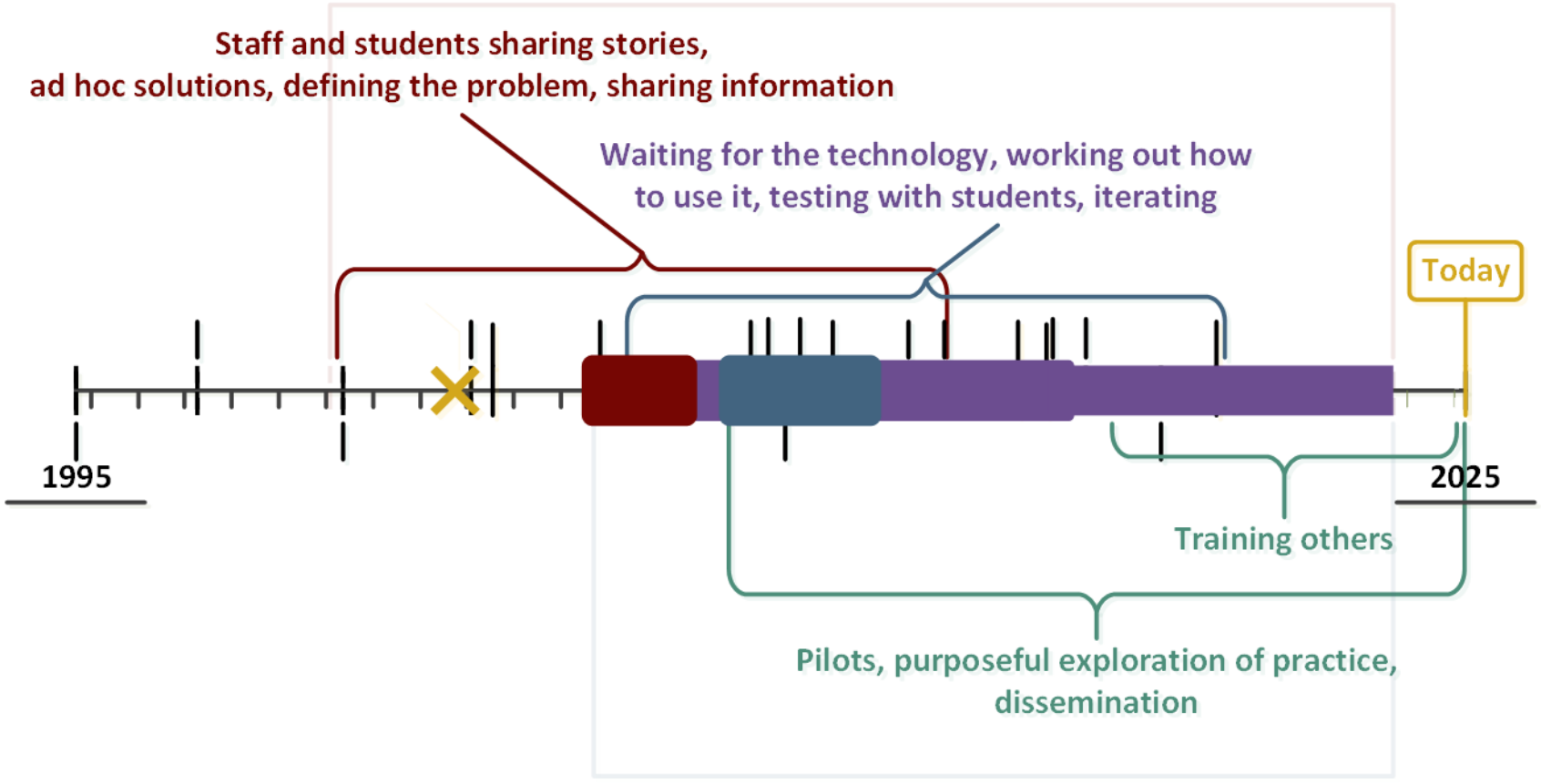
Practitioners



Phases


Staff and students sharing stories,
ad hoc solutions, defining the problem, sharing information
Waiting for the technology, working out how
to use it, testing with students, iterating
Today
1995
2025
Training others
Pilots, purposeful exploration of practice,
dissemination

Change

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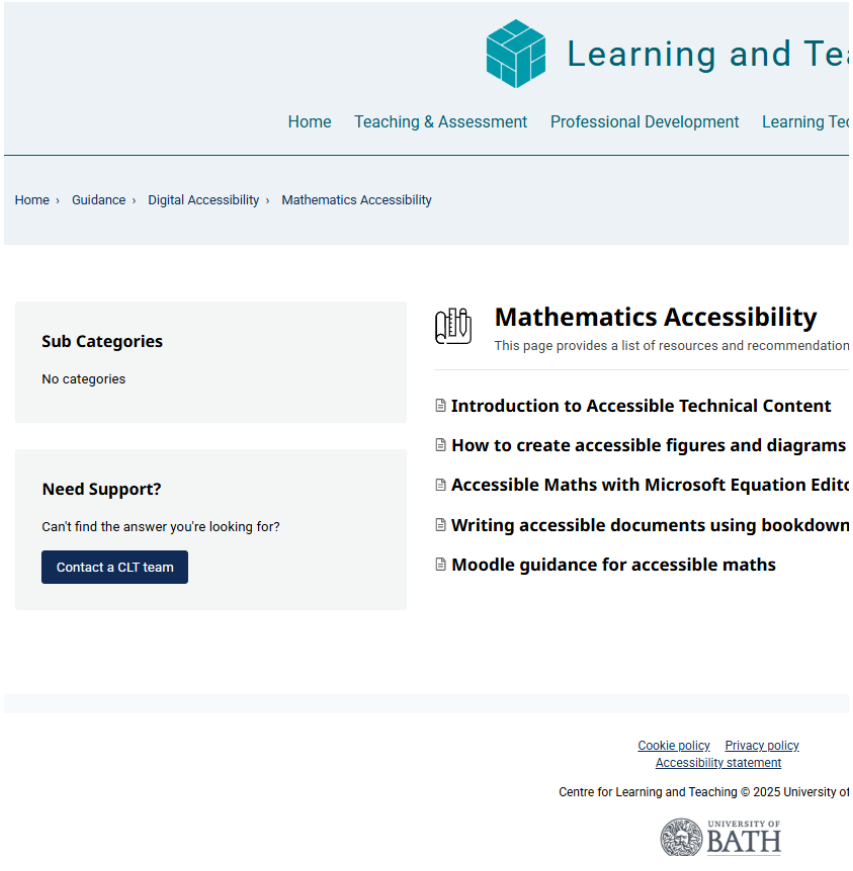
CLT & Lecturers



Lecture notes (pdf)

Last updated on Feb 3rd.

Lecture notes (html)

Week 3: Feb 17

Problem Sheet 3

Problem Sheet 3 (html)

Problem Sheet 3 Solutions

Problem Sheet 3 Solutions (html)

Problem class recording

MASH & Everyone!

Maths support

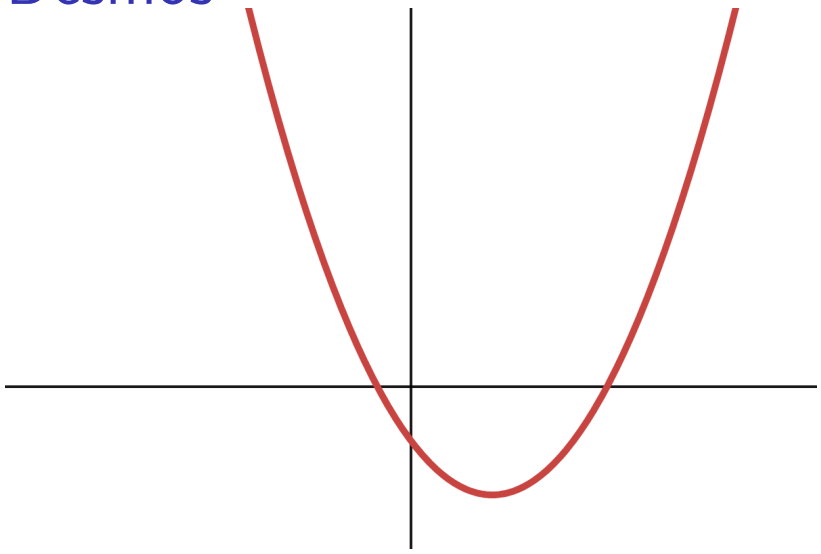
On this page

- Directing students to us
- Maths teaching support
- Individual student referrals

MathJax

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Desmos



Interactive accessible version of the quadratic graph

What next?

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Getting started. . .

- RMarkdown, Bookdown and possibly ClavertonDown
- Quarto
- Chirun
- LWarp
- PreTeXt
- Word
- Desmos and Geogebra
- BrailleR

Dissemination

We are still doing this, now others are too... Can you:

- Have a go yourself and tell others?
- Join JISC Accessibility Community Maths Working Group
- Consider and communicate regarding the implications for mathematical pedagogy?
- Consider and communicate regarding the implications for open and reproducible science?
- Build functionality into software and packages you create so that users automatically produce accessible output?

Diagrams

- It is possible to use Desmos, some functionality of Geogebra and the BrailleR package to help make accessible diagrams
- This is nowhere near sufficient or flexible enough to represent the variety of diagrams we produce in e.g. TikZ
- These formats are not easily consumed and manipulated by other software or AIs

Meaning

- We are no longer losing syntactic structure
- We are still losing enough of the semantics *known to the author* that things we want to do are affected
  - Sometimes the author encodes these in their LaTeX
  - Not always though...
- Consider

$$|\{(a, b) \mid a \in A, b \in B\}|$$

Questions and discussion

Thank you for your time! Papers for discussion:

- Authoring Web-accessible Mathematical Diagrams.
- Author Intent: Eliminating Ambiguity in MathML., Pre-print

Slides: https://ehcliffe.github.io/TEMSE2025/

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Mathematics Resources Centre

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