ASCIIMathML 2.0: A free way to add Formulas and Graphs to Webpages

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The problem

1. How to make computers display and understand e.g.:

$$\sin^{-1} \sqrt{\log_e e} = \frac{\pi}{2}$$

2. How to create and interact with visual mathematical content to learn from graphs and diagrams

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Text based input

- Keyboards are the most widely used form of character-based input

- Likely to remain true for at least another decade

- But want to communicate math content easily online

- Chat, read, edit email replies in a non-proprietary way

- Most math formulas on a computer are produced by:

  1. LaTeX (free, high quality, difficult for students)

  2. computer algebra systems: Mathematica, Maple, Scientific Notebook, ... (nonportable, expensive)

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Aims of a convenient linear math notation

- Close to standard mathematics

  Motto: if it looks like math, it should work

- Easy to read

- Easy to type

- Formulas should be short

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- Syntax easy to define and remember

- Mostly language independent

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Examples of ASCIIMath

$\lim_{x\to\infty} \tan^{-1}x = \frac{\pi}{2}$

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lim_(x->oo)tan^-1x = pi/2
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$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$

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sum_(n=1)^oo 1/n^2 = pi^2/6
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$\int_{-1}^{1} \sqrt{1-x^2}dx = \frac{\pi}{2}$

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$[0,1) = \{x \in \mathbb{R} : 0 \le x < 1\}$

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These examples carry students a long way

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How to use ASCIIMathML.js

- Implemented in a single JavaScript file
- Conversion to MathML is done as the web page loads
- Makes MathML work in **HTML** in Firefox **and** IE

```
<html>
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<script type="text/javascript" src="ASCIIMathML.js"></script>
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Some formulas: `sum_(i=1)^n i=(n(n+1))/2`
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How about visual content

A graph can be included by typing e.g.

agraph plot(sin(x)) endagraph

Each graph can be **modified** by the reader **directly on the webpage**, to allow for a hands-on learning experience.

Interactive dynamic pictures are possible with minimal programming.

Ease of use: A new **auto-math-recognize** mode allows formulas and text to be freely mixed

E.g. Let m,b in RR and consider the line y = m x + b.

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- Downloaded by thousands of users around the globe

- Integrated into many wikis (MediaWiki, PmWiki,...), blogs (Blogger), course management systems (Moodle)

- Now includes ASCIIsvg and a scientific calculator

- ASCIIMath serverside in PHP [Chan 2004], Perl [Nodine 2006]

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- **Few** (school/undergrad) students know how to type mathematics

- Most math homework is **handwritten**

- Math tests are often multiple choice (presentation is not tested)

- Mathematics seems **oldfashioned** to computer savvy youth

- Mathematics education is affected **negatively**

- Difficult to help students by **email** or **chat**

- Online **interactive** math content is **low**

- Ironically, it's hard to **do** math on a computer!

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- Math tests are often multiple choice (presentation is not tested)
- Mathematics seems **oldfashioned** to computer savvy youth
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Conclusion

- Math uses formulas since they are **short** and **precise**

- Typed linear math notation needs to be **standardized**

- ASCIIMath is **system neutral** and fairly language independent

- Also **easy** to learn, use and implement (on top of MathML)

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Acknowledgements

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