

Sage: Open Source Mathematical Software

<http://www.sagemath.org>

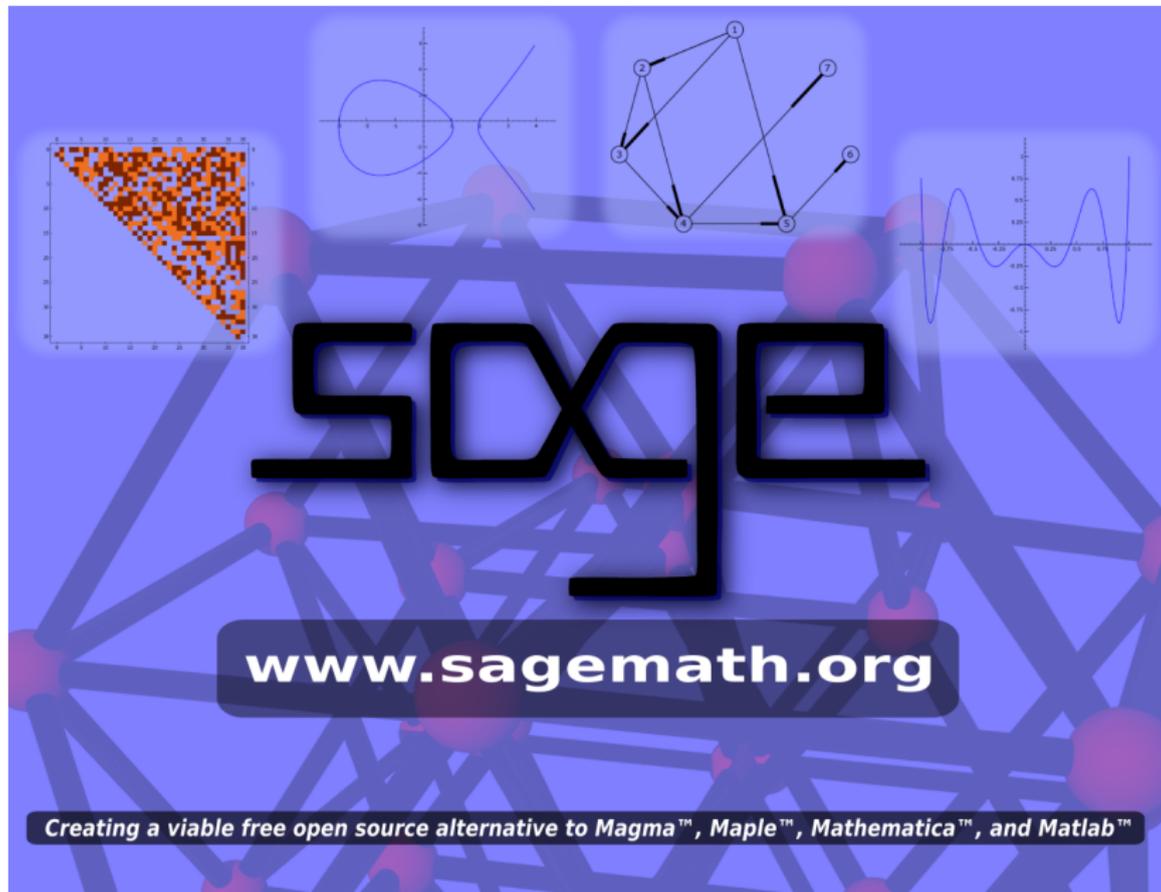
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January 14, 2010



Sage: Creating a viable free open source alternative to Magma, Maple, Mathematica, and Matlab

The background of the slide features a blue gradient with a network of grey lines and red nodes. Overlaid on this are several mathematical plots: a heatmap in the top left, a cardioid curve in the top center, a directed graph with nodes 1-7 in the top right, and a sine wave in the middle right. The word 'Sage' is written in a large, bold, black, stylized font in the center. Below it, the website address 'www.sagemath.org' is displayed in white text on a dark blue rounded rectangle. At the bottom, a black banner contains the text 'Creating a viable free open source alternative to Magma™, Maple™, Mathematica™, and Matlab™' in white. In the bottom right corner, there are three small white icons: a magnifying glass, a search icon, and a refresh icon.

Sage

www.sagemath.org

Creating a viable free open source alternative to Magma™, Maple™, Mathematica™, and Matlab™

History: I started the Sage project...

1997–1999 (**Berkeley**) **HECKE** – C++ (modular forms)

1999–2004 (**Berkeley, Harvard**) I wrote over 25,000 lines of **Magma** code.

Feb 2005 I released **SAGE-0.1** (almost 5 years ago)

Feb 2006 **UCSD SAGE Days 1** workshop – SAGE 1.0. ...

May 2007 Sage NSF grant: funds Clement Pernet. [...]

October 2007 **Clay Math Institute SAGE Days 5** workshop.

Nov. 2007 Sage wins Tropheés du Libre

Nov. 2007 **Heilbronn Institute SAGE Days 6**

Feb,Mar 2008 **IPAM Sage Days 7; Austin Sage Days 8**

...

Dec 2009 **Sage Days 18** on BSD at Clay Math Institute.

January 2010 **Sage Days 19** (bug days): starts Saturday.

See <http://wstein.org/mathsoftbio/> for way more background details.

- I must be able to **see inside and be able to change anything** in my math software in order to do first rate computational number theory research.
- Open Source: analogous **understanding the proofs** of theorems you use in your research, instead of just taking them all as black boxes.
- Also, I **care about graduate students** and forcing them to use expensive closed software to do research with me is mean.

Nov 2007: Sage wins first place in Trophées du Libre and gets slashdotted...



Science: Open Source 'Sage' Takes Aim at High End Math Software

Posted by [CmdrTaco](#) on Saturday December 08, @09:15AM
from the [that'll-take-awhile](#) dept.

[coondoggie](#) writes

"A [new open source mathematics program](#) is looking to push aside commercial software commonly used in mathematics education, in large government laboratories and in math-intensive research. The program's backers say the software, called Sage, can do anything from mapping a 12-dimensional object to calculating rainfall patterns under global warming."



octave, sage, it, software, maxima (*tagging beta*)

[Read More...](#) | science.slashdot.org

[259](#) of [333](#) comments

Tons of articles all over resulted, about 10,000 downloads in a weekend, etc...



Mission Statement

Provide a uniform open source high-quality **viable alternative** to **Magma, Mathematica, Maple** and **MATLAB**.

When possible, do not reinvent the wheel but **reuse existing building blocks**. Make code that is:

- rigorously tested,
- easy to modify,
- very well documented, and
- peer reviewed.

Also create a **helpful environment** and community (mailing lists, irc-channel, workshops, coding sprints). There are 1588 subscribers to sage-support, 1118 subscribers to sage-devel and about 3000 messages a month.

What is Sage?

Sage is a very large mathematics software package developed by a worldwide community of over 200 developers. Sage is:

- 1 a **huge new library**, filling in gaps in functionality so Sage covers a wide range of algebraic, scientific, and statistical computing.
- 2 a **distribution** of the best free, open-source mathematics software available (Sage ships nearly 100 packages) that is easy to compile or install from binaries.
- 3 **interfaces** to almost all existing mathematics software packages (including Magma, PARI, GAP, Matlab, Mathematica, Maple, etc.)

Who Funds and Supports Sage Development?



CLAY
MATHEMATICS
INSTITUTE



Microsoft

Google

Python Binds all things in Sage Together

Python is a modern mainstream programming language.

- “Python is fast enough for our site and allows us to **produce maintainable features in record times**, with a minimum of developers,” said Cuong Do, Software Architect, **YouTube.com**.
- “Google has made no secret of the fact they use Python a lot for a number of internal projects. Even knowing that, once **I was an employee, I was amazed at how much Python code there actually is in the Google source code system.**”, said Guido van Rossum, **Google**, creator of Python.
- “Python plays a key role in our production pipeline. Without it a project the size of **Star Wars: Episode II** would have been very difficult to pull off. From crowd rendering to batch processing to compositing, **Python binds all things together**,” said Tommy Burnette, Senior Technical Director, **Industrial Light & Magic**.



Python

- A mainstream language with millions of users.

Cython: compiled Python, tightly integrated with Sage:

- Growing and getting used in other projects...
- Cython is a “killer feature”: *Maple, Mathematica, and Magma have nothing like this*

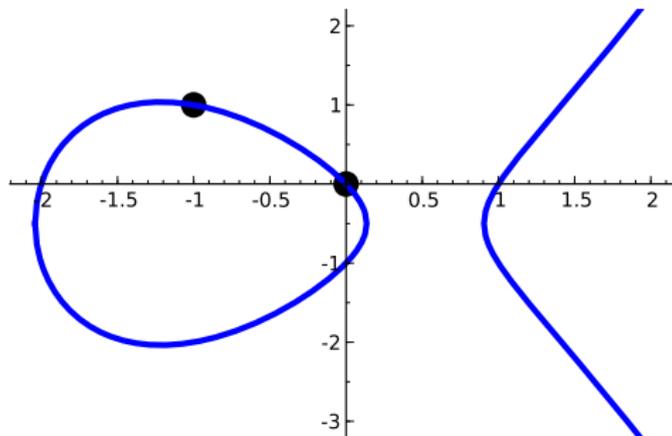
A Powerful Web-based Graphical User Interface

public notebooks available at <http://www.sagenb.org>

The screenshot shows a web browser window titled "Copy of 2.5.1 dirichlet characters (SAGE)". The address bar shows the URL "http://localhost:8000/home/admin/15/". The page header includes "SAGE Notebook" and user information "admin | Toggle | Home | Published | Log | Help | Sign out". The main title is "2.5.1 dirichlet characters" with a timestamp "last edited on November 07, 2007 08:49 PM by admin". Below the title are buttons for "Save", "Save & close", and "Discard changes". A menu bar contains "File...", "Action...", "Data...", "sage", "Print", "Use", "Edit", "Text", "Revisions", "Share", and "Publish". The content area is titled "SAGE Tutorial" and includes navigation links: "Previous: 2.5 Number Theory", "Up: 2.5 Number Theory", and "Next: 2.6 Linear Algebra". The main heading is "2.5.1 Dirichlet Characters". The text describes a Dirichlet character as an extension of a homomorphism $(\mathbf{Z}/N\mathbf{Z})^* \rightarrow R^*$ to a map $\mathbf{Z} \rightarrow R$. Below the text are three code input boxes: the first contains `G = DirichletGroup(21)` and `list(G)`, the second contains `G.gens()`, and the third contains `len(G)`. The output of the third box is "12". At the bottom, a note says "Having created the group, we next create an element and compute with it." and a "Done" button is visible.

- graphical user interface
- plotting
- LaTeX typesetting
- remote access
- worksheet sharing
- interface to 3rd party systems, e.g. Magma

Demo

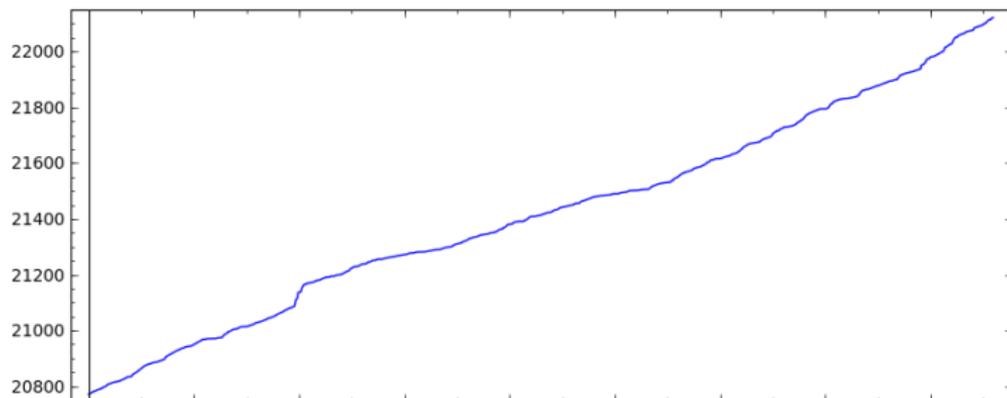


Getting Started With Sage

Web page: <http://www.sagemath.org>

- 1 Install Sage on your computer, or
- 2 Fully use Sage online at <http://www.sagenb.org>
- 3 Books, papers, and thousands of pages of documentation
- 4 Helpful mailing lists

Last 722.4 hours (30 days)



Number of <http://sagenb.org> accounts during the last month