

Sage: Open Source Mathematical Software

<http://www.sagemath.org>

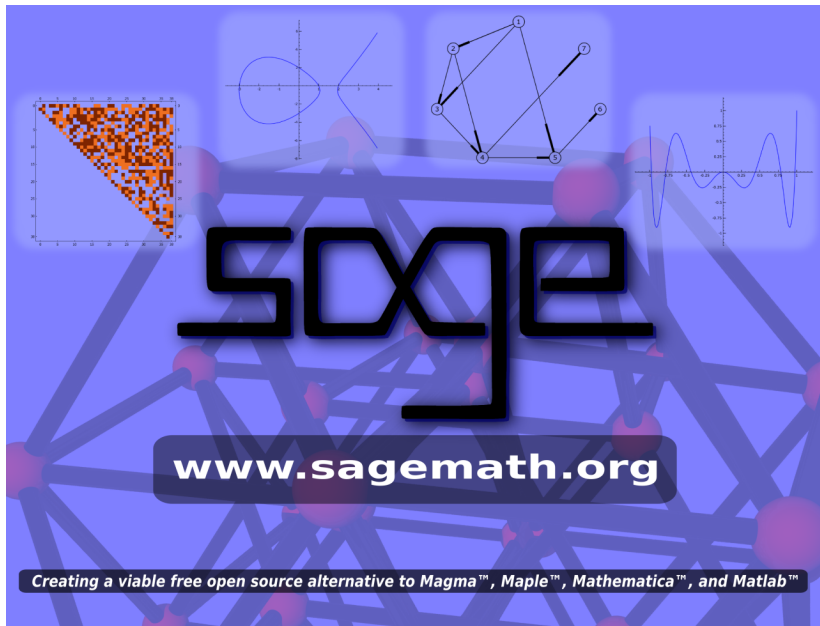
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Sage: Creating a viable free open source alternative to Magma, Maple, Mathematica, and Matlab

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 Tropheés 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*

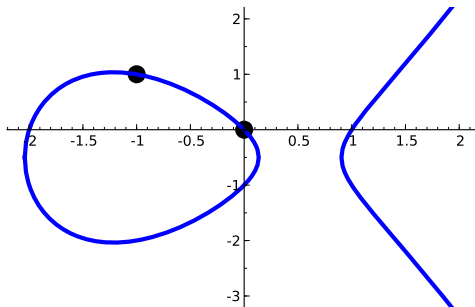
A Powerful Web-based Graphical User Interface

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 section title 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

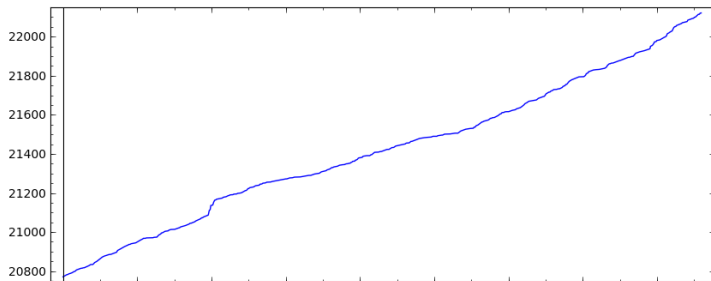


Getting Started With Sage

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