

Getting Started With SAGE

This document will help you get started using SAGE after it has been installed on your PC or if you are accessing SAGE from a server on the Internet. A more complete version of this document can be found at (http://sage.math.washington.edu/home/tkosan/newbies_book/)

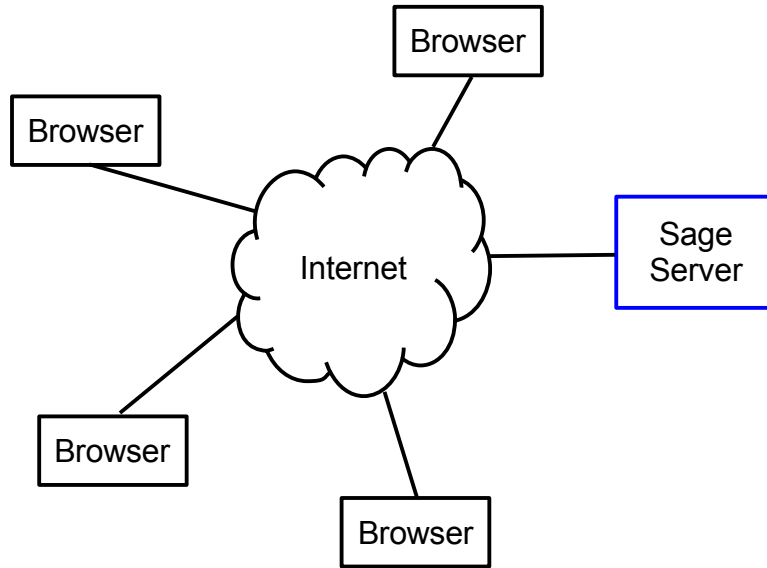
SAGE As A Web Service

The ways in which SAGE can be used are as flexible as its architecture. Most SAGE beginners, however, will first use SAGE as a web service which is accessed using a web browser. Any copy of SAGE can be configured to provide this web service. Figure 1 shows 3 SAGE web service scenarios.

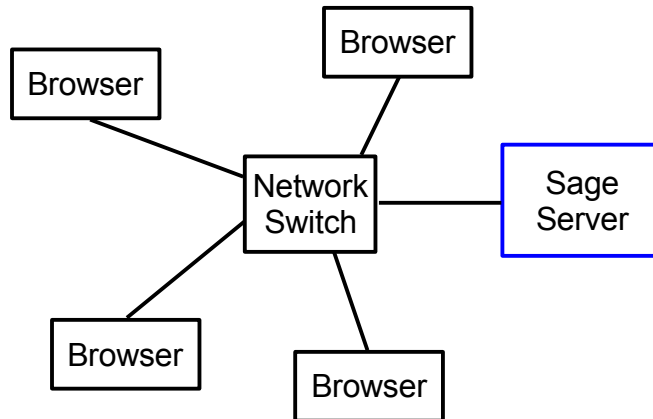
(See the next page)

Figure 1 3 Sage Web Service Usage Scenarios

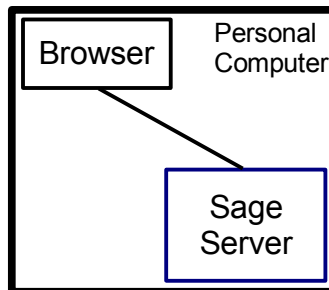
Scenario 1:
Sage web service
available on the
Internet.



Scenario 2:
Sage web service
available on a
Local Area Network.



Scenario 3:
Sage web service
available on the same
computer that the
browser is running on.



Accessing SAGE As A Web Service Using Scenario 1

SAGE currently works best with the Firefox web browser and if you do not yet have Firefox installed on your computer, it can be obtained at <http://mozilla.com/firefox>.

The SAGE development team provides a public SAGE web service at (sagenb.com) and this service can also be accessed from the top of the SAGE homepage. We will now walk through the steps that are needed to sign up for an account on this public SAGE web service.

Open a Firefox browser window and enter the following into the URL bar:

`http://sagenb.org`

The service will then display a Welcome page (see Fig. 2)

SAGE Mathematics Software: Welcome!

SAGE is a different approach to mathematics software.

The SAGE Notebook

With the SAGE Notebook anyone can create, collaborate on, and publish interactive worksheets. In a worksheet, one can write code using SAGE, Python, and other software included in SAGE.

General and Advanced Pure and Applied Mathematics

Use SAGE for studying calculus, elementary to very advanced number theory, cryptography, commutative algebra, group theory, graph theory, numerical and exact linear algebra, and more.

Use an Open Source Alternative

By using SAGE you help to support a viable open source alternative to Magma, Maple, Mathematica, and MATLAB. SAGE includes many high-quality open source math packages.

Use Most Mathematics Software from Within SAGE

SAGE makes it easy for you to use most mathematics software together. SAGE includes GAP, GP/PARI, Maxima, and Singular, and dozens of other open packages.

Use a Mainstream Programming Language

You work with SAGE using the highly regarded scripting language Python. You can write programs that combine serious mathematics with anything else.

Sign into the SAGE Notebook

Username:

Password:

[Sign up for a new SAGE Notebook account](#)

[Browse published SAGE worksheets
\(no login required\)](#)

Figure 2

The SAGE web service is called a SAGE **Notebook** because it simulates the kind of notebook that mathematicians traditionally use to perform mathematical calculations. Before you can access the Notebook, you must first sign up for a Notebook account. Select the **Sign up for a new SAGE Notebook account** link and a registration page will be displayed. (see Fig. 3)

Sign up for the SAGE Notebook.

Username:

Password:

Email Address:

[Cancel and return to the login page](#)

Figure 3

Enter a username and password in the Username and Password text boxes and then press the **Register Now** button. A page will then be displayed that indicates that the registration information was received and that a confirmation message was sent to the email address that you provided.

Open this email and select the link that it contains. This will complete the registration process and then you may go back to the Notebook's **Welcome** page and log in.

After successfully logging into your Notebook account, a **worksheet management** page will be displayed. (see Fig. 4)

SAGE Notebook tkosan2 | [Home](#) | [Published](#) | [Log](#) | [Help](#) | [Sign out](#)

[New Worksheet](#) [Upload](#)

Current Folder: [Active](#) [Archived](#) [Trash](#)

<input type="checkbox"/>	Active Worksheets	Owner / Collaborators	Last Edited
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Figure 4

Physical mathematics notebooks contain worksheets and therefore SAGE's virtual notebook contains worksheets too. The worksheet management page allows worksheets to be created, deleted, published on the Internet, etc. Since this is a newly created Notebook, it does not contain any worksheets yet.

Create a new worksheet now by selecting the **New Worksheet** link. A worksheet can either use special mathematics fonts to display mathematics in traditional form or it can use images of these fonts. If the computer you are working on does not have mathematics fonts installed, the worksheet will display a message which indicates that it will use its built-in image fonts as an alternative. (see Fig. 5)

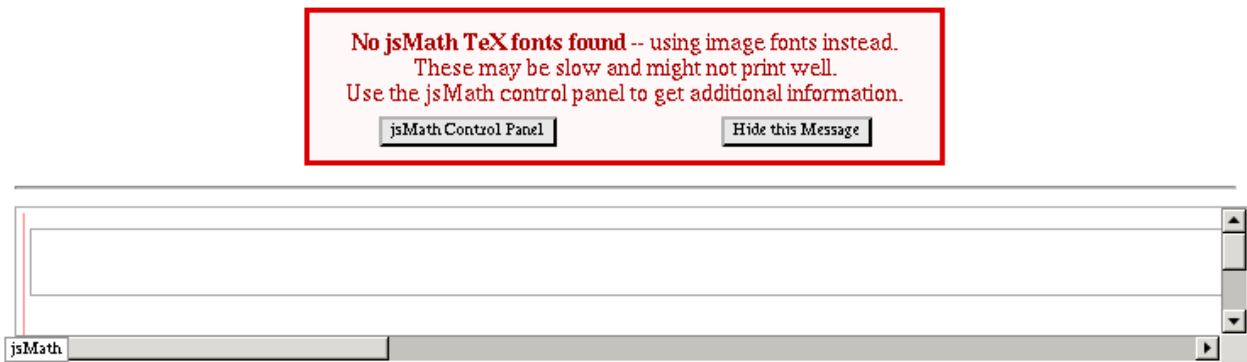


Figure 5

The image fonts are not as clear as normal mathematics fonts, but they are adequate for most purposes. Later we will cover how to install mathematics fonts on your computer but for now, just press the **Hide this Message** button and a page which contains a blank worksheet will be shown. (see Fig. 6)

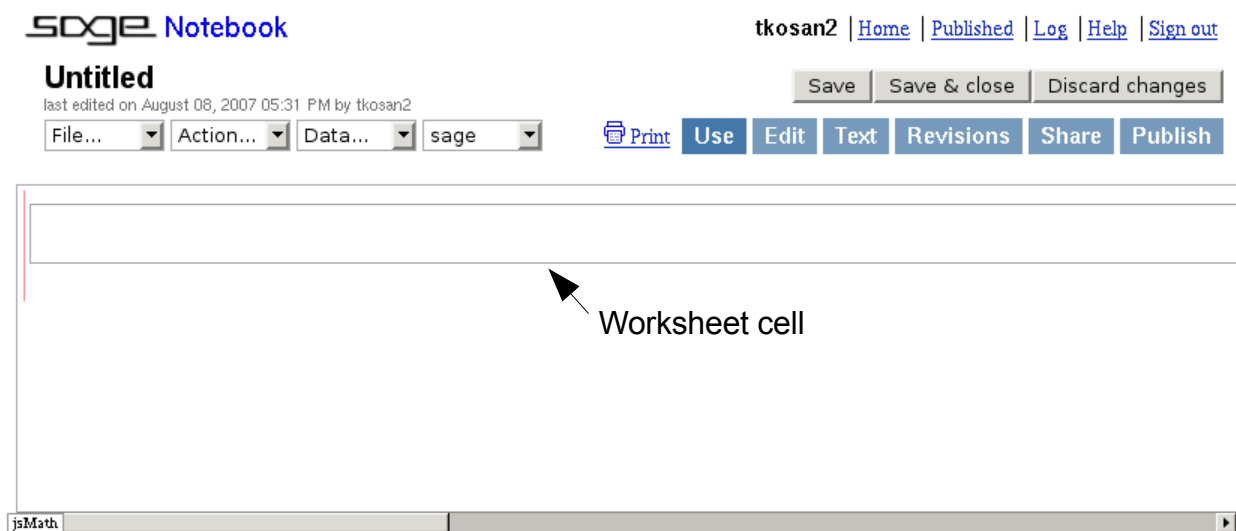


Figure 6

Worksheets contain 1 or more **cells** which are used to enter source code that will be executed by SAGE.

Cells have rectangles drawn around them as shown in Figure 6 and they are able to grow larger as more text is entered into them. When a worksheet is first created, an initial cell is placed at the top of its work area and this is where you will normally begin entering text.

Entering Source Code Into A SAGE Cell

Lets begin exploring SAGE by using it as a simple calculator. Place your mouse cursor inside of the cell that is at the top of your worksheet. Notice that the cursor is automatically placed against the left side of a new cell. You must always begin each line of SAGE source code at the left side of a cell with no indenting (unless you are instructed to do otherwise).

Type the following text, but do not press the enter key:

2 + 3

your worksheet should now look like Figure 7.

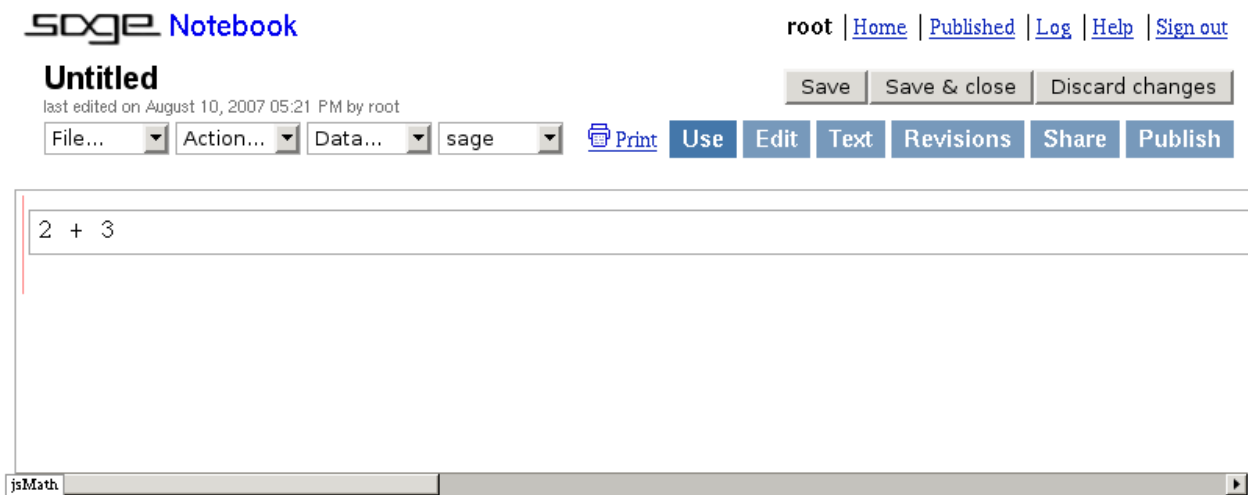


Figure 7

At this point you have 2 choices. You can either press the **enter key** <enter> or you can **hold down the shift key and press the enter key** <shift><enter>. If you simply press the enter key, the cell will expand and drop the cursor down to the next line so you can continue entering source code.

If you press shift and enter, however, the Worksheet will take all the source code that has been typed into the cell and send it to the SAGE server through the network so the server can execute the code. When SAGE is given source code to execute, it will first process it using software called the **SAGE preprocessor**. The preprocessor converts SAGE source code into Python source code so that it can be executed using the Python environment that SAGE is built upon.

The converted source code is then passed to the Python environment where it is compiled into a special

form of machine language called **Python bytecode**. The bytecode is then executed by a program that emulates a hardware CPU and this program is called the **Python interpreter**.

Sometimes the server is able to execute the code quickly and sometimes it will take a while. While the code is being executed by the server, the Worksheet will display a small green vertical bar beneath the cell towards the left side of the window as shown in Figure 8.

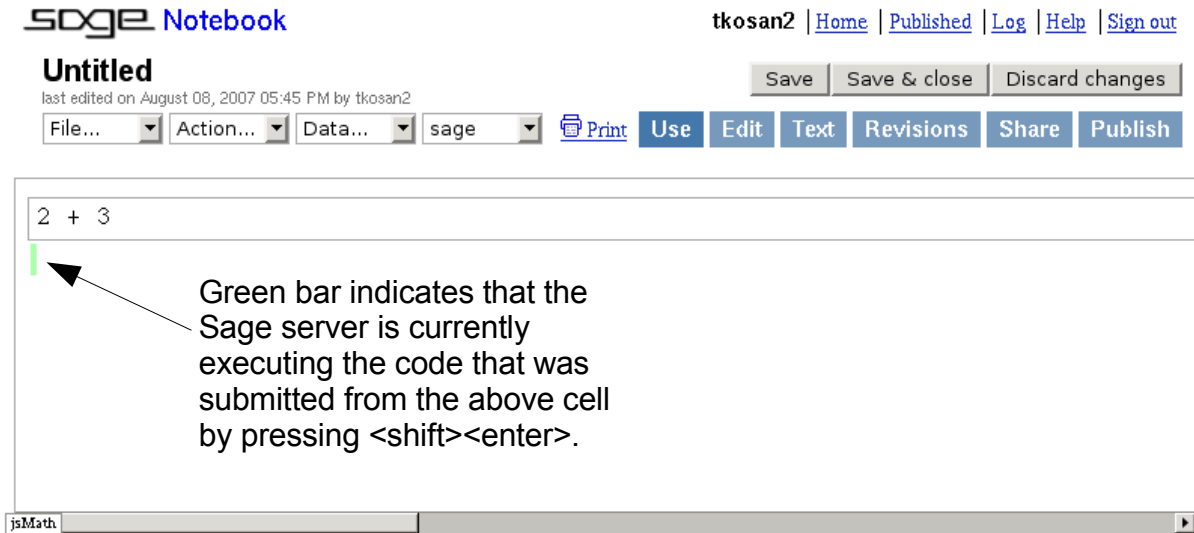


Figure 8

When the server is finished executing the source code, the green bar will disappear. If a displayable result was generated, this result is sent back to the Worksheet and the Worksheet then displays it in the area that is directly beneath the cell that the request was submitted from.

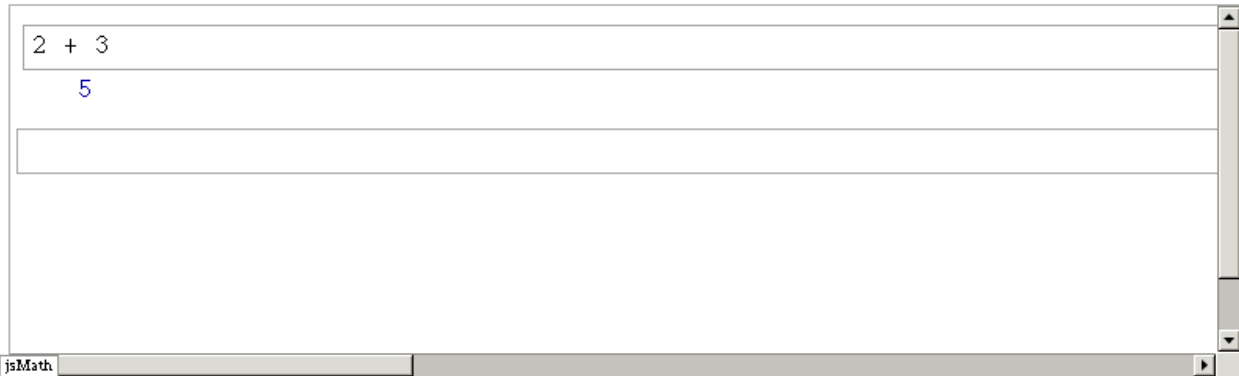
Press shift and enter in your cell now and in a few moments you should see a result that looks like Figure 9.

Untitled

last edited on August 08, 2007 05:45 PM by tkosan2

Save Save & close Discard changes

File... Action... Data... sage Print Use Edit Text Revisions Share Publish

*Figure 9*

If code was submitted for execution from the bottom cell in the Notebook, a blank cell is automatically added beneath this cell when the server has finished executing the code.

(A more complete version of this document can be found at http://sage.math.washington.edu/home/tkosan/newbies_book/)