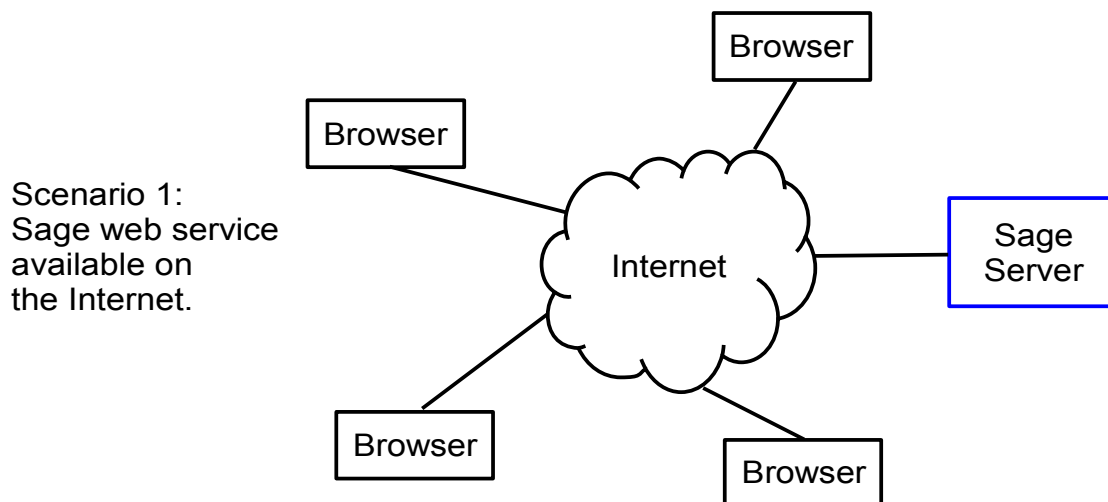
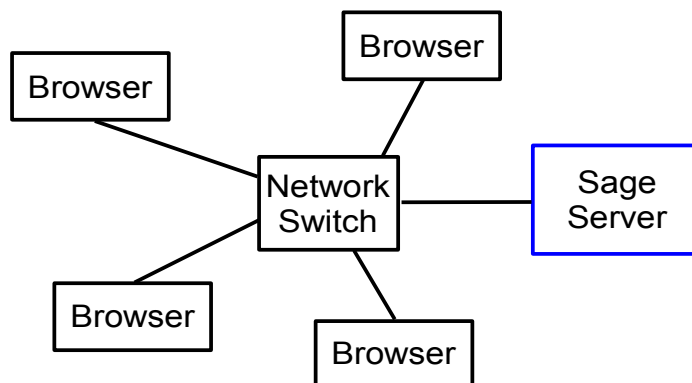


101 2.3 Accessing SAGE As A Web Service

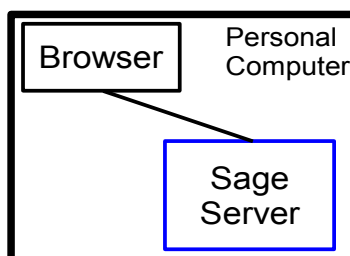
102 The ways in which SAGE can be used are as flexible as its architecture. Most
103 SAGE beginners, however, will first use SAGE as a web service which is accessed
104 using a web browser. Any copy of SAGE can be configured to provide this web
105 service. Drawing 2.1 shows 3 SAGE web service scenarios:



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.



Drawing 2.1: Three SAGE web service scenarios.

2.3.1 Accessing SAGE As A Web Service Using Scenario 1

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

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

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

114 `http://sagenb.com`

115 The service will then display a Welcome page (see Drawing 2.2)

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
\(no login required\)](#)

Drawing 2.2: SAGE Welcome screen.

116 The SAGE web service is called a SAGE **Notebook** because it simulates the kind
 117 of notebook that mathematicians traditionally use to perform mathematical
 118 calculations. Before you can access the Notebook, you must first sign up for a
 119 Notebook account. Select the **Sign up for a new SAGE Notebook account**
 120 link and a registration page will be displayed. (see Drawing 2.3)

Sign up for the SAGE Notebook.

Username:

Password:

Email Address:

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

Drawing 2.3: Signup page.

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

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

128 After successfully logging into your Notebook account, a **worksheet**
129 **management** page will be displayed. (see Drawing 2.4)

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

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

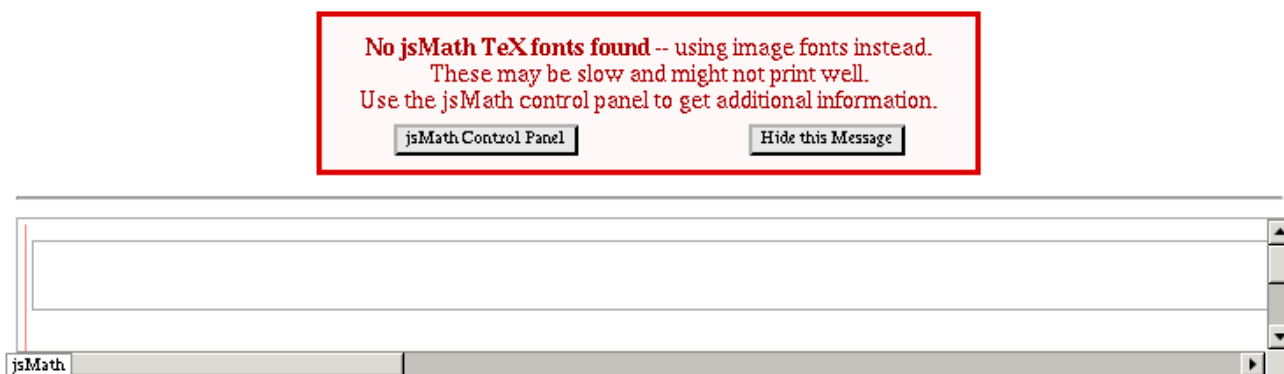
Current Folder: [Active](#) [Archived](#) [Trash](#)

<input type="checkbox"/>	Active Worksheets	Owner / Collaborators	Last Edited
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Drawing 2.4: Worksheet management page.

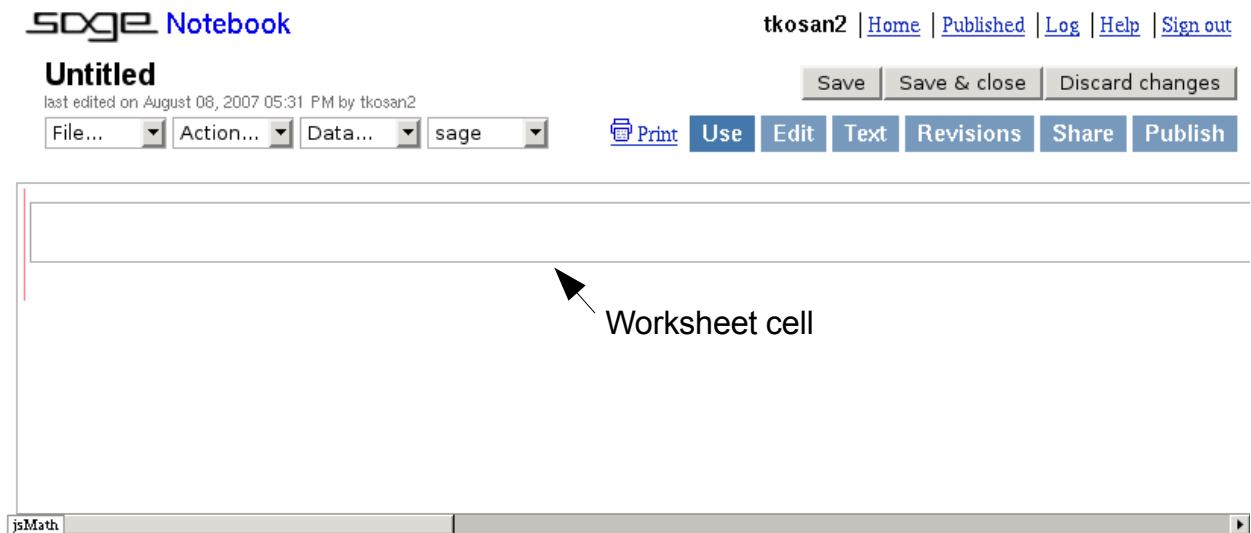
130 Physical mathematics notebooks contain worksheets and therefore SAGE's
131 virtual notebook contains worksheets too. The worksheet management page
132 allows worksheets to be created, deleted, published on the Internet, etc. Since
133 this is a newly created Notebook, it does not contain any worksheets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

134 Create a new worksheet now by selecting the **New Worksheet** link. A
135 worksheet can either use special mathematics fonts to display mathematics in
136 traditional form or it can use images of these fonts. If the computer you are
137 working on does not have mathematics fonts installed, the worksheet will display
138 a message which indicates that it will use its built-in image fonts as an
139 alternative. (see Drawing 2.5)



Drawing 2.5: jsMath No TeXfonts alert.

140 The image fonts are not as clear as normal mathematics fonts, but they are
141 adequate for most purposes. Later you can install mathematics fonts on your
142 computer if you would like, but for now just press the **Hide this Message**
143 button and a page which contains a blank worksheet will be shown. (see Drawing
144 2.6)



Drawing 2.6: Blank worksheet.

145 Worksheets contain 1 or more **cells** which are used to enter source code that will
146 be executed by SAGE. Cells have rectangles drawn around them as shown in
147 Figure 6 and they are able to grow larger as more text is entered into them.
148 When a worksheet is first created, an initial cell is placed at the top of its work
149 area and this is where you will normally begin entering text.

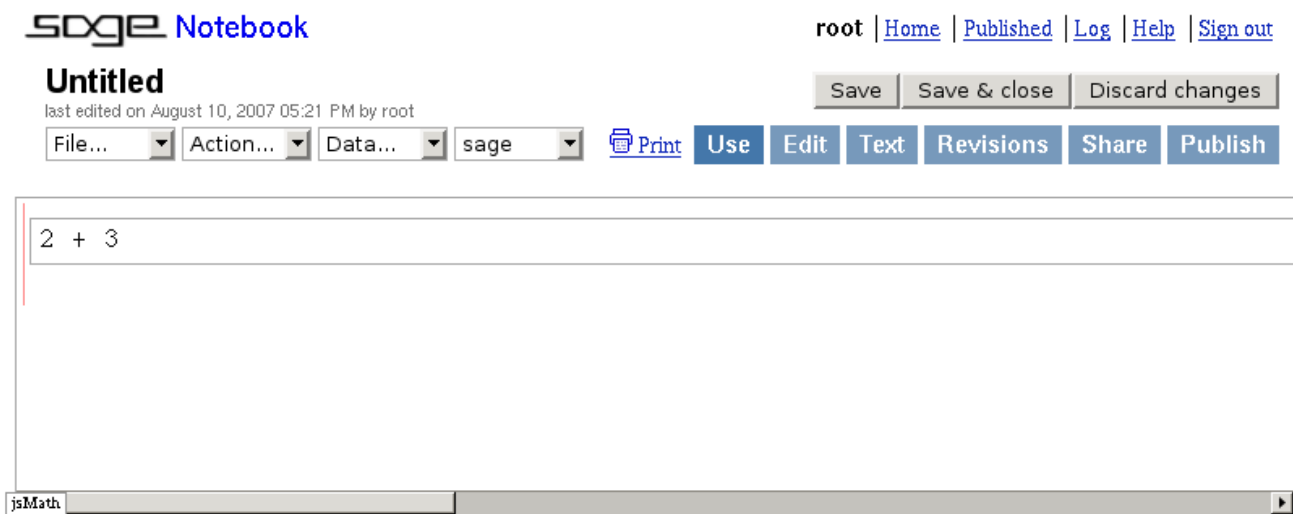
150 2.4 Entering Source Code Into A SAGE Cell

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

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

157 $2 + 3$

158 your worksheet should now look like Drawing 2.7.



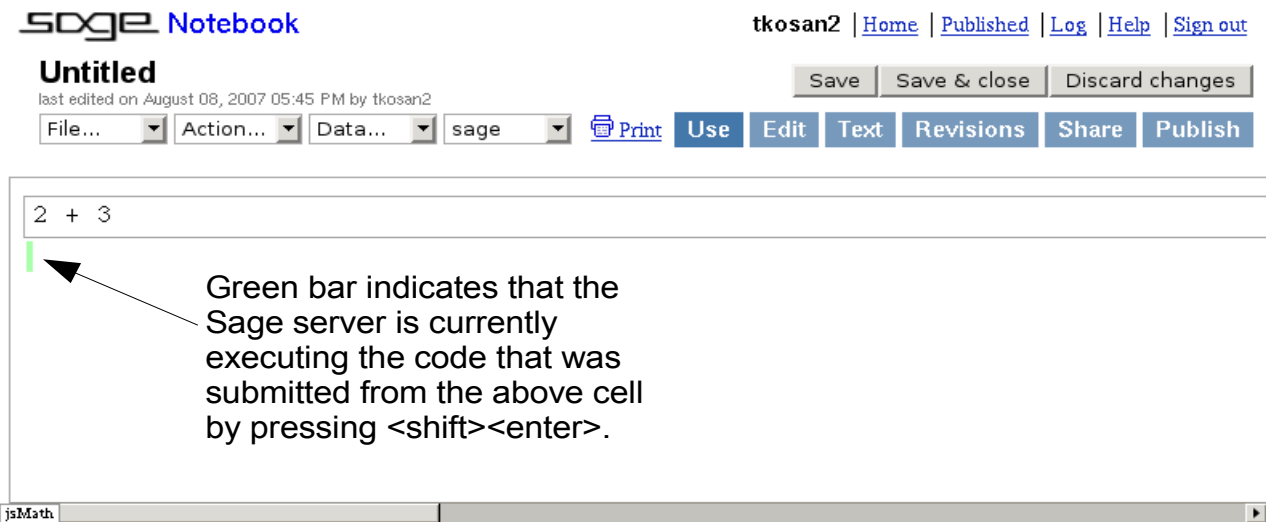
Drawing 2.7: Entering text into a cell.

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

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

169 The converted source code is then passed to the Python environment where it is
170 compiled into a special form of machine language called **Python bytecode**. The
171 bytecode is then executed by a program that emulates a hardware CPU and this
172 program is called the **Python interpreter**.

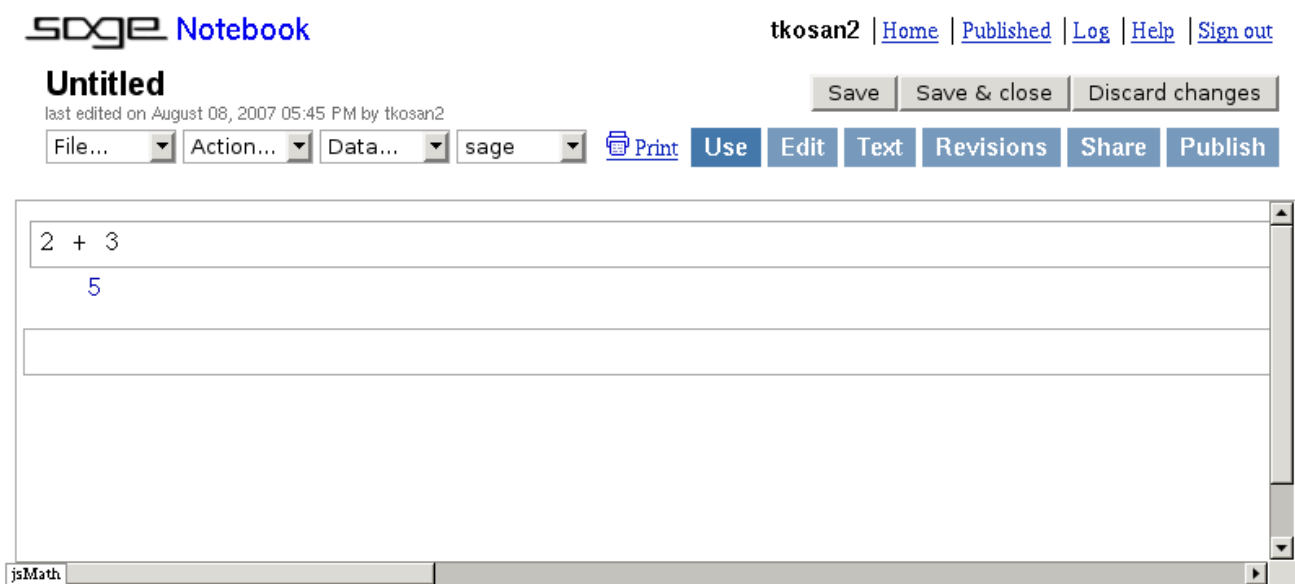
173 Sometimes the server is able to execute the code quickly and sometimes it will
174 take a while. While the code is being executed by the server, the Worksheet will
175 display a small green vertical bar beneath the cell towards the left side of the
176 window as shown in Drawing 2.8.



Drawing 2.8: Executing the text in a cell.

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

181 Press **shift** and **enter** in your cell now and in a few moments you should see a
 182 result that looks like Drawing 2.9.



Drawing 2.9: The results of execution are displayed.

183 If code was submitted for execution from the bottom cell in the Notebook, a

184 blank cell is automatically added beneath this cell when the server has finished
185 executing the code.

186 Now enter the source code that is shown in the second cell in Drawing 2.10 and
187 execute it.

The screenshot shows the SAGE Notebook web interface. At the top left is the "SAGE Notebook" logo. To the right of the logo are navigation links: "root", "Home", "Published", "Log", "Help", and "Sign out". Below the logo, the title "Untitled" is displayed, followed by the text "last edited on August 10, 2007 05:21 PM by root". To the right of the title are three buttons: "Save", "Save & close", and "Discard changes". Below the title bar is a row of controls: "File..." (dropdown), "Action..." (dropdown), "Data..." (dropdown), a "sage" dropdown menu, a "Print" icon, and a row of buttons: "Use", "Edit", "Text", "Revisions", "Share", and "Publish". The main workspace contains two cells. The first cell has the input $2 + 3$ and the output 5 . The second cell has the input $5 + 6 * 21 / 18 - 2^3$ and the output 4 . At the bottom left of the workspace is a "jsMath" label, and at the bottom right is a right arrow button.

Drawing 2.10: A more complex calculation