

# Sage and latexmk

## 1. SETUP

Go to <[https://github.com/3-manifolds/Sage\\_macOS/releases](https://github.com/3-manifolds/Sage_macOS/releases)> and download the latest version of SageMath-x.x.dmg (where x.x is the version number of Sage in the app); it was SageMath-9.4.dmg with version 1.2.1 of the applications at the time of this writing. Open the .dmg file and copy the SageMath-x.x.app to the /Applications folder. *Don't rename it.*

Double-Click the Recommended\_x\_x.pkg and follow the instructions. This installs an executable sage script in /usr/local/bin as well as additional information for those folks using Jupyter (not relevant for sagetex).

The sagetex folder contains the sagetex.sty package file. Move that folder into the ~/Library/texmf/tex/latex/ (you may have to create some of this string of embedded folders). NOTE: ~/Library is the Library folder in your HOME folder, *not* the one at the root of your hard drive which is /Library. To open ~/Library open the Go menu in Finder and hold down the Opt key to reveal an item to open that Library folder.

Finally open the SageMath-x.x application and follow the direction until you get a dialog box that gives you a choice of opening sage in a Terminal window or Jupyter Notebook and Quit. This initializes the application in macOS.

When the SageMath application is updated (e.g., to SageMath-9.5) simply follow the directions above and finally remove the older version.

## 2. USING SageTeX WITH T<sub>E</sub>XShop's latexmk BASED ENGINES

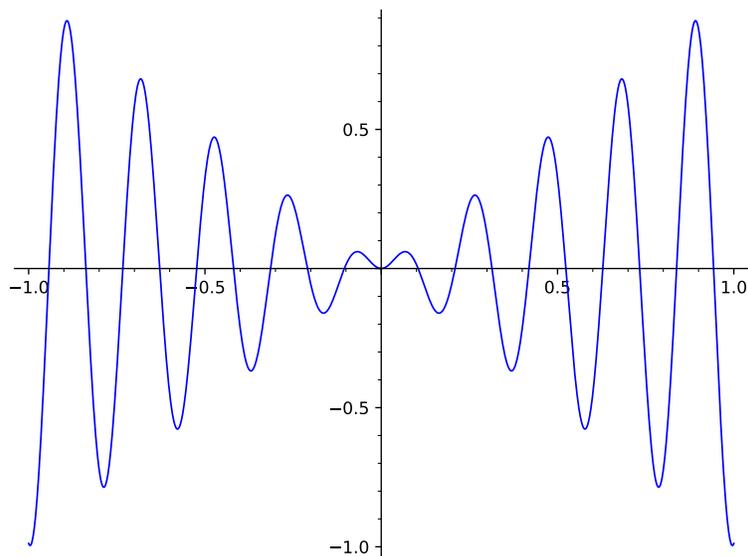
You can use any of T<sub>E</sub>XShop's basic latexmk engines, (pdf/x<sub>e</sub>/lua)latexmk, with SageTeX. Just have the enclosed platexmkrc file, written by John Collins, the maintainer of latexmk, in the same folder as the file that gets typeset.

## 3. SAMPLE

This is an example of using Sage within a T<sub>E</sub>X document. We can compute extended values like

$$32^{31} = 45671926166590716193865151022383844364247891968$$

We can plot functions like  $x \sin x$ :



We can integrate:

$$\int \frac{x^2 + x + 1}{(x-1)^3(x^2 + x + 2)} dx$$

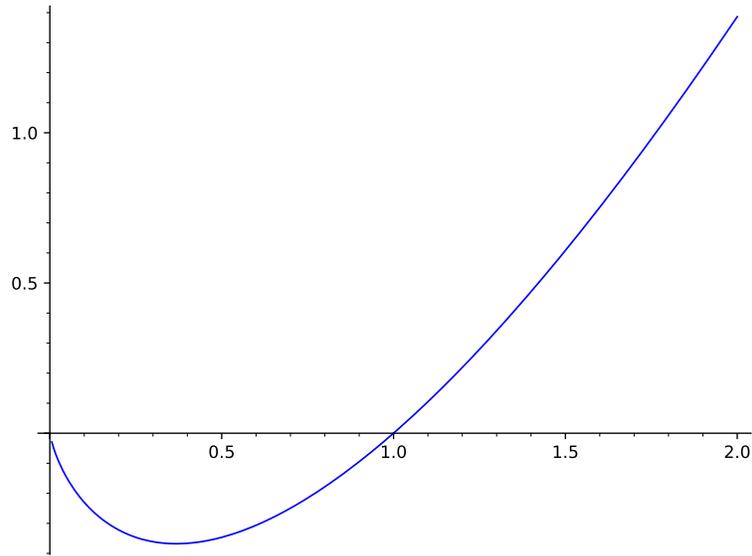
$$= -\frac{9}{448} \sqrt{7} \arctan\left(\frac{1}{7} \sqrt{7}(2x+1)\right) - \frac{3(x+1)}{16(x^2 - 2x + 1)} + \frac{5}{128} \log(x^2 + x + 2) - \frac{5}{64} \log(x-1)$$

We can perform matrix calculations:

$$\begin{pmatrix} 468 & 576 & 684 \\ 1062 & 1305 & 1548 \\ 1656 & 2034 & 2412 \end{pmatrix}$$

$$AB = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} 5 & 6 \\ 6 & 8 \end{pmatrix} = \begin{pmatrix} 17 & 22 \\ 39 & 50 \end{pmatrix}$$

Plots are fun; here is a second one showing  $x \ln x$ . The “width” command in the source is sent to the include graphics command in LaTeX rather than to Sage.



Sage understands mathematical constants and writes them symbolically unless it is told to produce a numerical approximation. The term  $e\pi$  below is not in the LaTeX source; instead it is the result of a Sage calculation, as is the numerical value on the other side of the equal sign.

The product of  $e$  and  $\pi$  is  $\pi e = 8.53973422267357$ .