

# USING SAGE WITH LATEXMK

HERBERT SCHULZ

## 1. SAGE AND LATEXMK

This document is independent of the other material in this folder, and explains how to use Sage with TeX if you want to use latexmk.

## 2. SETUP

Download and install the SageMath application in `/Applications`. It will install as `SageMath-x.x.app` where `x.x` is a version number. Remove the `-x.x` from the application name to get `Sagemath.app`. Make a symbolic link of the `sage` executable in `/usr/local/bin`:

```
cd /usr/local/bin
sudo ln -s /Applications/SageMath.app/Contents/Resources/sage/sage .
```

and then make sure `sage` is expanded by running

```
cd
sage --version
```

which *may* generate quite a few lines of output and finally end with a line giving the version number of the `sage` you are running.

Next create a `sagetex` folder in `/usr/local/texlive/texmf-local/tex/latex` and make a symbolic link of `sagetex.sty` in that folder:

```
cd /usr/local/texlive/texmf-local/tex/latex
sudo mkdir sagetex
cd sagetex
sudo ln -s \
  /Applications/SageMath.app/Contents/Resources/sage/local/share/texmf/tex/latex/sagetex.sty .
sudo mktexlsr
```

to allow  $\TeX$  to use the `sagetex` package.

## 3. USING SAGE AND LATEXMK

Inside "TeXShop/Engines/Inactive/Sage/Sage and latexmk" there is a file named "platexmkrc". Create a folder for your new document and add a copy of platexmkrc to this folder. Create the document as usual in the folder, making sure that the top line is

```
% !TEX TS-program = pdflatexmk
```

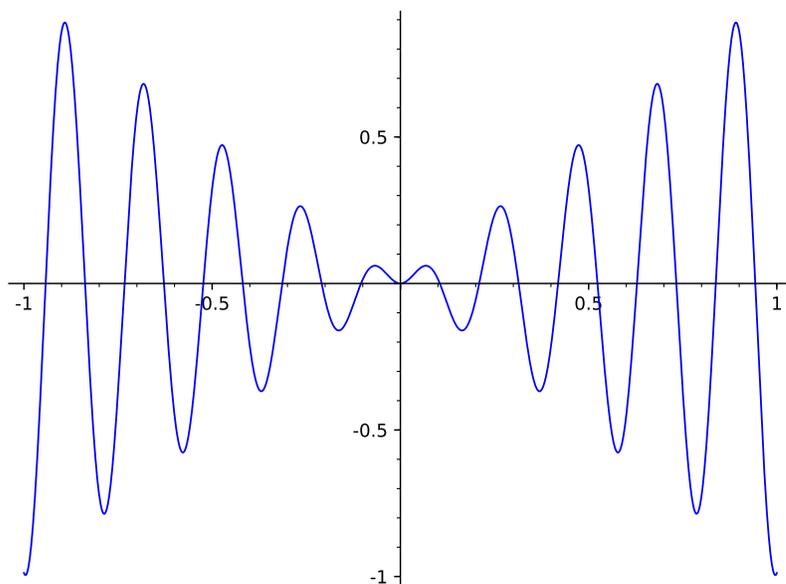
Then typesetting will use pdflatexmk and the resource file platexmkrc, and cooperate nicely with Sage.

## 4. INTRODUCTION

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:

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

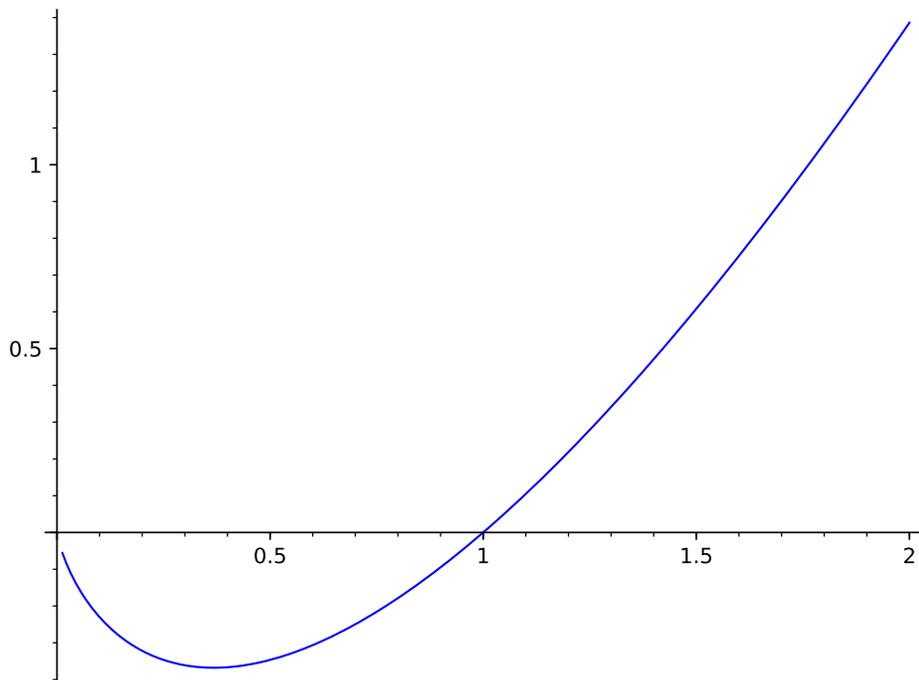
$$= -\frac{9}{448} \sqrt{7} \arctan\left(\frac{1}{7} \sqrt{7}(2x+1)\right) - \frac{3(x+1)}{16(x^2 - 2x + 1)} + \frac{5}{128} \log(x^2 + x + 2) - \frac{5}{64} \log(x-1)$$

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  $\pi e = 8.53973422267357$ .