

# Script for Sage talk at Marshfield MAA meeting

Gregory Bard

April 5, 2013

What is SAGE?

"SAGE is the open-source competitor to Maple, Mathematica, MATLAB, and Magma"

SAGE Aleph is the "light weight" version, which competes with WolframAlpha or a graphing calculator.

Makes SAGE suitable for Calc I and Precalculus, whereas the notebook interface, which I will also show you later, is good for Calculus II and higher.

Now let's go to <http://aleph.sagemath.org/>

~~~~~

2+2

~~~~~

sin(pi/12)

n( sin(pi/12) )

~~~~~

integral( x^10\*e^x, x)

~~~~~

g(x) = sin( x + sin(5\*x) )

plot( g(x), x, -5, 5)

f(x) = sin( exp( 1/(x-2) ) )

plot( f(x), -2, 4)

~~~~~

```
f(x) = x^6 - 21*x^5 + 145*x^4 - 435*x^3 + 574*x^2 - 264*x
```

```
solve( f(x)==0, x)
```

```
f(x).factor()
```

```
~~~~~
```

```
factor(7152321357)
```

```
~~~~~
```

```
for j in range(0, 11):  
    print j,  
    print "^10 = ",  
    print (j^3) % 11
```

Now how about the 10th power instead?

```
~~~~~
```

```
f(x) = exp( 1/(2-x) )
```

```
for j in range(0, 11):  
    position = 2 - 10^-j  
    print n( f(position) )
```

```
~~~~~
```

```
var("y")
```

```
plot3d( sin(x)*sin(y), (x, -10, 10), (y, -10, 10) )
```

```
~~~~~
```

Now we'll switch to a SAGE server and try out the notebook interface

```
~~~~~
```

```
integral(x*arctan(4*x), x)
```

(click typeset button)

(double click on the typeset formula to obtain LaTeX)

```
~~~~~
```

$$f(x) = x^2 + 3x + 5$$

$$g(x) = \cos(4x)$$

$$\text{integral}( f(x), x ) * \text{integral}( g(x), x )$$

$$\text{integral}( f(x)*g(x), x )$$

~~~~~

Now that doesn't mean you can't use SAGE with lower-level courses. I've used it personally in my Finite Mathematics classroom---that's a course for business students which includes about 1.5 weeks of linear algebra. Using SAGE to do some of the row-reduction allows us to tackle more realistic problems which might have a large number of variables.

~~~~~

Here's a way to use SAGE for a 20-question algebra-review homework assignment suitable for the beginning of a precalculus course or even a Calculus I.

$$f(x+2)$$

$$f(x) + 2$$

$$f(x) + f(2)$$

~~~~~

[make sure typeset is on]

$$a(x) = x^3 - x$$

$$\text{solve}( a(x)==0, x )$$

$$\text{var}("k")$$

$$a(x) = x^3 - x + k$$

$$\text{solve}( a(x)==0, x )$$

~~~~~

[make sure typeset is off]

$$\text{solve}( a*x^4 + b*x^3 + c*x^2 + d*x + e, x )$$

~~~~~

jump to the regressions demo now.

~~~~~

## Wrap Up

What are the advantages/disadvantages of the notebook interface???

- They need a user-name and password. (Disadvantage)
- You can make much longer, more complex problems.
- They can print the homework out and turn it in.
- You have saved copies of all the work you've ever done.
- You can use the "publish" button to make a world-viewable notebook page.
- There is online help.
- There is a "which command was it again" feature.
- You can get the LaTeX codes for anything that you compute.
- The students can share their work via cut-and-paste very easily. (Disadvantage)
- Since they will collaborate anyway, you should permit them to collaborate.