Sage Homework

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This is a running document that will be updated weekly.

Basic Sage

Problem 1

Use Sage to rederive the quadratic formula. I.e. declare new variables a, b, c, x and use Sage to solve $ax^2 + bx + c = 0$.

Rings

Problem 2

Compute the quotient ring $\mathbb{Q}[x]/(x^3 + 2x + 1)$. Reduce $x^4, x^5 + x^4, x^5 + 2x$.

Problem 3

1. Find an irreducible polynomial of degree two over $\mathbb{Z}/2\mathbb{Z}$.

2. Use this to generate the finite field of order 4.

3. Write out the multiplication table of this field. Try to do this in a slick way.

4. What is a generator of the multiplicative group?

Problem 4

Is $\mathbb{Z}[\sqrt{5}]$ a UFD? Use Sage!!!

Programming

Problem 5

Compute $1 + 2 + \cdots + 100$ using a `for` loop on the command line. Now do it by creating a function.

Problem 6

In a separate file titled `matrixproduct.sage`, write a function that takes as input two matrices in the format
`[[a,b],[c,d]]` and multiplies them.

As a comment sage has functionality to multiply matrices automatically. How do you do it?

For a bonus do this for arbritrary size matrices.

Problem 7

Find the number of points of $y^2 = x^3 - x$ over $\mathbb{F}_{7^k}$ for $k = 1, 2, 3$.

Problem 8

There exists exactly one Pythagorean triplet for which $a + b + c = 1000$. Find the product abc.

Problem 9

Use list comprehensions to list all multiples of 3 or 5 but not both under 100.