

Mathematical Prerequisites

We mentioned that the mathematical background we're expecting in CS103 is “high-school math.” We're often asked what that means, since depending on your high school this could be anything from basic algebra to number theory. I figured I'd clarify this a bit with this handout.

From your high school algebra courses, I'm going to assume you have a solid background in the following concepts:

- Manipulating equalities involving one or more unknowns: for example, simplifying the equation $2x + 3 = 5$ to $2x = 2$ and from there to $x = 1$.
- Multiplying polynomials: for instance, simplifying $(x + 1)(2x - 3)$ to $2x^2 - x - 3$.
- Factoring simple polynomials: recognizing that $x^2 + 2x + 1 = (x + 1)^2$, for example.
- Manipulating and simplifying sums, differences, products, and quotients of fractions. For example, you should be comfortable with the idea that $a / b + c / d = (ad + bc) / bd$.
- Manipulating inequalities: for example, you should be able to see that if $2x \leq -4$, then $x \geq -2$ and that if $x^2 > 9$, then either $x < -3$ or $x > 3$.

Despite what you might think, you're probably not going to need to do much algebra in this course. Most of the actual algebra involved here will be simplifying expressions or trying to combine expressions together.

Periodically, we'll need to use properties of exponents. The main ones to know are the following:

$$a^b \cdot a^c = a^{b+c} \qquad (a^b)^c = a^{bc} = (a^c)^b$$

In particular, note that

$$a \cdot a^b = a^{b+1}$$

Unlike most high-school math courses, CS103 is a discrete math course, meaning that we'll be focusing extensively on the natural numbers and integers and will pay only a little bit of attention to the real numbers. Here are a few refreshers on those topics:

- The **natural numbers** are the numbers 0, 1, 2, 3, ..., etc.
- The **integers** are the numbers ..., -3, -2, -1, 0, 1, 2, 3, ..., etc.
- The sum or product of any two natural numbers is a natural number. You can check a few examples to see this: $1 + 1 = 2$, $4 + 5 = 9$, $3 \times 5 = 15$, $10 \times 0 = 0$, etc. However, the difference of two natural numbers is not necessarily a natural number ($4 - 10 = -6$), and the quotient of two natural numbers is not necessarily a natural number ($4 / 8 = 0.5$, and $1 / 0$ doesn't even exist!)
- The sum, product, and difference of any two integers is an integer. However, the quotient of two integers is not necessarily an integer.

You might notice that there are some key concepts that are part of many high school math curricula that are *not* included here:

- Graphing functions on a coordinate axis.
- The formulas for circles, parabolas, hyperbolas, ellipses, etc.
- Trigonometry (sine, cosine, etc.).
- Limits.
- Vectors and matrices.
- Calculus.

I've taught CS103 to about 2,000 students and have never met anyone who was not appropriately mathematically prepared for the course. I've encountered many students who didn't feel *confident* with their understanding of mathematics or who were a bit *out of practice* with it, but I've never turned someone away from CS103 due to a lack of mathematical background. If anything, the students I've recommended not take CS103 usually have *too strong* of a math background!

If you're concerned about whether or not you're prepared for CS103, I strongly recommend checking out our CS103A companion course, which meets for two hours a week and goes over extra practice problems with the material. It's a great way to practice, to meet students who you might end up working with on the problem sets, and to ask questions in a low-stress environment.