Math 2001
Discrete Mathematics
Week 0
Introduction to discrete math

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Today's topics

1. Syllabus
2. Sets

Welcome to Math 2001

While mathematics has been studied for thousands of years, the past couple centuries have been a time of rapid development. Classical studies of shapes and numbers gave way to paradoxes and gaps in reasoning which could not be resolved by classical methods. This course introduces the language of modern mathematics and the technique of rigorous proof using logic and sets. We will survey applications to the theory of combinatorial graphs as well as probability.

Welcome to Math 2001

Have people had linear algebra? Calculus? What kinds of majors are represented in the class?

Welcome to Math 3140

I'll go over the course syllabus, which will also be posted on the 3140 Canvas page.

Sets

- A *set* is a collection of objects.
- For examples, there is the set of all integers (which we denote by $\mathbb{Z}$), the set of all rational numbers (which we denote by $\mathbb{Q}$)), and the set of all real numbers (which we denote by $\mathbb{R}$).

Sets

- We can also specify a set by listing the things in that set.
- There is the set $\left\{1, 3, \sqrt{2}\right\}$, for example.
- There are three things which belong to this set: the numbers 1, 3, and $\sqrt{2}$.
- We refer to these numbers as *elements* or *members* of $\left\{1, 3, \sqrt{2}\right\}$.

Sets

- As shorthand for "$\sqrt{2}$ is an element of $\left\{1, 3, \sqrt{2}\right\}$" we write $\sqrt{2} \in \left\{1, 3, \sqrt{2}\right\}$.
- It is not the case that $5 \in \left\{1, 3, \sqrt{2}\right\}$.
- We can write $5 \notin \left\{1, 3, \sqrt{2}\right\}$ to indicate this situation.

Sets

- Sets are like a bag whose contents may jumble about. That is, sets are like lists if we forget about the order.
- Two sets are considered the same when they have the same elements.
- For example, $\left\{1, 3, \sqrt{2}\right\}$ and $\left\{1, \sqrt{2}, 3\right\}$ are the same set.
- We write $\left\{1, 3, \sqrt{2}\right\} = \left\{1, \sqrt{2}, 3\right\}$ to indicate this situation.

Sets

- It is not the case that $\{1, 3\} \in \left\{1, 3, \sqrt{2}\right\}$. We will introduce a different terminology for the situation where every member of one set is a member of another set next time.
- Sets can have members which are not numbers, but are shapes, functions, or even other sets.
- For instance, it is true that $\{1, 3\} \in \{5, 7, \{1, 3\}\}$.

Sets

- It gets kind of tedious to write out $\left\{1, 3, \sqrt{2}\right\}$ over an over.
- Just like when we say "Let $f(x) = x^2$." in calculus, we can say "Let $A = \left\{1, 3, \sqrt{2}\right\}$.".
- This allows us to succinctly write and read expressions like $1 \in A$ or $5 \notin A$.