itself.exe Exercises for Chapter itself

Mathematical reasoning, logic, and set theory

In order to communicate mathematical ideas effectively, **formal languages** have been developed within which **logic**, i.e. deductive (mathematical) **reasoning**, can proceed. **Propositions** are statements that can be either true $\top$ or false $\perp$. Axiomatic systems begin with statements (axioms) assumed true. **Theorems** are **proven** by deduction. In many forms of logic, like **propositional calculus** (Wikipedia, 2019i), compound propositions are constructed via **logical connectives** like "and" and "or" of atomic propositions (see Lec. sets.logic). In others, like **first-order logic** (Wikipedia, 2019d), there are also logical **quantifiers** like "for every" and "there exists."

The mathematical objects and operations about which most propositions are made are expressed in terms of **set theory**, which was introduced in Lec. itself.found and will be expanded upon in Lec. sets.setintro. We can say that mathematical reasoning is comprised of mathematical objects and operations expressed in set theory and logic allows us to reason therewith.