1 Logic

- \( \neg p \) means “not \( p \).”
- \( p \lor q \) means “\( p \) or \( q \)”
- \( p \land q \) means “\( p \) or \( q \)”
- \( p \Rightarrow q \) means “If \( p \), then \( q \)”
- \( p \iff q \) means “\( p \) if and only if \( q \),” sometimes abbreviated “\( p \) iff \( q \).”
- \( \forall \) the universal quantifier, pronounced “for all”
- \( \exists \) is the existential quantifier, pronounced “there exists”

2 Numbers

- \( \mathbb{N} = \{1, 2, 3, \ldots\} \) is the set of natural numbers. WARNING: A lot of people include 0 in the set of natural numbers, but I don’t think this is your book’s convention.
- \( \mathbb{Z} \), the integers, consists of 0, plus all natural numbers and their negatives.
- \( \mathbb{Q} \) is the set of rational numbers—of the form \( p/q \), where \( p \in \mathbb{Z} \) and \( q \in \mathbb{Z} \setminus \{0\} \).
- \( \mathbb{R} \) is the set of real numbers, which contains \( \mathbb{Q} \), plus numbers like \( \sqrt{2}, \pi \), and many, many more.

3 Sets

- “\( x \in S \)” means “\( x \) is a member of the set \( A \).” Example: “banana” \( \in F \), where \( F \) is the set of all types of fruit. Sometimes abbreviate \( \neg (x \in A) \) by \( x \notin A \).
- \( S \subseteq T \) means all members of \( S \) are members of \( T \)—we say “\( S \) is a subset of \( T \),” or “\( T \) contains \( S \).” Note: every set is a subset of itself, but no set is a member of itself.
• $S \subset T$ means $S$ is a proper subset of $T$—that means there are members of $T$ which aren’t members of $S$. Example: \{1, 2, 3\} \subset \mathbb{N}.

• \{x, y, \ldots\}” means the set containing $x$, $y$, ... Example: the set of colors of the American flag is \{red, white, blue\}

• $\emptyset$ is the empty set—the unique set with 0 members.

• $A \cup B$ means set union—all $x$ such that $(x \in A) \lor (x \in B)$

• $A \cap B$ means set intersection—all $x$ such that $(x \in A) \land (x \in B)$

• $A \setminus B$ is a difference of sets—all $x$ such that $(x \in A) \land (x \notin B)$.

• $A \times B$ is the cartesian product of sets $A$ and $B$—that is, all pairs $(a, b)$ such that $(a \in A) \land (b \in B)$. Example: the coordinate plane is $\mathbb{R} \times \mathbb{R}$.

4 Relations and Functions

• $f : A \rightarrow B$ means $f$ is a function that takes things in $A$ to things in $B$. $A$ is called the domain of $f$. Your book calls $B$ the target of $f$.

• With $f$ as above, $\text{rng } f$ is the set of stuff in $B$ that actually gets hit by $f$. Example: $f : \{-1, 0, 1\} \rightarrow \{-2, -1, 0, 1, 2\}$ by $x \mapsto 2x^2$. The domain of $f$ is $\{-1, 0, 1\}$, the target is $\{-2, -1, 0, 1, 2\}$, and the range is $\{-2, 0, 2\}$. 