Some Big Ideas, Week 2

Jan 26 – Jan 30, 2026

⊙ **Definition:** A **proposition** or **statement** is a sentence that is true or false, but not both.

⊙ **Notation:** If p and q are propositions, then

- $\sim p$ or $\neg p$ means "not p", also called the **negation** of p.
- $p \vee q$ means "p or q", also called the **disjunction** of p and q.
- $p \wedge q$ means "p and q", also called the **conjunction** of p and q.
- $p \to q$ means "p implies q", also called the **conditional**. p is the **hypothesis** and q is the **conclusion**

⊙ **Definition:** The **truth table** for a logical expression displays the truth values for the expression corresponding to all possible combinations of truth values for the propositions in the expression.

⊙ **Notation:** If expressions P and Q are logically equivalent, then we denote this with $P \equiv Q$.

⊙ **DeMorgan's Laws:** If P and Q are logical expressions, then

- $\neg(P \wedge Q) \equiv \neg P \vee \neg Q$
- $\neg(P \vee Q) \equiv \neg P \wedge \neg Q$

⊙ **Definition:** The **biconditional** "p if-and-only-if q" means $(p \to q) \wedge (q \to p)$.
We will often abbreviate to "p iff q".

⊙ **Definition:** The **contrapositive** of a conditional statement "If p then q" is the statement "If $\neg q$ then $\neg p$".

⊙ **Definition:** The **converse** of a conditional statement "If p then q" is the statement "If q then p".

⊙ **Definition:** The **inverse** of a conditional statement "If p then q" is the statement "If $\neg p$ then $\neg q$".

Some of the resources I used in constructing the Big Ideas notes this semester are: Ernst: *Introduction to Proof via Inquiry-Based Learning*; Epp: *Discrete Mathematics with Applications, 4th edition*; Levin: *Discrete Mathematics, An Open Introduction, 4th edition*; Sundstrom: *Mathematical Reasoning, Writing and Proof, Version 3*.

Check the **Tentative Weekly Syllabus** on the course webpage for the specific sections relevant for this week.