

Proof Technique	Approach to prove $P \rightarrow Q$	Remarks
Exhaustive Proof	Demonstrate $P \rightarrow A$ for all cases	only finite domains
Direct Proof	Assume P, deduce Q	Standard approach
Proof by contraposition	Assume Q' , derive P'	Use if Q' seems more useful than P .
Proof by contradiction	Assume $P \wedge Q'$, deduce a contradiction	Use this when Q says something is not true

Equivalence Rules	Expression	Equivalent To	Abbreviation for Rule
	$R \vee S$ $R \wedge S$	$S \vee R$ $S \wedge R$	Commutative - comm
	$(R \vee S) \vee Q$ $(R \wedge S) \wedge Q$	$R \vee (S \vee Q)$ $R \wedge (S \wedge Q)$	Associative - ass
	$(R \vee S)'$ $(R \wedge S)'$	$R' \wedge S'$ $R' \vee S'$	De Morgan's Laws - De Morgan
	$R \rightarrow S$	$R' \vee S$	Implication - imp
	R	$(R')'$	Double negation - dn
	$P \leftrightarrow Q$	$(P \rightarrow Q) \wedge (Q \rightarrow P)$	Equivalence - equ

Inference Rules

From	Can Derive	Abbreviation for Rule
$R, R \rightarrow S$	S	Modus ponens - mp
$R \rightarrow S, S'$	R'	Modus tollens - mt
R, S	$R \wedge S$	Conjunction - con
$R \wedge S$	R, S	Simplification - sim
R	$R \vee S$	Addition - add
$P \rightarrow Q, Q \rightarrow R$	$P \rightarrow R$	Hypothetical syllogism - hs
$P \vee Q, P'$	Q	Disjunctive syllogism - ds
$P \rightarrow Q$	$P' \rightarrow Q'$ - Contraposition - cont	
$P' \rightarrow Q'$	$P \rightarrow Q$	- Contraposition - cont
P	$P \wedge P$	Self-reference - self
$(P \wedge Q) \rightarrow R$	$P \rightarrow (Q \rightarrow R)$	Exportation - exp
P, P'	Q	Inconsistency - inc
$P \wedge (Q \vee R)$	$(P \wedge Q) \vee (P \wedge R)$	Distributive - dist
$P \vee (Q \wedge R)$	$(P \vee Q) \wedge (P \vee R)$	Distributive - dist

Ackermann function

$$A(m, n) = \begin{cases} n + 1 & m = 0 \\ A(m - 1, 1) & \text{for } m > 0 \text{ and } n = 0 \\ A(m - 1, A(m, n - 1)) & \text{for } m > 0 \text{ and } n > 0 \end{cases}$$