SL Rules

Modus Ponens ($\rightarrow E$)

$P \rightarrow Q$
P
Q

Conjunction Introduction ($\wedge I$)

P
Q
$(P \wedge Q)$

Conjunction Elimination ($\wedge E$)

$(P \wedge Q)$
P
Q

Disjunction Introduction ($\vee I$)

(P)
$P \vee Q$

Disjunction Elimination ($\vee E$)

$P \vee Q$
$\neg P$
Q

Biconditional Elimination ($\leftrightarrow E$)

$(P \leftrightarrow Q)$
$P \rightarrow Q$
$Q \rightarrow P$

Negation Elimination ($\neg E$)

$\neg\neg P$
P

Hypothetical Rules

Reiteration (R)

*[1]

P
P

Conditional Introduction ($\rightarrow I$)

$n.$ P
$\vdots$
$m.$ Q
$P \rightarrow Q$

Reductio ad Absurdum(RAA)

$n.$ P
$\vdots$
$m.$ Q
m' $\neg Q$
$\neg P$

Quantifier Rules

Universal Introduction ($\forall$ I)

$\Phi\alpha$
$\triangleright$ $\forall\chi\Phi\chi$

provided that
(1) a does not occur in an open assumption
(2) a does not occur in $\forall\chi\Phi\chi$

Universal Elimination ($\forall$ E)

$\forall\chi\Phi\chi$
$\triangleright$ $\Phi\alpha$

Existential Introduction ($\exists I$)

$\Phi\alpha$
$\triangleright$ $\exists\chi\Phi\chi$

Existential Elimination ($\exists E$)

$\exists\chi\Phi\chi$
$\Phi\alpha$
Ψ
$\triangleright$ Ψ

provided that
(1) α does not occur in an open assumption
(2) α does not occur in $\exists\chi\Phi\chi$
(3) α does not occur in Ψ

Quantifier Negation (QN):

$\neg\forall\chi\Phi\chi \equiv \exists\chi\neg\Phi\chi$
$\neg\exists\chi\Phi\chi \equiv \forall\chi\neg\Phi\chi$

Identity Rules

Identity Introduction ($= I$)

$\hat{\alpha} = \hat{\alpha}$

Identity Elimination ($= e$)

$\alpha = \beta$
$\Phi\alpha$
$\triangleright$ $\Phi\beta$

[1]Not a hypothetical rule but often used together.