

Natural deduction proof questions

1. $\{(P \wedge Q) \rightarrow r\} \vdash (P \rightarrow (Q \rightarrow r))$
2. $\{(P \rightarrow (Q \rightarrow r))\} \vdash ((P \wedge Q) \rightarrow r)$
3. $\{(P \wedge (Q \vee r))\} \vdash ((P \wedge Q) \vee (P \wedge r))$
4. $\{(P \rightarrow Q)\} \vdash ((\neg \vee P) \rightarrow (\neg \vee Q))$
5. $\{\alpha \rightarrow (\neg \alpha)\} \vdash (\neg \alpha)$
6. $\{P \rightarrow Q, (\neg Q)\} \vdash (\neg P)$ (modus tollens)
7. $\{(P \rightarrow (Q \rightarrow r)), P, (\neg r)\} \vdash (\neg Q)$
8. $\{((P \wedge (\neg Q)) \rightarrow r), (\neg r), P\} \vdash Q$
9. $\{(\neg \alpha) \wedge (\neg \beta)\} \vdash (\neg (\alpha \vee \beta))$