

$$\begin{array}{c}
\frac{}{\vdash \textcolor{red}{p}^\perp \Downarrow [\cdot][1 : p]\cdot; \cdot} \text{I} \\
\hline
\vdash [\cdot][1 : p]\cdot; \cdot //^1 \vdash [\cdot][\cdot]p^\perp; \cdot \\
\hline
\vdash [\cdot][1 : p]\cdot; \cdot //^1 \vdash [\cdot][\cdot]\cdot; p^\perp \\
\hline
\vdash \textcolor{red}{!}^1 p^\perp \Downarrow [\cdot][1 : p]\cdot; \cdot \\
\hline
\vdash [\cdot][1 : p]\cdot; \cdot //^1 \vdash [\cdot][\cdot]\textcolor{red}{!}^1 p^\perp; \cdot \\
\hline
\vdash [\cdot][1 : p]\cdot; \cdot //^1 \vdash [\cdot][\cdot]\cdot; \textcolor{red}{!}^1 p^\perp \\
\hline
\vdash \textcolor{red}{!}^1 \textcolor{red}{!}^1 p^\perp \Downarrow [\cdot][1 : p]\cdot; \cdot \\
\hline
\vdash [\cdot][\cdot]\cdot; ?^1 p, \textcolor{red}{!}^1 \textcolor{red}{!}^1 p^\perp
\end{array}
\begin{array}{l}
4 \\
* \\
! \\
4 \\
* \\
! \\
*
\end{array}$$