

$$\begin{aligned}
& \forall x. \forall y. (\neg Q(x, y) \Rightarrow \neg P(x, y)) \\
&= \forall x. \forall y. (\neg \neg Q(x, y) \vee \neg P(x, y)) \\
&= \forall x. \forall y. (Q(x, y) \vee \neg P(x, y))
\end{aligned}$$

$$\begin{aligned}
& \forall x. \forall y. ((P(x, y) \wedge Q(x, y)) \Rightarrow R(x, y)) \\
&= \forall x. \forall y. (\neg (P(x, y) \wedge Q(x, y)) \vee R(x, y)) \\
&= \forall x. \forall y. (\neg P(x, y) \vee \neg Q(x, y) \vee R(x, y))
\end{aligned}$$

$$\begin{aligned}
& \forall x. \exists y. (P(x, y) \Rightarrow Q(x, y)) \\
&= \forall x. \exists y. (\neg P(x, y) \vee Q(x, y))
\end{aligned}$$