

Second-Order Formulas

Problem 20. For each of the following second-order formulas, find an equivalent first-order formula.

(i) $\exists p(p(x) \wedge \neg p(y))$.

(ii) $\forall p q x(p(x) \leftrightarrow q(x))$.

(iii) $\exists p(\neg \exists x(p(x) \wedge Q(x)) \wedge p(y))$.

(iv) $\forall p(\forall x(Q(x) \rightarrow p(x)) \rightarrow p(y))$.

(v) $\exists p(\forall x(Q(x) \rightarrow p(x)) \wedge \forall x(p(x) \rightarrow R(x)))$.