

1. (4 points) Show that $\forall x P(x) \vee \forall x Q(x)$ and $\forall x (P(x) \vee Q(x))$ are not logically equivalent.

2. (2 points) Express the negation of this statement so that all negation symbols immediately precede predicates: $\exists x \exists y P(x, y) \wedge \forall x \forall y Q(x, y)$

3. (4 points) Determine the truth value of each of these statements if the domain for all variables consists of all integers:

(a) $\forall x \exists y (x^2 < y)$

(b) $\exists x \forall y (x^2 < y)$

(c) $\forall x \exists y (x + y = 0)$

(d) $\exists x \forall y (xy = y)$