1. Let \( P(x) \) denote “\( x = -2 \)” and let \( Q(x) \) denote “\( x^2 = 4 \)” (as in exercise 2.16 in the book). Determine (and explain!) the truth values of the following statements:

(a) \( \exists x \neg P(x) \)
(b) \( \forall x (P(x) \lor Q(x)) \)
(c) \( \exists x (P(x) \land Q(x)) \)
(d) \( \forall x (P(x) \implies Q(x)) \)
(e) \( \exists x (Q(x) \implies P(x)) \)
(f) \( \forall x (P(x) \iff Q(x)) \)

2. Let \( F(x, y) \) be statement “\( x \) can fool \( y \)”, where the domain for both variables is the set of all people in the world. Use quantifiers to express each of the following statements:

(a) Mike can fool everybody.
(b) Everybody can fool somebody.
(c) No one can fool both Fred and Jerry.

3. Let \( Q(x, y) \) denote “\( x + y = 0 \)”. What are the truth values of the statements \( \exists y \forall x Q(x, y) \) and \( \forall x \exists y Q(x, y) \)? Explain your answers!

4. Rewrite each of the following statements so that negations appear only within predicates:

(a) \( \neg \forall y \exists x P(x, y) \)
(b) \( \neg (\exists x \exists y \neg P(x, y) \land \forall x \forall y Q(x, y)) \)

5. Let \( x \in \mathbb{R} \). Prove that if \(-2 < x < 4\), then \( x^2 + 2x + 4 \geq 3 \).

6. Let \( n \in \mathbb{Z} \). Prove that if \( n^2 - 2n + 5 \leq 3 \), then \( n \) is even.

7. Prove that if \( n \) is an integer, then \( 2n^2 - 8n + 10 \) is an even integer.

8. (Problem 3.2 on page 64.) Prove that if \( x \) is an even integer, then \( 5x - 3 \) is an odd integer.