1. Let the domain of discourse consist of the non-zero integers. Give the truth value of each of the following propositions. (5 points)
   a) \( \forall x, (x < 2x) \).
   b) \( \exists x, (x + x = x - x) \).
   c) \( \exists x, (x^2 = 2x) \).
   d) \( \forall x, (\frac{x}{2x} < x) \).
   e) \( \exists x, (\frac{x}{x} = x) \).

2. Consider the following two propositions: (8 points)
   (1) \( \exists x \in \mathbb{N}, \forall y \in \mathbb{N}, P(x, y) \).
   (2) \( \forall x \in \mathbb{N}, \exists y \in \mathbb{N}, P(x, y) \).

   Using the above two statements, give a predicate \( P(x, y) \) that makes (or explain why it is not possible):
   a) Both statements true.
   b) Both statements false.
   c) Statement 1 true and Statement 2 false.
   d) Statement 1 false and Statement 2 true.

3. Express the following statement using only the existential quantifier. (3 points)
   \( \exists x \forall y \forall z, P(x, y, z) \)

4. Symbolize the statement: (4 points)
   “There are exactly two cats.”