1. (P53, Ex.10, [R]) Let \( C(x) \) be the statement ”\( x \) has a cat,” let \( D(x) \) be the statement ”\( x \) has a dog,” and let \( F(x) \) be the statement ”\( x \) has a ferret.” Express each of these statements in terms of \( C(x) \), \( D(x) \), \( F(x) \), quantifiers, and logical connectives. Let the domain consist of all students in your class.

   a) A student in your class has a cat, a dog, and a ferret.
   b) All students in your class have a cat, a dog, or a ferret.
   c) Some student in your class has a cat and a ferret, but not a dog.
   d) No student in your class has a cat, a dog, and a ferret.
   e) For each of the three animals, cats, dogs, and ferrets, there is a student in your class who has this animal as a pet.

**Answer Area:**

- a) \( \exists x (C(x) \land D(x) \land F(x)) \)
- b) \( \forall x (C(x) \lor D(x) \lor F(x)) \)
- c) \( \exists x (C(x) \land F(x) \land \neg D(x)) \)
- d) \( \neg \exists x (C(x) \land D(x) \land F(x)) \)
- e) \( (\exists x (C(x)) \land (\exists y D(y))) \land (\exists z F(z)) \)

2. (P53, Ex.14, [R]) Determine the truth value of each of these statements if the domain consists of all real numbers.
   a) \( \exists x (x^3 = -1) \)  
   b) \( \exists x (x^4 < x^2) \)  
   c) \( \forall x ((-x)^2 = x^2) \)  
   d) \( \forall x (2x > x) \)

**Answer Area:**

- a) true
- b) true
- c) true
- d) false, zero or negative numbers
Suppose the domain of the propositional function $P(x, y)$ consists of pairs $x$ and $y$, where $x$ is 1, 2, or 3 and $y$ is 1, 2, or 3. Write out these propositions using disjunctions and conjunctions.

a) $\exists x \ P(x, 3)$
d) $\forall x \ \neg P(x, 2)$

**Answer Area:**
a) $P(1, 3) \lor P(2, 3) \lor P(3, 3)$
d) $\neg P(1, 2) \land \neg P(2, 2) \land \neg P(3, 2)$