Name: _____

Directions: Solve the following problems. Give supporting work/justification where appropriate.

1. **[3 parts, 1 point each]** Translate the following sentences to symbolic logic as directly and simply as possible. Is the statement true or false? Write the entire word.

   (a) Adding 1 to each positive real number results in a positive real number.

   (b) Every real number can be multiplied by some real number to produce a rational number.

   (c) The only set which is a subset of every set is the empty set.

2. **[3 parts, 1 point each]** Translate the following statements/open sentences in symbolic logic to English sentences as simply as possible. Is the statement true or false? Write the entire word.

   (a) $\sim (\exists x \in \mathbb{Q}, x^2 = 2)$

   (b) $\exists x \in \mathbb{Z}, \forall y \in \mathbb{Z}, \exists k \in \mathbb{Z}, x + y = 2k$

   (c) $\forall A \subseteq \mathbb{N}, \forall B \subseteq \mathbb{N}, (\exists a \in \mathbb{N}, |A| \leq a) \wedge (\exists b \in \mathbb{N}, |B| \leq b) \implies (\exists c \in \mathbb{N}, |A \cup B| \leq c)$

3. **[2 parts, 2 points each]** Negate the following sentences as simply and naturally as possible. (You may translate to and from symbolic logic if helpful, but this is not required.) Is the **original statement** true or false? Explain.

   (a) There are at least 7 prime numbers or 5 is less than 0.

   (b) Every infinite subset of integers contains an infinite subset of even integers.