Discrete Mathematics with Applications, 4th edition
Susanna S. Epp

Supplementary Exercises: Chapter 3

1. **Section 3.1**

   (a) Rewrite the following statement in the form ∀ ____ , ____: All dogs have tails.

   (b) Rewrite the following statement in the form ∀ ____ , ____: No fish have live births.

   (c) Rewrite the following statement in the form ∀ ____ , ____: The number 250,048 is not equal to the cube of any integer.

   (d) Rewrite the following statement in the form ∃ ____ such that ____: Some students live on campus.

2. **Section 3.2**: Write a negation for the following statement. (Do not use the phrase "It is not the case that. . .".):

   ∀ real numbers a and b, if a and b are irrational then $a + b$ is irrational.

3. **Section 3.2**: Rewrite the following statement in the form ∀ ____ , if ____ then ____: The number 1 does not have any positive integer divisors except 1.

4. **Section 3.2**: Write the converse, contrapositive, and inverse for the following statement:

   For all real numbers x, if f $0 < x < 6$ then $x^2 < 36$.

5. **Section 3.3**: In (a) and (b) below, (i) rewrite the statement without using variables and expressing your answer as simply as possible, and (ii) write a negation for the statement (either with or without variables).

   (a) For all positive real numbers r, there exists a positive real number s so that such that $s < r$.

   (b) There exists a positive real number x such that for all positive real numbers y, $x \leq y$.