1. a) State the definition of an even integer.

b) Is the statement "$(\forall x \in \mathbb{R})(\exists y \in \mathbb{R})(x - y = 3)$" true or false? Support your answer.

2. a) Make a truth table for the statement P $\vee$ Q.

b) Determine whether the propositional (P $\wedge$ Q) $\Rightarrow$ R is equivalent to (P $\Rightarrow$ R) $\wedge$ (Q $\Rightarrow$ R).

3. Show that if n is an integer for which n^3 is even, then n is even.

4. Show that if x is a non-zero rational and y is irrational, then $x \cdot y$ is irrational.

5. Show that $(\forall n \in \mathbb{N})(5 \mid (6^n - 1))$.