1. (20 points) Let $A$ and $B$ be some subsets of a universal set $U$. Prove that

$$A \setminus B = A \cap \overline{B}.$$ 

2. (20 points) In the textbook it is shown that $\sqrt{2}$ is an irrational number. Use this fact to show that the following statement is true: there exist two irrational numbers $p$ and $q$, such that $q^p$ is a rational number.

3. (20 points) Show that every undirected simple graph with 2 or more nodes contains two nodes with the same degree.

4. (20 points) Show that there exist no integers $x, y, z$ such that $x^2 + y^2 = 3z^2$, except $x = y = z = 0$.

5. (20 points) Let $r$ be a number such that $r + 1/r$ is an integer. Use induction to show that for every positive integer $n$, $r^n + 1/r^n$ is an integer.