Tutorial 1

1. Determine whether each of the following sequence is increasing, decreasing, non-increasing or non-decreasing.
   (i) 5, 55, 555, 555, 606, 1001, 2002, 2020, 2020
   (ii) 5, -55, -555, -606, -1001, -2020, -2020, -3000
   (iii) 10, 22, 35, 100, 201, 500, 2000
   (iv) 5, 5

2. Find the value of each of the expression below without using a calculator.
   (i) lg 64
   (ii) lg 2^{1000}

3. Compute $\lfloor x \rfloor$ and $\lceil x \rceil$ for each of the following values of x :
   (i) 37.99
   (ii) 10/3

4. Determine if the following expression is true of false: n! = n(n-1)!

5. Prove that $\binom{n}{r} = \binom{n}{n-r}$

6. If k is an integer and $k \geq 2$, find a formula for $1 + 2 + 3 + \cdots + (k - 1)$.

7. If i is an integer and $i \geq 1$, find a formula for $1 + 2 + 2^2 + \cdots + 2^{i-1}$.

8. Use mathematical induction to prove that each equation is true for every positive integer n.

   (i) $\sum_{i=1}^{n} i(i!) = (n + 1)! - 1$

   (ii) $(1 + x)^n \geq 1 + nx$, where $x \geq -1$