Useful Math Identities

Summations

1. $\sum\limits_{i=0}^{\infty} x^i = \frac{1}{1-x}$ for $|x| < 1$

2. $\sum\limits_{i=1}^{n} cf(i) = c \sum\limits_{i=1}^{n} f(i)$

3. $\sum\limits_{i=0}^{n-1} 1 = \sum\limits_{i=1}^{n} 1 = n$

4. $\sum\limits_{i=0}^{n} i = 0 + \sum\limits_{i=1}^{n} i = \frac{n(n+1)}{2}$

5. $\sum\limits_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6} = \frac{n^3}{3} + \frac{n^2}{2} + \frac{n}{6}$

6. $\sum\limits_{i=1}^{n} i^3 = \left(\frac{n(n+1)}{2}\right)^2 = \frac{n^4}{4} + \frac{n^3}{2} + \frac{n^2}{4}$

7. $\sum\limits_{i=0}^{n-1} x^i = \frac{1-x^n}{1-x}$

8. $\sum\limits_{i=0}^{n-1} \frac{1}{2^i} = 2 - \frac{1}{2^{n-1}}$

In the worst case, if there is an uncommon summation, we recommend using Wolfram Alpha to simplify it.

Logs

A few useful formulas, more can be found on the bottom of these slides

1. $x^{\log_x n} = n$

2. $a^{\log_b c} = c^{\log_b a}$

3. $\log_b a = \frac{\log_d a}{\log_d b}$