SEQUENCES AND SERIES

Arithmetic sequence: $a_{n+1} = a_n + d$, any integer $n \geq 1$

d is called the "common difference"

Ex.: 8, 13, 18, 23, 28, 33, … is an arithmetic sequence with $d = 5$

Geometric sequence: $a_{n+1} = r \cdot a_n$, any integer $n \geq 1$

r is called the "common ratio"

Ex.: 24, 12, 6, 3, $\frac{3}{2}$, $\frac{3}{4}$, … is a geometric sequence with $r = \frac{1}{2}$

Finding the general term for an arithmetic sequence: $a_n = a_1 + (n-1) \cdot d$

Finding the general term for a geometric sequence: $a_n = a_1 \cdot r^{n-1}$

Finding the n^{th} partial sum for an arithmetic series: $S_n = \frac{n}{2}\left(a_1 + a_n\right)$

Finding the n^{th} partial sum for a geometric series: $S_n = \frac{a_1(1-r^n)}{1-r}$

Sum of infinite geometric series with |r| < 1: $S_\infty = \frac{a_1}{1-r}$

Factorial notation: $n! = n(n-1)(n-2)(n-3)\cdots(1)$ **Ex.**: $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

Binomial coefficient: $\binom{n}{k} = \frac{n!}{k!(n-k)!}$

Binomial Theorem: $(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} \cdot a^{n-k} b^k$

$$= \binom{n}{0} \cdot a^n b^0 + \binom{n}{1} \cdot a^{n-1} b^1 + \binom{n}{2} \cdot a^{n-2} b^2 + \ldots + \binom{n}{n} \cdot a^{n-n} b^n$$