SEQUENCES AND SERIES

ARITHMETIC	GEOMETRIC
first term $= a$, T_1 or S_1	first term $= a$, T_1, S_1
common difference $= d$, $d = T_n - T_{n-1}$	common ratio $= r$, $r = \frac{T_n}{T_{n-1}}$
the n^{th} term, $T_n = a + (n-1)d$	the n^{th} term, $T_n = ar^{n-1}$
the sum of the first n terms, $S_n = T_1 + T_2 + T_3 + \cdots + T_n$	
$S_n = \frac{n}{2}\left(2a + (n-1)d\right)$	$S_n = \frac{a(1-r^n)}{1-r}$, $\|r\| < 1$
$S_n = \frac{n}{2}(a + l)$, $l =$ last term	$S_n = \frac{a(r^n - 1)}{r-1}$, $\|r\| > 1$
	The sum to infinity, $S_\infty = \frac{a}{1-r}$, $\|r\| < 1$
How to find T_n without the values of a, d, r?	
(If only S_n given in the question.)	
$T_n = S_n - S_{n-1}$	

BINOMIAL EXPANSION

① If $n \in \mathbb{Z}^+$,

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \cdots + \binom{n}{r}a^{n-r}b^r + \cdots + b^n$$

General term of $(a+b)^n$ $\Rightarrow$ $T_{r+1} = \binom{n}{r}a^{n-r}b^r$

② If $n \in \mathbb{Z}^-$ or $n \in \mathbb{Q}$,

$$(1+ax)^n = 1 + n(ax) + \frac{n(n-1)}{2!}(ax)^2 + \frac{n(n-1)(n-2)}{3!}(ax)^3 + \cdots$$

The expansion is valid for $|x| < \frac{1}{|a|}$