Taylor Series of $f(x)$ at $x=a$.

$$f(x)=\sum_{n=0}^{\infty}\frac{f^{(n)}(a)}{n!}(x-a)^n$$

If $a=0$, it is Maclaurin Series of $f(x)$

Memorize the Common MacLaurin Series

$f(x)=\frac{1}{1-x}$: $\sum_{n=0}^{\infty}x^n$ $R=1$

$f(x)=e^x$: $\sum_{n=0}^{\infty}\frac{x^n}{n!}$ $R=\infty$

$f(x)=\sin x$: $\sum_{n=0}^{\infty}\frac{(-1)^n x^{2n+1}}{(2n+1)!}$ $R=\infty$

$f(x)=\cos x$: $\sum_{n=0}^{\infty}\frac{(-1)^n x^{2n}}{(2n)!}$ $R=\infty$

$f(x)=\arctan x$: $\sum_{n=0}^{\infty}\frac{(-1)^n x^{2n+1}}{2n+1}$ $R=1$

n^{th}-degree Taylor polynomial of $f(x)$ at $x=a$:

$$T_n(x)=\sum_{k=0}^{n}\frac{f^{(k)}(a)}{k!}(x-a)^k$$

The remainder $R_n(x)=f(x)-T_n(x)=\sum_{k=n+1}^{\infty}\frac{f^{(k)}(a)}{k!}(x-a)^k$

If $|f^{(n+1)}(x)|\le M$, then $|R_n(x)|\le\frac{M}{(n+1)!}|x-a|^{n+1}$

$(1+x)^a=\sum_{n=0}^{\infty}\binom{a}{n}x^n$ for $|x|<1$, $\binom{a}{n}=\frac{a(a-1)\cdots\cdots(a-n+1)}{n!}$, $\binom{a}{0}=1$