## Power Series for Several Elementary Functions

| *Function* | *Interval of Convergence* |
|---|---|
| $\dfrac{1}{x}=1-(x-1)+(x-1)^2-(x-1)^3+\cdots+(-1)^n(x-1)^n+\cdots$ | $0<x<2$ |
| $\dfrac{1}{1+x}=1-x+x^2-x^3+\cdots+(-1)^n x^n+\cdots$ | $-1<x<1$ |
| $\ln x=(x-1)-\dfrac{(x-1)^2}{2}+\dfrac{(x-1)^3}{3}-\cdots+(-1)^{n-1}\dfrac{(x-1)^n}{n}+\cdots$ | $0<x\le 2$ |
| $\ln(1+x)=x-\dfrac{x^2}{2}+\dfrac{x^3}{3}-\dfrac{x^4}{4}+\cdots+(-1)^{n-1}\dfrac{x^n}{n}+\cdots$ | $-1<x\le 1$ |
| $e^x=1+x+\dfrac{x^2}{2!}+\dfrac{x^3}{3!}+\cdots+\dfrac{x^n}{n!}+\cdots$ | $-\infty<x<\infty$ |
| $\sin x=x-\dfrac{x^3}{3!}+\dfrac{x^5}{5!}-\dfrac{x^7}{7!}+\cdots+(-1)^n\dfrac{x^{2n+1}}{(2n+1)!}+\cdots$ | $-\infty<x<\infty$ |
| $\cos x=1-\dfrac{x^2}{2!}+\dfrac{x^4}{4!}-\dfrac{x^6}{6!}+\cdots+(-1)^n\dfrac{x^{2n}}{(2n)!}+\cdots$ | $-\infty<x<\infty$ |
| $\tan^{-1}x=x-\dfrac{x^3}{3}+\dfrac{x^5}{5}-\dfrac{x^7}{7}+\cdots+(-1)^n\dfrac{x^{2n+1}}{2n+1}+\cdots$ | $-1\le x\le 1$ |
| $\sin^{-1}x=x+\dfrac{x^3}{2\cdot 3}+\dfrac{1\cdot 3x^5}{2\cdot 4\cdot 5}+\dfrac{1\cdot 3\cdot 5x^7}{2\cdot 4\cdot 6\cdot 7}+\cdots+\dfrac{(2n)!\,x^{2n+1}}{(2^n n!)^2(2n+1)}+\cdots$ | $-1\le x\le 1$ |
| $(1+x)^k=1+kx+\dfrac{k(k-1)x^2}{2!}+\dfrac{k(k-1)(k-2)x^3}{3!}+\cdots+\dfrac{k(k-1)\cdots(k-n+1)x^n}{n!}+\cdots$ | $-1<x<1$* |

**The binomial series may converge at $x=\pm 1$ for some values of $k$.*