Power Series.

$$f(x) = \sum_{n=0}^{\infty} c_n x^n$$

$f(x)$ = infinite sum of polys, x^n.

$\frac{d}{dx}$ & $\int dx$ term-by-term.

⋮

Fourier Series.

Periodic function = ∞ sum of $\cos(nx)$ and $\sin(nx)$.

→ Fourier Transform
→ Signal Processing
→ PDE & boundary value problems.
⋮

Diff. Eqns.

→ series solutions. eg.
$\sum c_n x^n$ solution to $y'' = -y$
gives recurrence relations among c_i
⇝ $y = c_0 \cos(x) + c_1 \sin(x)$.

→ Bessel functions - - -

→ Continuous version – Laplace Transform

$$A(x) = \sum_0^{\infty} a(n)\, x^n = \sum_0^{\infty} a(n)\, e^{\ln(x) n}$$

$s = \ln(x)$, $n \to t$, $\sum_n \rightsquigarrow \int dt$

$$F(s) = \int_0^{\infty} f(t)\, e^{st}\, dt$$

Wavelets.

$f(x)$ = ∞ sum of scalings and shifts of a localized waveform.

→ Wavelet transform
→ Compression, JPEG etc.
→ Multiresolution processing
⋮

Complex Versions.

eg. $e^{it} = 1 + (it) + \frac{(it)^2}{2!} + - - -$

$= \cos(t) + i \sin(t)$

$\boxed{e^{i\pi} = -1}$