Source: http://www.maths.manchester.ac.uk/~cds/internal/tables/tables.html

DERIVATIVES

function	derivative
x^n	nx^{n-1}
e^x	e^x
$a^x(a>0)$	$a^x \ell n a$
$\ell n x$	$\frac{1}{x}$
$\log_a x$	$\frac{1}{x\ell n a}$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\text{cosec } x$	$-\text{ cosec } x \cot x$
$\sec x$	$\sec x \tan x$
$\cot x$	$-\text{ cosec }^2 x$
$\sin^{-1} x$	$\dfrac{1}{\sqrt{1-x^2}}$
$\cos^{-1} x$	$-\dfrac{1}{\sqrt{1-x^2}}$
$\tan^{-1} x$	$\dfrac{1}{1+x^2}$
$\sinh x$	$\cosh x$
$\cosh x$	$\sinh x$
$\tanh x$	$\text{sech }^2 x$
$\text{cosech } x$	$-\text{ cosech } x \coth x$
$\text{sech } x$	$-\text{ sech } x \tanh x$
$\coth x$	$-\text{ cosech}^2 x$
$\sinh^{-1} x$	$\dfrac{1}{\sqrt{1+x^2}}$
$\cosh^{-1} x(x>1)$	$\dfrac{1}{\sqrt{x^2-1}}$
$\tanh^{-1} x(\|x\|<1)$	$\dfrac{1}{1-x^2}$
$\coth^{-1} x(\|x\|>1)$	$-\dfrac{1}{x^2-1}$

Product Rule

$$\frac{d}{dx}(u(x)\ v(x)) = u(x)\frac{dv}{dx} + v(x)\frac{du}{dx}$$

Quotient Rule

$$\frac{d}{dx}\left(\frac{u(x)}{v(x)}\right) = \frac{v(x)\frac{du}{dx} - u(x)\frac{dv}{dx}}{[v(x)]^2}$$

Chain Rule

$$\frac{d}{dx}\left(f(g(x))\right) = f'(g(x)) \times g'(x)$$

Leibnitz's theorem

$$\frac{d^n}{dx^n}(f.g) = f^{(n)}.g + nf^{(n-1)}.g^{(1)} + \frac{n(n-1)}{2!}f^{(n-2)}.g^{(2)} + ... + \binom{n}{r}f^{(n-r)}.g^{(r)} + ... + f.g^{(n)}$$

INTEGRALS

function	integral
$f(x)\dfrac{dg(x)}{dx}$	$f(x)g(x) - \displaystyle\int \frac{df(x)}{dx} g(x)dx$
$x^n (n \neq -1)$	$\frac{x^{n+1}}{n+1}$
$\frac{1}{x}$	$\ell n\lvert x\rvert$ Note:- $\ell n\lvert x\rvert + K = \ell n\lvert x/x_0\rvert$
e^x	e^x
$\sin x$	$-\cos x$
$\cos x$	$\sin x$
$\tan x$	$\ell n\lvert \sec x\rvert$
$\text{cosec } x$	$-\ell n\lvert \text{ cosec } x + \cot x\rvert$ or $\ell n \left\lvert \tan \frac{x}{2} \right\rvert$
$\sec x$	$\ell n\lvert \sec x + \tan x\rvert = \ell n \left\lvert \tan\left(\frac{\pi}{4} + \frac{x}{2}\right)\right\rvert$
$\cot x$	$\ell n\lvert \sin x\rvert$
$\dfrac{1}{a^2 + x^2}$	$\dfrac{1}{a}\tan^{-1}\dfrac{x}{a}$
$\dfrac{1}{a^2 - x^2}$	$\dfrac{1}{2a}\ell n\dfrac{a+x}{a-x}$ or $\dfrac{1}{a}\tanh^{-1}\dfrac{x}{a}$ $(\lvert x\rvert < a)$
$\dfrac{1}{x^2 - a^2}$	$\dfrac{1}{2a}\ell n\dfrac{x-a}{x+a}$ or $-\dfrac{1}{a}\coth^{-1}\dfrac{x}{a}$ $(\lvert x\rvert > a)$
$\dfrac{1}{\sqrt{a^2 - x^2}}$	$\sin^{-1}\dfrac{x}{a}$ $(a > \lvert x\rvert)$
$\dfrac{1}{\sqrt{a^2 + x^2}}$	$\sinh^{-1}\dfrac{x}{a}$ or $\ell n\left(x + \sqrt{x^2 + a^2}\right)$
$\dfrac{1}{\sqrt{x^2 - a^2}}$	$\cosh^{-1}\dfrac{x}{a}$ or $\ell n\lvert x + \sqrt{x^2 - a^2}\rvert$ $(\lvert x\rvert > a)$
$\sinh x$	$\cosh x$
$\cosh x$	$\sinh x$
$\tanh x$	$\ell n \cosh x$
$\text{cosech } x$	$-\ell n\,\lvert cosechx + cothx\rvert$ or $\ell n \left\lvert \tanh\frac{x}{2}\right\rvert$
$\text{sech } x$	$2\ \tan^{-1} e^x$
$\coth x$	$\ell n\lvert \sinh x\rvert$

Double integral

$$\int\int f(x,y)dxdy = \int\int g(r,s)Jdrds$$

where

$$J = \frac{\partial(x,y)}{\partial(r,s)} = \begin{vmatrix} \frac{\partial x}{\partial r} & \frac{\partial x}{\partial s} \\ \frac{\partial y}{\partial r} & \frac{\partial y}{\partial s} \end{vmatrix}$$

SERIES

Powers of Natural Numbers

$$\sum_{k=1}^{n} k = \frac{1}{2}\, n(n+1)\ ;\quad \sum_{k=1}^{n} k^2 = \frac{1}{6}\, n(n+1)(2n+1); \sum_{k=1}^{n} k^3 = \frac{1}{4}\, n^2(n+1)^2$$

Arithmetic $\qquad S_n = \sum_{k=0}^{n-1}(a+kd) = \frac{n}{2}\,\{2a+(n-1)d\}$

Geometric (convergent for $-1 < r < 1$)

$$S_n = \sum_{k=0}^{n-1} ar^k = \frac{a(1-r^n)}{1-r}\ ,\ S_\infty = \frac{a}{1-r}$$

Binomial (convergent for $|x| < 1$)

$$(1+x)^n = 1 + nx + \binom{n}{2}x^2 + ... + \binom{n}{r}x^r + ...$$

where $\binom{n}{r} = \dfrac{n(n-1)(n-2)...(n-r+1)}{r!}$

Maclaurin series

$$f(x) = f(0) + xf'(0) + \frac{x^2}{2!}f''(0) + ... + \frac{x^k}{k!}f^{(k)}(0) + R_{k+1}$$

where $R_{k+1} = \dfrac{x^{k+1}}{(k+1)!}f^{(k+1)}(\theta x),\quad 0 < \theta < 1$

Taylor series

$$f(a+h) = f(a) + hf'(a) + \frac{h^2}{2!}f''(a) + ... + \frac{h^k}{k!}f^{(k)}(a) + R_{k+1}$$

where $R_{k+1} = \dfrac{h^{k+1}}{(k+1)!}f^{(k+1)}(a+\theta h)\ ,\ 0 < \theta < 1.$

OR

$$f(x) = f(x_0) + (x-x_0)f'(x_0) + \frac{(x-x_0)^2}{2!}f''(x_0) + ... + \frac{(x-x_0)^k}{k!}f^{(k)}(x_0) + R_{k+1}$$

where $R_{k+1} = \dfrac{(x-x_0)^{k+1}}{(k+1)!}f^{(k+1)}(x_0+(x-x_0)\theta),\quad 0 < \theta < 1$