Calculus & Analysis Symbols with Examples

Symbol	Symbol Name	Symbol Meaning	Example
$\lim_{x \to x0} f(x)$	limit	limit value of a function	$\lim_{x \to 1} \frac{x^2 - 1}{x - 1} = 2$
ε	epsilon	represents a very small number, near zero	$\varepsilon \to 0$
e	e constant/ Euler's number	$e = 2.718281828...$	$e = \lim (1+1/x)^x, x \to \infty$
y'	derivative	derivative - Lagrange's notation	$(3x^3)' = 9x^2$
y''	second derivative	derivative of derivative	$(3x^3)'' = 18x$
$y^{(n)}$	nth derivative	n times derivation	$(3x^3)^{(3)} = 18$
$\frac{dy}{dx}$	derivative	derivative - Leibniz's notation	$d(3x^3)/dx = 9x^2$
$\frac{d^2y}{dx^2}$	second derivative	derivative of derivative	$d^2(3x^3)/dx^2 = 18x$
$\frac{d^ny}{dx^n}$	nth derivative	n times derivation	$y_n = \frac{d^n y}{dx^n} = (-1)^{n-1} \cdot \frac{(n-1)!a^n}{(ax+b)^n}$
$\dot{y}$	time derivative	derivative by time - Newton's notation	$\dot{y} \equiv \frac{dy}{dt} = \frac{d}{dt}\left(f(t)\right) = D_t y = f'(t) = y'_t$
$\ddot{y}$	time second derivative	derivative of derivative	$\ddot{y} = \frac{d^2y}{dt^2} = \frac{d}{dt}\left(\frac{dy}{dt}\right) = \frac{d}{dt}\left(\dot{y}\right) = \frac{d}{dt}\left(f'(t)\right) = D_t^2 y = f''(t) = y''_t$
$D_x y$	derivative	derivative - Euler's notation	$D_x y$ for the first derivative
$D_x^2 y$	second derivative	derivative of derivative	$D_x^2 y$ for the second derivative
$\frac{\partial f(x,y)}{\partial x}$	partial derivative	partial derivative	$\partial(x^2+y^2)/\partial x = 2x$
$\int$	integral	opposite to derivation	$\int x^{0.5}\,dx = x^{1.5}/1.5 + C$
$\iint$	double integral	integration of function of 2 variables	$\int_0^1 \left(\int_0^2 xy^2 dx\right) dy = \int_0^1 \left(\frac{x^2}{2} y^2 \Big\|_{x=0}^{x=2}\right) dy$

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$\iiint$	triple integral	integration of function of 3 variables	$\iiint_W dV = \int_{1/\sqrt{2}}^{1/\sqrt{2}} \int_{\sqrt{1/2-x^2}}^{\sqrt{1/2-x^2}} \int_{\sqrt{x^2+y^2}}^{\sqrt{1-x^2-y^2}} dz\,dy\,dx$
$\oint$	closed contour / line integral	closed contour / line integral	$\oint_C \frac{1}{z}\,dz = \int_0^{2\pi} \frac{1}{e^{it}} ie^{it}\,dt = i\int_0^{2\pi} 1\,dt = [t]_0^{2\pi} i = (2\pi - 0)i = 2\pi i$
$\oiint$	closed surface integral	closed surface integral	
$\oiiint$	closed volume integral	closed volume integral	
$[a,b]$	closed interval	closed interval	$[a,b] = \{x \mid a \le x \le b\}$
(a,b)	open interval	open interval	$(a,b) = \{x \mid a < x < b\}$
i	imaginary unit	$i \equiv \sqrt{-1}$	$z = 3 + 2i$
z^*	complex conjugate	$z = a+bi \rightarrow z^* = a-bi$	$z^* = 3 + 2i$
$\overline{z}$	complex conjugate	$z = a+bi \rightarrow \overline{z} = a-bi$	$\overline{z} = 3 + 2i$
∇	nabla / del	gradient / divergence operator	$\nabla f(x,y,z)$
$\overrightarrow{x}$	vector	vector	$\vec{u} \cdot \vec{w} = xx' + yy' = 2\times1 + 1\times3 = 2+3 = 5$
$\widehat{x}$	unit vector	unit vector	$\|\mathbf{w}\| = \sqrt{\left(\frac{1}{\sqrt{2}}\right)^2 + \left(-\frac{1}{\sqrt{2}}\right)^2} = \sqrt{\frac{1}{2}+\frac{1}{2}} = \sqrt{1} = 1$
$x * y$	convolution	convolution	$y(t) = x(t) * h(t)$
$\mathcal{L}$	Laplace transform	Laplace transform	$F(s) = \mathcal{L}\{f(t)\}$
$\mathcal{F}$	Fourier transform	Fourier transform	$X(\omega) = \mathcal{F}\{f(t)\}$
δ	delta function	delta function	$\delta_\alpha(x) = \frac{1}{\pi x}\sin(\alpha x)$
∞	lemniscate	infinity symbol	$\left(c - \sqrt{x^2+y^2}\right)^2 + z^2 = a^2$