Greek Alphabet

α	A	alpha	ν	N	nu
β	B	beta	ξ	Ξ	xi
γ	Γ	gamma	o	O	omicron
δ	Δ	delta	π	Π	pi
ϵ	E	epsilon	ρ	P	rho
ζ	Z	zeta	σ	Σ	sigma
η	H	eta	τ	T	tau
θ	Θ	theta	υ	Υ	upsilon
ι	I	iota	ϕ	Φ	phi
κ	K	kappa	χ	X	chi
λ	Λ	lambda	ψ	Ψ	psi
μ	M	mu	ω	Ω	omega

$u(t)$

Notation

$u'' = d^2u/dx^2$

$$u' \equiv \frac{\mathrm{d}u}{\mathrm{d}x} \qquad u^{(r)} \equiv \frac{\mathrm{d}^r u}{\mathrm{d}x^r}$$

$\dot{u} = \frac{du}{dt}$

$\ddot{u} = \frac{d^2u}{dt^2}$

Properties of trigonometric functions

$$\tan x = \frac{\sin x}{\cos x} \qquad \cot x = \frac{\cos x}{\sin x}$$

$$\sec x = \frac{1}{\cos x} \qquad \operatorname{cosec} x = \frac{1}{\sin x}$$

$$\cos^2 x + \sin^2 x = 1 \qquad 1 + \tan^2 x = \sec^2 x$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B \qquad \sin 2A = 2 \sin A \cos A$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B \qquad \cos 2A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$$

$$\begin{aligned}
\sin A + \sin B &= 2 \sin \tfrac{1}{2}(A+B) \cos \tfrac{1}{2}(A-B) \\
\sin A - \sin B &= 2 \sin \tfrac{1}{2}(A-B) \cos \tfrac{1}{2}(A+B) \\
\cos A + \cos B &= 2 \cos \tfrac{1}{2}(A+B) \cos \tfrac{1}{2}(A-B) \\
\cos A - \cos B &= 2 \sin \tfrac{1}{2}(A+B) \sin \tfrac{1}{2}(B-A)
\end{aligned}$$

Rules for differentiation

If $f(x) = x^n$ then $f'(x) = nx^{n-1}$

Product rule $\frac{\mathrm{d}}{\mathrm{d}x}(fg) = \frac{\mathrm{d}f}{\mathrm{d}x}g + \frac{\mathrm{d}g}{\mathrm{d}x}f$

Quotient rule $\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{f}{g}\right) = \frac{\frac{\mathrm{d}f}{\mathrm{d}x}g - \frac{\mathrm{d}g}{\mathrm{d}x}f}{g^2}$

Function of a function. If $f(x) = F(u(x))$ then $\frac{\mathrm{d}f}{\mathrm{d}x} = \frac{\mathrm{d}F}{\mathrm{d}u}\frac{\mathrm{d}u}{\mathrm{d}x}$

Partial derivatives

$u(x,t)$

$\frac{\partial u}{\partial t} = \left.\frac{\partial u}{\partial t}\right|_x = u_t$

$\frac{\partial u}{\partial x} = \left.\frac{\partial u}{\partial x}\right|_t = u_x$

$u_{xx} = \frac{\partial^2 u}{\partial t^2}$

Derivatives of common functions

$$\frac{\mathrm{d}}{\mathrm{d}x}\sin x = \cos x \qquad \frac{\mathrm{d}}{\mathrm{d}x}\cos x = -\sin x$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\tan x = \sec^2 x \qquad \frac{\mathrm{d}}{\mathrm{d}x}\ln x = \frac{1}{x} \qquad \frac{\mathrm{d}}{\mathrm{d}x}e^x = e^x$$

Taylor Series

$$f(x) = f(a) + f'(a)(x-a) + \frac{1}{2}f''(a)(x-a)^2 + \frac{1}{3!}f'''(a)(x-a)^3 + \cdots$$

$$f(a+h) = f(a) + f'(a)h + \frac{1}{2}f''(a)h^2 + \frac{1}{3!}f'''(a)h^3 + \cdots$$

Maclaurin series

$$f(x) = f(0) + f'(0)x + \frac{1}{2}f''(0)x^2 + \frac{1}{3!}f'''(0)x^3 + \cdots$$

Standard expansions:

$$1/(1-x) = 1 + x + x^2 + x^3 + \cdots \qquad (-1 < x < 1)$$

$$(1+x)^a = 1 + ax + \frac{a(a-1)}{2}x^2 + \frac{a(a-1)(a-2)}{3!}x^3 + \cdots \qquad (-1 < x < 1)$$

$$\ln(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \cdots \qquad (-1 < x \le 1)$$

$$e^x = 1 + x + \frac{1}{2}x^2 + \frac{1}{3!}x^3 + \frac{1}{4!}x^4 + \cdots$$

$$\begin{aligned} \sin x &= x - \frac{1}{3!}x^3 + \frac{1}{5!}x^5 - \cdots \\ \cos x &= 1 - \frac{1}{2}x^2 + \frac{1}{4!}x^4 - \cdots \\ \tan x &= x + \frac{1}{3}x^3 + \frac{2}{15}x^5 + \cdots \qquad \left(-\frac{\pi}{2} < x < \frac{\pi}{2}\right) \end{aligned}$$

Standard integrals

$f(x)$	$\int f(x)dx$	$f(x)$	$\int f(x)dx$
x^a	$\frac{1}{a+1}x^{a+1}$ $(a \neq -1)$	e^{kx}	$\frac{1}{k}e^{kx}$
$\frac{1}{x}$	$\ln\lvert x\rvert$	$(x^2+b)^{-\frac{1}{2}}$	$\ln\left[x + \sqrt{(x^2+b)}\right]$
$\cos kx$	$\frac{1}{k}\sin kx$		
$\sin kx$	$-\frac{1}{k}\cos kx$	$(x^2-a^2)^{-1}$	$\frac{1}{2a}\ln\frac{x-a}{x+a}$
$\tan kx$	$-\frac{1}{k}\ln\lvert\cos kx\rvert$		(for $x > a$)
$\cot kx$	$-\frac{1}{k}\ln\lvert\sin kx\rvert$	$(a^2-x^2)^{-1}$	$\frac{1}{2a}\ln\frac{a+x}{a-x}$
$\sec^2 kx$	$\frac{1}{k}\tan kx$		(for $-a < x < a$)
$\mathrm{cosec}^2 kx$	$-\frac{1}{k}\cot kx$		

$$\int \frac{f'(x)}{f(x)}dx = \ln|f(x)|$$