Math 302

Ressources

Table of Integrals and Derivatives

Contents

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First Case

Each factor of the form $(ax+b)^k$ in the denominator gives rise to k $(k \in \mathbb{N})$ quotients of the form

$$\frac{A_1}{ax+b} + \frac{A_2}{(ax+b)^2} + \ldots + \frac{A_k}{(ax+b)^k},$$

where $A_i \in \mathbb{R}$, for $i = 1, 2, \ldots, k$.

Second Case

Each factor of the form $(ax^2+bx+c)^k$ in the denominator give rise to a sum of k $(k \in \mathbb{N})$ quotients of the form

$$\frac{A_1x+B_1}{ax^2+bx+c} + \frac{A_2x+B_2}{(ax^2+bx+c)^2} + \ldots + \frac{A_kx+B_k}{(ax^2+bx+c)^k},$$

where $A_i, B_i \in \mathbb{R}$, for $i = 1, 2, \ldots, k$.

INTEGRATION FORMULAS

Basic Integration Formulas Table

Integrands	Integration	Integrands	Integration
x^r, $r \neq -1$	$\int x^r\,dx = \frac{x^{r+1}}{r+1} + C$	e^x	$\int e^x\,dx = e^x + C$
$\frac{1}{x}$	$\int \frac{1}{x}\,dx = \ln\lvert x\rvert + C$	$a^x \ln a$	$\int a^x \ln a\,dx = a^x + C$
$\cos x$	$\int \cos x\,dx = \sin x + C$	$\frac{-1}{\sqrt{1-x^2}}$	$\int \frac{-1}{\sqrt{1-x^2}}\,dx = \mathrm{Arc}\cos x + C$
$-\sin x$	$\int -\sin x\,dx = \cos x$	$\frac{1}{\sqrt{1-x^2}}$	$\int \frac{1}{\sqrt{1-x^2}}\,dx = \mathrm{Arc}\sin x + C$
$\sec^2 x$	$\int \sec^2 x\,dx = \tan x$	$\frac{1}{1+x^2}$	$\int \frac{1}{1+x^2}\,dx = \mathrm{Arc}\tan x + C$
$-\csc^2 x$	$\int -\csc^2 x\,dx = \cot x$	$\frac{-1}{1+x^2}$	$\int \frac{-1}{1+x^2}\,dx = \mathrm{Arc}\cot x + C$
$\sec x \tan x$	$\int \sec x \tan x\,dx = \sec x$	$\frac{1}{x\sqrt{x^2-1}}$	$\int \frac{1}{x\sqrt{x^2-1}}\,dx = \mathrm{Arc}\sec x + C$
$-\csc x \cot x$	$\int -\csc x \cot x\,dx = \cot x$	$\frac{-1}{x\sqrt{x^2-1}}$	$\int \frac{-1}{x\sqrt{x^2-1}}\,dx = \mathrm{Arc}\csc x + C$
$\tan x$	$\int \tan x\,dx = -\ln\lvert\cos x\rvert + C$	$\sec x$	$\int \sec x\,dx = \ln\lvert\sec x + \tan x\rvert + C$
$\cot x$	$\int \cot x\,dx = \ln\lvert\sin x\rvert + C$	$\csc x$	$\int \csc x\,dx = -\ln\lvert\csc x + \cot x\rvert + C$

Integration by Parts

$$\int u\,dv = uv - \int v\,du.$$

Reduction Formulas

(a) $\int \sin^n\ du = \frac{-\sin^{n-1} u \cos u}{n} + \frac{n-1}{n} \int \sin^{n-2} u\,du$

(b) $\int \cos^n u\,du = \frac{\cos^{n-1} u \sin u}{n} + \frac{n-1}{n} \int \cos^{n-2} u\,du$

(c) $\int \sec^n u\,du = \frac{\sec^{n-2} u \tan u}{n-1} + \frac{n-2}{n-1} \int \sec^{n-2} u\,du$

(d) $\int \tan^n u = \frac{\tan^{n-1} u}{n-1} - \int \tan^{n-2} u\,du.$

General Differentiation Rules

1) $r \in \mathbb{R},\ (x^r)' = rx^{r-1}$
2) $(f_1(x) + f_2(x) + \ldots + f_k(x))' = f_1'(x) + f_2'(x) + \ldots + f_k'(x))$
3) $(f(x) \cdot g(x))' = f'(x)g(x) + f(x)g'(x)$
4) $\left(\dfrac{f(x)}{g(x)}\right)' = \dfrac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}.$

Exponential and Logarithmic Functions

Fonction	**Derivative**	**Fonction**	**Derivative**
a^x	$(\ln a)a^x$	$a^{f(x)}$	$f'(x)(\ln a)a^{f(x)}$
e^x	e^x	$e^{f(x)}$	$f'(x)e^{f(x)}$
$\ln x$	$\dfrac{1}{x}$	$\ln f(x)$	$\dfrac{f'(x)}{f(x)}$
$\log_a x$	$\dfrac{1}{(\ln a)x}$	$\log_a f(x)$	$\dfrac{f'(x)}{(\ln a)f(x)}$

Trigonometric Functions

Fonction	**Derivative**	**Fonction**	**Derivative**
$\sin x$	$\cos x$	$\sin(f(x))$	$f'(x)\cos(f(x))$
$\cos x$	$-\sin x$	$\cos(f(x))$	$-f'(x)\sin(f(x))$
$\tan x$	$\sec^2 x$	$\tan(f(x))$	$f'(x)\sec^2(f(x))$
$\cot x$	$-\csc^2 x$	$\cot(f(x))$	$-f'(x)\csc^2(f(x))$
$\sec x$	$\sec x \tan x$	$\sec(f(x))$	$f'(x)\sec(f(x))\tan(f(x))$
$\csc x$	$-\csc x \cot x$	$\csc(f(x))$	$-f'(x)\csc(f(x))\cot(f(x))$