

MATH 302

RESSOURCES

TABLE OF INTEGRALS AND DERIVATIVES

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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

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

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

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

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

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

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	$\int e^x dx = e^x + C$
$\frac{1}{x}$	$\int \frac{1}{x} dx = \ln x + C$	$a^x \ln a$	$\int a^x \ln a dx = a^x + C$
$\cos x$	$\int \cos x dx = \sin x + C$	$\frac{-1}{\sqrt{1-x^2}}$	$\int \frac{-1}{\sqrt{1-x^2}} dx = \text{Arc cos } x + C$
$-\sin x$	$\int -\sin x dx = \cos x$	$\frac{1}{\sqrt{1-x^2}}$	$\int \frac{1}{\sqrt{1-x^2}} dx = \text{Arc sin } x + C$
$\sec^2 x$	$\int \sec^2 x dx = \tan x$	$\frac{1}{1+x^2}$	$\int \frac{1}{1+x^2} dx = \text{Arc tan } x + C$
$-\csc^2 x$	$\int -\csc^2 x dx = \cot x$	$\frac{-1}{1+x^2}$	$\int \frac{-1}{1+x^2} dx = \text{Arc cot } x + C$
$\sec x \tan x$	$\int \sec x \tan x dx = \sec x$	$\frac{1}{x\sqrt{x^2-1}}$	$\int \frac{1}{x\sqrt{x^2-1}} dx = \text{Arc sec } x + C$
$-\csc x \cot x$	$\int -\csc x \cot x dx = \cot x$	$\frac{-1}{x\sqrt{x^2-1}}$	$\int \frac{-1}{x\sqrt{x^2-1}} dx = \text{Arc csc } x + C$
$\tan x$	$\int \tan x dx = -\ln \cos x + C$	$\sec x$	$\int \sec x dx = \ln \sec x + \tan x + C$
$\cot x$	$\int \cot x dx = \ln \sin x + C$	$\csc x$	$\int \csc x dx = -\ln \csc x + \cot x + C$

Integration by Parts

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

Reduction Formulas

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

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

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

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

General Derivatives Rules

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

Exponential and Logarithmic Functions

Fonction	Dérivée	Fonction	Dérivée
a^x	$(\ln a)a^x$	$a^{f(x)}$	$f'(x)(\ln a)a^{f(x)}$
e^x	e^x	$e^{f(x)}$	$f'(x)e^{f(x)}$
$\ln x$	$\frac{1}{x}$	$\ln f(x)$	$\frac{f'(x)}{f(x)}$
$\log_a x$	$\frac{1}{(\ln a)x}$	$\log_a f(x)$	$\frac{f'(x)}{(\ln a)f(x)}$

Trigonometric Functions

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