Calculus Cheatsheet

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Differentiation Rules

Rule	Formula
Power Rule	$\frac{d}{dx}x^n = nx^{n-1}$
Constant Multiple Rule	$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}f(x)$
Sum/Difference Rule	$\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}f(x) \pm \frac{d}{dx}g(x)$
Product Rule	$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$
Quotient Rule	$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$
Chain Rule	$\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$
Logarithm	$\frac{d}{dx}\ln x = \frac{1}{x}$
Exponential	$\frac{d}{dx}e^x = e^x$

Trigonometric Differentiations

Function	Derivative
$\sin x$	$\frac{d}{dx}\sin x = \cos x$
$\cos x$	$\frac{d}{dx}\cos x = -\sin x$
$\tan x$	$\frac{d}{dx}\tan x = \sec^2 x$
$\csc x$	$\frac{d}{dx}\csc x = -\csc x \cot x$
$\sec x$	$\frac{d}{dx}\sec x = \sec x \tan x$
$\cot x$	$\frac{d}{dx}\cot x = -\csc^2 x$

Inverse Trigonometric Differentiations

Function	Derivative
$\arcsin x$	$\frac{d}{dx}\arcsin x = \frac{1}{\sqrt{1-x^2}}$
$\arccos x$	$\frac{d}{dx}\arccos x = -\frac{1}{\sqrt{1-x^2}}$
$\arctan x$	$\frac{d}{dx}\arctan x = \frac{1}{1+x^2}$
$\mathrm{arccot}\ x$	$\frac{d}{dx}\mathrm{arccot}\ x = -\frac{1}{1+x^2}$
$\mathrm{arcsec}\ x$	$\frac{d}{dx}\mathrm{arcsec}\ x = \frac{1}{\lvert x\rvert\sqrt{x^2-1}}$
$\mathrm{arccsc}\ x$	$\frac{d}{dx}\mathrm{arccsc}\ x = -\frac{1}{\lvert x\rvert\sqrt{x^2-1}}$

Integration Rules

Rule	**Formula**
Power Rule	$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \text{ for } n \neq -1$
Logarithm	$\int \frac{1}{x} dx = \ln \lvert x \rvert + C$
Constant Multiple Rule	$\int cf(x)dx = c\int f(x)dx$
Sum/Difference Rule	$\int [f(x) \pm g(x)]dx = \int f(x)dx \pm \int g(x)dx$
Integration by Parts	$\int udv = uv - \int vdu$
Exponential	$\int e^x dx = e^x + C$

Trigonometric Integrations

Function	**Integral**
$\sin x$	$\int \sin x dx = -\cos x + C$
$\cos x$	$\int \cos x dx = \sin x + C$
$\sec^2 x$	$\int \sec^2 x dx = \tan x + C$
$\csc^2 x$	$\int \csc^2 x dx = -\cot x + C$
$\sec x \tan x$	$\int \sec x \tan x dx = \sec x + C$
$\csc x \cot x$	$\int \csc x \cot x dx = -\csc x + C$
$\tan x$	$\int \tan x dx = -\ln \lvert \cos x \rvert + C = \ln \lvert \sec x \rvert + C$
$\cot x$	$\int \cot x dx = \ln \lvert \sin x \rvert + C$
$\sec x$	$\int \sec x dx = \ln \lvert \sec x + \tan x \rvert + C$
$\csc x$	$\int \csc x dx = -\ln \lvert \csc x + \cot x \rvert + C$

Integrals Resulting in Inverse Trigonometric Functions

Integral	**Result**
$\int \frac{dx}{\sqrt{a^2-x^2}}$	$\arcsin\left(\frac{x}{a}\right) + C$
$\int \frac{dx}{a^2+x^2}$	$\frac{1}{a}\arctan\left(\frac{x}{a}\right) + C$
$\int \frac{dx}{x\sqrt{x^2-a^2}}$	$\frac{1}{a}\text{arcsec}\left(\frac{\lvert x \rvert}{a}\right) + C$