Table of Derivatives

Power Rule

$$\frac{d}{dx}x^n = nx^{n-1}$$

Product Rule

$$\frac{d}{dx}(f(x)g(x)) = f'g + fg'$$

Quotient Rule

$$\frac{d}{dx}\frac{f(x)}{g(x)} = \frac{f'g - fg'}{g^2}$$

Chain Rule

$y = u(x)$

$$\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx} \quad \text{or} \quad \frac{dy}{dx} = \frac{dy}{du}u'(x)$$

OR

$$\frac{d}{dx}f(g(x) = f'(g(x))g'(x)$$

Trigonometric Derivatives

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

Table of Integrals

Power Rule

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$$

Integration by Parts(the backward Product Rule)

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

Substitution Rule (the backward Chain Rule)

$$\int f(g(x)) \cdot g'(x)\ dx$$

Let $u = g(x)$

$du = g'(x)\ dx$

$$\int f(g(x)) \cdot g'(x)\ dx = \int f(u)\ du$$

Trigonometric Integrals

$$\int \cos bx\ dx = \frac{\sin bx}{b} + C$$

$$\int \sin bx\ dx = -\frac{\cos bx}{b} + C$$

This rule for the constant "*b*" applies to the rest of these trigonometric integrals

$$\int \sec^2 x\ dx = \tan x + C$$

$$\int \sec x \tan x\ dx = \sec x + C$$

$$\int -\csc x \cot x\ dx = \csc x + C$$

$$\int -\csc^2 x = \cot x + C$$

Exponential and Logarithmic Derivatives

$$\frac{d}{dx}a^x = a^x \ln a$$
$$\frac{d}{dx}e^x = e^x$$
$$\frac{d}{dx}\log_a x = \frac{1}{x\ln a}$$
$$\frac{d}{dx}\ln x = \frac{1}{x}$$

Derivatives of Inverse Trig Functions

$$\frac{d}{dx}\sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}\cos^{-1} x = -\frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}\tan^{-1} x = \frac{1}{1+x^2}$$

Exponential and Logarithmic Integrals

$$\int a^x\,dx = \frac{a^x}{\ln a} + C$$

$$\int e^x\,dx = e^x + C \qquad \textit{also} \int e^{bx}\,dx = \frac{e^{bx}}{b} + C$$

This rule for the constant "*b*" applies to the rest of these logarithmic and exponential integrals

$$\int \frac{dx}{x\ln a}dx = \log_a x + C$$

$$\int \frac{dx}{x} = \ln x + C$$

Inverse Trig Function Integrals

$$\sin^{-1} x + C = \int \frac{dx}{\sqrt{1-x^2}}$$

$$\textit{also} \quad \sin^{-1}\frac{x}{a} + C = \int \frac{dx}{\sqrt{a-x^2}}$$

$$\cos^{-1} x + C = \int -\frac{dx}{\sqrt{1-x^2}}$$

This rule for the constant "*a*" applies to $\cos^{-1} x$ as well

$$\frac{1}{a}\tan^{-1}\frac{x}{a} + C = \int \frac{dx}{a+x^2}$$

Mean Value Theorem: $f'(c) = \dfrac{f(b)-f(a)}{b-a}$ for some c such that $a \le c \le b$…or the slope of the tangent line is equal to the slope of the secant line somewhere on the interval $a \le c \le b$.

Average Value of a Function: $f_{avg} = \dfrac{1}{b-a}\displaystyle\int_a^b f(x)\,dx$ or the average area under the curve of *f(x)*.

Methods of approximating the Area under a Curve: *Area* from a to b = $\int_a^b f(x)\,dx$

Rectangles(Left, Mid, Right) or Riemann Sums: $\lim_{n\to\infty}\sum_{i=1}^{n} f(x_i)\Delta x$ where Δx

Trapezoidal Rule: $\frac{h}{2}(y_0 + 2y_1 + 2y_2 + ... + 2y_{n-1} + y_n)$ where $h = \Delta x$