Calculus Formulas

Integrals

Limit Definition of an Integral

$$\int_a^b f(x)dx = \lim_{n\to\infty} \sum_{i=1}^{n} f(x_i)\Delta x$$

Where $\Delta x = \frac{b-a}{n}$ and $x_i = a + i\Delta x$

Common Summation Formulas

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

$$\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\sum_{i=1}^{n} i^3 = \left[\frac{n(n+1)}{2}\right]^2$$

Midpoint Rule

$$\int_a^b f(x)dx \approx \lim_{n\to\infty} \sum_{i=1}^{n} f(\overline{x}_i)\Delta x =$$

$$\Delta x[f(\overline{x}_1) + \ldots + f(\overline{x}_n)]$$

Where $\Delta x = \frac{b-a}{n}$ and $\overline{x}_i = \frac{1}{2}(x_{i-1} + x_i)$

FTC Part 1

If f is continuous on [a,b], then the function g defined by

$$g(x) = \int_a^x f(t)dt \; for \; a \le x \le b$$

Is continuous on [a,b] and differentiable on (a,b) and g'(x) = f(x)

Fundamental Indefinite Integrals

$$\int k dx = kx + C$$

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

$$\int \frac{1}{x} dx = ln|x| + C$$

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

Trig Integrals

$$\int sin\, x\, dx = -cos\, x + C$$

$$\int cos\, x\, dx = sin\, x + C$$

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

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

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

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

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Inverse Trig Integrals

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

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

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

Integrals of Symmetric Functions

If f is even, then $\int_{-a}^{a} f(x)\,dx = 2\int_{0}^{a} f(x)\,dx$

If f is odd, then $\int_{-a}^{a} f(x)\,dx = 0$

Techniques of Integration

- Algebraic Manipulation
- U Substitution
- Integration By Parts
- Trigonometric Identities
- Trigonometric Substitution
- Partial Fraction Decomposition