



MATHEMATICS 201-NYB-05

Integral Calculus

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Integration Formulas

Definition

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

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

Table of Indefinite Integrals

1. $\int cf(x) dx = c \int f(x) dx$

2. $\int [f(x) + g(x)] dx = \int f(x) dx + \int g(x) dx$

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

4. $\int x^n dx = \frac{1}{n+1} x^{n+1} + C \quad (n \neq -1)$

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

6. $\int e^x dx = e^x + C$

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

8. $\int \sin x dx = -\cos x + C$

9. $\int \cos x dx = \sin x + C$

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

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

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

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

14. $\int \tan x dx = \ln|\sec x| + C$

15. $\int \cot x dx = \ln|\sin x| + C$

16. $\int \sec x dx = \ln|\sec x + \tan x| + C$

17. $\int \csc x dx = \ln|\csc x - \cot x| + C$

18. $\int \frac{1}{x^2 + a^2} dx = \frac{1}{a} \arctan\left(\frac{x}{a}\right) + C$

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

Techniques

Substitution: $\int f(x) g'(x) dx = \int f(u) du$ where $u = g(x)$

$$\int_a^b f(x) g'(x) dx = \int_{g(a)}^{g(b)} f(u) du$$

Integration by parts: $\int u dv = uv - \int v du$