Notes: The Indefinite Integral

Indefinite Integrals

The function $\int f(x)dx$ is called the **indefinite integral**.

The indefinite integral is an antiderivative: $\int f(x)dx = F(x)$ means $F'(x) = f(x)$.

If $F'(x) = f(x)$, the **general indefinite integral** is $\int f(x)dx = F(x) + C$, where C is a constant.

Remember the difference between definite and indefinite integrals: A definite integral $\int_a^b f(x)dx$ is a *number* (a constant), while an indefinite integral $\int f(x)dx$ is a *function* (or a family of functions).

Common Indefinite Integrals

Just as with definite integrals, if f and g are integrable and c is a constant, then $\int [f(x) \pm g(x)]dx = \int f(x)dx \pm \int g(x)dx$, and $\int cf(x)dx = c\int f(x)dx$.

By working backwards from lists of derivatives that we know, we can obtain a list of common antiderivatives or indefinite integrals:

Function type	Indefinite integral
Constant	$\int c\, dx = cx + C$
Power Function ($n \neq -1$)	$\int x^n\, dx = \dfrac{x^{n+1}}{n+1} + C$
Power Function with $n = -1$	$\int \dfrac{1}{x}dx = \ln|x| + C$
Exponential Function	$\int b^x\, dx = \dfrac{b^x}{\ln b} + C$
	$\int e^x\, dx = e^x + C$
Trigonometric Function	$\int \sin x\, dx = -\cos x + C$