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28 – Antiderivatives & The Indefinite Integral

Definition: Antiderivative

We say that F is an **antiderivative** for f if $F'(x) = f(x)$.

Theorem: General Antiderivative

If F is any one antiderivative for f, then *every* antiderivative for f has the form

$$F(x) + C$$

where C is an arbitrary constant. This is called the **general antiderivative**.

1. Find the general antiderivative of each of the following.

(a) $f(x) = x^4$

(b) $f(x) = 2\cos x + 1$

Definition: Indefinite Integral

If F is any antiderivative for f, then we use an **indefinite integral** to represent the general antiderivative as follows:

$$\int f(x)\,dx = F(x) + C.$$

2. Find a formula for each of the following.

(a) $\displaystyle\int x^{-3} + \sec^2(x)\,dx$

(b) $\displaystyle\int \frac{2}{\sqrt{1-x^2}}\,dx$

Theorem: Antiderivatives of Power Functions

- $\displaystyle\int x^n\,dx = \frac{1}{n+1}x^{n+1} + C$ for $n \neq -1$
- $\displaystyle\int x^{-1}\,dx = \ln|x| + C$

3. Compute.

(a) $\displaystyle\int \sqrt{x}(1 + x^{\frac{5}{2}})\,dx$

(b) $\displaystyle\int \frac{2}{\sqrt{1-x^2}}\,dx$

(c) $\displaystyle\int \frac{3 + x^{-3}}{x}\,dx$

(d) $\displaystyle\int \cos(2x)\,dx$