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# 28 – Antiderivatives & Indefinite Integrals

**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**

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

**3.** Compute.

**(a)** $\int (5x^3 + \pi - \frac{1}{\sqrt{x}}) \, dx$

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

**(c)** $\int \cos(3x) \, dx$

**4.** Find a function $f(x)$ satisfying the following conditions.

$$f'(x) = \frac{3 + x^{-3}}{x}, \quad f(1) = 2$$