

9. Integration

- Integration is the inverse process of differentiation. If $\frac{d}{dx}f(x) = g(x)$, then we can write $\int g(x) dx = f(x) + C$. This is called the general or the indefinite integral and C is called the constant of integration.
- Some standard indefinite integrals are given as follows:
 - $\int x^n dx = \frac{x^{n+1}}{n+1} + C, n \neq -1$
 - $\int dx = x + C$
 - $\int \sin x dx = -\cos x + C$
 - $\int \cos x dx = \sin x + C$
 - $\int \sec^2 x dx = \tan x + C$
 - $\int \operatorname{cosec}^2 x dx = -\cot x + C$
 - $\int \sec x \tan x dx = \sec x + C$
 - $\int \operatorname{cosec} x \cot x dx = -\operatorname{cosec} x + C$
 - $\int \frac{dx}{\sqrt{1-x^2}} = \sin^{-1} x + C$ or $-\cos^{-1} x + C$
 - $\int \frac{dx}{\sqrt{1-x^2}} = \tan^{-1} x + C$ or $-\cot^{-1} x + C$
 - $\int \frac{dx}{x\sqrt{x^2-1}} = \sec^{-1} x + C$ or $-\operatorname{cosec}^{-1} x + C$
 - $\int e^x dx = e^x + C$
 - $\int a^x dx = \frac{a^x}{\log a} + C$
 - $\int \frac{1}{x} dx = \log |x| + C$
 - $\int e^{ax} dx = \frac{e^{ax}}{a} + C$
- Properties of indefinite integrals:
 - $\frac{d}{dx} \int f(x) dx = f(x)$ and $\int f'(x) dx = f(x) + C$
 - If the derivative of two indefinite integrals is the same, then they belong to same family of curves and hence they are equivalent.
 - $\int [f(x) \pm g(x)] dx = \int f(x) dx \pm \int g(x) dx$
 - $\int kf(x) dx = k \int f(x) dx$, where k is any constant