CALCULUS WITH SINGLE VARIABLE

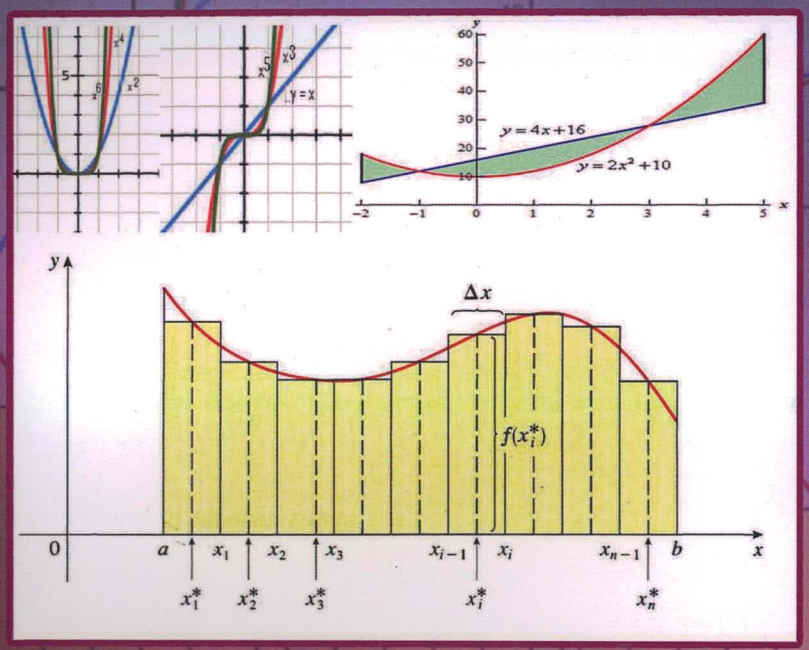

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Table of Content

CHAPTER 4

INTEGRATION

M.S.H Chowdhury

4.1 Indefinite Integral

Indefinite integral is a process of summation, or the inverse process of the differentiation. If $f(x)$ be any anti-derivative of $F(x)$ then indefinite integral of $F(x)$ is defined by

$\int F(x)\,dx = f(x) + C$, where C is an arbitrary constant (called integrating constant)

where $F(x)$ is called the anti-derivative function of $f(x)$ or indefinite integral. $F(x)$ is called the integrand, dx is called the variable of integration.

Example 4.1-1: Prove that $f(x)=[sin(x^4) + e^{x^3}]$ is an anti-derivative of

$$F(x) = 4x^3 \cos x^4 + 3x^2 e^{x^3}.$$

Solution:

We have, $f(x) = \sin x^4 + e^{x^3}$

$\therefore \frac{d[f(x)]}{dx} = 4x^3 \cos x^4 + 3x^2 e^{x^3} = F(x).$

Example 4.1-2: Find the anti-derivative of $F(x) = x^3$.

Solution:

$$f(x) = \int x^3\,dx = \frac{1}{4}x^4$$

$$\therefore \frac{df}{dx} = \frac{d}{dx}\left[\frac{1}{4}x^4\right] = x^3 = F(x).$$

Note that: By adding any constant C to the anti-derivative function $f(x)$ the derivative does not change i.e.,

$\int F(x)dx = f(x) + C$ is a general solution where C is an arbitrary constant.