Definite Integral

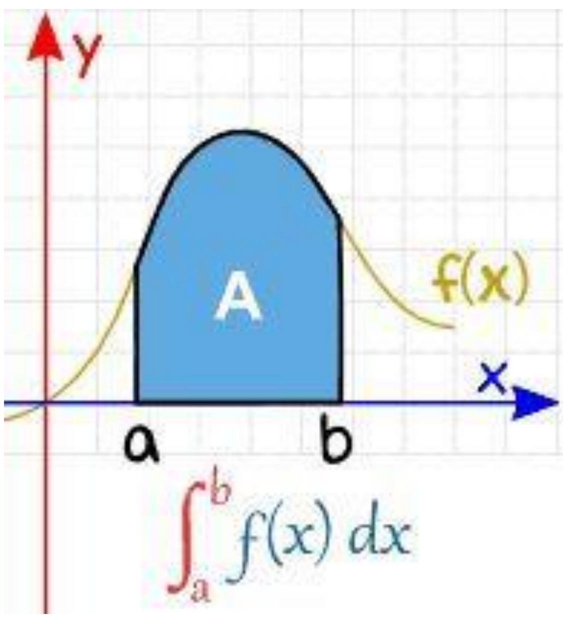
Let f(x) be a continuous function defined on closed interval $[a, b]$ then $\int_a^b f(x)dx$ is called definite integral of f(x) in the interval $[a, b]$.

First fundamental theorem of integral calculus

f (x) be a continuous function defined on a closed interval [a, b]and (A(x) area function) A (x) = $\int_a^x f(u)du$ for all $x \in [a, b]$,then $\frac{d}{dx}A(x)$ = f(x). In other words, A(x) is an anti-derivative of f (x).

Second fundamental theorem of integral calculus

If f (x) be a continuous function defined on a closed interval [a, b] and F(x) is an anti-derivative of f (x), then, $\int_a^b f(x)dx$ = F(b) - F(a).



A definite integral is denoted by $\int_a^b f(x)dx$, where a is called the lower limit of the integral and b is called the upper limit of the integral. The definite integral has a unique value.

$\int_a^b f(x)dx$ defined as the definite integral of f(x) from x = a to x = b denotes area bounded by f(x) x-axis and x = a and x- b.

Note: **There is no need to write integration constant C in definite integration.**

Suppose if we consider F(x) + C then,

$$\int_a^b f(x) = [F(x) + C]_a^b = (F(b) + C) - (F(a) + C) = F(b) + C - F(a) - C = F(b) - F(a)$$

Evaluation of Definite Integrals by Substitution

Consider a definite integral of the following form

$$I = \int_a^b f[g(x)]g'(x)dx$$

Substitute g(x) = t, ⇒ g '(x) dx = dt

When x=b, t=g(b) and when x= a, t = g(a)

Therefore, $I = \int_{g(a)}^{g(b)} f(t)dt$

Integrate the new integrand with respect to the new variable.