

Differentiation of Integral Function.

If $g_1(x)$ and $g_2(x)$ both functions are defined on $[a, b]$ and differentiable at a point $x \in (a, b)$ and $f(t)$ is continuous for $g_1(a) \leq f(t) \leq g_2(b)$

$$\text{Then } \frac{d}{dx} \int_{g_1(x)}^{g_2(x)} f(t) dt = f[g_2(x)]g_2'(x) - f[g_1(x)]g_1'(x) = f[g_2(x)] \frac{d}{dx} g_2(x) - f[g_1(x)] \frac{d}{dx} g_1(x).$$