

Fundamental theorem of calculus flashcard

Basic forms

Provided that the integrand is continuous on $[a, b]$ and that $x \in [a, b]$, the derivative undoes any *precisely* corresponding integral

$$\frac{d}{dx} \int_a^x f(t) dt = f(x)$$

Provided that the integrand is continuous on $[a, b]$, integration corresponds to anti-differentiation

$$\int_a^b \frac{df}{dx} dx = f(b) - f(a)$$

Note

$$\frac{df}{dx} = f'(x)$$

Superficially-modified forms

Provided that the integrand is continuous on $[a, b]$, that $u(x) \in [a, b]$, and that u is differentiable with respect to x , differentiation removes integration (keeping chain-rule in mind)

$$\frac{d}{dx} \int_a^{u(x)} f(t) dt = \underbrace{\left(\frac{d}{du(x)} \int_a^{u(x)} f(t) dt \right)}_{f(u(x))} \cdot \frac{du(x)}{dx}$$

Total change theorem

Provided that the integrand is continuous on $[a, b]$,

$$f(b) = f(a) + \int_a^b \frac{df}{dx} dx$$