

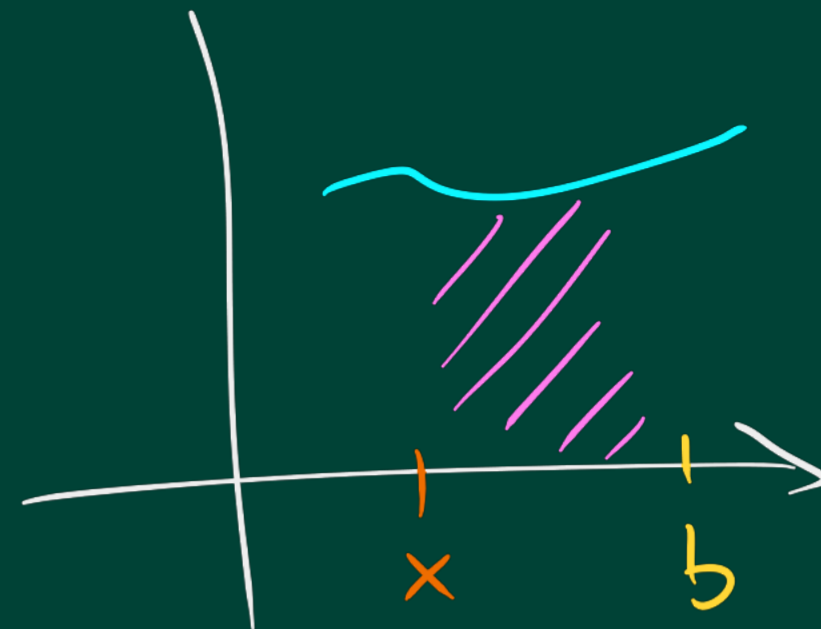
FTC - Part 1:

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

↑

Remarks:

$$1) \frac{d}{dx} \left\{ \int_b^x f(t) dt \right\} = f(x)$$



$$= - \int_x^b f(t) dt$$

$$2) \frac{d}{dx} \left\{ \int_x^b f(t) dt \right\} = -f(x)$$

Examples:

$$\left. \frac{d}{dx} \int_0^x \sqrt{9+t^2} dt \right\} = \sqrt{9+x^2}$$

$$\left. \frac{d}{dx} \int_x^1 \frac{1}{1+\cos(u)} du \right\} = - \left(\frac{1}{1+\cos(x)} \right)$$

Remark:

$$\int_a^x f'(t) dt = f(x) - f(a) \quad (*)$$

$$\frac{d}{dx} \left\{ \int_a^x f'(t) dt \right\} = f'(x)$$

$$\int_a^{x^2} f'(t) dt = \underbrace{f(x^2)} - f(a)$$

$$\frac{d}{dx} \left\{ \int_a^{x^2} f'(t) dt \right\} = \underbrace{2x}_{\frac{d}{dx}} f'(x^2)$$

Example:

$$\frac{d}{dx} \left\{ \int_1^{x^2} \frac{1}{3 + \cos(t)} dt \right\} = 2x \cdot \frac{1}{3 + \cos(x^2)}$$

$$\frac{d}{dx} \left\{ \int_1^{x^3+3} \frac{1}{3 + \cos(t)} dt \right\} = \overbrace{3x^2}^{\frac{d}{dx}} \cdot \frac{1}{3 + \cos(x^3+3)}$$

$$\int_a^b f'(x) dx = f(x) \Big|_a^b$$

$$= (f(x) + C) \Big|_a^b$$

$$= (f(b) + \cancel{C}) - (f(a) + \cancel{C})$$

$$\int_{-1}^1 x^2 dx = \left. \frac{x^3}{3} \right|_{-1}^1 = \frac{1}{3} - \left(\frac{(-1)^3}{3} \right)$$

$$= \frac{2}{3}$$

$h(t)$ = my height \rightarrow in ft. @ time t in years.

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$$\int_7^{23} \underbrace{h'(t)} dt = \underbrace{h(23) - h(7)}$$

↑
rate of
change of
height.

how much I grew
from 7 to 23

↑
net gain in
height