

Mean Value Theorem

Average Value of a Function

2ND Fundamental Theorem

MEAN VALUE THEOREM - f is continuous on $[a, b]$ then $\exists c$
in $[a, b]$ such that

$$\int_a^b f(x) dx = f(c)(b-a)$$

Average Value of a Function - f is integrable on $[a, b]$,
then.

$$\text{Average Value} = \frac{1}{b-a} \int_a^b f(x) dx$$

2nd Fundamental Theorem of Calculus

2nd F.T.C - if f is continuous open interval I containing " a ", then $\forall x$ in the interval

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

OK, let's go slowly.

$$F(x) = \int_{\frac{\pi}{2}}^x \cos t dt$$

⇒ FIND THE DERIVATIVE

We are looking for "essentially speaking" $\cos t dt$ BUT in terms of " x " AND NOT " t ".

$$F'(x) = \frac{dF}{dx}$$

$$F(x) = \int_{\frac{\pi}{2}}^x \cos t \, dt \Rightarrow \sin t \Big|_{\frac{\pi}{2}}^x$$

$$F(x) = \sin x - \sin\left(\frac{\pi}{2}\right)$$

$$F(x) = \sin x - 1$$

$F'(x) = \cos x (dx)$
 What do you notice?

ok, level 2.

$$F(x) = \int_{\frac{\pi}{2}}^{x^3} \cos t \, dt$$

THIS IS DIFFERENT.
 THIS HAS AN x^3 ...
CHAIN RULE

$$F(x) = \sin t \Big|_{\frac{\pi}{2}}^{x^3}$$

$$F(x) = \sin x^3 - \sin\left(\frac{\pi}{2}\right)$$

$$F(x) = \sin x^3 - 1$$

$$F'(x) = \cos(x^3)(3x^2)$$

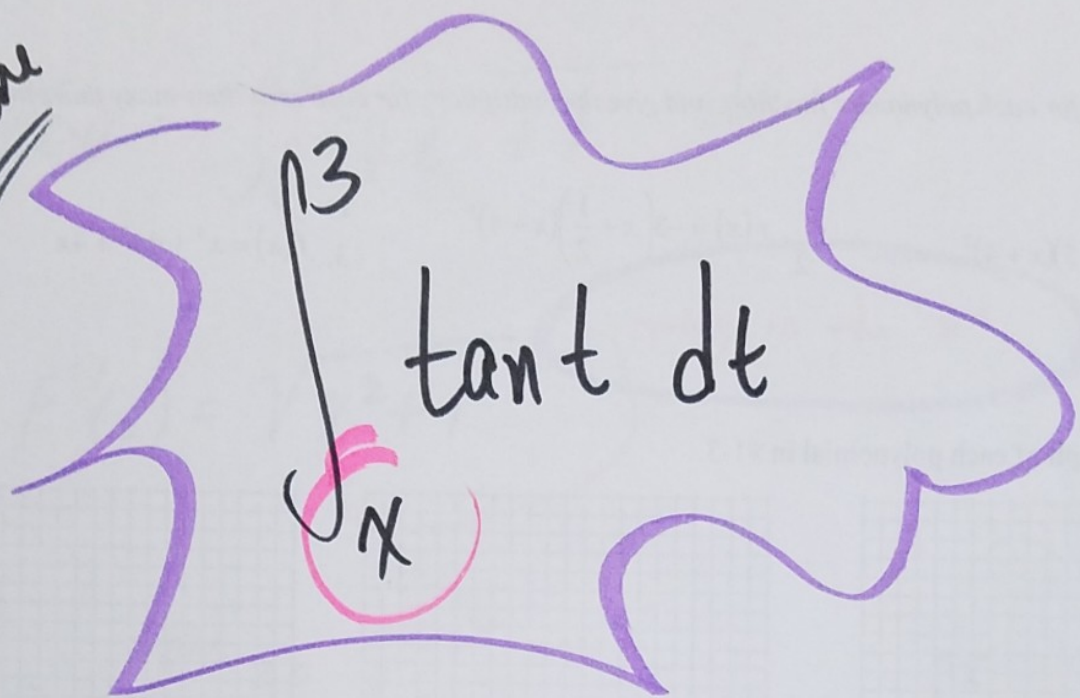
CHAIN RULE

So LET'S EXPLAIN what we are doing.

Substitute t with the upper bound and

multiply by the derivative of the upper bound.
 (dt)

McStone



0

$$\int_b^a f(x) dx = - \int_a^b f(x) dx$$

$$= - \int_3^x \tan(t) dt =$$

$$- \left[\text{SEC}^2(x) - \text{SEC}^2(3) \right]$$

CONSTANT

$$F(x) = -\text{SEC}^2(x) + \text{SEC}^2(3)$$

$$F'(x) = -\tan x$$

$$F(x) = \int_0^x \sqrt{t^2 + 1} dt$$

$$F'(x) = \sqrt{x^2 + 1}$$

plug in the 'x'

$$F(x) = \int_1^x \frac{20}{v^2} dv$$

Alissa

$$F'(x) = \frac{20}{x^2}$$

$$F(x) = \int_2^x (t^3 + 2t - 2) dt$$

Camis

$$F'(x) = (x^3 + 2x - 2)$$

$$F(x) = \int_0^{x^4} \sin t dt$$

Jane

$$F'(x) = \sin x^4 (4x^3)$$